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PROPORTIONAL VALVES

SERVOPROPORTIONAL DIRECTIONALS

zero overlap with LVDT transducer

		Size	Qmax [l/min]	Table	Pag
DLHZO-TEB/TES DLKZOR-TEB/TES	direct, sleeve execution, on-board driver	06 ÷ 10	70 ÷ 160	FS180	**9**
DLHZO-T, DLKZOR-T	direct, sleeve execution, off-board driver	06 ÷ 10	70 ÷ 160	F180	**21**
DHZO-TEB/TES DKZOR-TEB/TES	direct, on-board driver	06 ÷ 10	80 ÷ 180	FS168	**27**
DHZO-T, DKZOR-T	direct, off-board driver	06 ÷ 10	80 ÷ 180	F168	**39**
DPZO-LEB/LES	piloted, on-board driver, 2 LVDT transducers	10 ÷ 35	180 ÷ 3500	FS178	**45**
DPZO-L	piloted, off-board driver, 2 LVDT transducers	10 ÷ 32	180 ÷ 1600	F178	**61**
LIQZO-LEB/LES LIQZP-LEB/LES	3 way cartridge, piloted, on-board driver, 2 LVDT transducers	25 ÷ 80	500 ÷ 5000	FS340	**69**
LIQZO-L LIQZP-L	3 way cartridge, piloted, off-board driver, 2 LVDT transducers	25 ÷ 80	500 ÷ 5000	F340	**83**

HIGH PERFORMANCE DIRECTIONALS

positive overlap with LVDT transducer

		Size	Qmax [l/min]	Table	Pag
DHZO-TEB/TES DKZOR-TEB/TES	direct, on-board driver	06 ÷ 10	80 ÷ 180	FS165	**91**
DHZO-T, DKZOR-T	direct, off-board driver	06 ÷ 10	80 ÷ 180	F165	**103**
DPZO-LEB/LES	piloted, on-board driver, 2 LVDT transducers	10 ÷ 35	180 ÷ 3500	FS175	**109**
DPZO-L	piloted, off-board driver, 2 LVDT transducers	10 ÷ 32	180 ÷ 1600	F175	**125**
DPZO-TEB/TES	piloted, on-board driver, 1 LVDT transducer	10 ÷ 32	180 ÷ 1600	FS172	**135**
DPZO-T	piloted, off-board driver, 1 LVDT transducer	10 ÷ 32	180 ÷ 1600	F172	**149**
LIQZO-LEB/LES LIQZP-LEB/LES	2 way ISO cartridge, piloted, on-board driver, 2 LVDT transducers	16 ÷ 100	600 ÷ 16000	FS330	**157**
LIQZO-L, LIQZP-L	2 way ISO cartridge, piloted, off-board driver, 2 LVDT transducers	16 ÷ 100	600 ÷ 16000	F330	**171**

DIRECTIONAL VALVES

positive overlap without transducer

		Size	Qmax [l/min]	Table	Pag
DHZO-A/AEB/AES DKZOR-A/AEB/AES	direct, off-board or on-board driver	06 ÷ 10	70 ÷ 160	FS160	**179**
DHZE-A, DKZE-A	direct, off-board driver	06 ÷ 10	70 ÷ 160	F150	**193**
DPZO-A/AEB/AES	piloted, off-board or on-board driver	10 ÷ 32	180 ÷ 1500	FS170	**199**

		Size	Qmax [l/min]	Table	Pag
SAFETY PROPORTIONALS					
IEC 61508 & ISO 13849, on-board driver with double power supply /U					
DLHZO-TES, DLKZOR-TES	direct, zero overlap, sleeve execution, LVDT transducer	06 ÷ 10	70 ÷ 160	FY100	**215**
DHZO-TES, DKZOR-TES	direct, positive or zero overlap, LVDT transducer	06 ÷ 10	80 ÷ 180		
DPZO-TES, DPZO-LES	piloted, positive or zero overlap, 1 or 2 LVDT transducers	10 ÷ 35	180 ÷ 3500		
IEC 61508 & ISO 13849, on-board driver with on-off signals /K					
DLHZO-TES, DLKZOR-TES	direct, zero overlap, sleeve execution, LVDT transducer	06 ÷ 10	70 ÷ 160	FY200	**221**
DHZO-TES, DKZOR-TES	direct, positive or zero overlap, LVDT transducer	06 ÷ 10	80 ÷ 180		
DPZO-TES, DPZO-LES	piloted, positive or zero overlap, 1 or 2 LVDT transducers	10 ÷ 35	180 ÷ 3500		
HIGH PERFORMANCE PRESSURE VALVES					
with pressure transducer					
RZMO-R/REB/RES-010	relief, direct, off-board or on-board driver	06	4	FS010	**229**
RZMO-R/REB/RES-030	relief, piloted, off-board or on-board driver	06	40	FS067	**237**
AGMZO-R/REB/RES	relief, piloted, off-board or on-board driver	10 ÷ 32	200 ÷ 600	FS040	**245**
RZGO-R/REB/RES-010	reducing, direct, off-board or on-board driver	06	12	FS020	**255**
RZGO-R/REB/RES-033	reducing, piloted, off-board or on-board driver	06	40	FS075	**263**
AGRCZO-R/REB/RES	reducing, piloted, off-board or on-board driver	10 ÷ 20	160 ÷ 300	FS055	**271**
ISO cartridges, with pressure transducer					
LIMZO-R/REB/RES	relief, piloted, off-board or on-board driver	16 ÷ 80	200 ÷ 4500	FS305	**281**
LIRZO-R/REB/RES	reducing, piloted, off-board or on-board driver	16 ÷ 40	160 ÷ 800		
LICZO-R/REB/RES	compensator, piloted, off-board or on-board driver	16 ÷ 50	200 ÷ 2000		
PRESSURE VALVES					
without transducer					
RZMO-A/AEB/AES-010	relief, direct, off-board or on-board driver	06	4	FS007	**293**
RZME-A	relief, direct, off-board driver, subplate	06	4	F005	**301**
CART RZME-A	relief, direct, off-board driver, screw-in cartridge	M20			
RZMO-A/AEB/AES-030	relief, piloted, off-board or on-board driver	06	40	FS065	**307**
HZMO-A	relief, piloted, off-board driver, modular				
AGMZO-A/AEB/AES	relief, piloted, off-board or on-board driver	10 ÷ 32	200 ÷ 600	FS035	**315**
AGMZE-A	relief, piloted, off-board driver	10 ÷ 32	200 ÷ 600	F030	**325**
RZGO-A/AEB/AES-010	reducing, direct, off-board or on-board driver	06	12	FS015	**331**
RZGE-A	reducing, direct, off-board driver, subplate	06	12	F012	**339**
CART RZGE-A	reducing, direct, off-board driver, screw-in cartridge	M20	12		
RZGO-A/AEB/AES-033	reducing, piloted, off-board or on-board driver	06 ÷ 10	40 ÷ 100	FS070	**345**
HZGO-A, KZGO-A	reducing, piloted, off-board driver, modular				
AGRCZO-A/AEB/AES	reducing, piloted, off-board or on-board driver	10 ÷ 20	160 ÷ 300	FS050	**355**
ISO cartridges, without transducer					
LIMZO-A/AEB/AES	relief, piloted, off-board or on-board driver	16 ÷ 80	200 ÷ 4500	FS300	**365**
LIRZO-A/AEB/AES	reducing, piloted, off-board or on-board driver	16 ÷ 40	160 ÷ 800		
LICZO-A/AEB/AES	compensator, piloted, off-board or on-board driver	16 ÷ 50	200 ÷ 2000		
for pilot lines, without transducer					
DHRZO-A/AEB/AES	3 way reducing, direct, off-board or on-board driver	06	24	FS025	**377**
DHRZE-A	3 way reducing, direct, off-board driver	06	24	F022	**385**

NEXT ▶▶▶

FLOW VALVES

pressure compensated

		Size	Qmax [l/min]	Table	Pag
QVHZO-TEB/TES QVKZOR-TEB/TES	direct, on-board driver, LVDT transducer	06 ÷ 10	45 ÷ 90	FS412	**389**
QVHZO-T, QVKZOR-T	direct, off-board driver, LVDT transducer	06 ÷ 10	45 ÷ 90	F412	**399**
QVHZO-A/AEB/AES QVKZOR-A/AEB/AES	direct, off-board or on-board driver, without transducer	06 ÷ 10	45 ÷ 90	FS410	**403**

ELECTRONIC DRIVERS

off-board digital, DIN-rail EN 60715

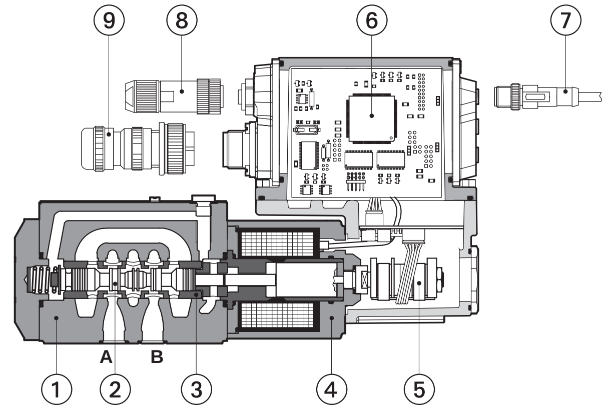
E-BM-TES, E-BM-LES	for directional and flow valves with LVDT transducers, fieldbus, P/Q control	GS240	**415**
E-BM-TEB, E-BM-LEB	for directional and flow valves with LVDT transducers	GS230	**423**
E-BM-TID, E-BM-LID	for directional and flow valves with LVDT transducers	GS235	**429**
E-BM-RES	for pressure valves with transducer, fieldbus	GS203	**435**
E-BM-AES	for valves without transducer, fieldbus	GS050	**441**
E-BM-AS	for valves without transducer	G030	**447**

on-board, solenoid plug-in DIN 43650

E-MI-AS-IR	digital, for valves without transducer	G020	**453**
E-MI-AC	analog, for valves without transducer	G010	**457**

Digital servoproportional directional valves sleeve execution

direct, with on-board driver, LVDT transducer and zero spool overlap with fail safe



DLKZOR-TES-SN-BC-160

① Valve body
② Spool
③ Sleeve
④ Proportional solenoid
⑤ LVDT transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector

DLHZO-TEB, DLHZO-TES DLKZOR-TEB, DLKZOR-TES

Digital servoproportional directional valves, direct, in sleeve execution with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.

TEB basic execution with analog reference signal and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital TEZ version (see tech. table FS610) integrates on-board driver and axis card, while TEB and TES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

DLHZO:	**DLKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DLHZO	-	TES	-	SN	-	NP	-	0	40	-	L	7	3	/	*	*	/	*

DLHZO = size 06
DLKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

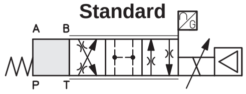
Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

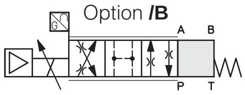
Valve size ISO 4401: **0** = 06 **1** = 10

Configuration:

Standard Option **/B**

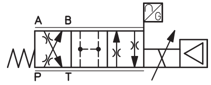
40 =

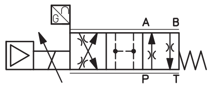




with fail safe configuration 1 or 3

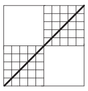
60 =



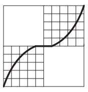


without fail safe

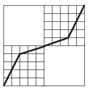
Spool type, regulating characteristics:



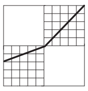
L = linear



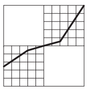
V = progressive



T = not linear **(2)**



D = differential-linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q



DT = differential-not linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Series number

Seals material,
see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (3):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

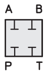
Electronics options (3):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(4)**

Safety options TÜV certified - only **TES (3)**:
U = safe double power supply
K = safe on/off signals
See section 7

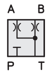
SAFETY CERTIFIED

Fail safe configuration, see section 13 :

1 =



3 =



Note: select **1** for configuration **60** even without fail safe

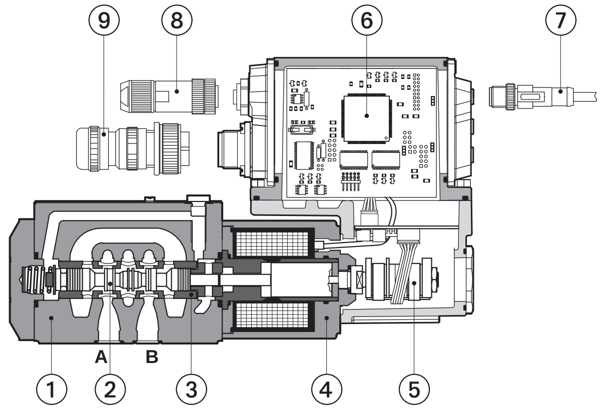
Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Only in version **SN-NP**
(2) Only for configuration **40**
(3) For possible combined options, see section 16
(4) Double power supply only for **TES**

Digital servoproportional directional valves sleeve execution

direct, with on-board driver, LVDT transducer and zero spool overlap with fail safe



DLKZOR-TES-SN-BC-160

① Valve body
② Spool
③ Sleeve
④ Proportional solenoid
⑤ LVDT transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector

DLHZO-TEB, DLHZO-TES
DLKZOR-TEB, DLKZOR-TES

Digital servoproportional directional valves, direct, in sleeve execution with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.

TEB basic execution with analog reference signal and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital TEZ version (see tech. table FS610) integrates on-board driver and axis card, while TEB and TES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

DLHZO:	**DLKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DLHZO	-	TES	-	SN	-	NP	-	0	40	-	L	7	3	/	*	*	/	*

DLHZO = size 06
DLKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

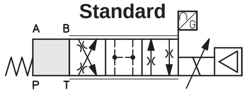
Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

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

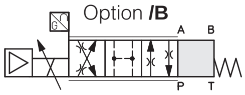
Configuration:

40 =

Standard

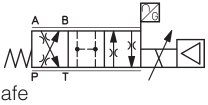


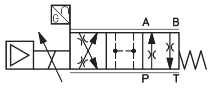
Option **/B**



with fail safe configuration 1 or 3

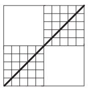
60 =

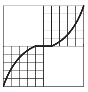


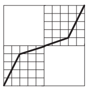


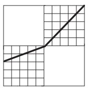
without fail safe

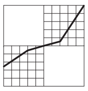
Spool type, regulating characteristics:


L = linear


V = progressive


T = not linear **(2)**


D = differential-linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q


DT = differential-not linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Series number

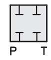
Hydraulic options (3):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

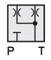
Electronics options (3):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(4)**

Safety options TÜV certified - only **TES (3)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Fail safe configuration, see section 13 :

1 =


3 =


Note: select **1** for configuration **60** even without fail safe

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

---

(1) Only in version **SN-NP**
(2) Only for configuration **40**
(3) For possible combined options, see section 16
(4) Double power supply only for **TES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

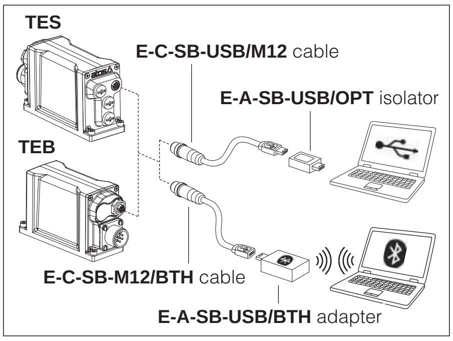
3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

USB or Bluetooth connection



⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for TES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table FS610

Digital servoproportional with on-board electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated P/Q control to the basic position ones.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 **HYDRAULIC CHARACTERISTICS** - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DLHZO**												**DLKZOR**						
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10												ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10						
Spool type	**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Nominal flow Δp P-T [l/min] **(1)** Δp= 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
Δp= 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
Max permissible flow	8	14	16	30	40	50		70			70÷40		90		160			160÷80	
Leakage **(2)** [cm^3/min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(3)** [ms]	≤ 10												≤ 15						
Hysteresis	≤ 0,1 [% of max regulation]																		
Repeatibility	± 0,1 [% of max regulation]																		
Thermal drift	zero point displacement < 1% at ΔT = 40°C																		

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) Referred to spool in neutral position and 50°C oil temperature
(3) 0-100% step signal

10 **ELECTRICAL CHARACTERISTICS**

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DLHZO** = 2,6 A **DLKZOR** = 3 A			
Coil resistance R at 20°C	**DLHZO** = 3 ÷ 3,3 Ω **DLKZOR** = 2,2 ÷ 2,4 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 **SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

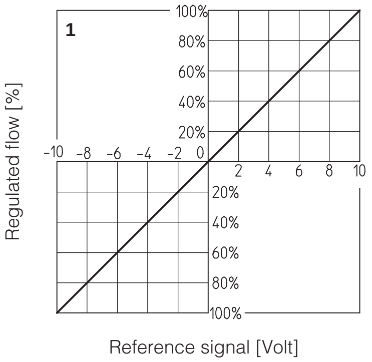
12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

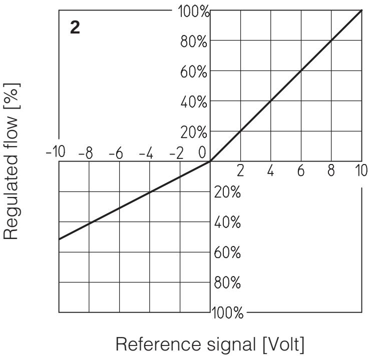
12.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZO)

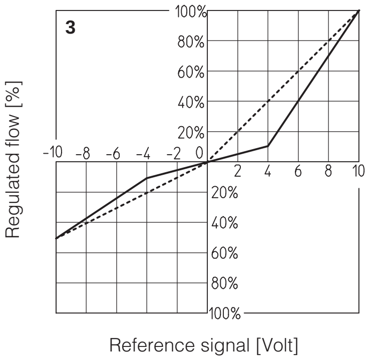
5 = Non linear spool T3 (only for DLKZOR) and T7
6 = Progressive spool V

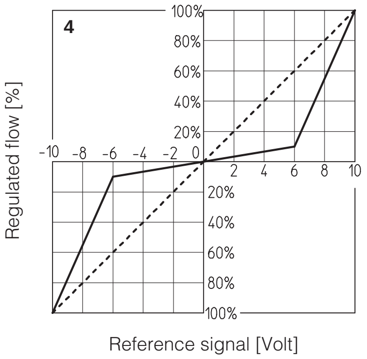




T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2





Note:
Hydraulic configuration vs. reference signal:

Standard:

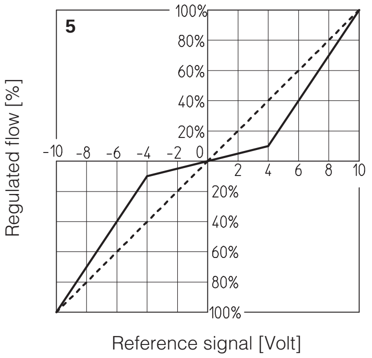
Reference signal $\left.\begin{matrix} 0 \div +10\text{ V} \\ 12 \div 20\text{ mA} \end{matrix}\right\}$ P → A / B → T

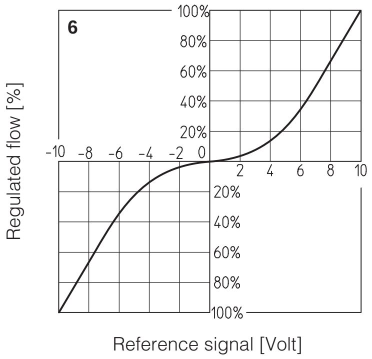
Reference signal $\left.\begin{matrix} 0 \div -10\text{ V} \\ 12 \div 4\text{ mA} \end{matrix}\right\}$ P → B / A → T

option /B:

Reference signal $\left.\begin{matrix} 0 \div +10\text{ V} \\ 12 \div 20\text{ mA} \end{matrix}\right\}$ P → B / A → T

Reference signal $\left.\begin{matrix} 0 \div -10\text{ V} \\ 12 \div 4\text{ mA} \end{matrix}\right\}$ P → A / B → T



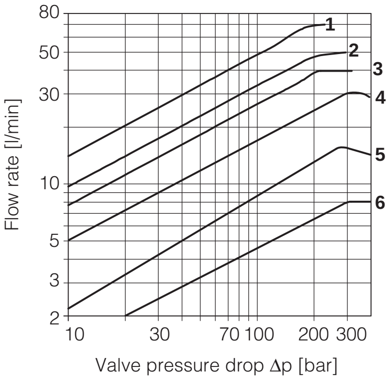


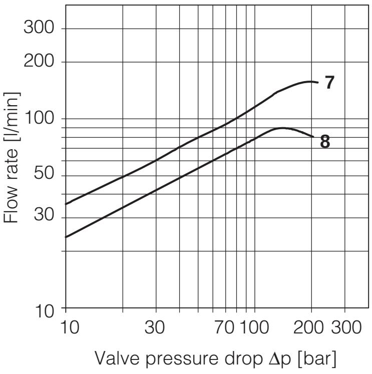
12.2 Flow /Δp diagrams

Stated at 100% of spool stroke

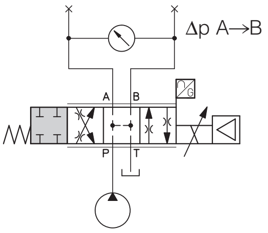
DLHZO:
1 = spool L7, T7, V7, D7, DT7
2 = spool L5, T5
3 = spool V3
4 = spool L3
5 = spool L1, V1
6 = spool L0

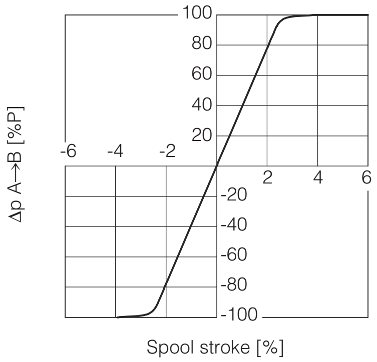
DLKZOR:
7 = spool L7, T7, V7, D7, DT7
8 = spool L3, T3





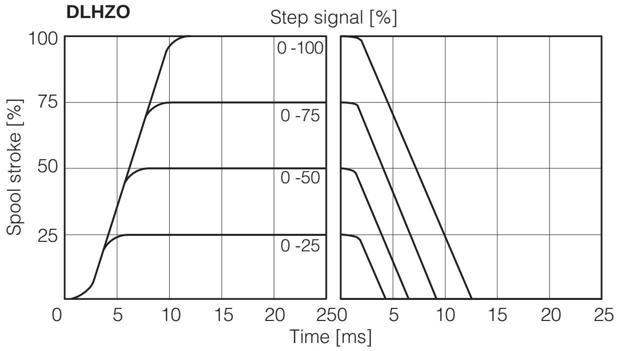
12.3 Pressure gain

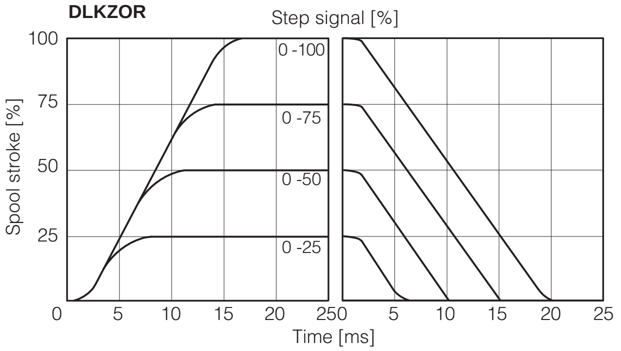




12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



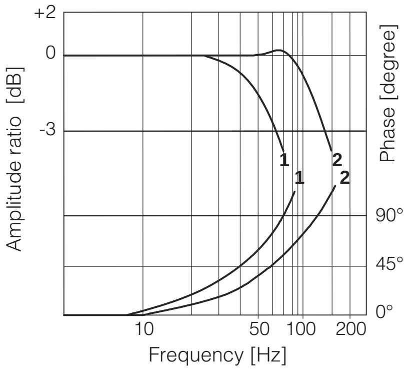


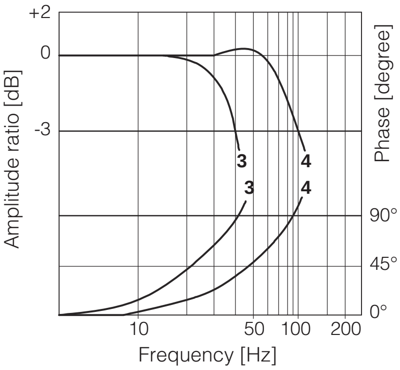
12.5 Bode diagrams

Stated at nominal hydraulic conditions

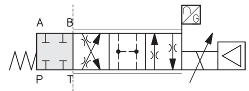
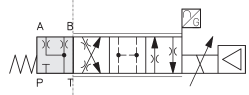
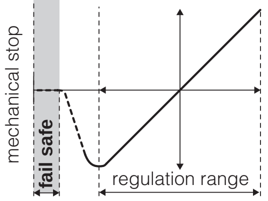
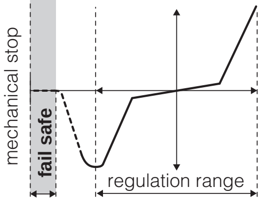
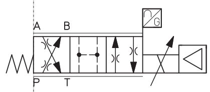
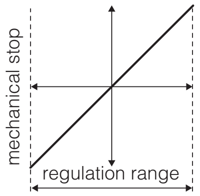
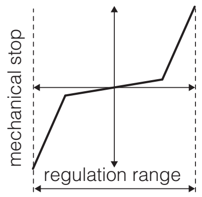
DLHZO:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZOR:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





13 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
 fail safe **1**  fail safe **3**	**t** = 7-10 ms (DLHZO) **t** = 15-20 ms (DLKZOR)  	**t** = 7-10 ms (DLHZO) **t** = 15-20 ms (DLKZOR) 
	t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar	
 without fail safe	 	

Fail safe connections			P → A	P → B	A → T	B → T
Leakage [cm³/min] at P = 100 bar **(1)**		Fail safe 1	50	70	70	50
		Fail safe 3	50	70	-	-
Flow [l/min] **(2)**	DLHZO	Fail safe 3	-	-	15÷30	10÷20
	DLKZOR		-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature **(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

14 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

15 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 17.8)
Power supply for driver's logics and communication - only for **TES** (see 17.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

16 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:
/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY,
/IQ, /IQY, /IY, /IYZ, /IZ,
/QY, /YZ

Standard versions for **TES-SP, SF, SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:
/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and TES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL		TECHNICAL SPECIFICATIONS	NOTES
			Fieldbus	**NP**		
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors Ⓑ - Ⓒ

Ⓑ	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2)	**BC fieldbus execution, connector - M12 - 5 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2)	**BP fieldbus execution, connector - M12 - 5 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2)	**EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

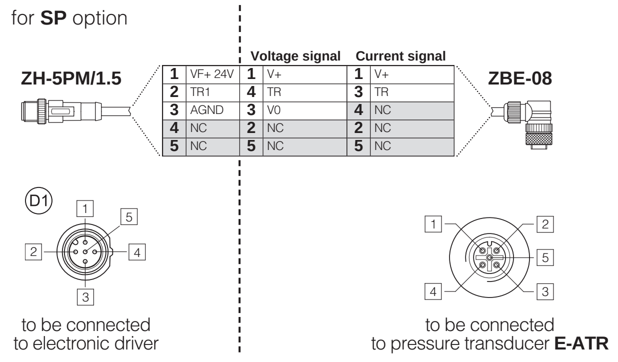
18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) **SP, SL - Single transducer** (1)		(D2) **SF - Double transducers** (1)	
				Voltage	**Current**	**Voltage**	**Current**
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example

for **SP** option

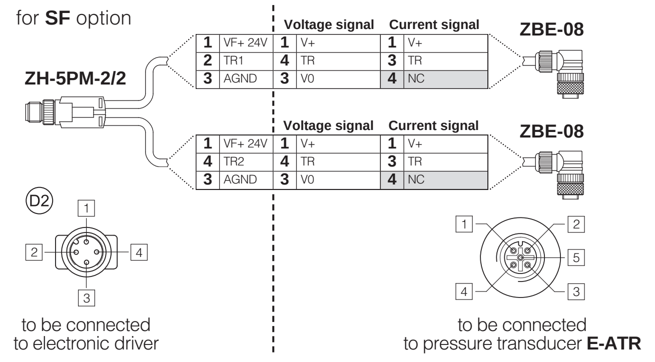


		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR1	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC
4	NC	**2**	NC	**2**	NC
5	NC	**5**	NC	**5**	NC

to be connected to electronic driver

to be connected to pressure transducer **E-ATR**

for **SF** option



		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR1	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC

		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
4	TR2	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC

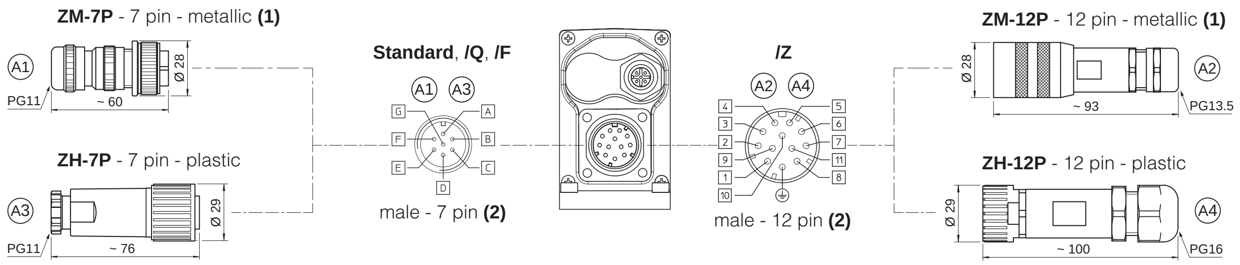
to be connected to electronic driver

to be connected to pressure transducer **E-ATR**

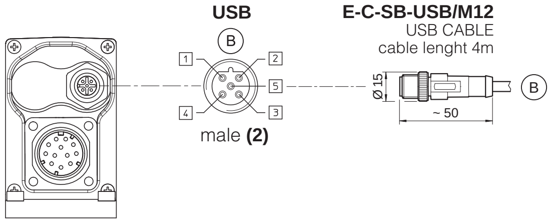
Note: pin layout always referred to driver's view

18.5 TEB connections layout

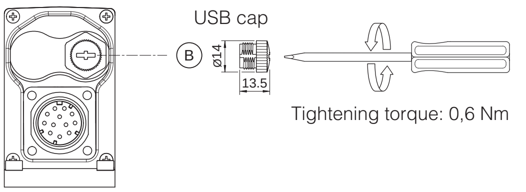
MAIN CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves

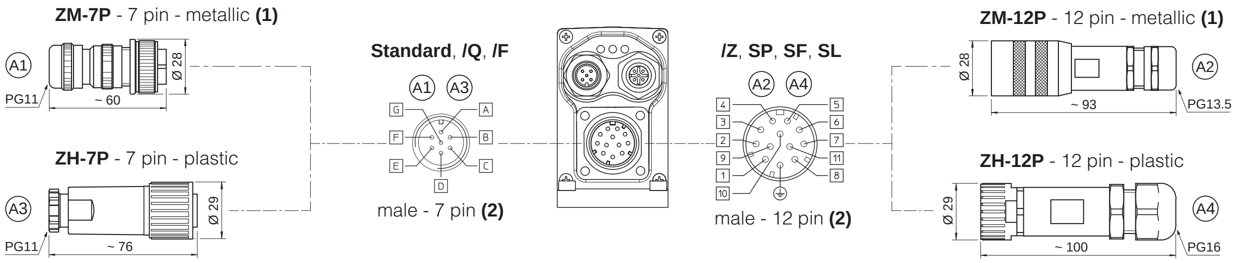


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

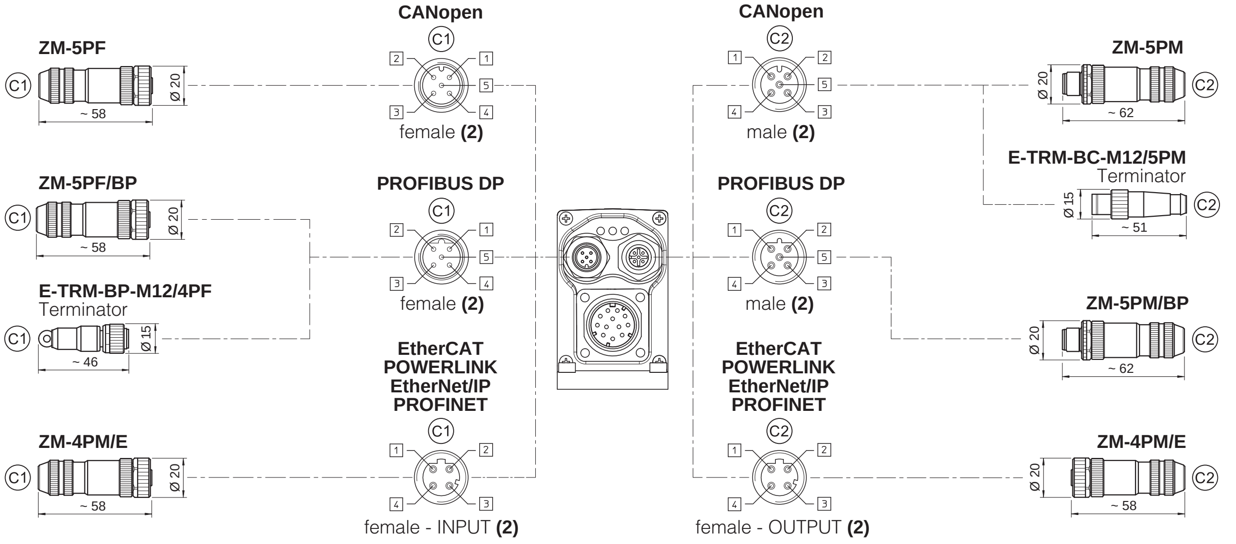
(2) Pin layout always referred to driver's view

18.6 TES connections layout

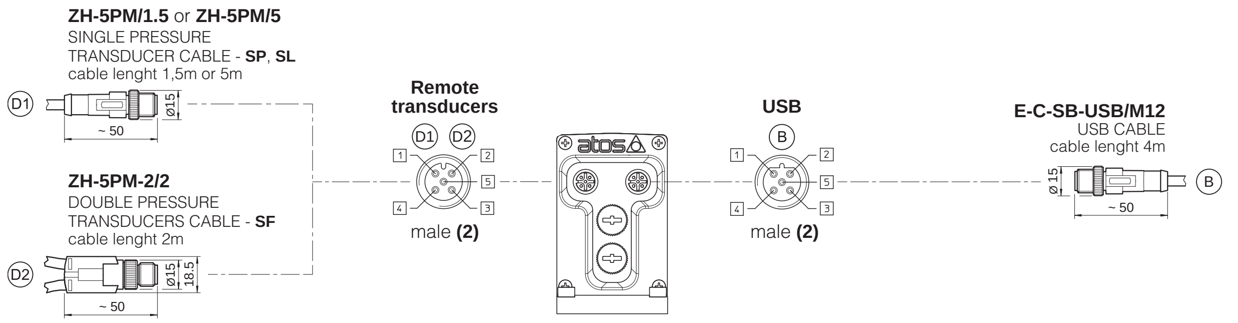
MAIN CONNECTORS



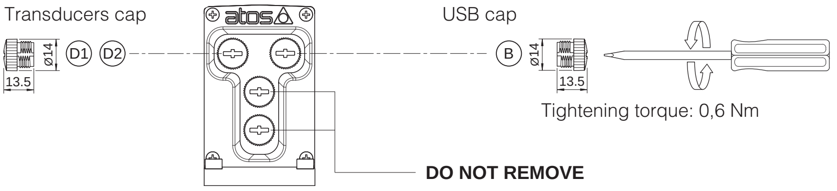
FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS



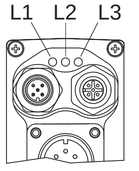
PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for TES

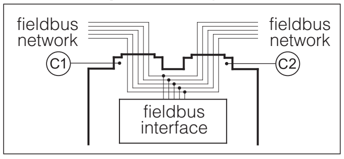
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	 L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - 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 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

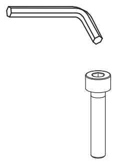
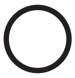
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20.4 Pressure/Force transducer connectors - only for **SP, SF, SL**

CONNECTOR TYPE	**SP, SL - Single transducer**		**SF - Double transducers**
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**	(D2) **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm^2		3 x 0,25 mm^2 (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

21 FASTENING BOLTS AND SEALS

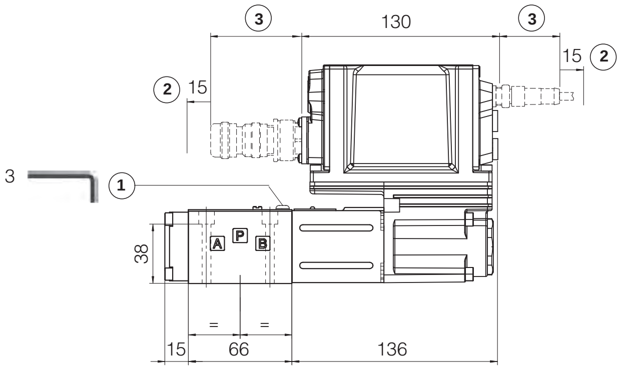
	DLHZO	**DLKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

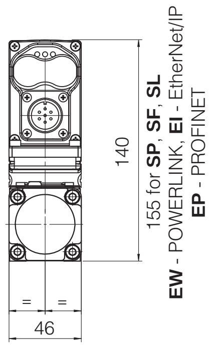
22 INSTALLATION DIMENSIONS [mm]

DLHZO-TEB, DLHZO-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DLHZO	2,3



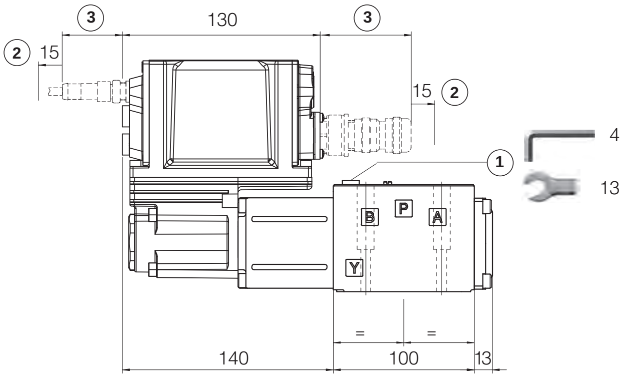


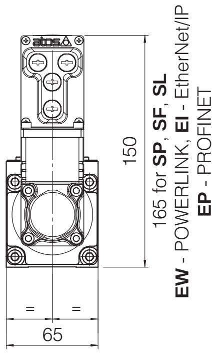
140
155 for **SP**, **SF**, **SL**
EW - POWERLINK, **EI** - EtherNet/IP
EP - PROFINET
=
=
46

DLKZOR-TEB, DLKZOR-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3





150
165 for **SP**, **SF**, **SL**
EW - POWERLINK, **EI** - EtherNet/IP
EP - PROFINET
=
=
65

① = Air bleeding

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

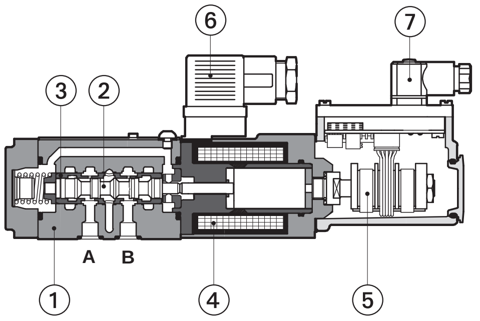
23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS500	Digital proportional valves with P/Q control	**K800**	Electric and electronic connectors
FS610	Digital proportional valves with integral axis controller	**P005**	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	**QB300**	Quickstart for TEB valves commissioning
FY100	Safety proportional valves - option /U	**QF300**	Quickstart for TES valves commissioning
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		

Servoproportional directional valves sleeve execution

direct, with LVDT transducer and zero spool overlap with fail safe

CE



DLHZO-T-060

① Valve body
② Spool
③ Sleeve
④ Proportional solenoid
⑤ LVDT transducer
⑥ Solenoid connector
⑦ Transducer connector

DLHZO-T, DLKZOR-T

Servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for best performances in any position closed loop.

The valves operate in association with digital off-board divers or axis card, see section 2.

The LVDT transducer and the sleeve execution grant very high regulation accuracy and response sensitivity.

The fail safe position permits to intercept the actuator movement in case of power supply interruption.

Spools regulation characteristics:
L = linear
V = progressive
T = non linear for fine low flow control
D and DT = differential, for control of actuators with area ratio 1:2

DLHZO:
Size: **06** - ISO 4401
Max flow: **70 l/min**
Max pressure: **350 bar**

DLKZOR:
Size: **10** - ISO 4401
Max flow: **160 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLHZO - T - 0 40 - L 7 3 / * * / *

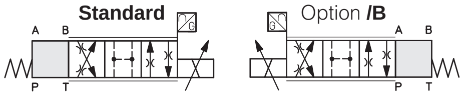
DLHZO = size 06
DLKZOR = size 10

T = with LVDT transducer

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

Configuration:

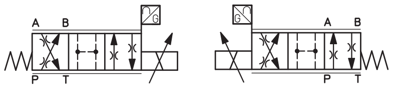
40 =



Standard Option **/B**

with fail safe configuration 1 or 3

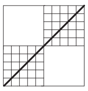
60 =



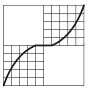
without fail safe

Spool type, regulating characteristics:

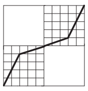
L = linear



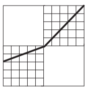
V = progressive



T = not linear **(1)**

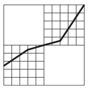


D = differential-linear **(1)**



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DT = differential-not linear **(1)**



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

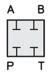
Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR

Series number

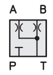
Hydraulic options (2):
B = solenoid and LVDT transducer at side of port A
Y = external drain

Fail safe configuration, see section 8:

1 =



3 =



Note: select **1** for configuration **60** even without fail safe

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Not available for configuration **60**
(2) Possible combined options: /BY

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TID	E-BM-TES	Z-BM-TEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DLHZO**												**DLKZOR**						
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10												ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10						
Spool type	**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Nominal flow Δp P-T [l/min] **(1)** Δp= 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
Δp= 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
Max permissible flow	8	14	16	30	40	50		70			70÷40		90		160			160÷80	
Leakage **(2)** [cm^3/min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(3)** [ms]	≤ 10												≤ 15						
Hysteresis	≤ 0,1 [% of max regulation]																		
Repeatibility	± 0,1 [% of max regulation]																		
Thermal drift	zero point displacement < 1% at ΔT = 40°C																		

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2
(2) Referred to spool in neutral position and 50°C oil temperature
(3) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	**DLHZO** = 2,6 A **DLKZOR** = 3 A
Coil resistance R at 20°C	**DLHZO** = 3 ÷ 3,3 Ω **DLKZOR** = 2,2 ÷ 2,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

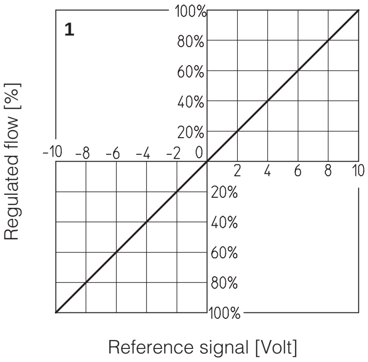
7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

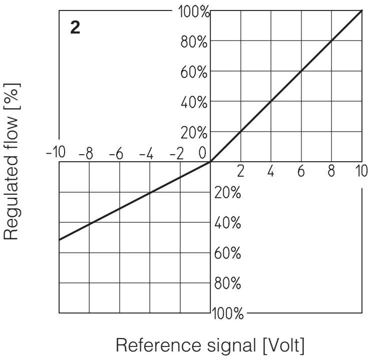
7.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZO)

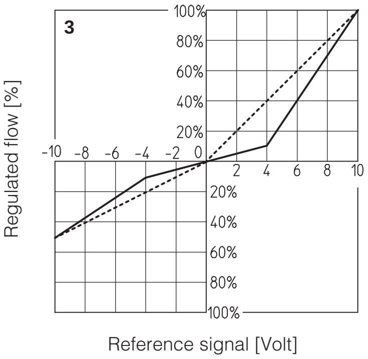
5 = Non linear spool T3 (only for DLKZOR) and T7
6 = Progressive spool V

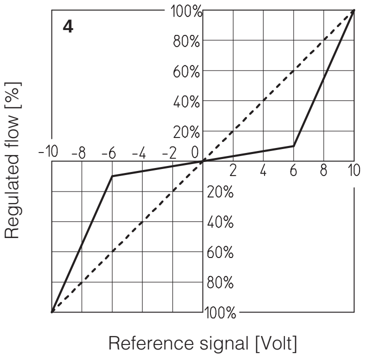




T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3, T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2





Note:
Hydraulic configuration vs. reference signal:

Standard:

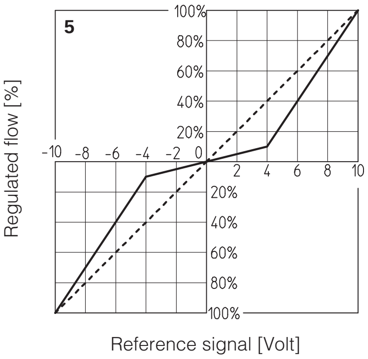
Reference signal $\left.\begin{array}{l}0 \div +10\ V\\ 12 \div 20\ mA\end{array}\right\}$ P → A / B → T

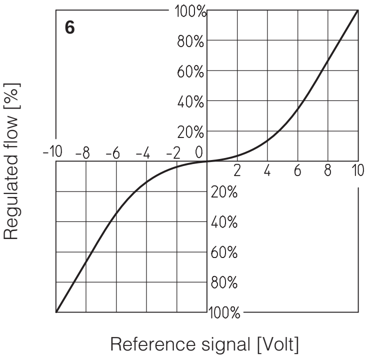
Reference signal $\left.\begin{array}{l}0 \div -10\ V\\ 12 \div 4\ mA\end{array}\right\}$ P → B / A → T

option /B:

Reference signal $\left.\begin{array}{l}0 \div +10\ V\\ 12 \div 20\ mA\end{array}\right\}$ P → B / A → T

Reference signal $\left.\begin{array}{l}0 \div -10\ V\\ 12 \div 4\ mA\end{array}\right\}$ P → A / B → T



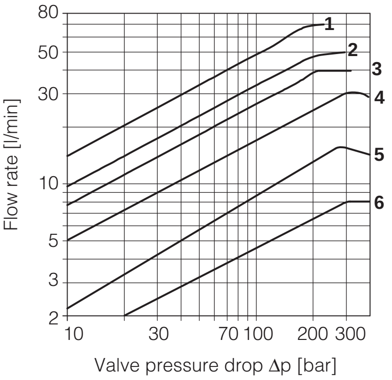


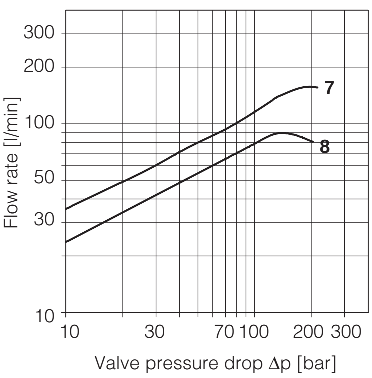
7.2 Flow /Δp diagrams

Stated at 100% of spool stroke

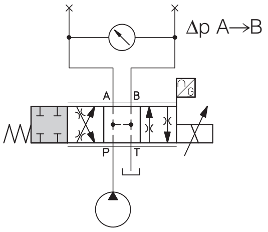
DLHZO:
1 = spool L7, T7, V7, D7, DT7
2 = spool L5, T5
3 = spool V3
4 = spool L3
5 = spool L1, V1
6 = spool L0

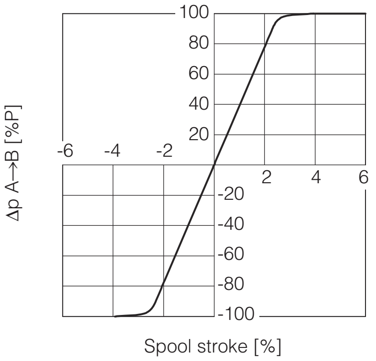
DLKZOR:
7 = spool L7, T7, V7, D7, DT7
8 = spool L3





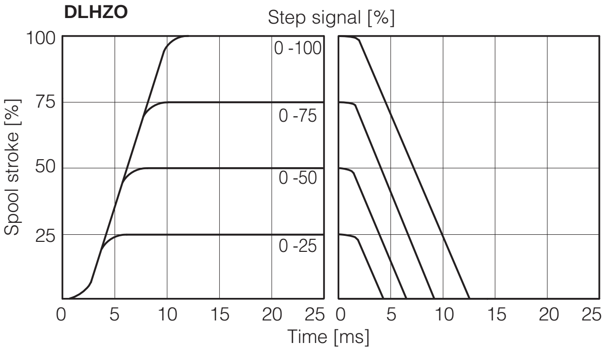
7.3 Pressure gain

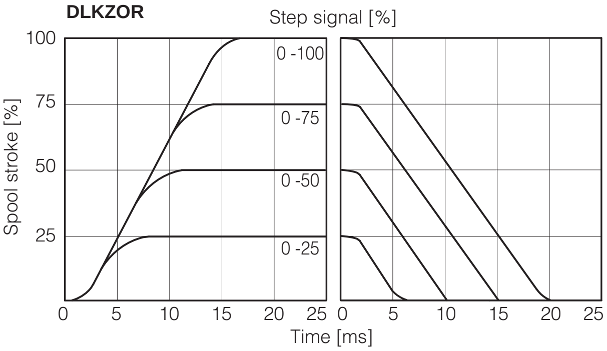




7.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



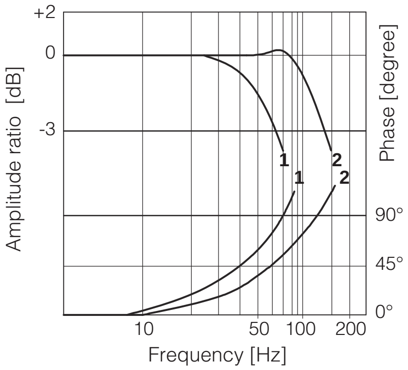


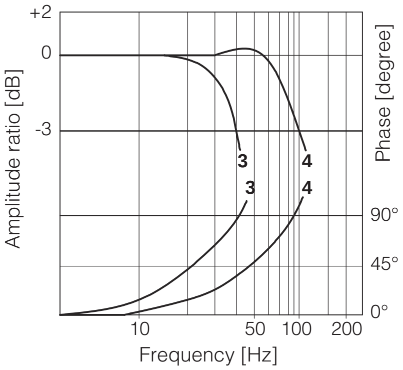
7.5 Bode diagrams

Stated at nominal hydraulic conditions

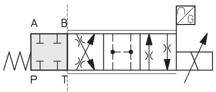
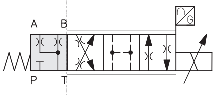
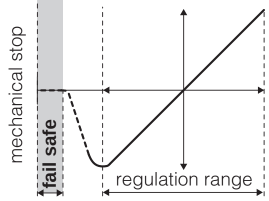
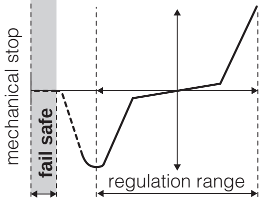
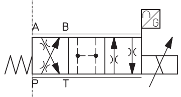
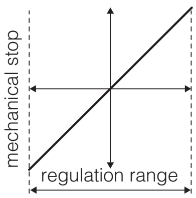
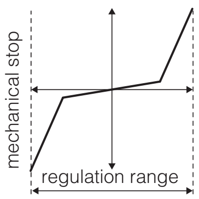
DLHZO:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZOR:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





8 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
 fail safe **1**  fail safe **3**	**t** = 7-10 ms (DLHZO) **t** = 15-20 ms (DLKZOR) 	**t** = 7-10 ms (DLHZO) **t** = 15-20 ms (DLKZOR) 
	t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar	
 without fail safe		

Fail safe connections			P → A	P → B	A → T	B → T
Leakage [cm³/min] at P = 100 bar **(1)**		Fail safe 1	50	70	70	50
		Fail safe 3	50	70	-	-
Flow [l/min] **(2)**	DLHZO	Fail safe 3	-	-	15÷30	10÷20
	DLKZOR		-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature **(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

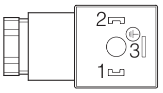
9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1

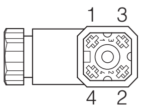
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

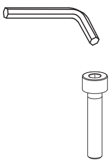
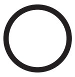
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 FASTENING BOLTS AND SEALS

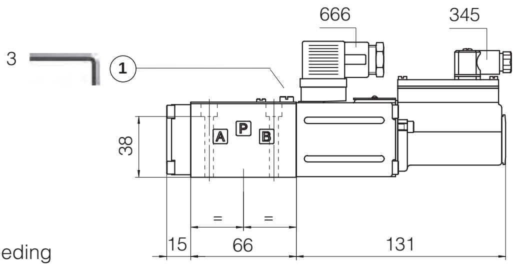
	DLHZO	DLKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

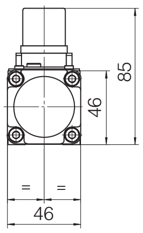
12 INSTALLATION DIMENSIONS [mm]

DLHZO-T

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DLHZO	2,3



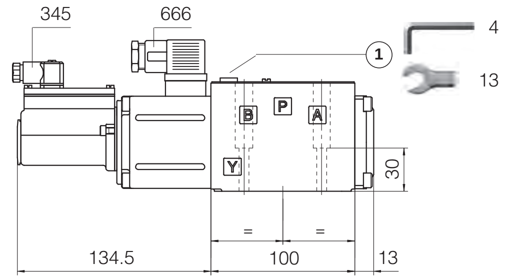


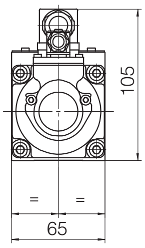
① = Air bleeding

DLKZOR-T

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3





① = Air bleeding

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

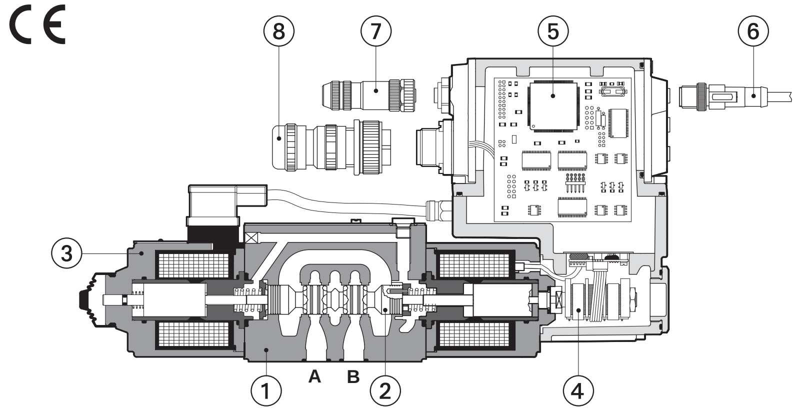
13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS330**	Z-BM-TEZ digital axis card
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-TEB digital driver	**GS510**	Fieldbus
GS235	E-BM-TID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-TES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital servoproportional directional valves

direct, with on-board driver, LVDT transducer and zero spool overlap

CE



DKZOR-TES-SN-BC-170

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DHZO-TEB, DHZO-TES
DKZOR-TEB, DKZOR-TES

Digital servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for position closed loop controls. The double solenoid construction involves larger flows and central safety rest position.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which also includes optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital TEZ version (see tech. table FS620) integrates on-board driver and axis card, while TEB and TES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZO	-	TES	-	SN	-	NP	-	0	70	-	L	5	/	*	*	/	*

Servoproportional directional valves, direct
DHZO = size 06
DKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

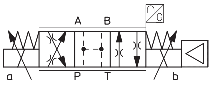
Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

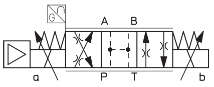
Valve size ISO 4401: **0** = 06 **1** = 10

Configuration:

Standard Option **/B**

70 =





Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Safety options TÜV certified - only **TES (2)**:
U = safe double power supply
K = safe on/off signals
See section 7

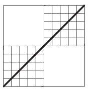
SAFETY CERTIFIED

Spool size:		**3** (L)	**5** (L,D)
DHZO	=	17	28
DKZOR	=	45	75

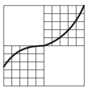
Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L = linear



D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) Only in version **SN-NP**
(2) For possible combined options, see section 15
(3) Double power supply only for **TES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

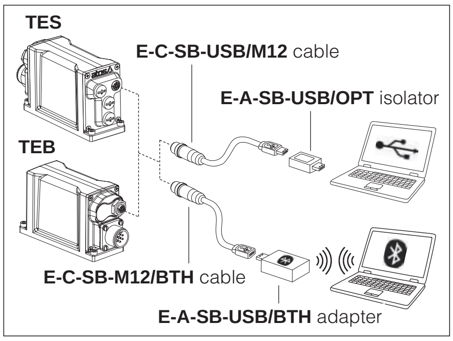
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for TES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table FS620

Digital servoproportional with integral electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated P/Q control to the basic position ones.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.
They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

SAFETY CERTIFIED

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZO			DKZOR		
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10			ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10		
Spool type	**L3**	**L5**	**D5**	**L3**	**L5**	**D5**
Nominal flow Δp P-T [l/min] **(1)** Δp= 10 bar	18	28	28	45	75	75
Δp= 30 bar	30	50	50	80	130	130
Δp= 70 bar	45	75	75	120	170	170
Max permissible flow **(2)**	50	80	80	130	180	180
Leakage [cm³/min]	<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time **(3)** [ms]	≤ 15			≤ 20		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatibility	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) See detailed diagrams in section 12.3
(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A			
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω **DKZOR** = 3,8 ÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

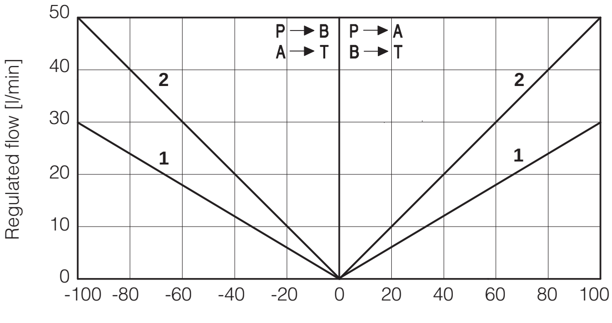
11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

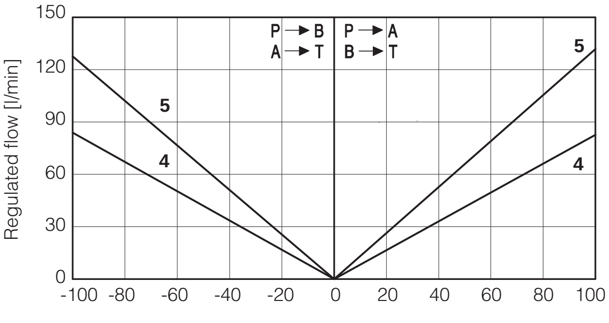
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

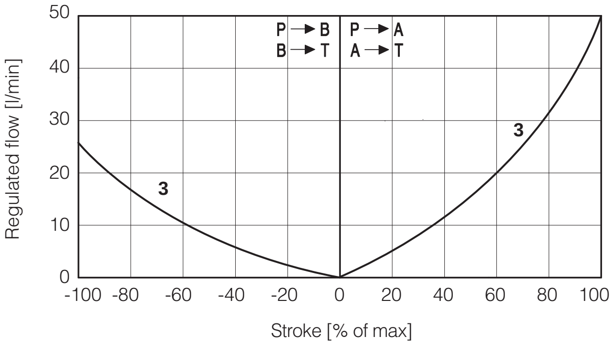
12.1 Regulation diagrams (values measure at Δp 30 bar P-T)



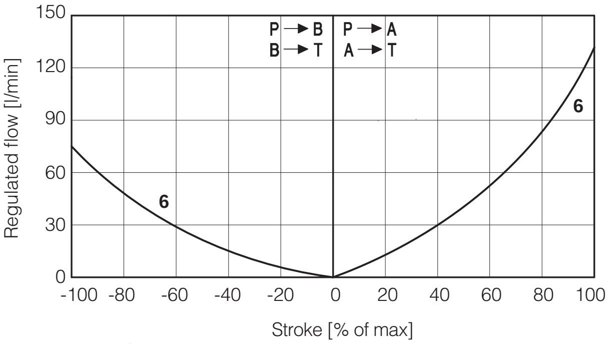
DHZO
1 = L3 **2** = L5



DKZOR
4 = L3 **5** = L5



DHZO
3 = D5



DKZOR
6 = D5

Note:
Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

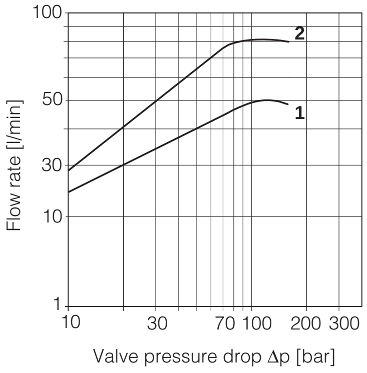
Reference signal $\left.\begin{matrix}0 \div +10\ \text{V}\\ 12 \div 20\ \text{mA}\end{matrix}\right\}$ P → A / B → T   Reference signal $\left.\begin{matrix}0 \div -10\ \text{V}\\ 12 \div 4\ \text{mA}\end{matrix}\right\}$ P → B / A → T

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

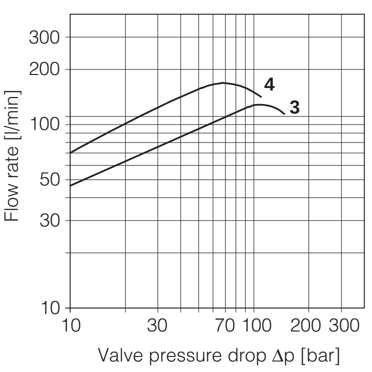
DHZO
1 = spool L3,
2 = spool L5, D5

DKZOR
3 = spool L3
4 = spool L5, D5

DHZO



DKZOR



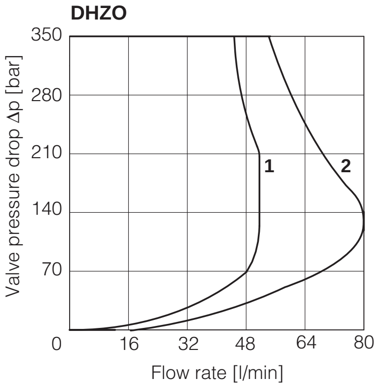
12.3 Operating limits

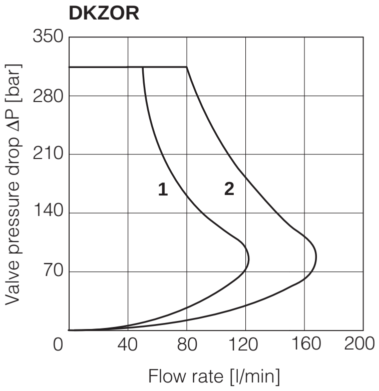
DHZO

1 = spool L3
2 = spool L5, D5

DKZOR

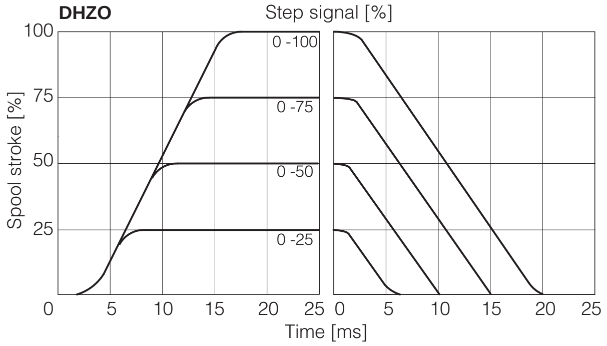
3 = spool L3
4 = spool L5, D5

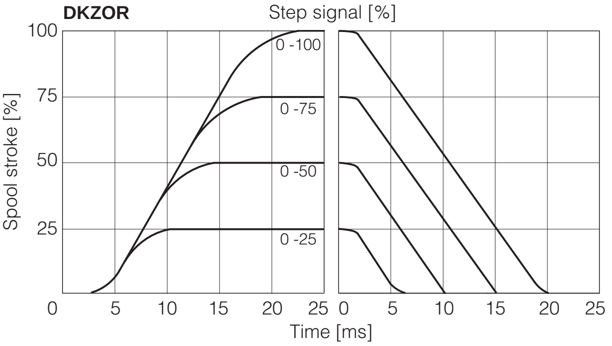




12.4 Response time

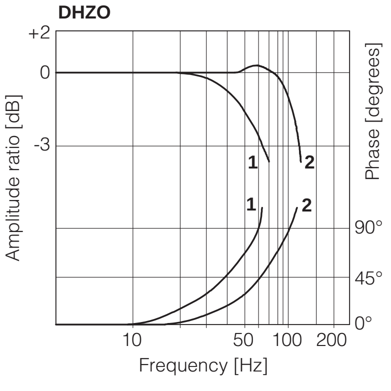
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

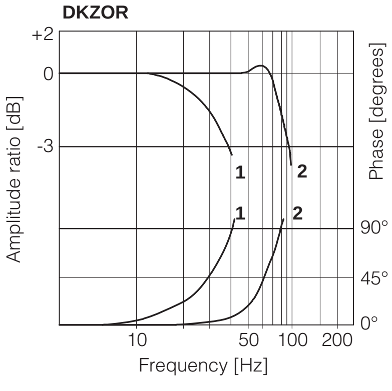




12.5 Bode diagrams

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





13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 17.8)
Power supply for driver's logics and communication - only for **TES** (see 17.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:
/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY, /IQ, /IQY,
/IY, /IYZ, /IZ,
/QY, /YZ

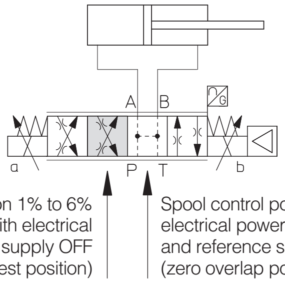
Standard versions for **TES-SP, SF, SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:
/BIU, /BIUY, /BU, /BUY,/IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

16 SAFETY REST POSITION - configuration 70

In absence of electric power supply (+24 VDC), the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.
The main spool moves to the closed loop control position (zero overlap) when the pilot pressure is activated, the valve is fed with power supply +24 VDC and reference input = 0V (or 12 mA for option /I) is applied to the driver.



Spool offset position 1% to 6% of total stroke with electrical power supply OFF (central safety rest position)

Spool control position with electrical power supply ON and reference signal = 0 (zero overlap position)

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and TES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL		TECHNICAL SPECIFICATIONS	NOTES
			Fieldbus	NP		
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors (B) - (C)

(B)	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2)	**BC fieldbus execution, connector - M12 - 5 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2)	**BP fieldbus execution, connector - M12 - 5 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2)	**EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

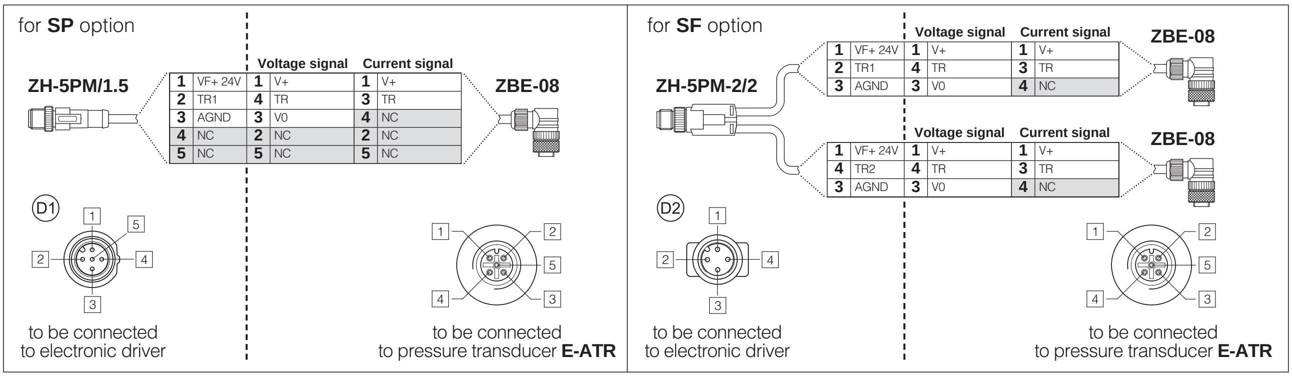
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) **SP, SL - Single transducer** (1)		(D2) **SF - Double transducers** (1)	
				Voltage	**Current**	**Voltage**	**Current**
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



for **SP** option

		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR1	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC
4	NC	**2**	NC	**2**	NC
5	NC	**5**	NC	**5**	NC

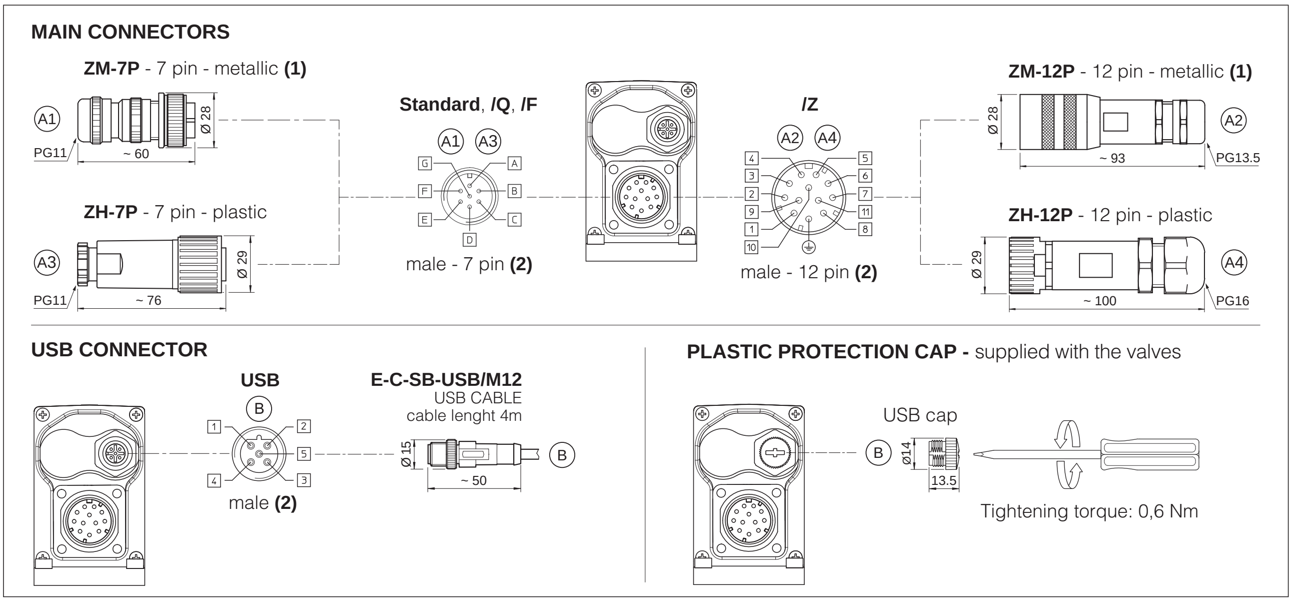
for **SF** option

		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR1	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC

		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
4	TR2	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC

Note: pin layout always referred to driver's view

18.5 TEB connections layout

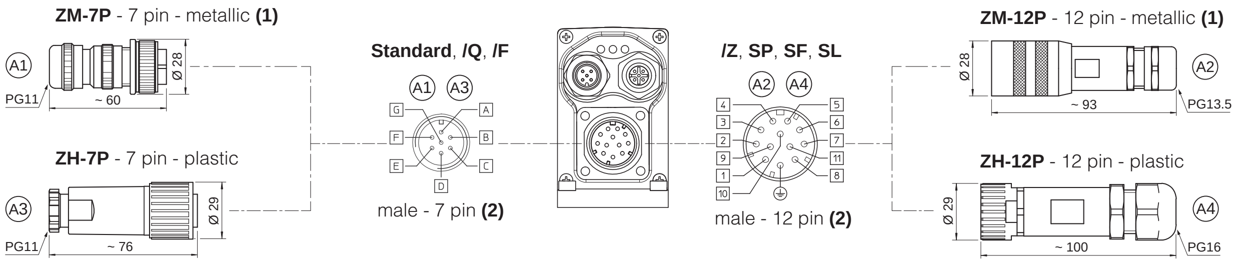


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

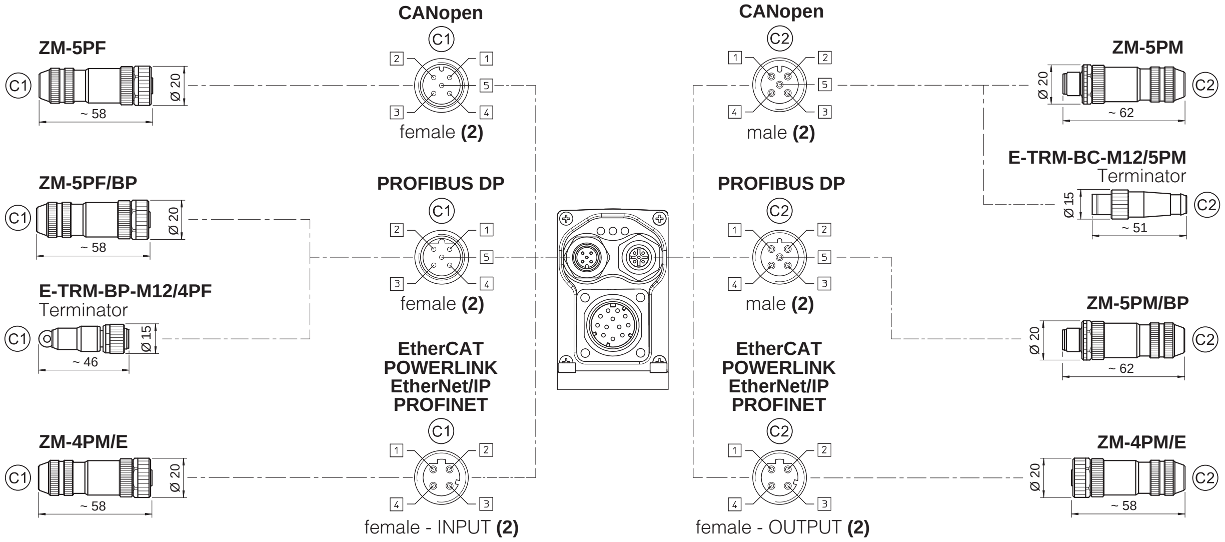
(2) Pin layout always referred to driver's view

18.6 TES connections layout

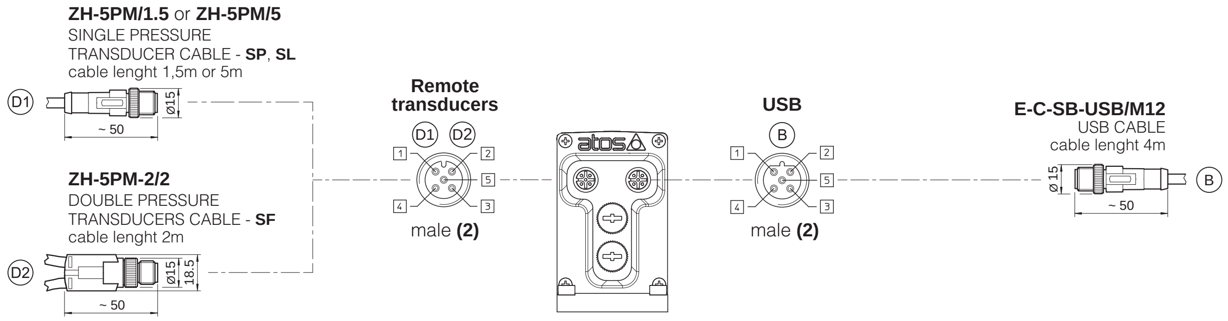
MAIN CONNECTORS



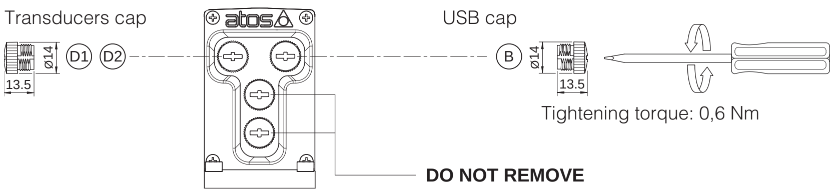
FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS



PLASTIC PROTECTION CAPS - supplied with the valves

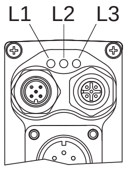


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for TES

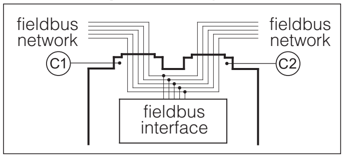
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

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 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - 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 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

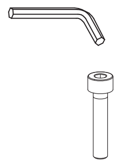
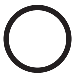
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	**SP, SL - Single transducer**		**SF - Double transducers**
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**	(D2) **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm^2		3 x 0,25 mm^2 (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

21 FASTENING BOLTS AND SEALS

	DHZO	**DKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

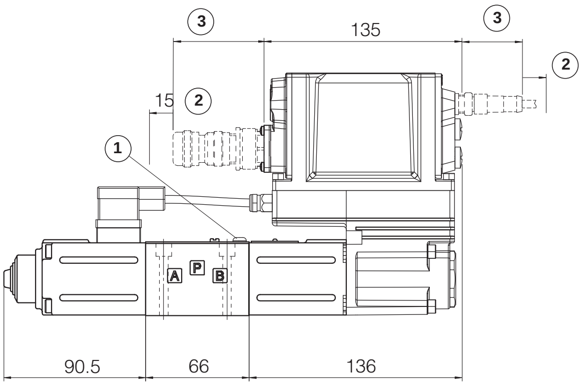
22 INSTALLATION DIMENSIONS [mm]

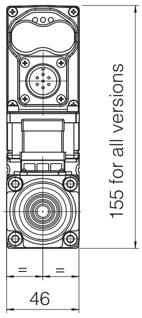
DHZO-TEB, DHZO-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO	3,1

DHZO-TEB-*-07
DHZO-TES-*-07





① = Air bleeding 3

② = Space to remove the connectors

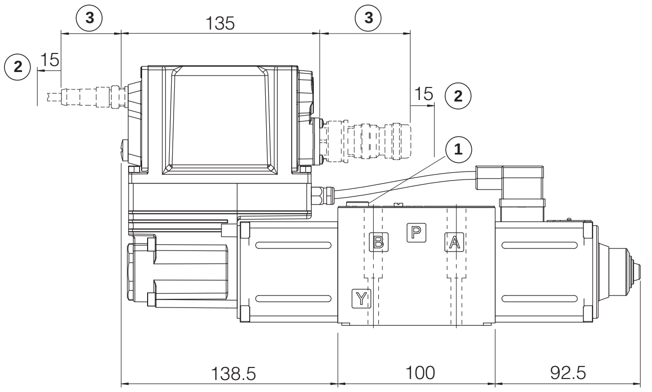
③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

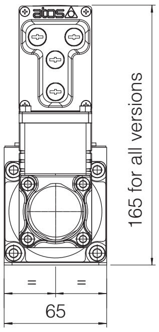
DKZOR-TEB, DKZOR-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR	5,0

DKZOR-TEB-*-17
DKZOR-TES-*-17





① = Air bleeding 4 13

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

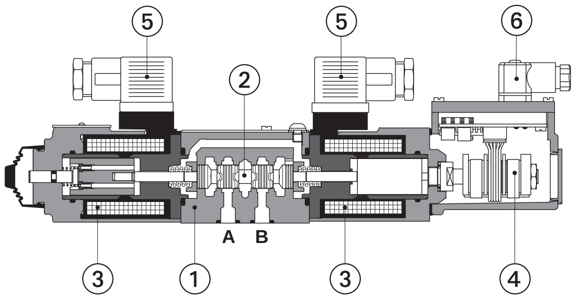
23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS500	Digital proportional valves with P/Q control	**K800**	Electric and electronic connectors
FS620	Digital proportional valves with integral axis controller	**P005**	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	**QB300**	Quickstart for TEB valves commissioning
FY100	Safety proportional valves - option /U	**QF300**	Quickstart for TES valves commissioning
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		

Servoproportional directional valves

direct, with LVDT transducer and zero spool overlap

CE



DHZO-T-070

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ Solenoid connector
⑥ Transducer connector

DHZO-T, DKZOR-T

Servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for best performances in any position closed loop.

The valves operate in association with digital off-board divers or axis card, see section 2.

The LVDT transducer grants very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:
L = linear
D = differential-progressive, for control of actuators with area ratio 1:2

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZO - T - 0 70 - L 5 / * * / *

DHZO = size 06
DKZOR = size 10

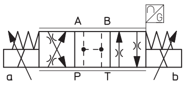
T = with LVDT transducer

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

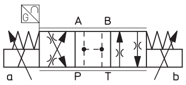
Configuration:

Standard

70 =

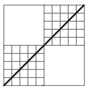


Option **/B**

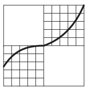


Spool type, regulating characteristics:

L = linear



D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid and LVDT transducer at side of port A
Y = external drain

Spool size:		**3** (L)	**5** (L,D)
DHZO	=	17	28
DKZOR	=	45	75

Nominal flow (l/min) at Δp 10bar P-T

(1) Possible combined options: /BY

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TID	E-BM-TES	Z-BM-TEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DHZO**			**DKZOR**		
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10			ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10		
Spool type	**L3**	**L5**	**D5**	**L3**	**L5**	**D5**
Nominal flow Δp P-T [l/min] **(1)** Δp= 10 bar	18	28	28	45	75	75
Δp= 30 bar	30	50	50	80	130	130
Δp= 70 bar	45	75	75	120	170	170
Max permissible flow **(2)**	50	80	80	130	180	180
Leakage [cm^3/min]	<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time **(3)** [ms]	≤ 15			≤ 20		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatibility	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2
(2) See detailed diagrams in section 7.3
(3) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	**DLHZO** = 2,6 A **DLKZOR** = 3 A
Coil resistance R at 20°C	**DLHZO** = 3 ÷ 3,3 Ω **DLKZOR** = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

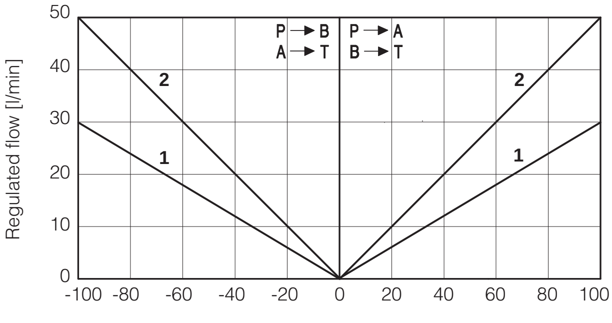
6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

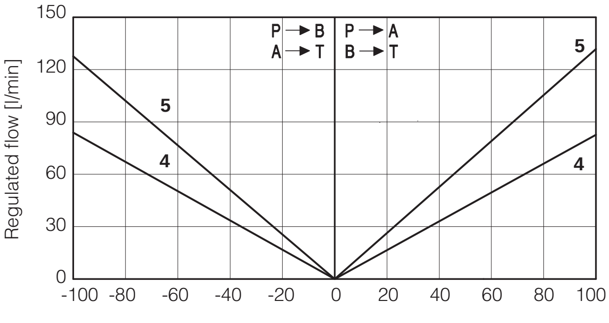
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

7 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

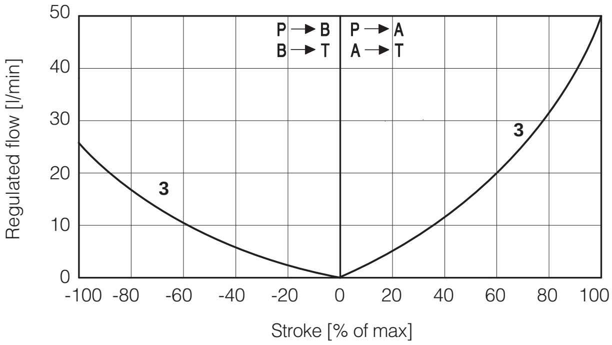
7.1 Regulation diagrams (values measure at Δp 30 bar P-T)



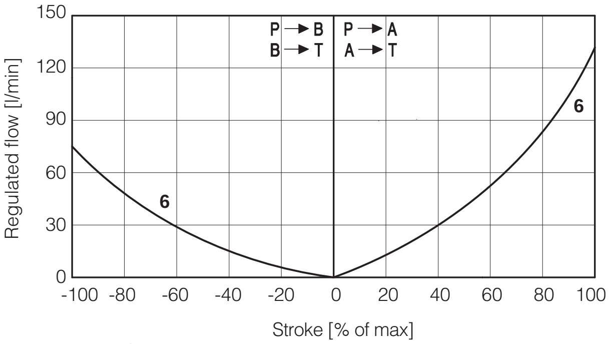
DHZO
1 = L3 **2** = L5



DKZOR
4 = L3 **5** = L5



DHZO
3 = D5



DKZOR
6 = D5

Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

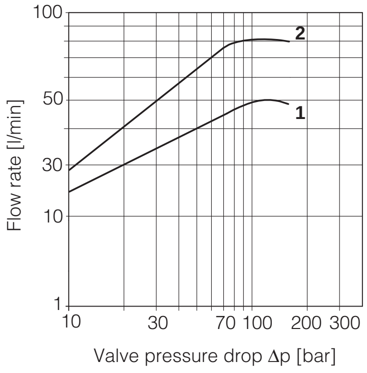
Reference signal $\left.\begin{matrix}0 \div +10\ V\\ 12 \div 20\ mA\end{matrix}\right\}$ P → A / B → T Reference signal $\left.\begin{matrix}0 \div -10\ V\\ 12 \div 4\ mA\end{matrix}\right\}$ P → B / A → T

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

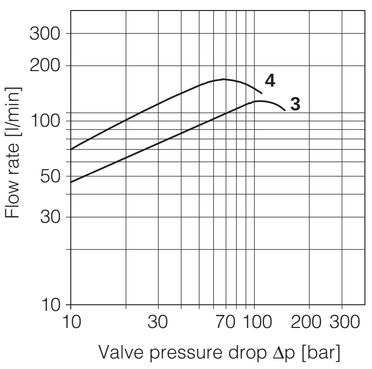
DHZO
1 = spool L3,
2 = spool L5, D5

DKZOR
3 = spool L3
4 = spool L5, D5

DHZO



DKZOR

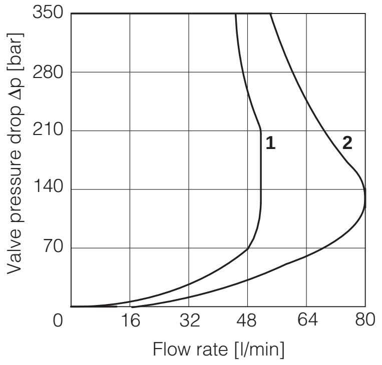


7.3 Operating limits

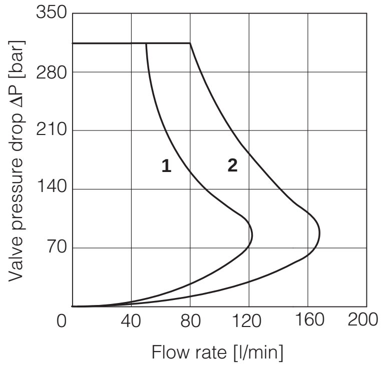
DHZO
1 = spool L3
2 = spool L5, D5

DKZOR
3 = spool L3
4 = spool L5, D5

DHZO

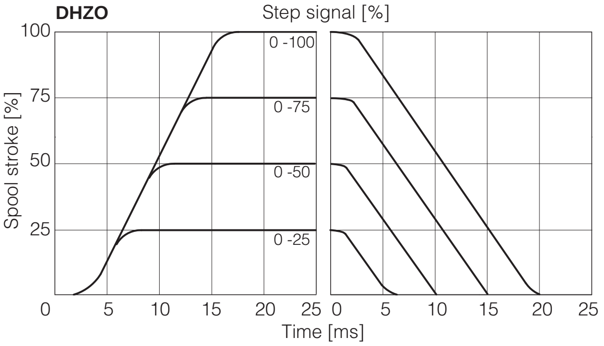


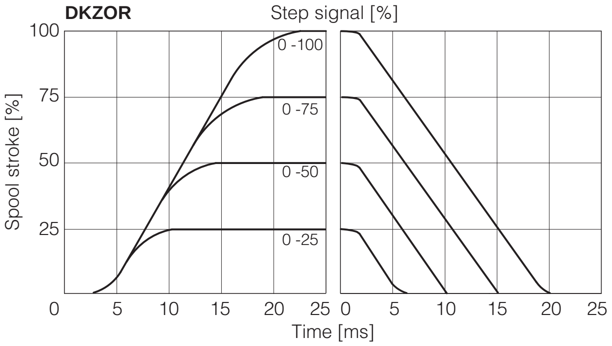
DKZOR



7.4 Response time

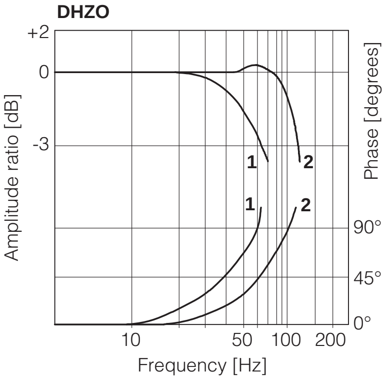
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

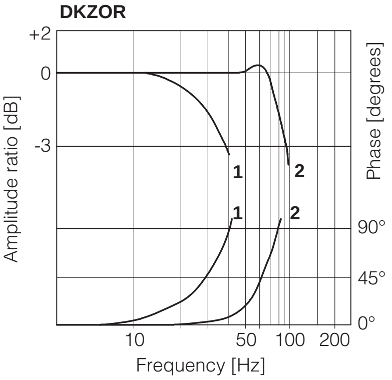




7.5 Bode diagrams

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





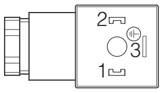
8 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1

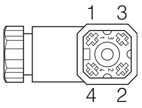
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

9 ELECTRICAL CONNECTION

9.1 Solenoid connector - supplied with the valve

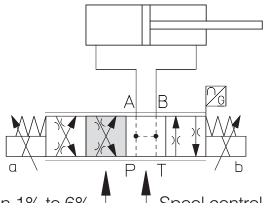
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

9.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

10 SAFETY REST POSITION - configuration 70

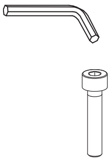
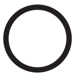
In absence of power supply to the solenoids, the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration. This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



Spool offset position 1% to 6% of total stroke with electrical power supply OFF (central safety rest position)

Spool control position with electrical power supply ON and reference signal = 0 (zero overlap position)

11 FASTENING BOLTS AND SEALS

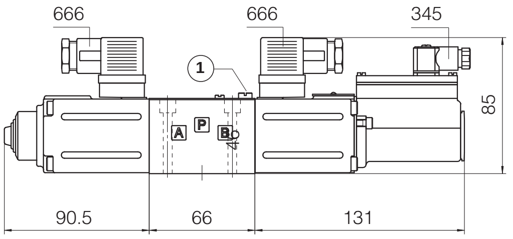
	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

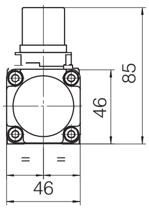
12 INSTALLATION DIMENSIONS [mm]

DHZO-T

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO-T-07	2,6



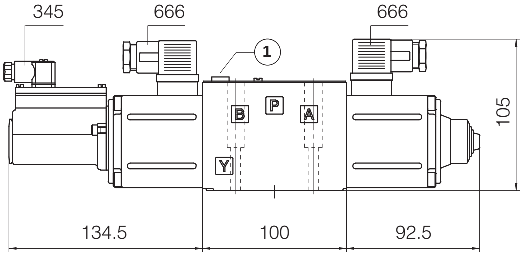


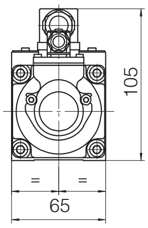
① = Air bleeding

DKZOR-T

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR-T-17	4,5





① = Air bleeding

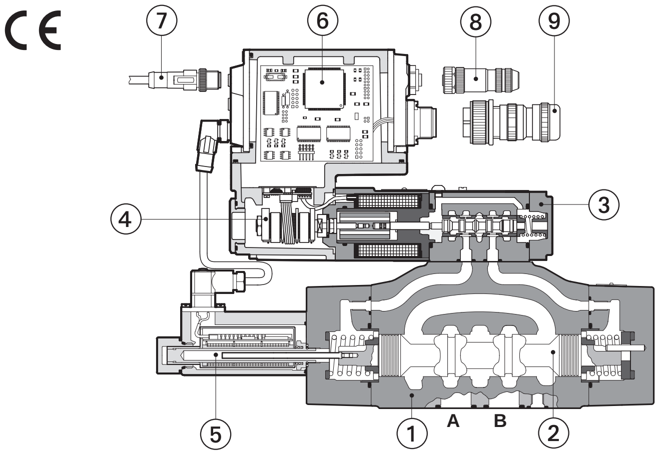
Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS330**	Z-BM-TEZ digital axis card
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-TEB digital driver	**GS510**	Fieldbus
GS235	E-BM-TID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-TES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital servoproportional directional valves

piloted, with on-board driver, two LVDT transducers and zero spool overlap



DPZO-LES-SN-BP-270

① Valve body	④ Pilot valve LVDT transducer	⑦ USB connector
② Main stage Spool	⑤ Main stage LVDT transducer	⑧ Fieldbus connectors
③ Pilot valve	⑥ On-board digital driver	⑨ Main connector

DPZO-LEB, DPZO-LES

Digital servoproportional directional valves, piloted, with two LVDT position transducer and zero spool overlap for position closed loop controls.

LEB basic execution with analog reference signals and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital LEZ version (see tech. table FS630) integrates on-board driver and axis card, while LEB and LES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

Size: **10** ÷ **35** - ISO 4401
Max flow: **180** ÷ **3500 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPZO	-	LES	-	SN	-	NP	-	2	70	-	L	5	/	*	*	/	*

Servoproportional directional valve, piloted

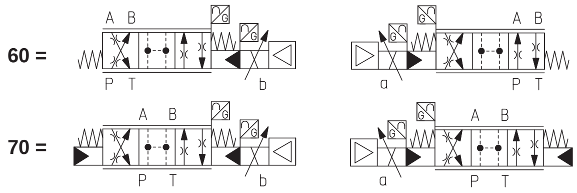
LEB = basic on-board digital driver **(1)**
LES = full on-board digital driver

Alternated P/Q controls, see section 5 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

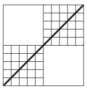
Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

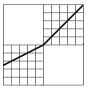
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

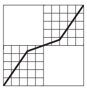
Configuration:



Spool type, regulating characteristics:

L =

linear

DL =

differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

T =

non linear **(2)**

Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (3):
B = solenoid with on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options (3):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **LES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(4)**

Safety options TÜV certified - only **LES (3)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Spool size:	**3** (L)	**5** (L,DL)	**5** (L)	**5** (T)
DPZO-1 =	-	100	-	-
DPZO-2 =	160	250	-	190
DPZO-4 =	-	480	-	-
DPZO-4M =	-	550	-	-
DPZO-6 =	-	-	640	-
DPZO-8 =	-	-	1200	-

Nominal flow (l/min) at Δp 10bar P-T

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(1) Only in version **SN-NP**
(2) Only for DPZO-*-270
(3) For possible combined options, see section 15
(4) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

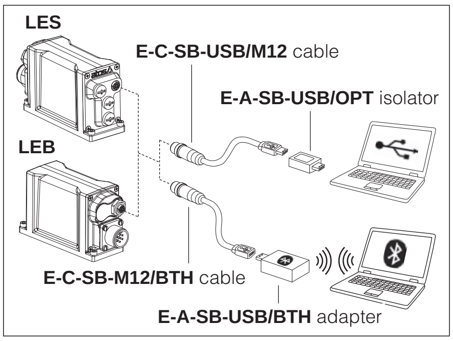
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table FS630

Digital servoproportional with integral electronics **LEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated P/Q control to the basic position ones.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for LES

SAFETY CERTIFIED

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.
They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-*-1	DPZO-*-2			DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;							
Spool type		**L5, DL5**	**L3**	**L5, DL5**	**T5**	**L5, DL5**		**L5**	
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	100	160	250	190	480	550	640	1200
	Δp= 30 bar	160	270	430	330	830	950	1100	2000
Max permissible flow	[l/min]	180	400	550	550	1000	1100	1600	3500
Piloting pressure	[bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)							
Piloting volume	[cm^3/min]	1,4	3,7			9	11,3	21,6	39,8
Piloting flow **(2)**	[l/min]	3,5	9			18	20	19	24
Leakage **(3)**	Pilot [cm^3/min]	100 / 300	150 / 450			200 / 600	200 / 600	900 / 2800	900 / 2800
	Main stage [l/min]	0,4 / 1,2	0,6 / 2,5			1,0 / 4,0	1,0 / 4,0	3,0 / 9,0	6,0 / 20
Response time **(4)**	[ms]	≤ 25	≤ 25			≤ 30	≤ 35	≤ 80	≤ 100
Hysteresis		≤ 0,1 [%of max regulation]							
Repeatability		± 0,1 [%of max regulation]							
Thermal drift		zero point displacement < 1% at ΔT = 40°C							

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2

(2) With step reference input signal 0 ÷100 %

(3) At p = 100/350 bar

(4) 0-100% step signal, see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

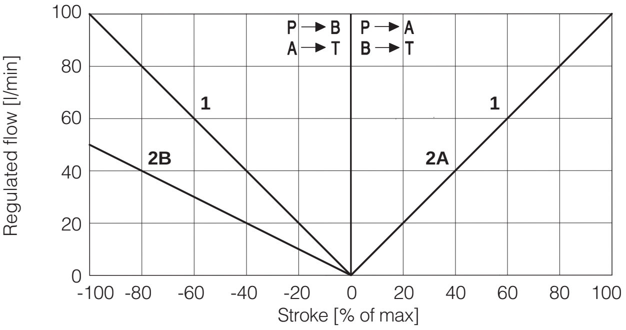
11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

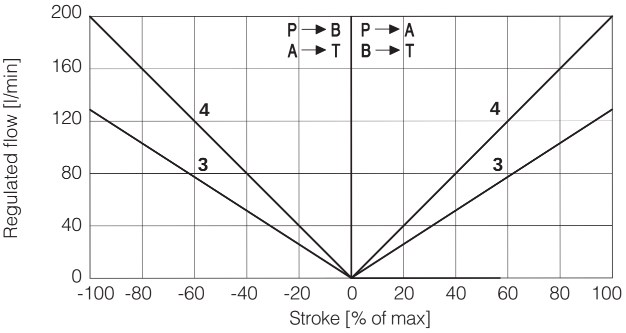
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

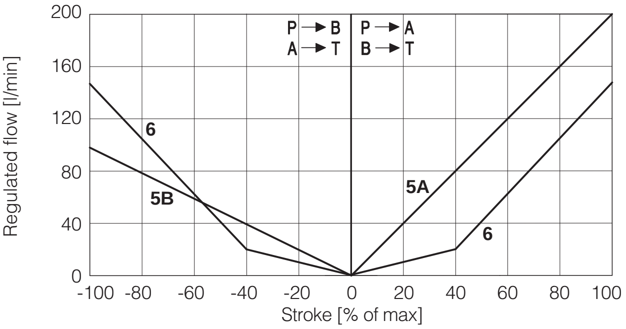
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



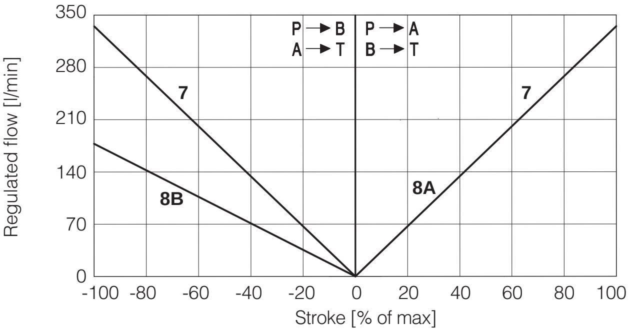
DPZO-1: **1** = L5 **2A** = DL5 (P → A, A → T)
2B = DL5 (P → B, B → T)



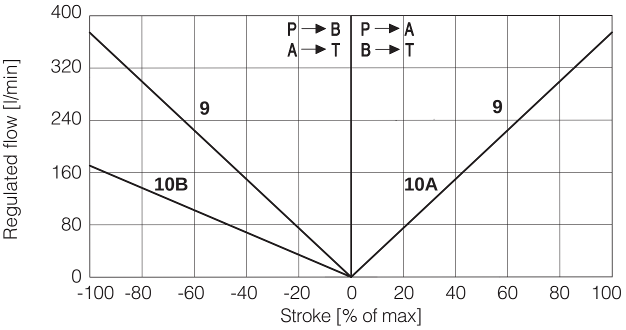
DPZO-2: **3** = L3 **4** = L5



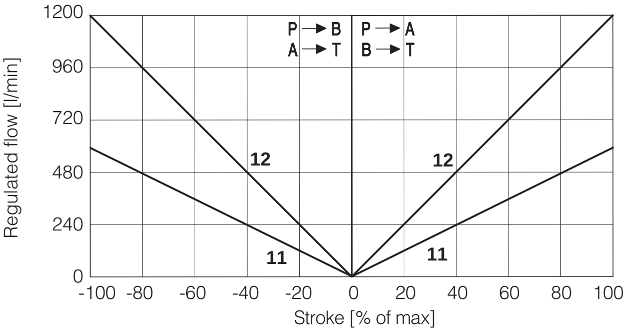
DPZO-2: **5A** = DL5 (P → A, A → T) **6** = T5
5B = DL5 (P → B, B → T)



DPZO-4: **7** = L5 **8A** = DL5 (P → A, A → T)
8B = DL5 (P → B, B → T)

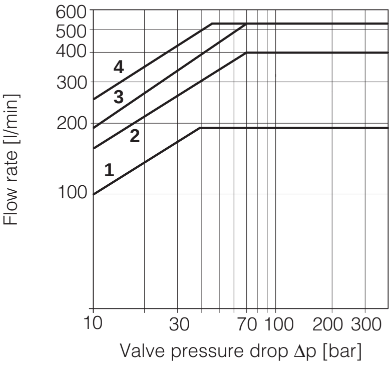


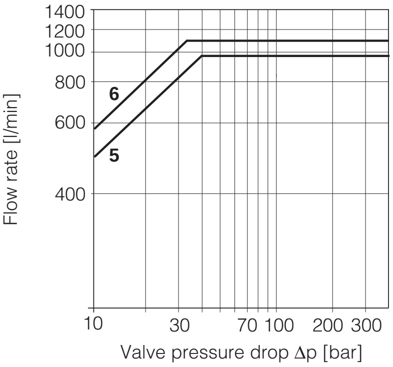
DPZO-4M: **9** = L5 **10A** = DL5 (P → A, A → T)
10B = DL5 (P → B, B → T)

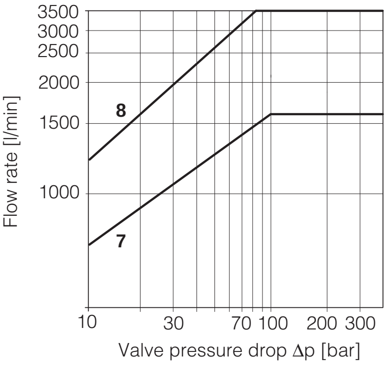


DPZO-6: **11** = L5
DPZO-8: **12** = L5

12.2 Flow /Δp diagram - stated at 100% of spool stroke







DPZO-1:
1 = spools L5, DL5
DPZO-2:
2 = spools L3
3 = spool T5
4 = spools L5, DL5

DPZO-4:
5 = spools L5, DL5
DPZO-4M:
6 = spools L5, DL5

DPZO-6:
7 = L5
DPZO-8:
8 = L5

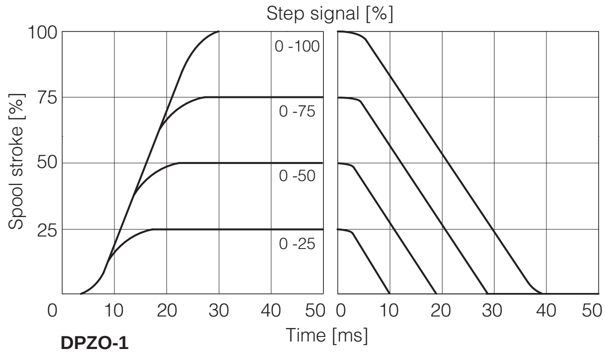
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

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

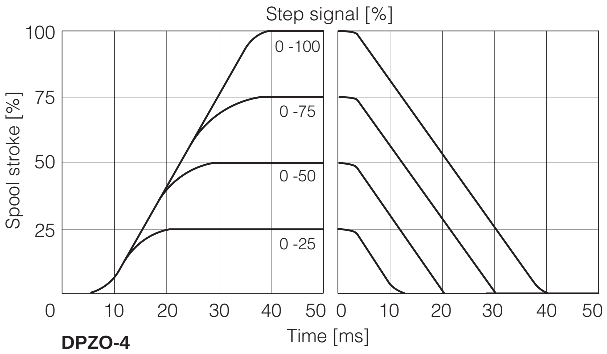
Reference signal 0 ÷-10 V
4 ÷12 mA } P → B / A → T

12.3 Response time

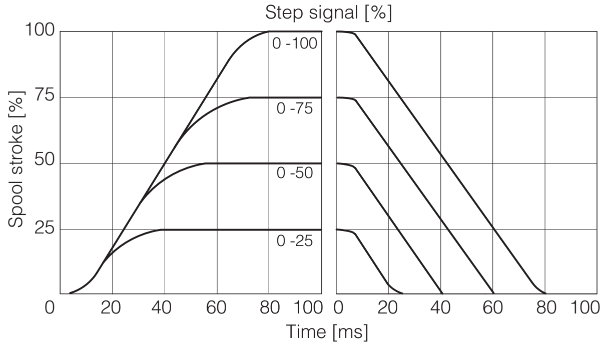
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



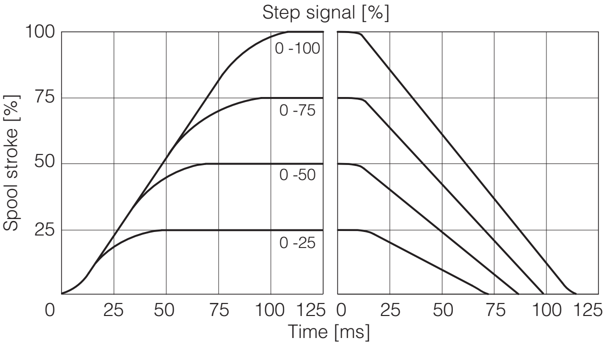
DPZO-1
DPZO-2



DPZO-4
DPZO-4M



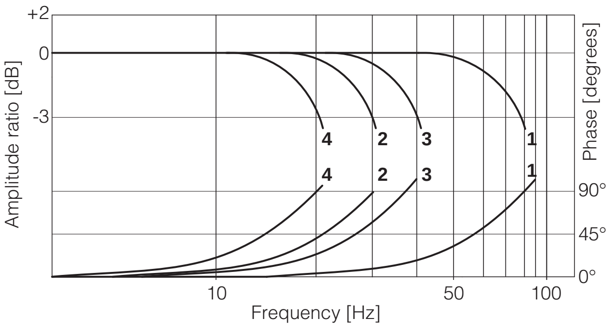
DPZO-6

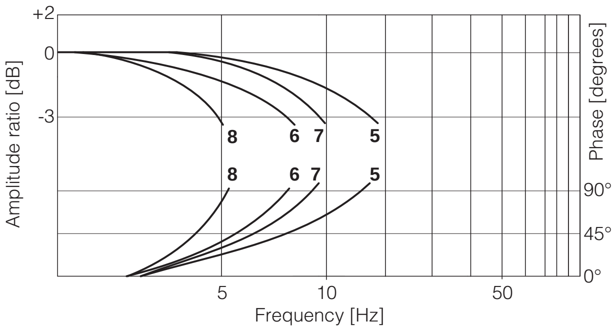


DPZO-8

12.4 Bode diagrams

Stated at nominal hydraulic conditions.





1 = DPZO-1 DPZO-2 } ± 5%

2 = DPZO-1 DPZO-2 } ± 100%

3 = DPZO-4 DPZO-4M } ± 5%

4 = DPZO-4 DPZO-4M } ± 100%

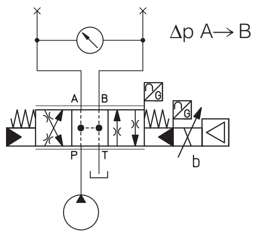
5 = DPZO-6 ± 5%

6 = DPZO-6 ± 100%

7 = DPZO-8 ± 5%

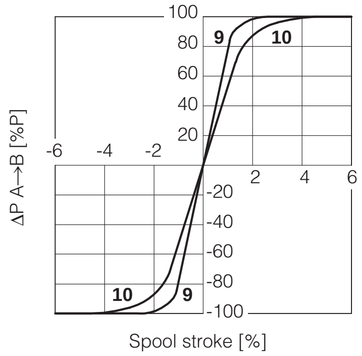
8 = DPZO-8 ± 100%

12.5 Pressure gain



9 = DPZO-1

10 = DPZO-2
DPZO-4
DPZO-4M
DPZO-6
DPZO-8



13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 21
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 21
The valve's standard configuration provides internal pilot and external drain.

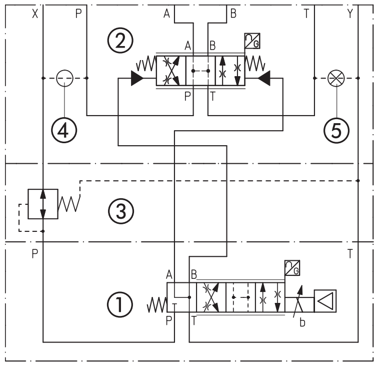
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-2, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 70



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 17.8)
Power supply for driver's logics and communication - only for **LES** (see 17.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:

LEB-SN, **LES-SN**
/FI, /IQ, /IZ

LES-SP, SF, SL
/CI

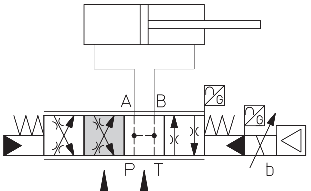
Electronics options - Safety certified versions:

LES-SN
/IU, /IK

LES-SP, SF, SL
/CU, /IU, /CIU, /CK, /IK, /CIK

16 SAFETY REST POSITION - configuration 70

In absence of electric power supply (+24 VDC), the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.
The main spool moves to the closed loop control position (zero overlap) when the pilot pressure is activated, the valve is fed with power supply +24 VDC and reference input = 0V (or 12 mA for option /I) is applied to the driver.



Spool offset position 1% to 6% of total stroke with electrical power supply OFF (central safety rest position)

Spool control position with electrical power supply ON and reference signal = 0 (zero overlap position)

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and TES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option and LES-SP, SF, SL

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SF, SL		TECHNICAL SPECIFICATIONS	NOTES
			Fieldbus	NP		
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors Ⓑ - Ⓒ

Ⓑ **USB connector - M12 - 5 pin** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

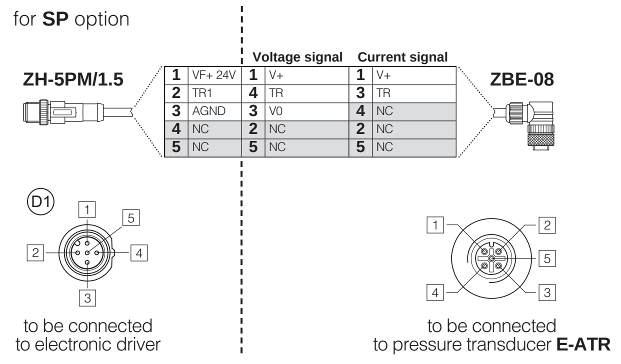
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL Ⓓ

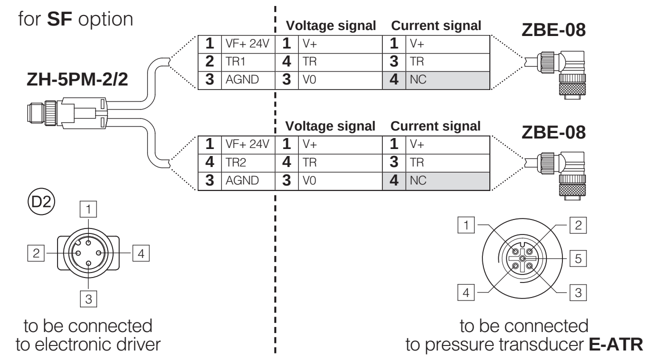
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Ⓓ1 SP, SL - Single transducer (1)		Ⓓ2 SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example


for **SP** option
ZH-5PM/1.5
ZBE-08
D1
1
2
3
4
5
to be connected to electronic driver
to be connected to pressure transducer **E-ATR**

		Voltage signal		Current signal	
1	VF+ 24V	1	V+	1	V+
2	TR1	4	TR	3	TR
3	AGND	3	V0	4	NC
4	NC	2	NC	2	NC
5	NC	5	NC	5	NC


for **SF** option
ZH-5PM-2/2
ZBE-08
ZBE-08
D2
1
2
3
4
5
to be connected to electronic driver
to be connected to pressure transducer **E-ATR**

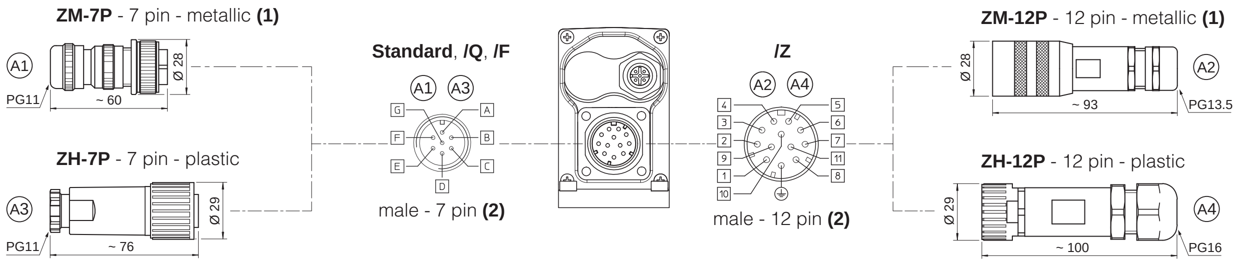
		Voltage signal		Current signal	
1	VF+ 24V	1	V+	1	V+
2	TR1	4	TR	3	TR
3	AGND	3	V0	4	NC

		Voltage signal		Current signal	
1	VF+ 24V	1	V+	1	V+
4	TR2	4	TR	3	TR
3	AGND	3	V0	4	NC

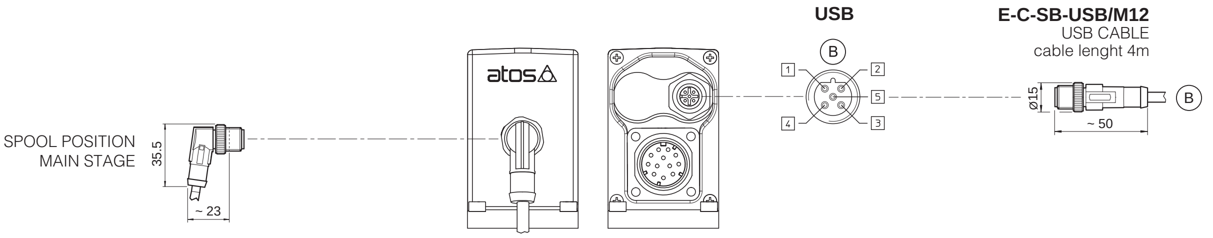
Note: pin layout always referred to driver's view

18.5 LEB connections layout

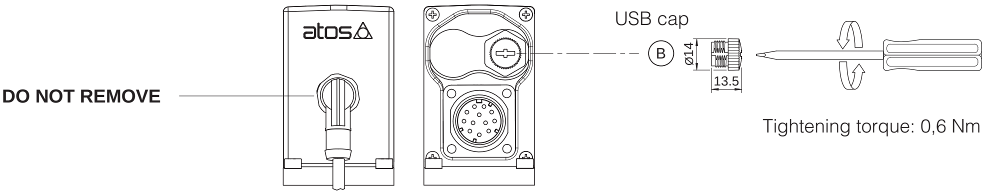
MAIN CONNECTORS


ZM-7P - 7 pin - metallic **(1)**
A1
Ø 28
PG11
~ 60
ZH-7P - 7 pin - plastic
A3
Ø 29
PG11
~ 76
Standard, **/Q**, **/F**
A1
A3
G
A
F
B
E
C
D
male - 7 pin **(2)**
/Z
A2
A4
4
5
3
6
2
7
9
11
1
8
10
male - 12 pin **(2)**
ZM-12P - 12 pin - metallic **(1)**
Ø 28
A2
~ 93
PG13.5
ZH-12P - 12 pin - plastic
Ø 29
A4
~ 100
PG16

TRANSDUCER AND USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves

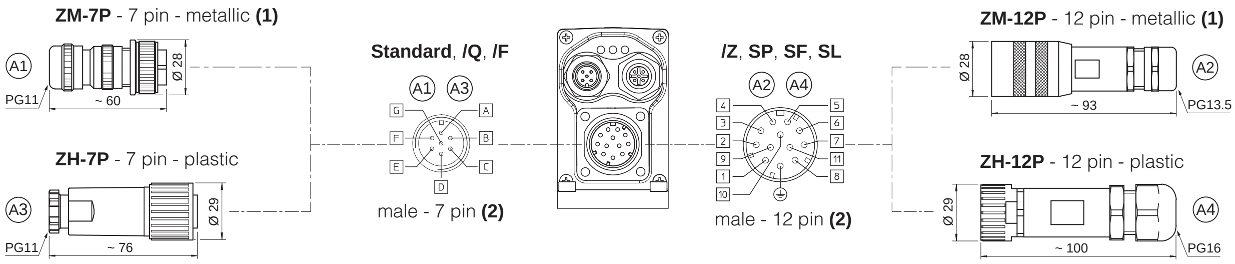


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

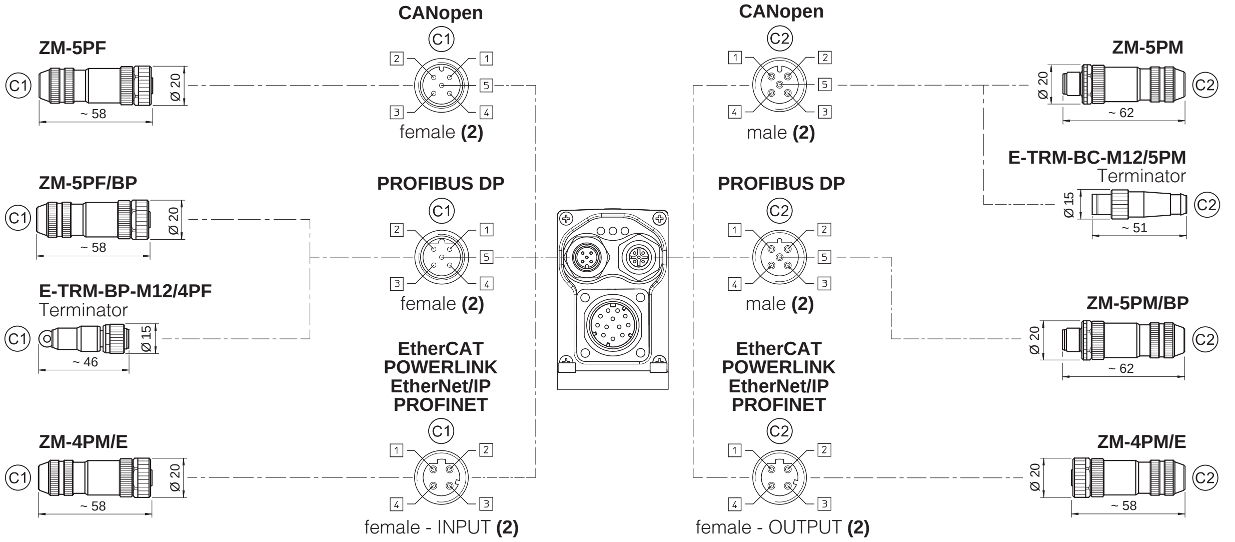
(2) Pin layout always referred to driver's view

18.6 LES connections layout

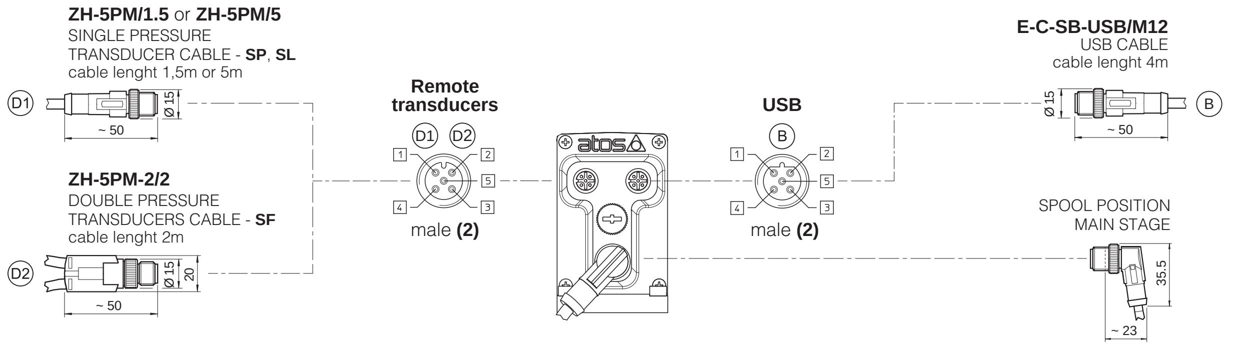
MAIN CONNECTORS



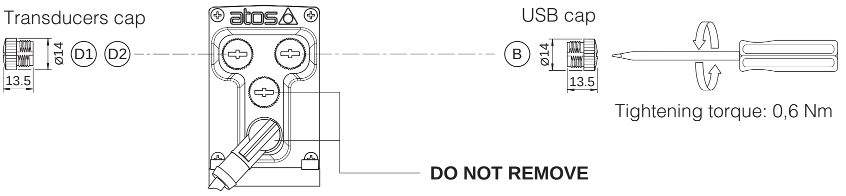
FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS



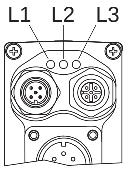
PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for LES

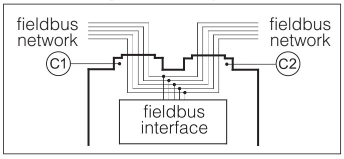
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	
L1	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 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - 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 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

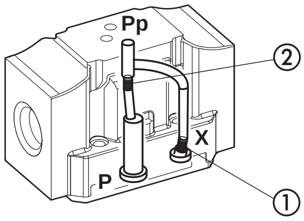
20.4 Pressure/Force transducer connectors - only for **SP, SF, SL**

CONNECTOR TYPE	**SP, SL - Single transducer**		**SF - Double transducers**
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**	(D2) **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm^2		3 x 0,25 mm^2 (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

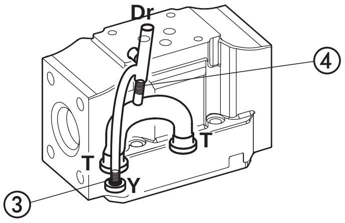
21 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels**

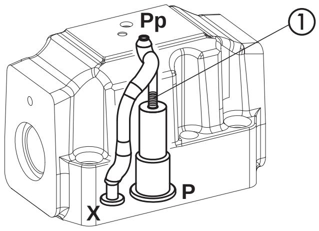


Drain channels

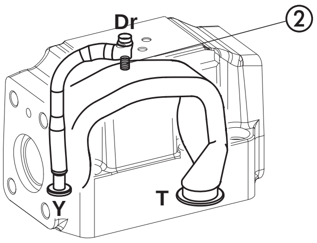


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels**

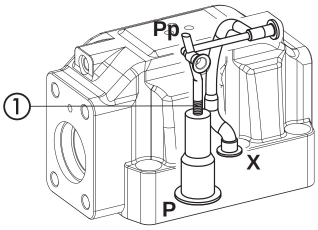


Drain channels

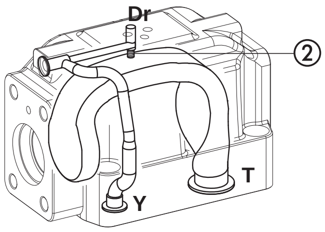


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels**

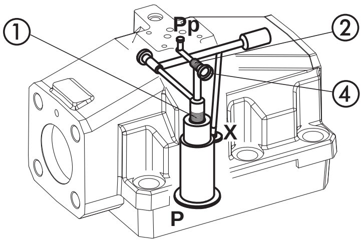


Drain channels

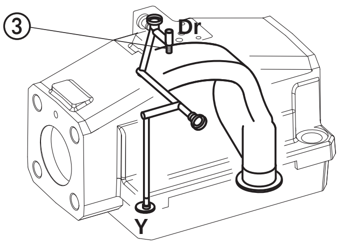


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels**

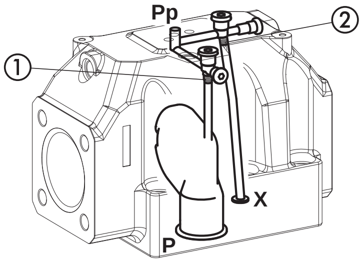


Drain channels

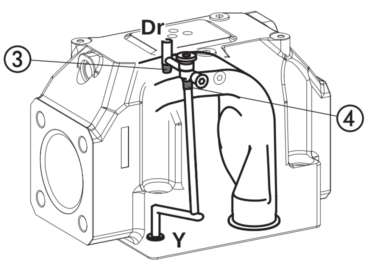


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 **Pilot channels**



Drain channels



Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

22 FASTENING BOLTS AND SEALS

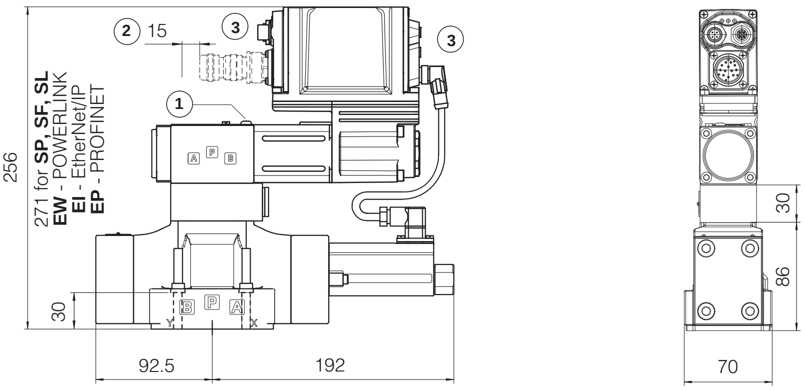
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

23 INSTALLATION DIMENSIONS [mm]

DPZO-LEB-*-1
DPZO-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-*-1	9,5



① = Air bleeding 3

② = Space to remove the connectors

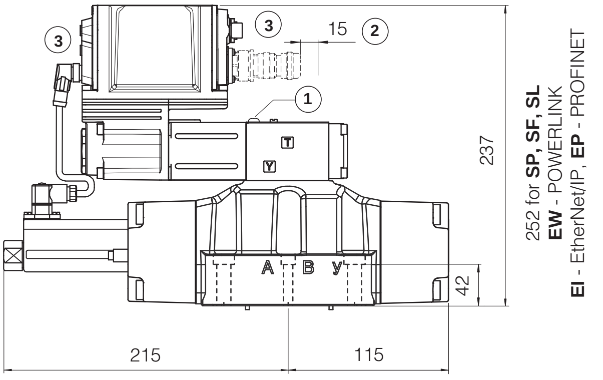
③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

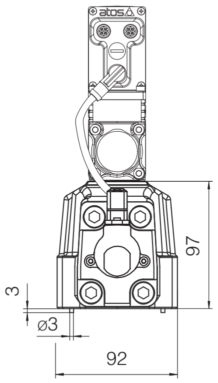
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-2
DPZO-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-*-2	14





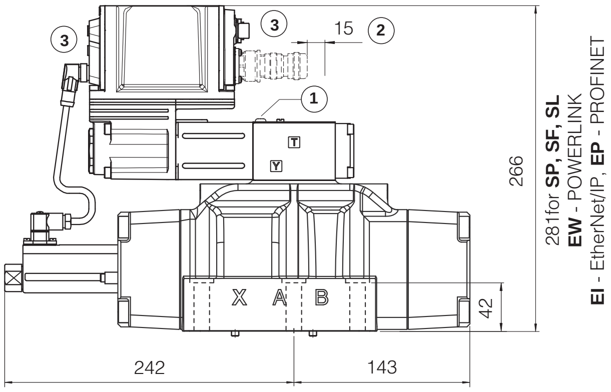
DPZO-LEB-*-4
DPZO-LES-*-4

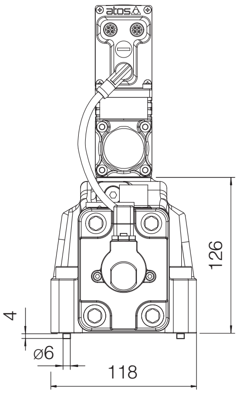
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-LEB-*-4M
DPZO-LES-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm

Mass [kg]	
DPZO-*-4	19





① = Air bleeding 3

② = Space to remove the connectors

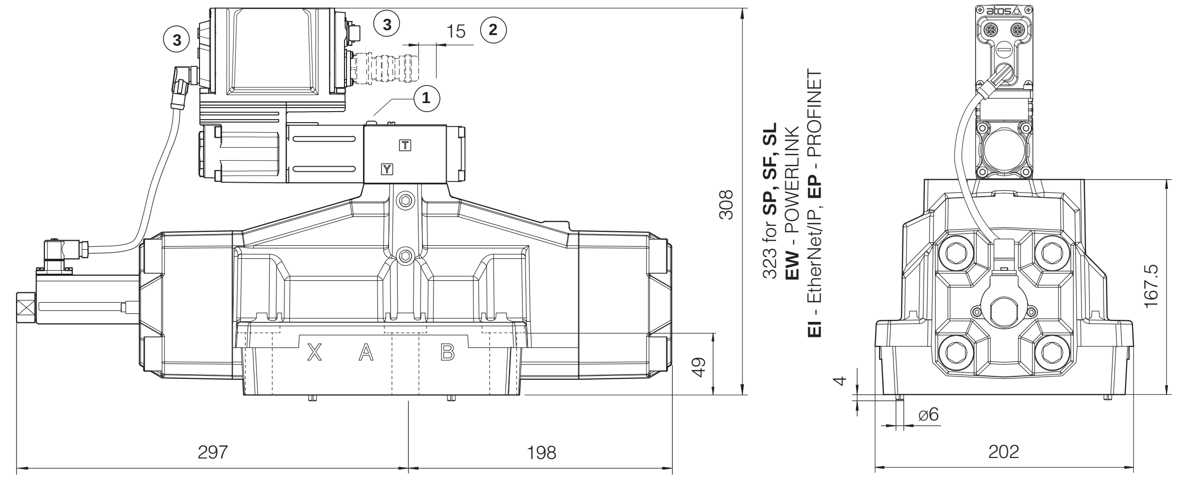
③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-6
DPZO-LES-*-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

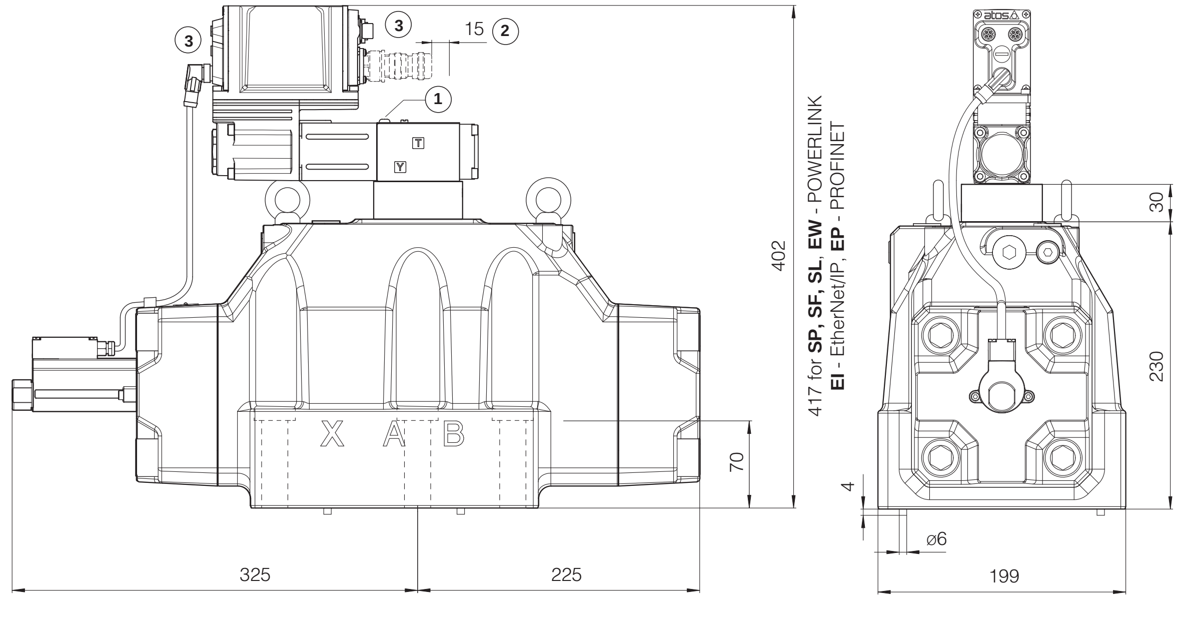
Mass [kg]	
DPZO-*-6	43



DPZO-LEB-*-8
DPZO-LES-*-8

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80


③
③
15 ②
①
T
Y
X A B
402
417 for **SP, SF, SL**, **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET
70
325
225
atos
30
230
4
ø6
199

① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

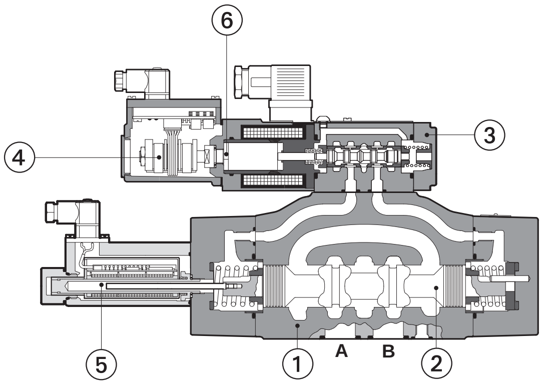
24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS630	Digital proportional valves with integral axis controller
FS900	Operating and maintenance information for proportional valves
FY100	Safety proportional valves - option /U
FY200	Safety proportional valves - option /K
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB320	Quickstart for LEB valves commissioning
QF320	Quickstart for LES valves commissioning
Y010	Basics for safety components

Servoproportional directional valves

piloted, with two LVDT transducers and zero spool overlap

CE



DPZO-L-270

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot valve LVDT transducer
⑤ Main stage LVDT transducer
⑥ Pilot valve solenoid

DPZO-L

Servoproportional directional valves, piloted, with two LVDT position transducer and zero spool overlap for position closed loop controls.

The valves operate in association with digital off-board divers or axis card, see section **2**.

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, full open position of the main stage spool is performed by configuration 60 or central position is performed by configuration 70, see section **10**.

Spools regulation characteristics:
L = linear
DL = differential-linear, for control of actuators with area ratio 1:2
T = non linear, for fine low flow control

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

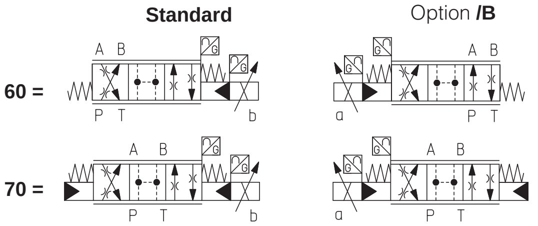
DPZO - **L** - **2** **70** - **L** **5** / ***** ***** / *****

Servoproportional directional valve, piloted

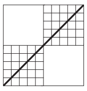
L = two LVDT transducers

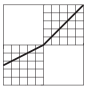
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32

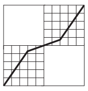
Configuration:



Spool type, regulating characteristics:

L =

linear

DL =

differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

T =

non linear **(2)**

Seals material,
see section **6** :
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Spool size:	**3** (L)	**5** (L,DL)	**5** (L)	**5** (T)
DPZO-1 =	-	100	-	-
DPZO-2 =	160	250	-	190
DPZO-4 =	-	480	-	-
DPZO-4M =	-	550	-	-
DPZO-6 =	-	-	640	-

Nominal flow (l/min) at Δp 10bar P-T

(1) All combination possible
(2) Only for DPZO-L-270

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LEB	E-BM-LID	E-BM-LES	Z-BM-LEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DPZO-L-1**	**DPZO-L-2**			**DPZO-L-4**	**DPZO-L-4M**	**DPZO-L-6**
Pressure limits [bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;						
Spool type	**L5, DL5**	**L3**	**L5, DL5**	**T5**	**L5, DL5**		**L5**
Nominal flow Δp P-T [l/min] **(1)** Δp= 10 bar	100	160	250	190	480	550	640
Δp= 30 bar	160	270	430	330	830	950	1100
Max permissible flow [l/min]	180	400	550	550	1000	1100	1600
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)						
Piloting volume [cm^3/min]	1,4	3,7			9	11,3	21,6
Piloting flow **(2)** [l/min]	3,5	9			18	20	19
Leakage **(3)** Pilot [cm^3/min]	100 / 300	150 / 450			200 / 600	200 / 600	900 / 2800
Main stage [l/min]	0,4 / 1,2	0,6 / 2,5			1,0 / 4,0	1,0 / 4,0	3,0 / 9,0
Response time **(4)** [ms]	≤ 25	≤ 25			≤ 30	≤ 35	≤ 80
Hysteresis	≤ 0,1 [%of max regulation]						
Repeatability	± 0,1 [%of max regulation]						
Thermal drift	zero point displacement < 1% at ΔT = 40°C						

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2

(2) With step reference input signal 0 ÷100 %

(3) At p = 100/350 bar

(4) 0-100% step signal, see detailed diagrams in section 7.3

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

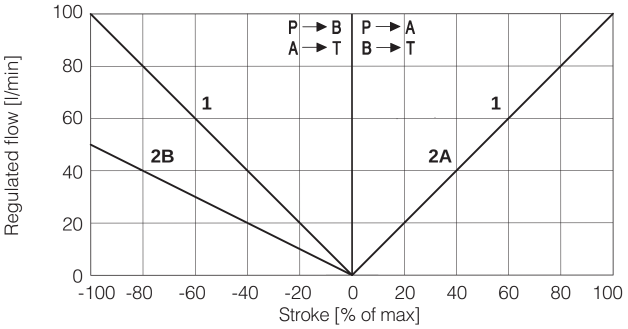
6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

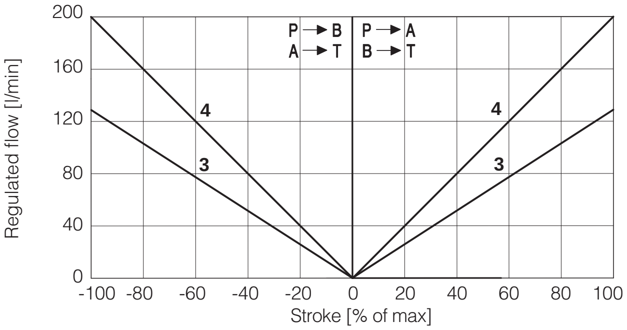
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

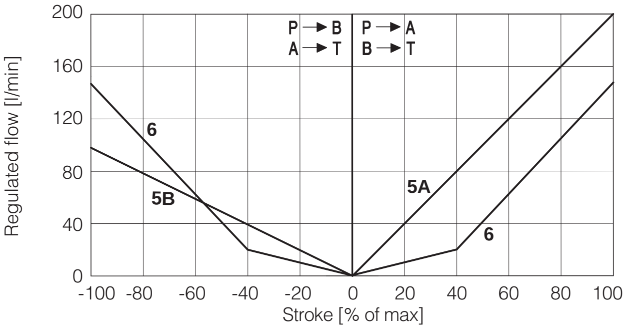
7.1 Regulation diagrams (values measure at Δp 10 bar P-T)



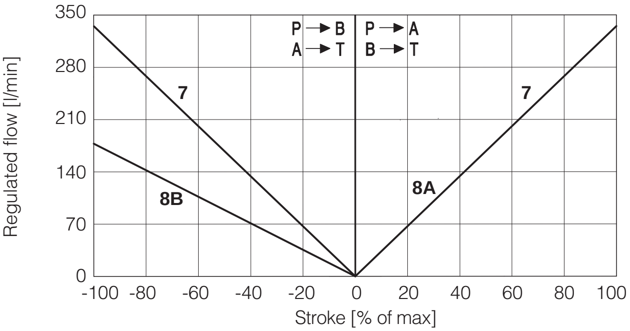
DPZO-1: **1** = L5 **2A** = DL5 (P → A, A → T)
2B = DL5 (P → B, B → T)



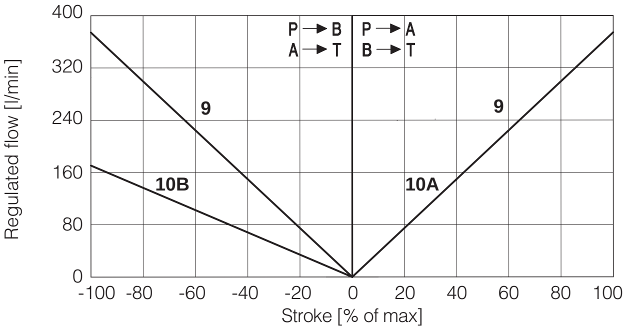
DPZO-2: **3** = L3 **4** = L5



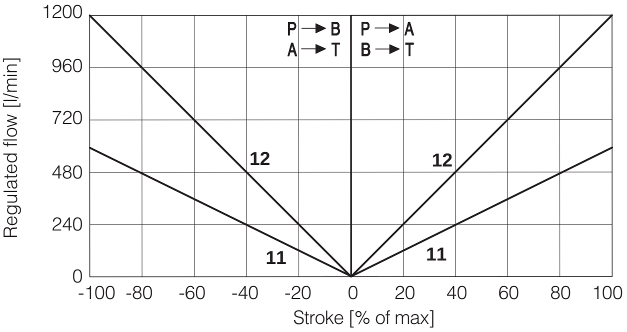
DPZO-2: **5A** = DL5 (P → A, A → T) **6** = T5
5B = DL5 (P → B, B → T)



DPZO-4: **7** = L5 **8A** = DL5 (P → A, A → T)
8B = DL5 (P → B, B → T)

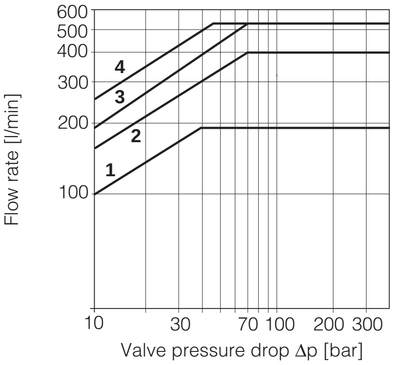


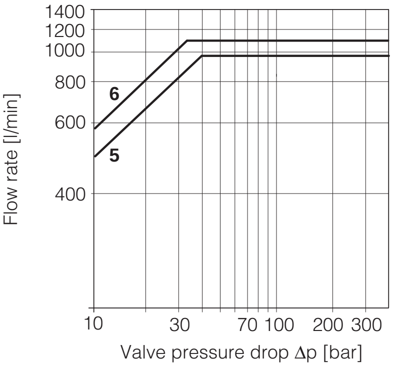
DPZO-4M: **9** = L5 **10A** = DL5 (P → A, A → T)
10B = DL5 (P → B, B → T)

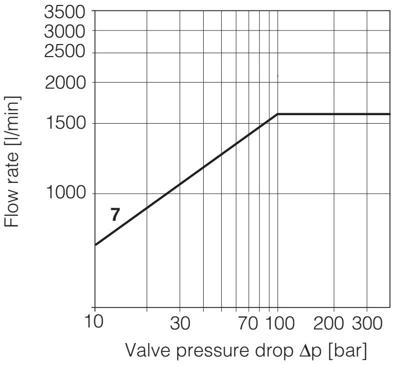


DPZO-6: **11** = L5
DPZO-8: **12** = L5

7.2 Flow /Δp diagram - stated at 100% of spool stroke







DPZO-1:
1 = spools L5, DL5
DPZO-2:
2 = spools L3
3 = spool T5
4 = spools L5, DL5

DPZO-4:
5 = spools L5, DL5
DPZO-4M:
6 = spools L5, DL5

DPZO-6:
7 = L5

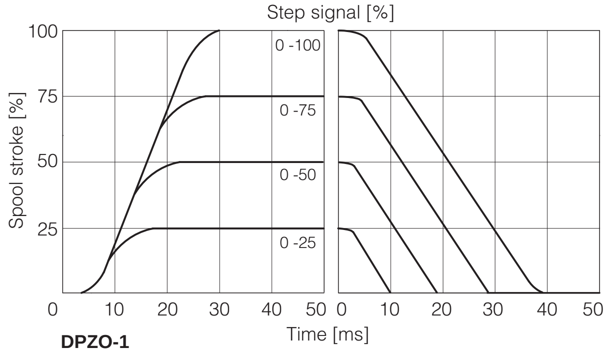
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

Reference signal $\left.\begin{matrix}0 \div +10\text{ V}\\ 12 \div 20\text{ mA}\end{matrix}\right\}$ P → A / B → T

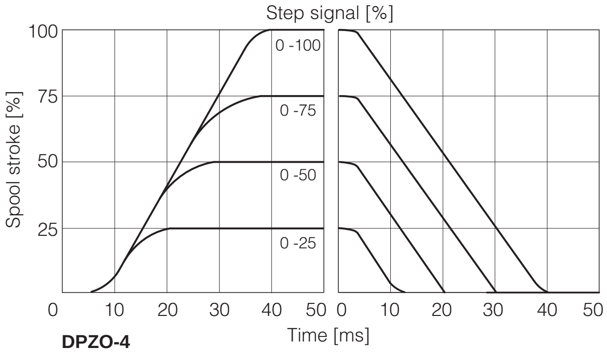
Reference signal $\left.\begin{matrix}0 \div -10\text{ V}\\ 4 \div 12\text{ mA}\end{matrix}\right\}$ P → B / A → T

7.3 Response time

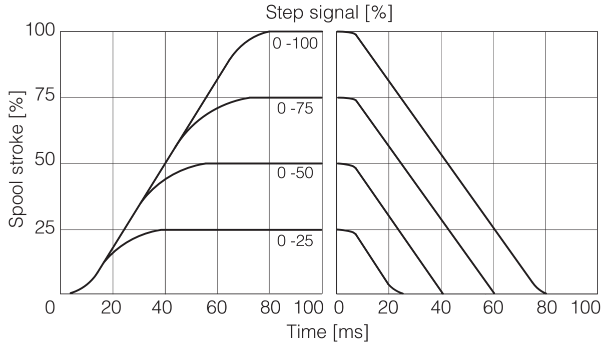
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



DPZO-1
DPZO-2



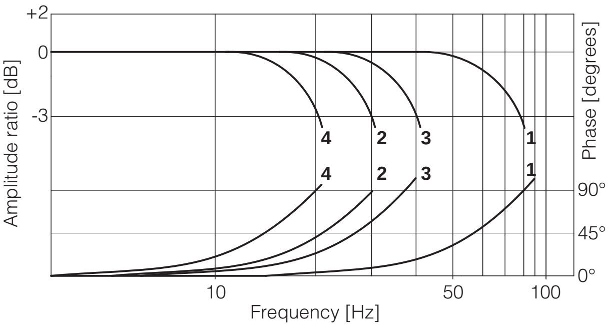
DPZO-4
DPZO-4M

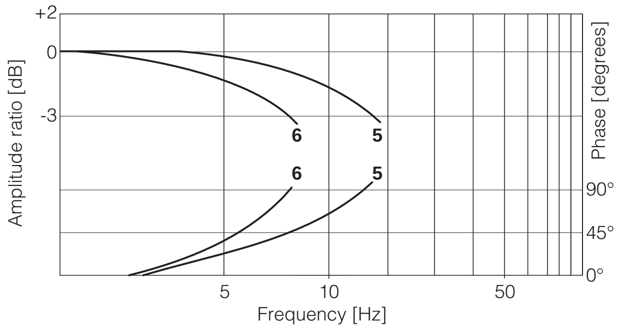


DPZO-6

7.4 Bode diagrams

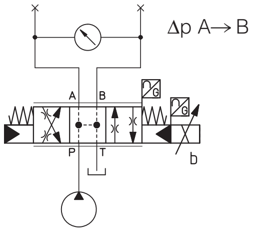
Stated at nominal hydraulic conditions.





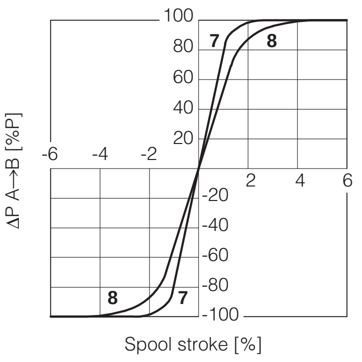
1 =	DPZO-1 DPZO-2	± 5%	**2** =	DPZO-1 DPZO-2	± 100%
3 =	DPZO-4 DPZO-4M	± 5%	**4** =	DPZO-4 DPZO-4M	± 100%
5 =	DPZO-6	± 5%	**6** =	DPZO-6	± 100%

7.5 Pressure gain



7 = DPZO-1

8 = DPZO-2
DPZO-4
DPZO-4M
DPZO-6



8 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 7.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

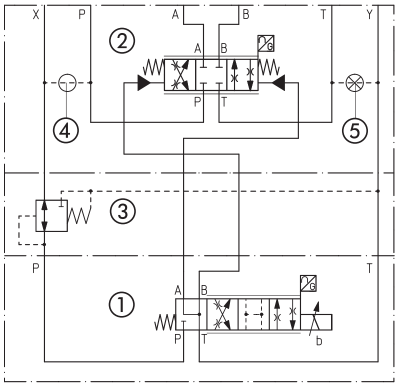
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-2, DPZO-4(M) and DPZO-6 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

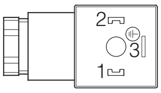
Functional Scheme - example of configuration 70



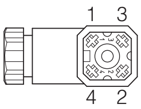
① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

9 ELECTRICAL CONNECTION

9.1 Solenoid connector - supplied with the valve

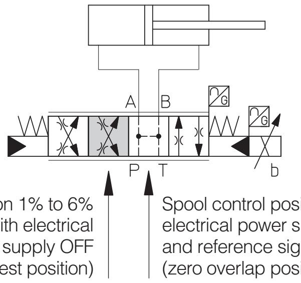
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

9.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

10 SAFETY REST POSITION - configuration 70

In absence of power supply to the solenoids, the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration. This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



Spool offset position 1% to 6% of total stroke with electrical power supply OFF (central safety rest position)

Spool control position with electrical power supply ON and reference signal = 0 (zero overlap position)

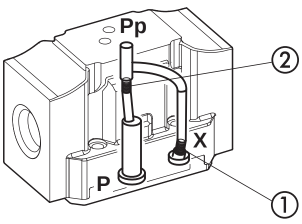
11 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

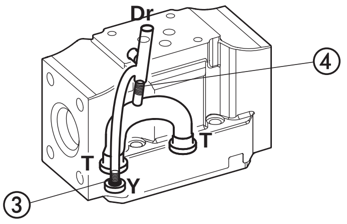
12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels**

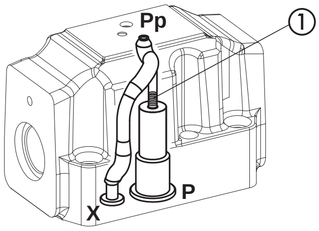


Drain channels

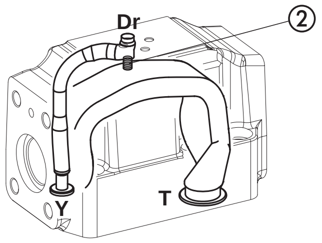


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels**

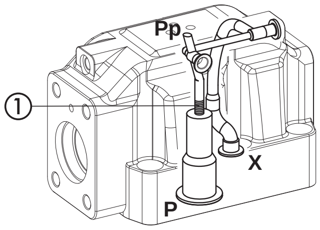


Drain channels

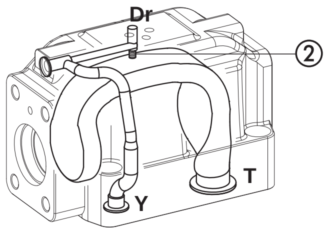


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels**

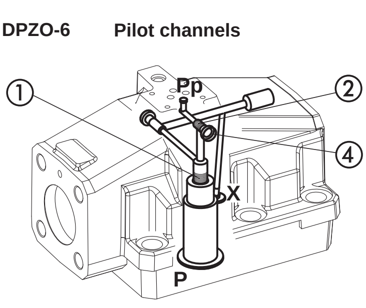


Drain channels

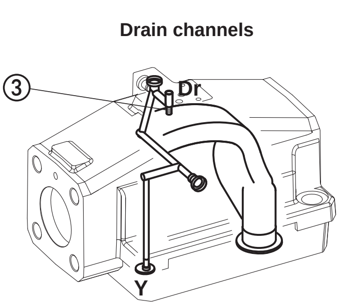


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels**



Drain channels



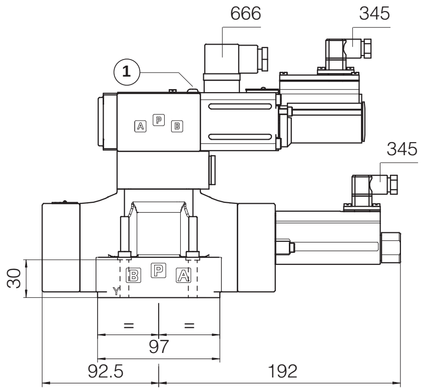
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

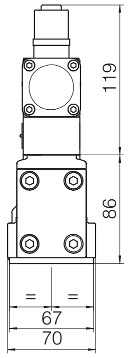
13 INSTALLATION DIMENSIONS [mm]

DPZO-L-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-L-1	9



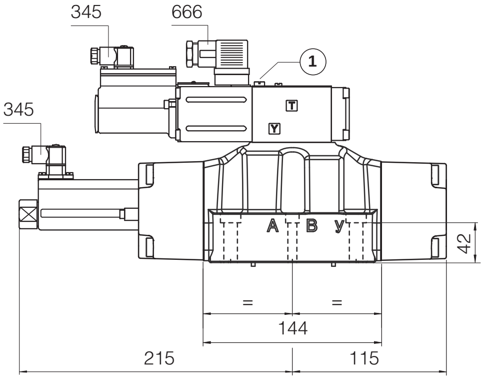


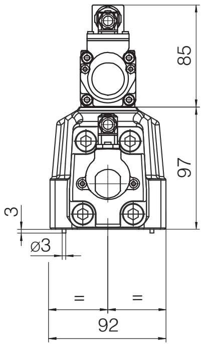
① = Air bleeding

DPZO-L-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-L-2	13,5





① = Air bleeding

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

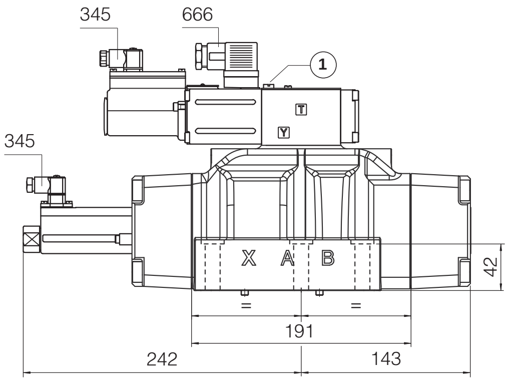
DPZO-L-4

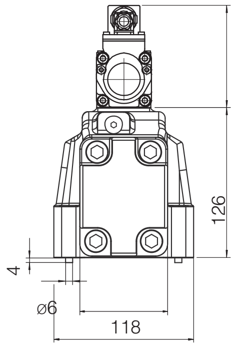
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-L-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm

Mass [kg]	
DPZO-L-4*	17,5



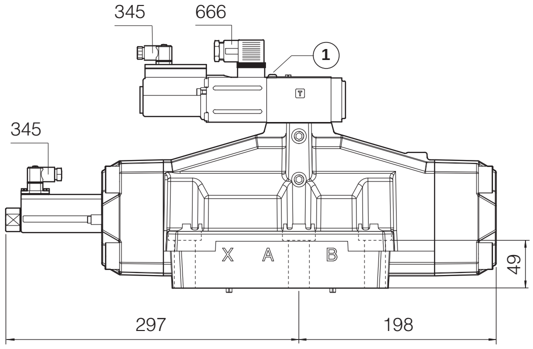


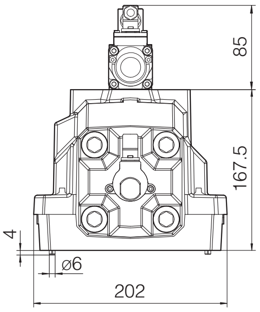
① = Air bleeding

DPZO-L-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-L-6	42,5





① = Air bleeding

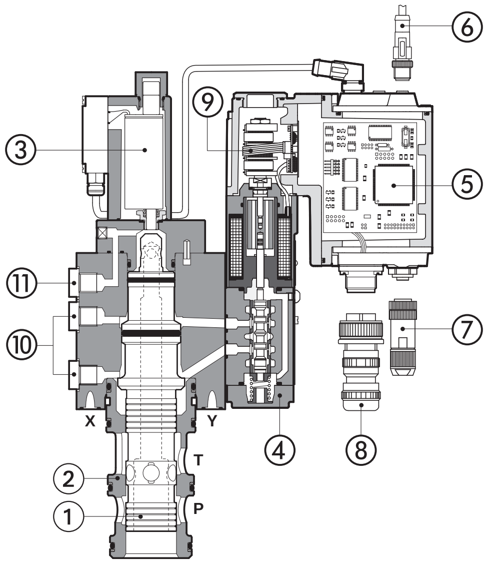
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS330**	Z-BM-LEZ digital axis card
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-LEB digital driver	**GS510**	Fieldbus
GS235	E-BM-LID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-LES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital servoproportional 3-way cartridges

piloted, with on-board driver and two LVDT transducers



- ① zMain spool
- ② Sleeve
- ③ Main stage LVDT transducer
- ④ Pilot valve
- ⑤ On-board digital driver
- ⑥ USB connector
- ⑦ Fieldbus connectors
- ⑧ Main connector
- ⑨ Pilot valve LVDT transducer
- ⑩ Air bleeding
- ⑪ Air suction port

LIQZO-LES-SN-BP-323L4/A

LIQZO-LEB, LIQZP-LEB LIQZO-LES, LIQZP-LES

Digital servoproportional 3-way cartridges specifically designed for high speed closed loop controls. They are equipped with two LVDT position transducers for best dynamics in directional controls and not compensated flow regulations. The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

LEB basic execution with analog reference signal and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

LIQZO: Size: **25 ÷ 40**
Max flow: **500 ÷ 1050 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50 ÷ 80**
Max flow: **2000 ÷ 5000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO - LES - SN - NP - 25 3 L4 / * * / *

Servoproportional 3-way cartridge, piloted

LIQZO = size 25 to 40, Pmax 350 bar
LIQZP = size 50 to 80, Pmax 420 bar

LEB = basic on-board digital driver **(1)**
LES = full on-board digital driver

Alternated P/Q controls:
SN = none
SP = pressure control (1 pressure transducer)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:

NP = Not present	
BC = CANopen	**EW** = POWERLINK
BP = PROFIBUS DP	**EI** = EtherNet/IP
EH = EtherCAT	**EP** = PROFINET RT/IRT

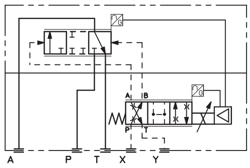
Valve size, see section 7 :

LIQZO =	**25**	**32**	**40**
l/min	185	330	420
LIQZP =	**50**	**63**	**80**
l/min	780	1250	2100

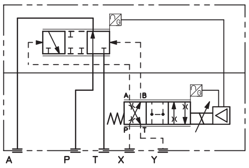
Nominal flow (l/min) at Δp 5 bar

Configuration: 3 = 3 way

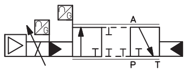
functional symbol: **Standard**



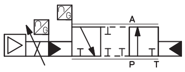
option **/A**



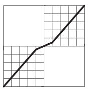
simplified symbol: **Standard**



option **/A**



Spool type
regulating characteristics:



L4 = linear

Hydraulic options (2):
A = reversal hydraulic configuration of main spool: P-A in rest position

Electronic options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **LES-SP, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) Only in version **SN-NP**

(2) For possible combined options, see section 13

(3) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage.
In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z).
A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also power supply note at sections 15 .

WARNING

The loss of the pilot pressure causes the undefined position of the main spool.
The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

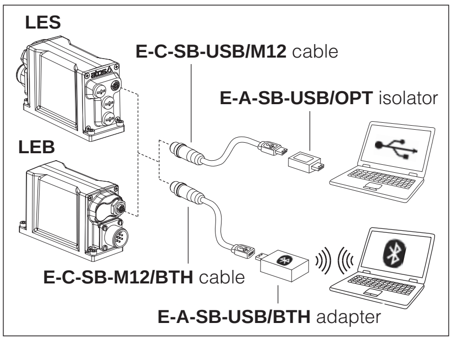
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SL**) to the basic functions of proportional directional valves flow regulation.
A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP or 1 load cell for SL).
The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 **HYDRAULIC CHARACTERISTICS** - based on mineral oil ISO VG 46 at 50 °C

Size		**25**	**32**	**40**	**50**	**63**	**80**
Nominal flow Δp P-A or A-T [l/min]							
	Δp = 5 bar	185	330	420	780	1250	2100
	Δp = 10 bar	260	470	590	1100	1750	3000
	Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	**LIQZO**	Ports P, A, T = **350** X = 350 Y ≤ 10					
	LIQZP	Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 70 bar [l/min]		4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]		0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]		min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume [cm^3]		2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow **(1)** [l/min]		6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal **(2)** [ms]		21	22	22	25	30	34
Hysteresis [% of the max regulation]		≤ 0,1					
Repeatability [% of the max regulation]		± 0,1					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 10.2

8 **ELECTRICAL CHARACTERISTICS**

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 **SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

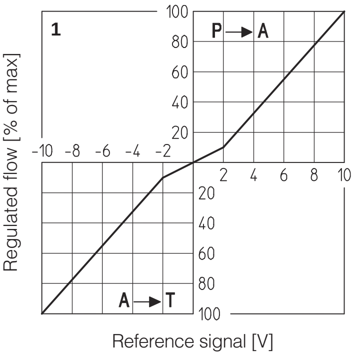
10 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams, see note

1 = LIQZO, LIQZP (all sizes)

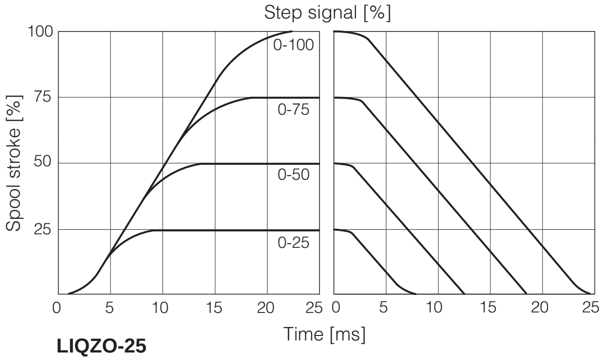
Hydraulic configuration vs. reference signal:

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

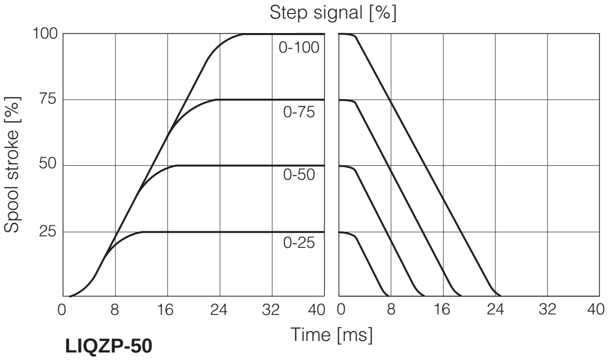


10.2 Response time

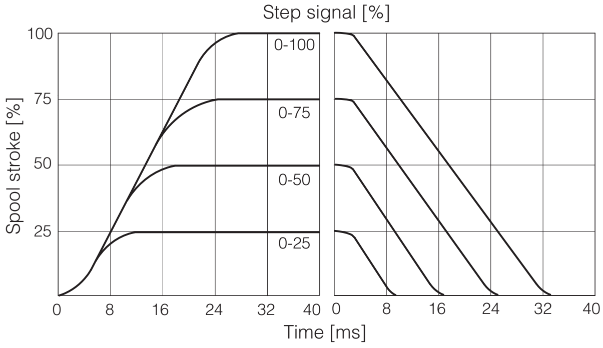
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



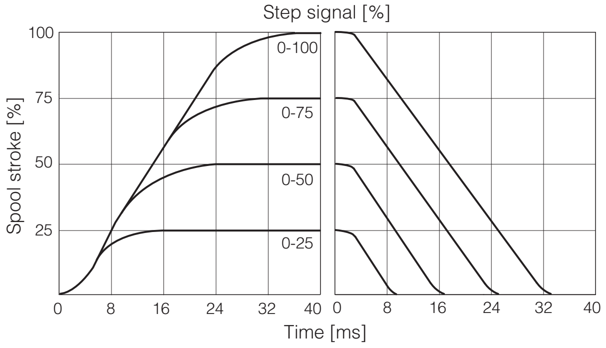
LIQZO-25
LIQZO-32
LIQZO-40



LIQZP-50

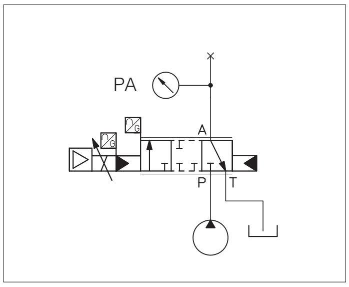


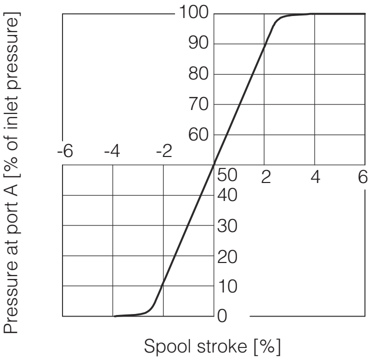
LIQZP-63



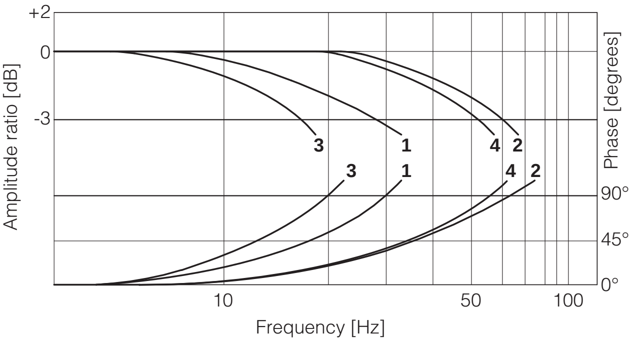
LIQZP-80

10.3 Pressure gain diagram

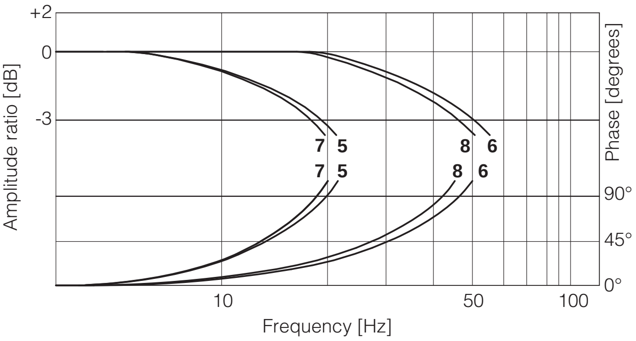




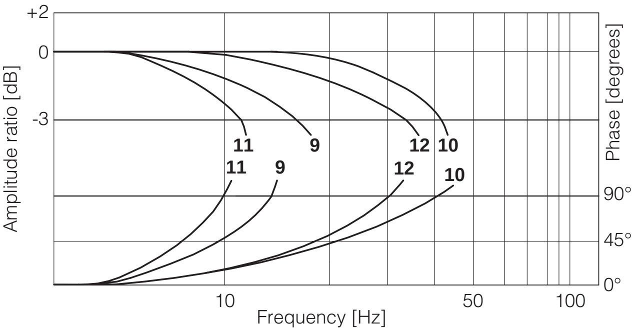
10.4 Bode diagrams



1 = LIQZO-L*-253L4: ± 90%
2 = LIQZO-L*-253L4: ± 5%
3 = LIQZO-L*-323L4: ± 90%
4 = LIQZO-L*-323L4: ± 5%



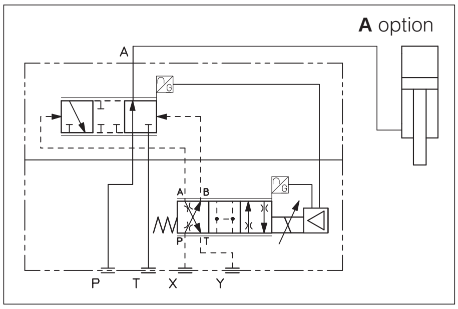
5 = LIQZO-L*-403L4: ± 90%
6 = LIQZO-L*-403L4: ± 5%
7 = LIQZP-L*-503L4: ± 90%
8 = LIQZP-L*-503L4: ± 5%



9 = LIQZP-L*-633L4: ± 90%
10 = LIQZP-L*-633L4: ± 5%
11 = LIQZP-L*-803L4: ± 90%
12 = LIQZP-L*-803L4: ± 5%

11 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.
The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.
This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.



12 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 13.7 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 13.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 13.6)
Power supply for driver's logics and communication - only for **LES** (see 13.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

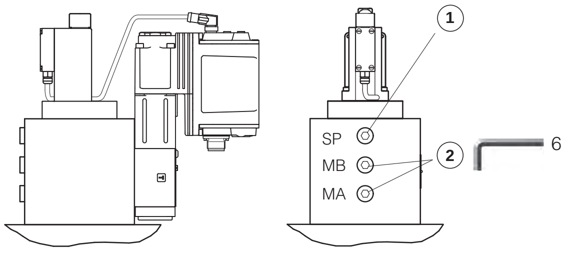
13 POSSIBLE COMBINED OPTIONS

LEB-SN, **LES-SN**
/AF, /AI, /AQ, /AZ, /FI, /IQ, /IZ, /AFI, /AIQ, /AIZ

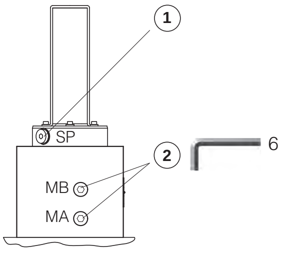
LES-SP, SL
/AC, /CI, /ACI

14 AIR BLEEDING

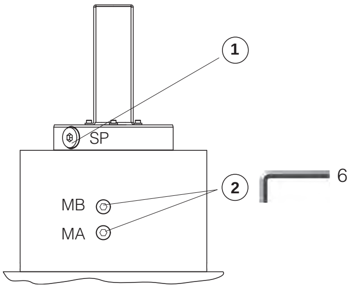
Size 25 to 40



Size 50



Sizes 63 to 80



① **Plugged port - do not open**

② **Air bleeding:**
N° 2 plugs G1/4"
At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.
Operate the valve for few seconds at low pressure and then lock the plugs.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and LES-SP, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Pressure or force reference input signal (F_INPUT+) - only for LES-SP, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.6 Pressure or force monitor output signal (F_MONITOR) - only for LES-SP, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.8 Repeat enable output signal (R_ENABLE) - only for LEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 15.7).

15.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

15.10 Remote pressure/force transducer input signal - only for LES-SP, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 16.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

15.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for LES-SP, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

16 ELECTRONIC CONNECTIONS AND LEDS

16.1 Main connector signals - 7 pin - standard, /F and /Q options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

16.2 Main connector signals - 12 pin - /Z option and SP, SL (A2)

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SL		TECHNICAL SPECIFICATIONS	NOTES
			Fieldbus	NP		
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

16.3 Communications connectors Ⓑ - Ⓒ

Ⓑ **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

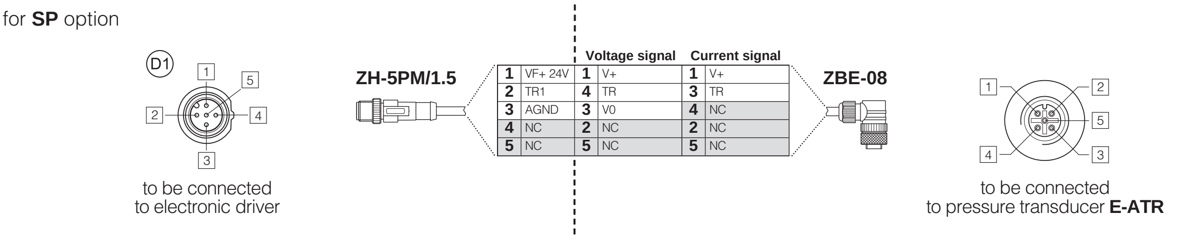
16.4 Remote pressure transducer connector - M12 - 5 pin - only for SP, SL Ⓓ

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer ±10 VDC / ±20 mA maximum range, software selectable Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example

for **SP** option



		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR1	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC
4	NC	**2**	NC	**2**	NC
5	NC	**5**	NC	**5**	NC

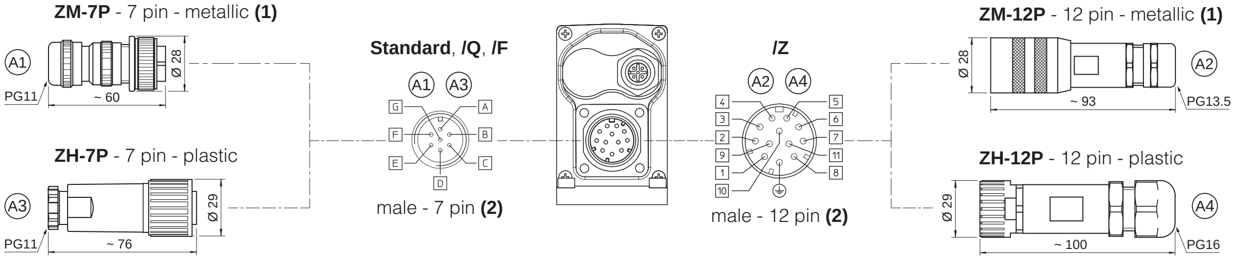
to be connected
to electronic driver

to be connected
to pressure transducer **E-ATR**

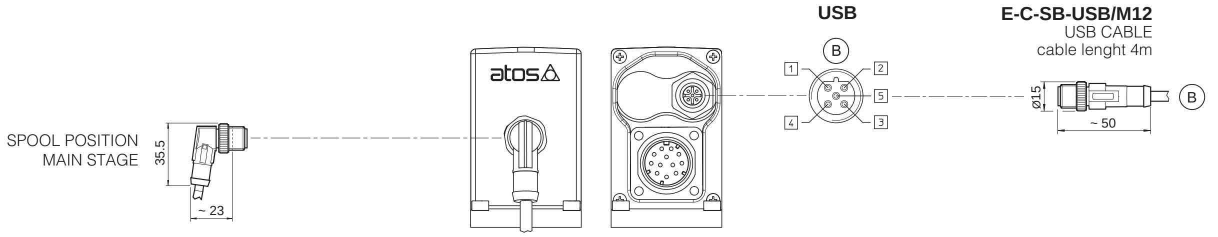
Note: pin layout always referred to driver's view

16.5 LEB connections layout

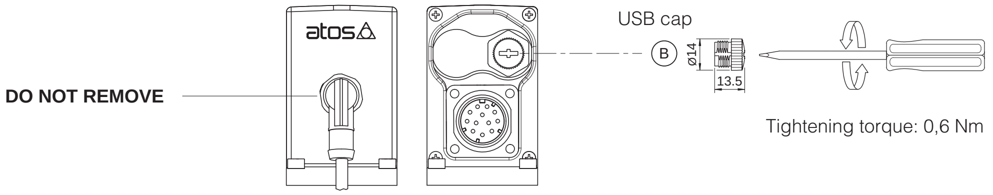
MAIN CONNECTORS



TRANSDUCER AND USB CONNECTOR



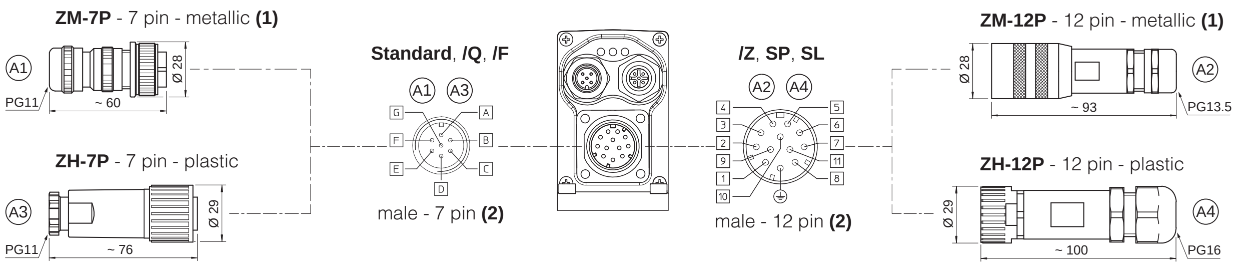
PLASTIC PROTECTION CAP - supplied with the valves



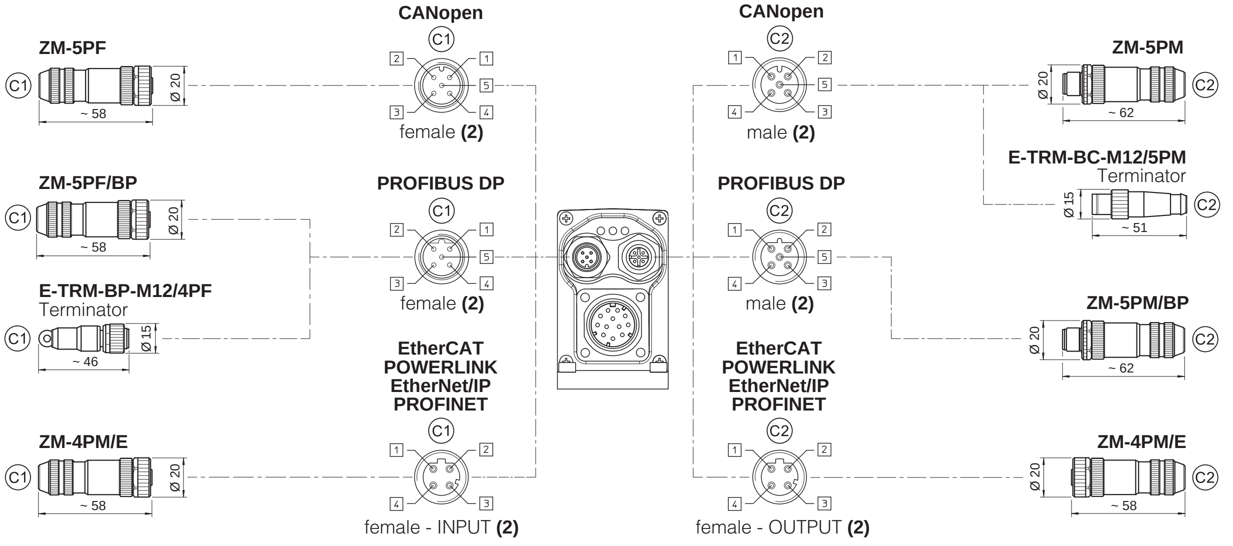
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.6 LES connections layout

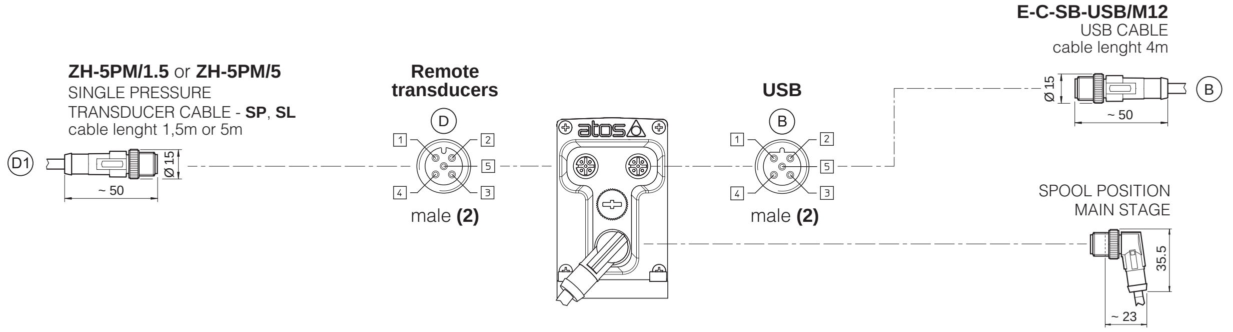
MAIN CONNECTORS



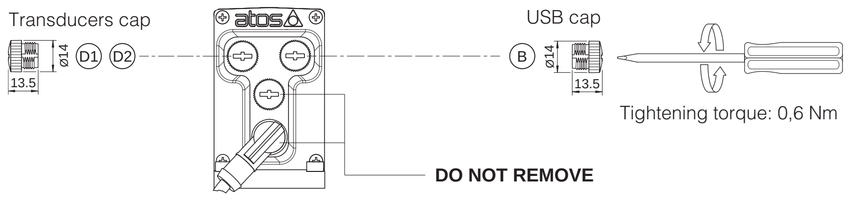
FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS



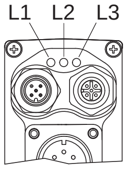
PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.7 Diagnostic LEDs - only for LES

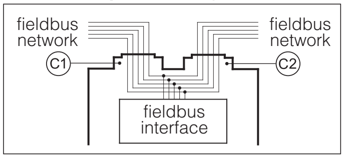
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	**NP** **Not Present**	**BC** **CANopen**	**BP** **PROFIBUS DP**	**EH** **EtherCAT**	**EW** **POWERLINK**	**EI** **EtherNet/IP**	**EP** **PROFINET**	
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

18.4 Pressure/Force transducer connectors - only for SP, SL

CONNECTOR TYPE	**SP, SL - Single transducer**	
CODE	(D) **ZH-5PM/1.5**	(D) **ZH-5PM/5**
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm^2	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

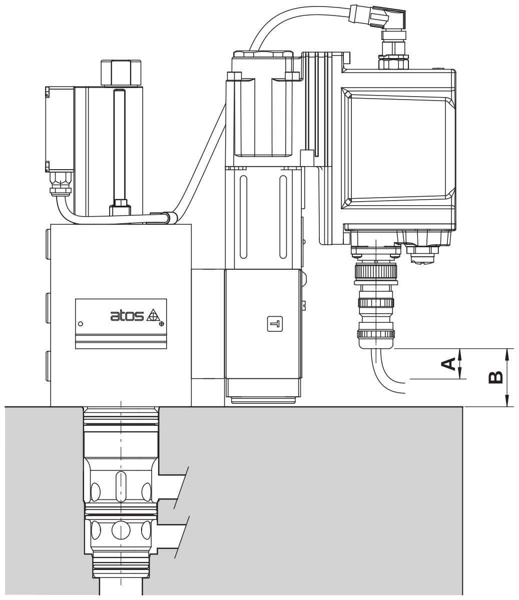
19 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2

(1) Fastening bolts supplied with the valve

20 MAIN CONNECTORS INSTALLATION DIMENSIONS

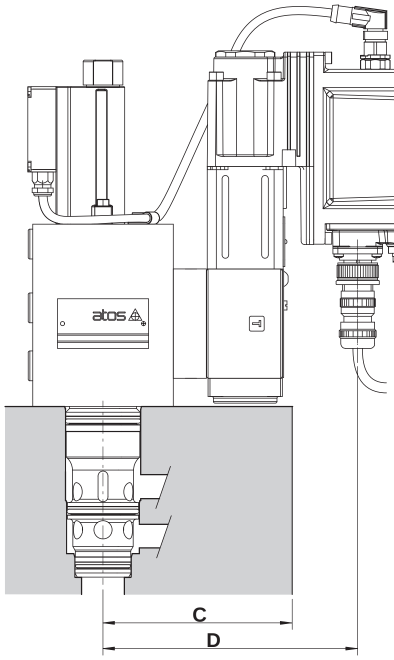
Installation 1 - possible interference between manifold and main connector



A = 15 mm space to remove the 7 or 12 pin main connectors

B = Clearance between main connector to valve's mounting surface. See the below table to verify eventual interferences, depending to the valve size and connector type

Installation 2 - no interference



C = Max manifold dimension to avoid interference with the main connector, see below table

Reference dimension	Main connector code	Valve size					
		25	**32**	**40**	**50**	**63**	**80**
B	ZM-7P	32	32	32	45	68	68
	ZH-7P	**(1)**	**(1)**	**(1)**	29	52	52
	ZM-12P	**(1)**	**(1)**	**(1)**	**(1)**	35	35
	ZH-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(2)**
C (max) for **standard valve**	-	134	141	154	161	192	222
C (max) for **/A option**	-	114	121	134	141	172	202
D for **standard valve**	-	154	161	174	181	212	242
D for **/A option**	-	134	141	154	161	192	222

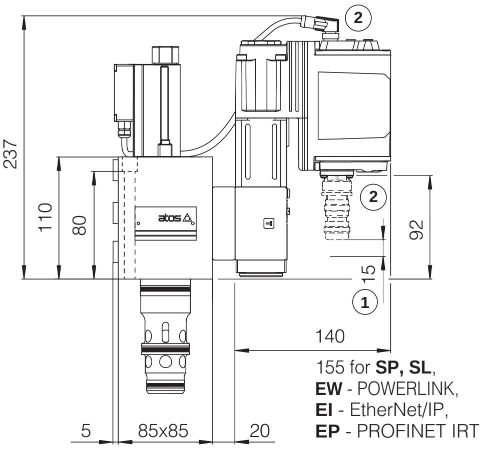
Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered

(1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as represented in above "Installation 2"

(2) The connector installation may be critic, depending to the cable size and bending radius

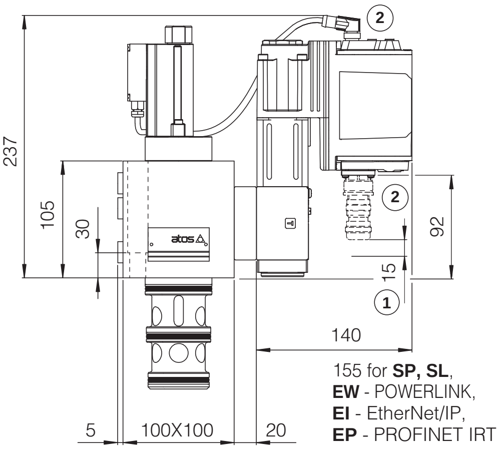
21 INSTALLATION DIMENSIONS [mm]

LIQZO-LEB-253
LIQZO-LES-253



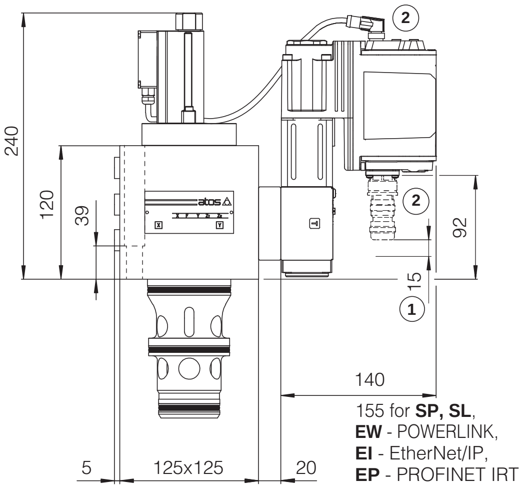
155 for **SP, SL**,
EW - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZO-LEB-323
LIQZO-LES-323



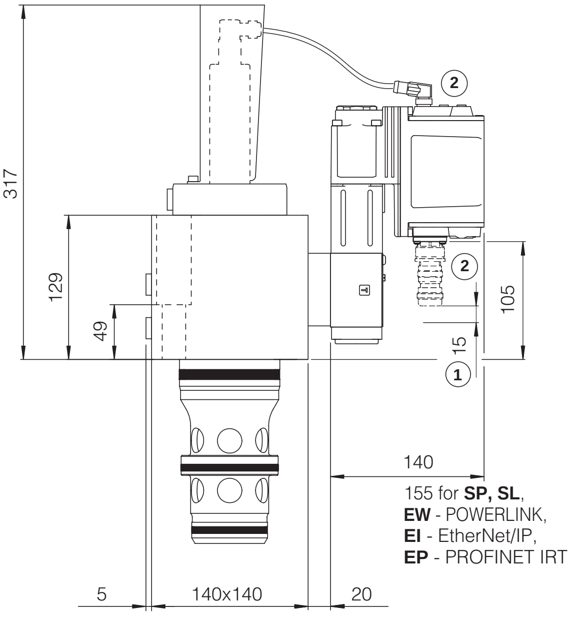
155 for **SP, SL**,
EW - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZO-LEB--403**
LIQZO-LES--403**



155 for **SP, SL**,
EW - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZP-LEB-503
LIQZP-LES-503



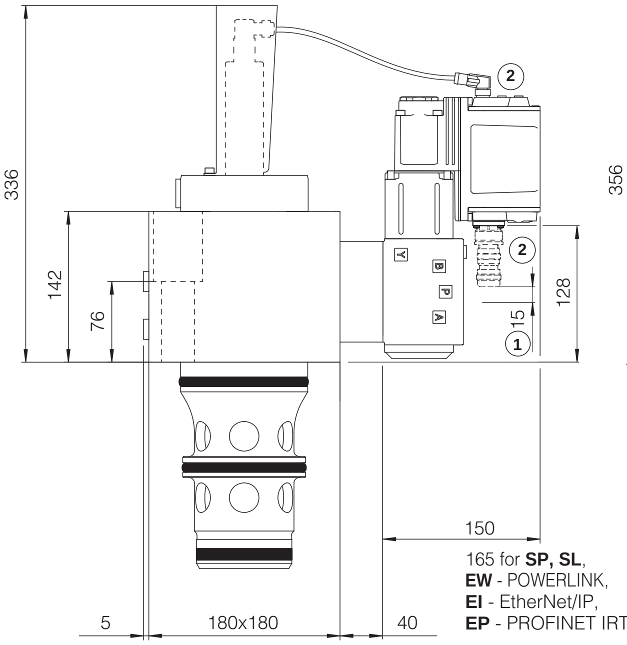
155 for **SP, SL**,
EW - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

① = Space to remove the connectors

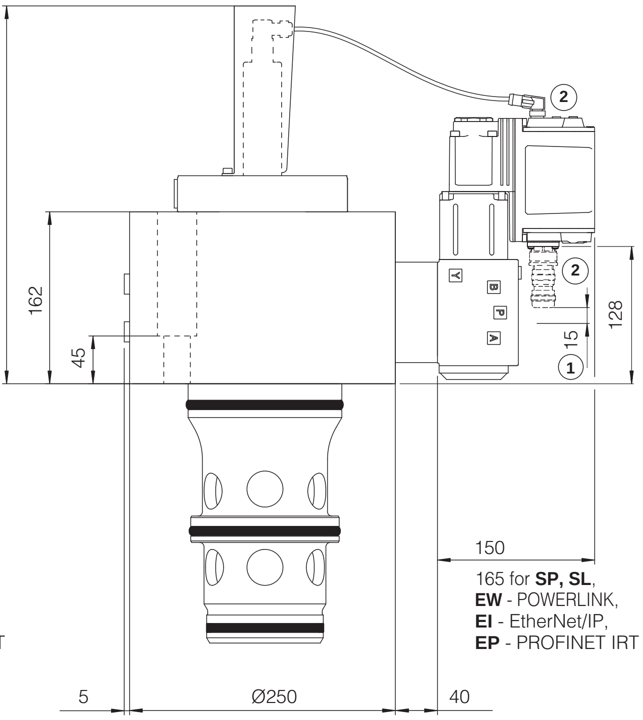
② = The dimensions of all connectors must be considered, see section 16.5 and 16.6
For main connectors installation, see also section 20 .

Note: for mounting surface and cavity dimensions, see table P006

LIQZP-LEB-633
LIQZP-LES-633



LIQZP-LEB-803
LIQZP-LES-803



① = Space to remove the connectors

② = The dimensions of all connectors must be considered, see section 16.5 and 16.6
For main connectors installation, see also section 20 .

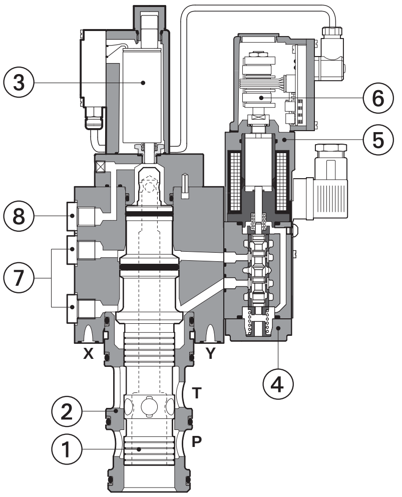
Note: for mounting surface and cavity dimensions, see table P006

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P006	Mounting surfaces and cavities for cartridge valves
QB340	Quickstart for LEB valves commissioning
QF340	Quickstart for LES valves commissioning

Servoproportional 3-way cartridges

piloted, with two LVDT transducers, sizes from 25 to 80



① Poppet
② Sleeve
③ Main stage LVDT transducer
④ Pilot valve
⑤ Proportional solenoid
⑥ Pilot valve LVDT transducer
⑦ Air bleeding
⑧ Air suction port

LIQZO-L-323L4/A

LIQZO-L, LIQZP-L

Servoproportional 3-way cartridge valves specifically designed for high speed closed loop controls.

The valves operate in association with digital off-board divers, see section 2.

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

Spool regulation characteristics: L = linear

LIQZO: Size: **25 ÷ 40**
Max flow: **500 ÷ 1050 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50 ÷ 80**
Max flow: **2000 ÷ 5000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	L	-	25	3	L4	/	*	*	/	*

Servoproportional cartridge, piloted
LIQZO = size 25 to 40, Pmax 350 bar
LIQZP = size 50 to 80, Pmax 420 bar

L = two LVDT transducers

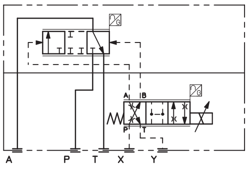
Valve size, see section 4 :

LIQZO =	**25**	**32**	**40**
l/min	185	330	420
LIQZP =	**50**	**63**	**80**
l/min	780	1250	2100

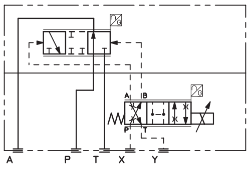
Nominal flow (l/min) at Δp 5 bar

Configuration: **3** = 3 way

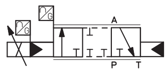
functional symbol: **Standard**



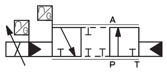
option **/A**



simplified symbol: **Standard**



option **/A**



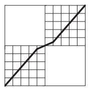
Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options:
A = reversal hydraulic configuration of main spool: P-A in rest position

Spool type, regulating characteristics:

L4 = linear



2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	**25**	**32**	**40**	**50**	**63**	**80**
Nominal flow Δp P-A or A-T [l/min]						
Δp = 5 bar	185	330	420	780	1250	2100
Δp = 10 bar	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar] **LIQZO**	Ports P, A, T = **350** X = 350 Y ≤ 10					
Max pressure [bar] **LIQZP**	Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 70 bar [l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume [cm^3]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow **(1)** [l/min]	6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal **(2)** [ms]	21	22	22	25	30	34
Hysteresis [% of the max regulation]	≤ 0,1					
Repeatability [% of the max regulation]	± 0,1					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 7.2

WARNING

The loss of the pilot pressure causes the undefined position of the main spool.
The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

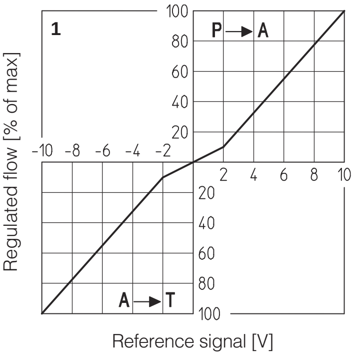
7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams, see note

1 = LIQZO, LIQZP (all sizes)

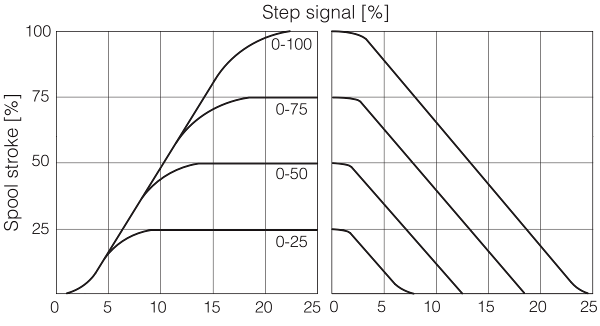
Hydraulic configuration vs. reference signal:

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

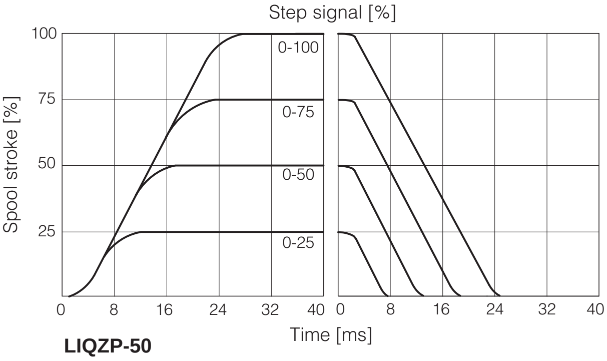


7.2 Response time

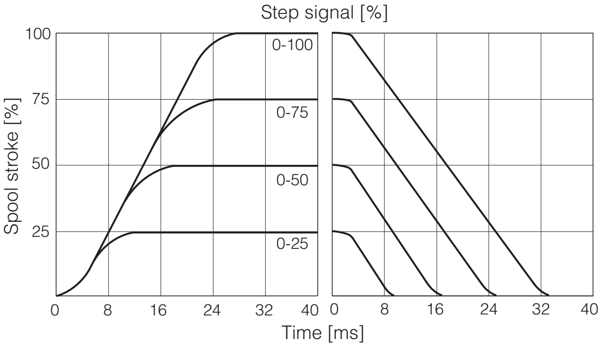
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



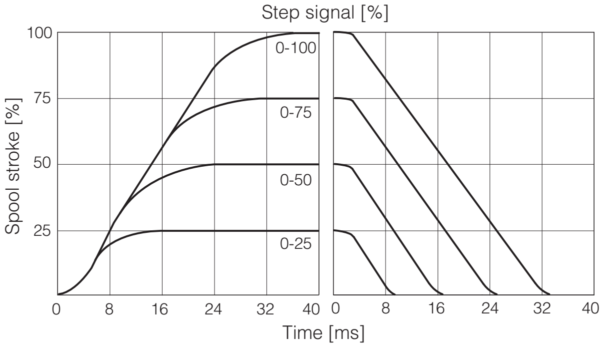
LIQZO-25
LIQZO-32
LIQZO-40



LIQZP-50

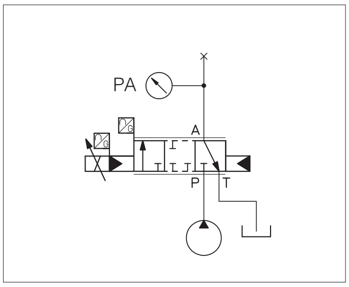


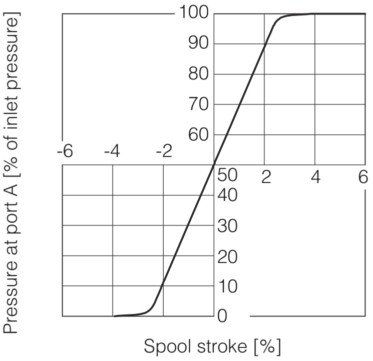
LIQZP-63



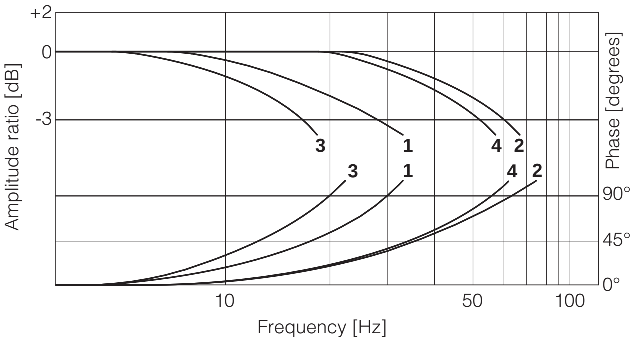
LIQZP-80

7.3 Pressure gain diagram

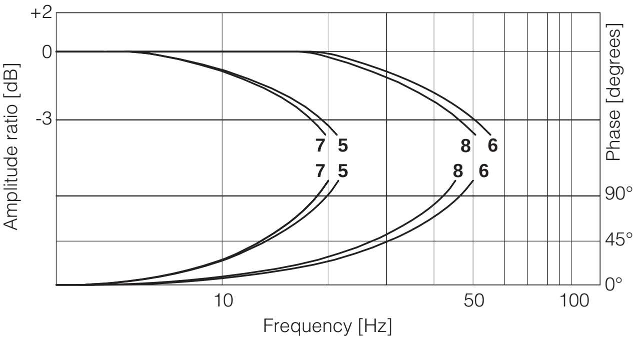




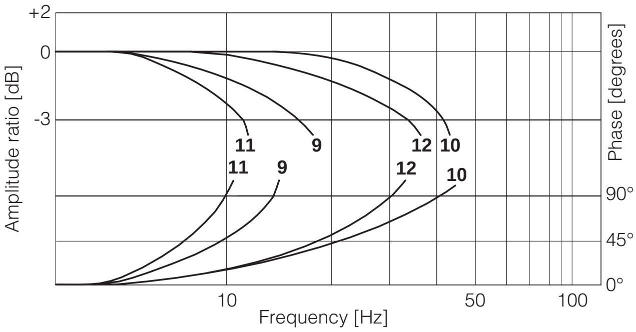
7.4 Bode diagrams



1 = LIQZO-L-253L4: ± 90%
2 = LIQZO-L-253L4: ± 5%
3 = LIQZO-L-323L4: ± 90%
4 = LIQZO-L-323L4: ± 5%



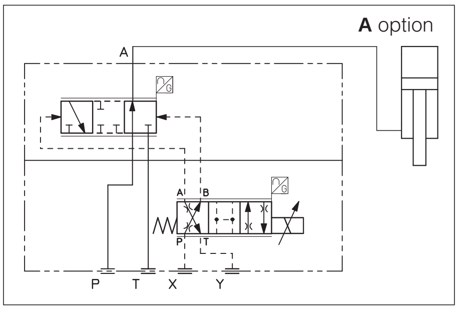
5 = LIQZO-L-403L4: ± 90%
6 = LIQZO-L-403L4: ± 5%
7 = LIQZP-L-503L4: ± 90%
8 = LIQZP-L-503L4: ± 5%



9 = LIQZP-L-633L4: ± 90%
10 = LIQZP-L-633L4: ± 5%
11 = LIQZP-L-803L4: ± 90%
12 = LIQZP-L-803L4: ± 5%

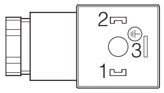
8 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.
The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.
This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.

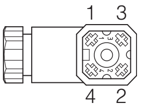


9 ELECTRICAL CONNECTION - connectors supplied with the valve

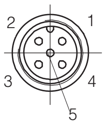
9.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

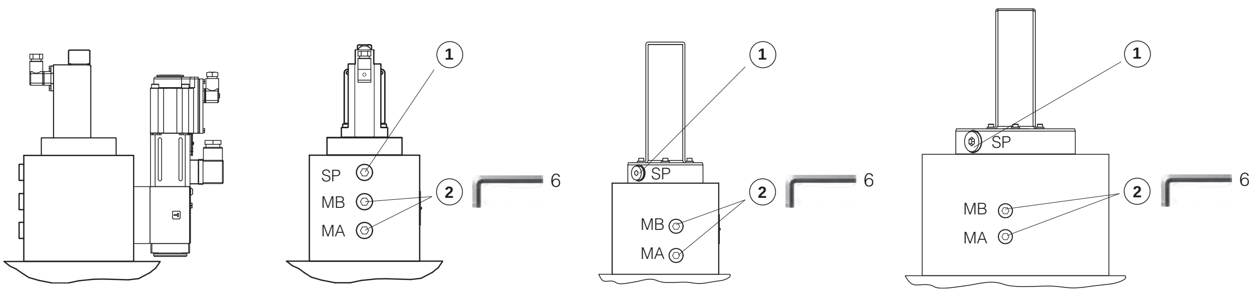
9.2 LVDT transducer connector - for LIQZO

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

9.3 LVDT transducer connector - for LIQZP

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**PROG**	Do not connect	
2	**VT+**	Power supply +15VDC	
3	**AGND**	Ground	
4	**TR**	Output signal	
5	**VT-**	Power supply -15VDC	

10 AIR BLEEDING



Size 25 to 40 **Size 50** **Sizes 63 to 80**

① **Plugged port - do not open**

② **Air bleeding:**

N° 2 plugs G1/4”

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.

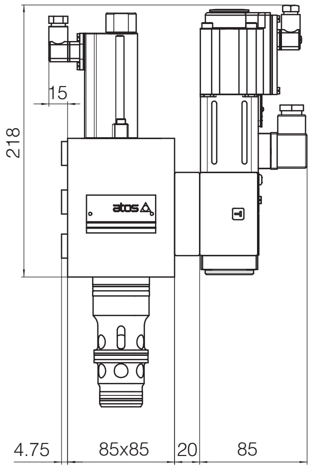
11 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	**25**	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3
LIQZP	**50**	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2

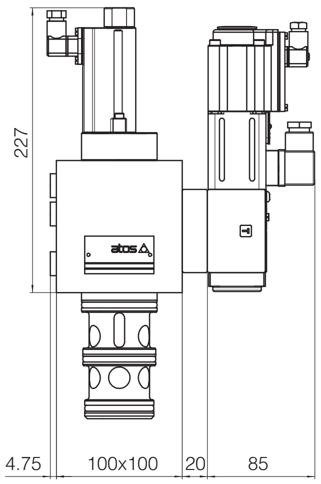
(1) Fastening bolts supplied with the valve

12 INSTALLATION DIMENSIONS [mm]

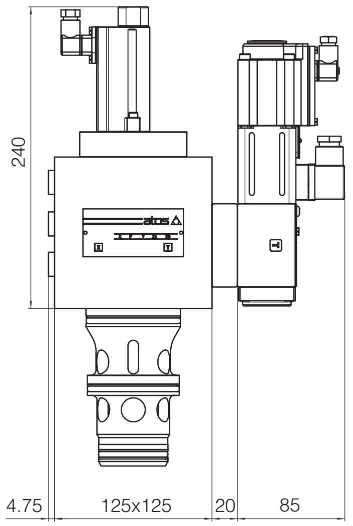
LIQZO-L-253



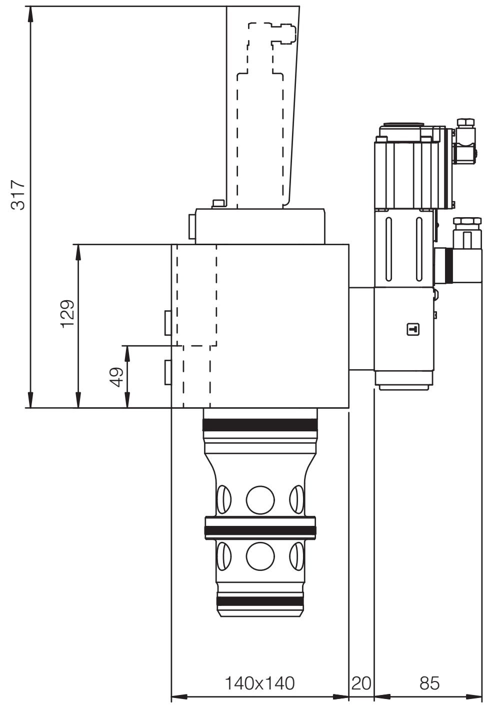
LIQZO-L-353



LIQZO-L-403

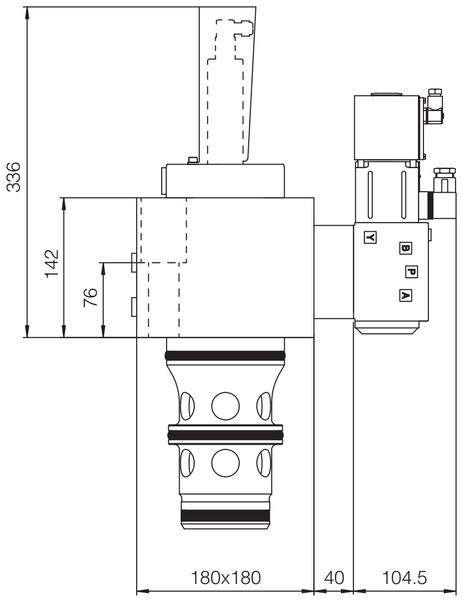


LIQZP-L-503

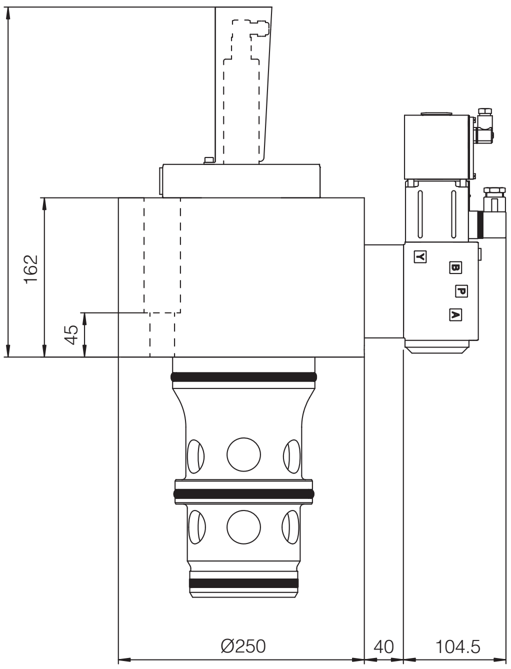


Note: for mounting surface and cavity dimensions, see table P006

LIQZP-L-603



LIQZP-L-803



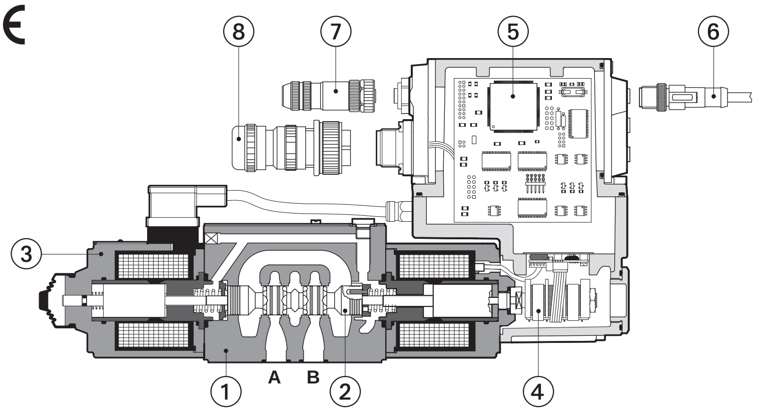
Note: for mounting surface and cavity dimensions, see table P006

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
GS230	E-BM-LEB digital driver	**K800**	Electric and electronic connectors
GS235	E-BM-LID digital driver	**P006**	Mounting surfaces and cavities for cartridge valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves high performance

direct, with on-board driver, LVDT transducer and positive spool overlap



DKZOR-TES-SN-BC-171

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DHZO-TEB, DHZO-TES
DKZOR-TEB, DKZOR-TES

Digital high performance directional proportional valves, direct, specifically designed for high speed closed loop controls.

They are equipped with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE OF STANDARD SPOOLS

DHZO - TES - SN - NP - 0 71 - L 5 / * * / *

DHZO = size 06
DKZOR = size 10

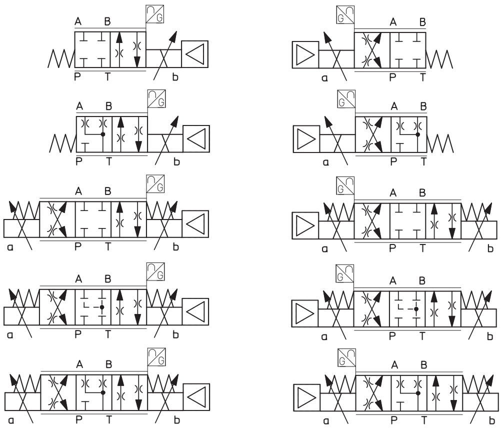
TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls, see section 6 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

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

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

Configuration: **Standard** Option **/B**



51 = (5)
53 =
71 = (5)
72 = (5) (6)
73 =

Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

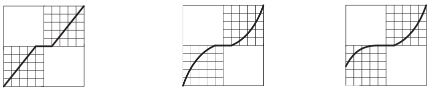
Safety options TÜV certified - only **TES (2)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	17	28
DKZOR =	-	-	-	45	75

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics **(4)**:
L = linear **S** = progressive **D** = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

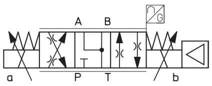
(1) Only in version **SN-NP**
(2) For possible combined options, see section 15
(3) Double power supply only for **TES**
(4) Spools for P/Q control, see section 2
(5) Do not use for P/Q control
(6) Only for **DKZOR-*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section 1

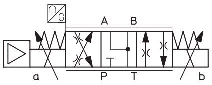
DHZO	-	TES	-	SP	-	NP	-	0	73 - V9	/	*	*	/	*

Configuration and spool:

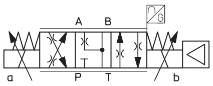
73-Q5



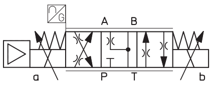
73-Q5/B



73-V9



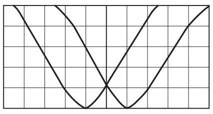
73-V9/B



Spool size:		**Q5**	**V9**
DHZO	=	30	30
DKZOR	=	75	75

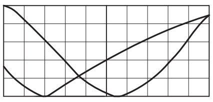
Nominal flow (l/min) at Δp 10 bar P-T

Q5



For alternated P/Q control
see 12.1 - diagram 16

V9



For alternated P/Q control of injection cycle in plastic machinery
see 12.1 - diagram 17

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

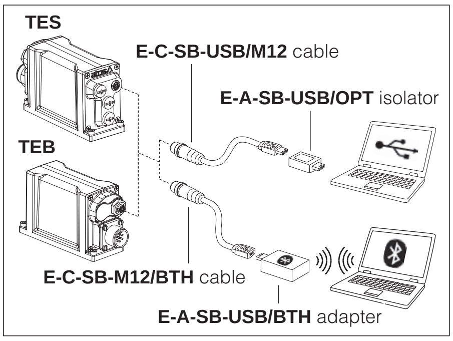
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 ALTERNATED P/Q CONTROLS - only for TES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

7 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** , designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHZO**						**DKZOR**			
Pressure limits	[bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10						ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10			
Configuration		**51, 53, 71, 73**					**73**	**51, 53, 71, 73**		**72**	**73**
Spool type	standard	**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**		**L3,S3,D3**	**L5,S5,D5**	**S5**	
	P/Q						**Q5,V9**				**Q5,V9**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	1	4,5	8	18	28	30	45	75	75	75
	Δp= 30 bar	1,7	8	14	30	50	52	80	130	130	130
	Δp= 70 bar	2,6	12	21	45	75	80	120	170	170	170
	Max permissible flow **(2)**	4	18	30	50	80	80	130	180	180	180
Leakage	[cm^3/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)			
Response time **(3)**	[ms]	≤ 15						≤ 20			
Hysteresis		≤ 0,2 [% of max regulation]									
Repeatibility		± 0,1 [% of max regulation]									
Thermal drift		zero point displacement < 1% at ΔT = 40°C									

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2
(2) See detailed diagrams in section 12.3
(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A			
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω **DKZOR** = 3,8 ÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

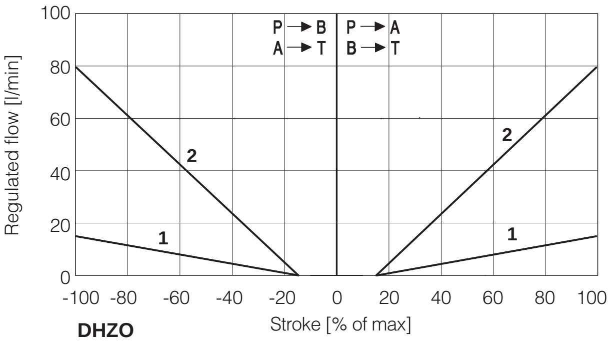
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 **SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

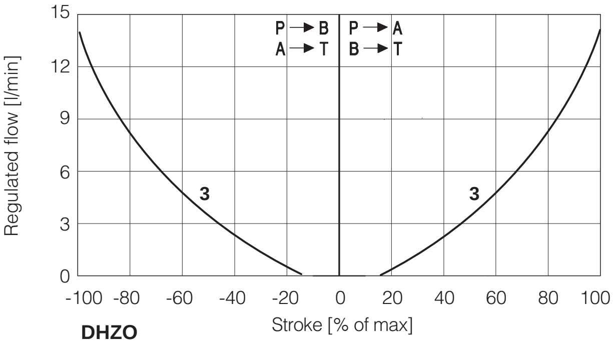
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

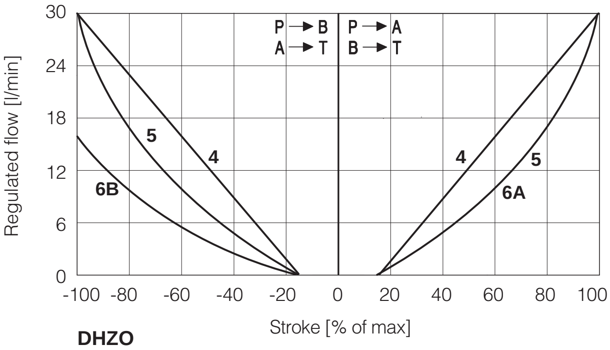
12.1 Regulation diagrams - values measure at Δp 30 bar P-T



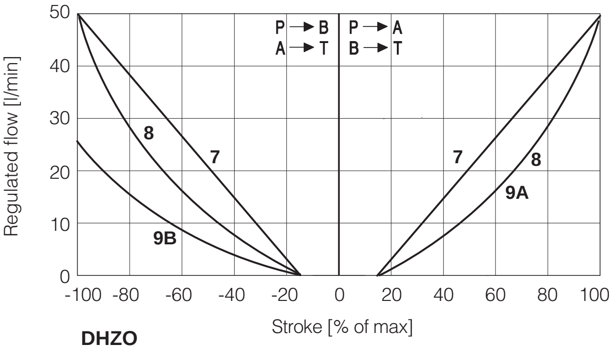
DHZO
1 = L14 **2** = L1



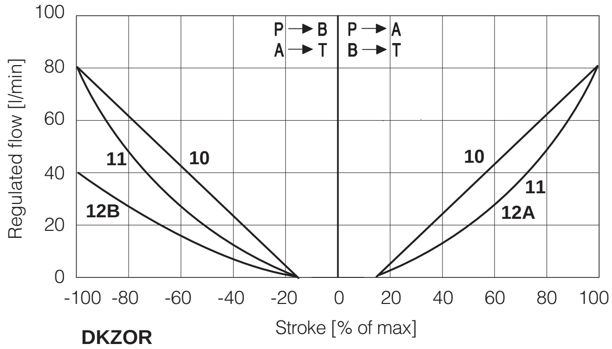
DHZO
3 = S2



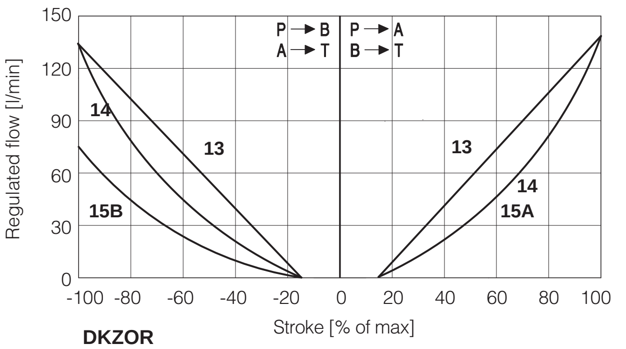
DHZO
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZO
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZOR
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



DKZOR
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

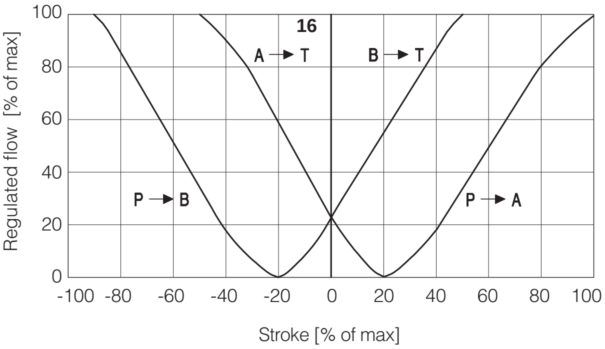
Note:
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

Reference signal $\left.\begin{matrix}0 \div +10\text{ V}\\ 12 \div 20\text{ mA}\end{matrix}\right\}$ P → A / B → T

Reference signal $\left.\begin{matrix}0 \div -10\text{ V}\\ 12 \div 4\text{ mA}\end{matrix}\right\}$ P → B / A → T

16 = linear spool **Q5**

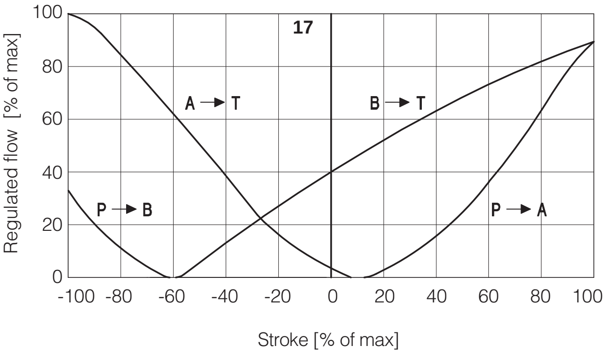
Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



17 = differential - progressive spool **V9**

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table **FS500**).
This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



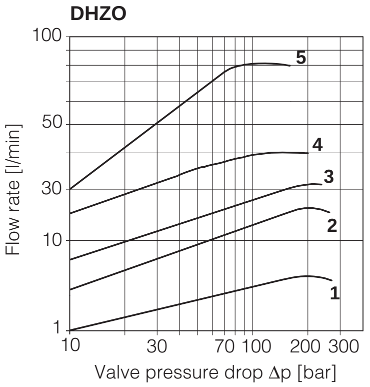
12.2 Flow /∆p diagrams
stated at 100% of valve stroke

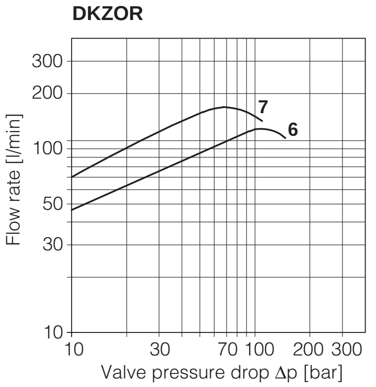
DHZO

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





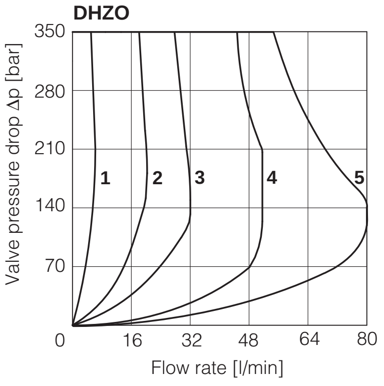
12.3 Operating limits

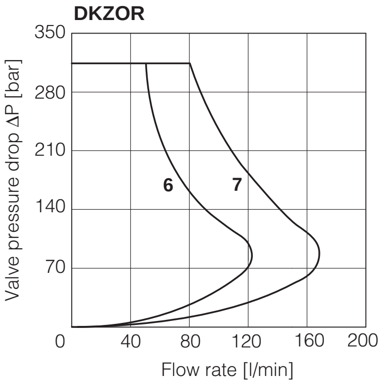
DHZO

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

DKZOR

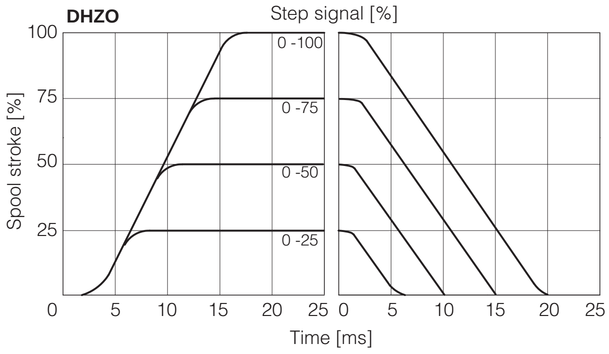
6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

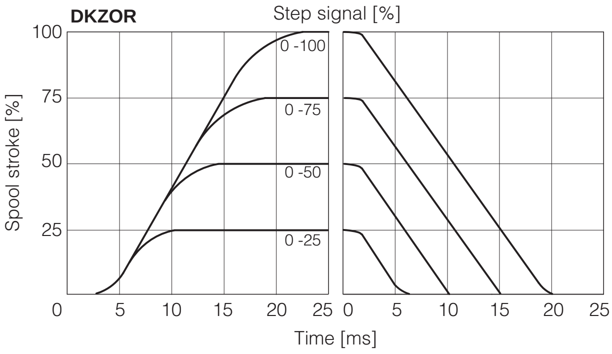




12.4 Response time

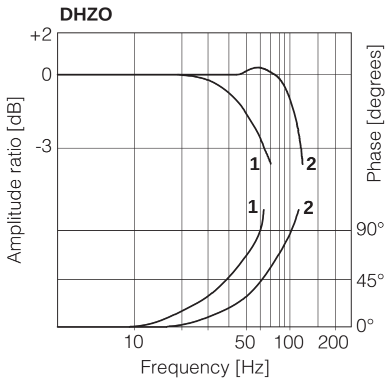
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

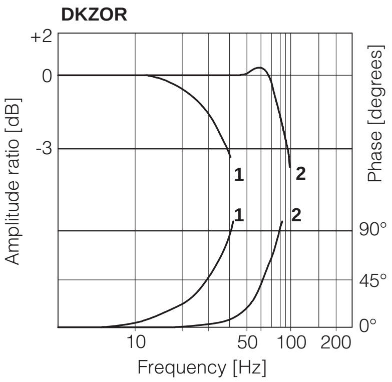




12.5 Bode diagrams

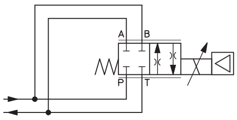
1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke





12.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow Δp= 15 bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3 S3**	**L5 S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 16.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 16.8)
Power supply for driver's logics and communication - only for **TES** (see 16.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:
/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY, /IQ, /IQY,
/IY, /IYZ, /IZ,
/QY, /YZ

Standard versions for **TES-SP, SF, SL**:
/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:
/BIU, /BIUY, /BU, /BUY,/IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:
/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCIK, /BCIKY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option and **TES-SP, SF, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Pressure or force reference input signal (F_INPUT+) - only for **TES-SP, SF, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.5 Flow monitor output signal (Q_MONITOR) - not for **/F**

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.6 Pressure or force monitor output signal (F_MONITOR) - only for **TES-SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - not for standard and **/F**

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.8 Repeat enable output signal (R_ENABLE) - only for **TEB** with **/Z** option

Repeat enable is used as output repeater signal of enable input signal (see 16.7).

16.9 Fault output signal (FAULT) - not for standard and **/Q**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.10 Remote pressure/force transducer input signal - only for **TES-SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver (see 17.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

16.11 Multiple PID selection (D_IN0 and D_IN1) - only **NP** execution for **TES-SP, SF, SL**

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin Ⓐ1 Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

17.2 Main connector signals - 12 pin Ⓐ2 /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL		TECHNICAL SPECIFICATIONS	NOTES
			Fieldbus	NP		
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

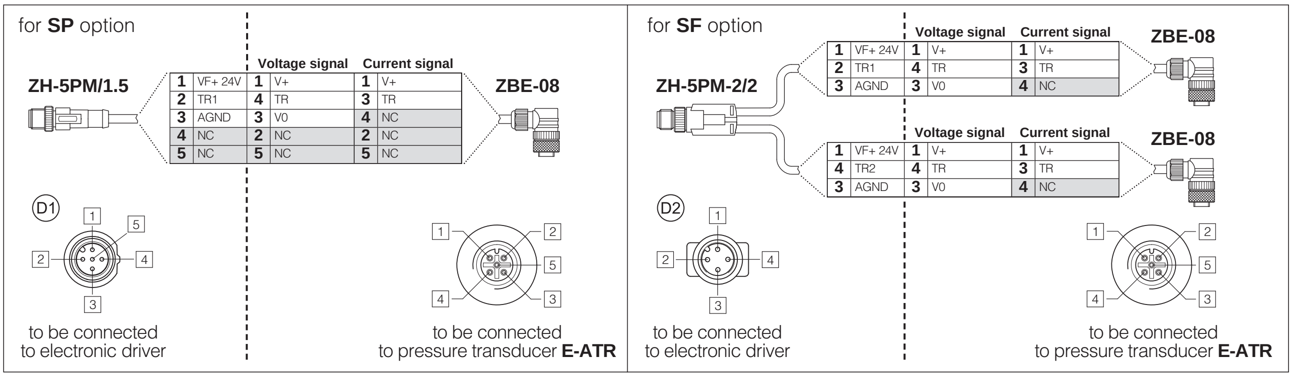
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	**Current**	**Voltage**	**Current**
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



for SP option

		Voltage signal		Current signal	
1	VF+ 24V	1	V+	1	V+
2	TR1	4	TR	3	TR
3	AGND	3	V0	4	NC
4	NC	2	NC	2	NC
5	NC	5	NC	5	NC

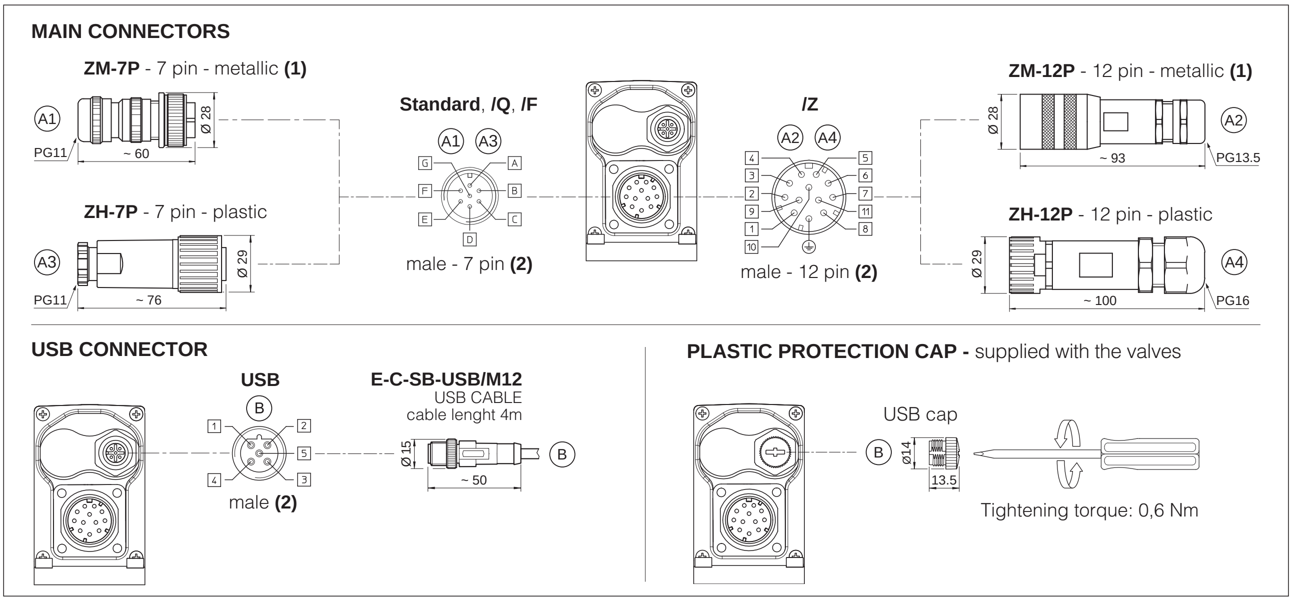
for SF option

		Voltage signal		Current signal	
1	VF+ 24V	1	V+	1	V+
2	TR1	4	TR	3	TR
3	AGND	3	V0	4	NC

		Voltage signal		Current signal	
1	VF+ 24V	1	V+	1	V+
4	TR2	4	TR	3	TR
3	AGND	3	V0	4	NC

Note: pin layout always referred to driver's view

17.5 TEB connections layout

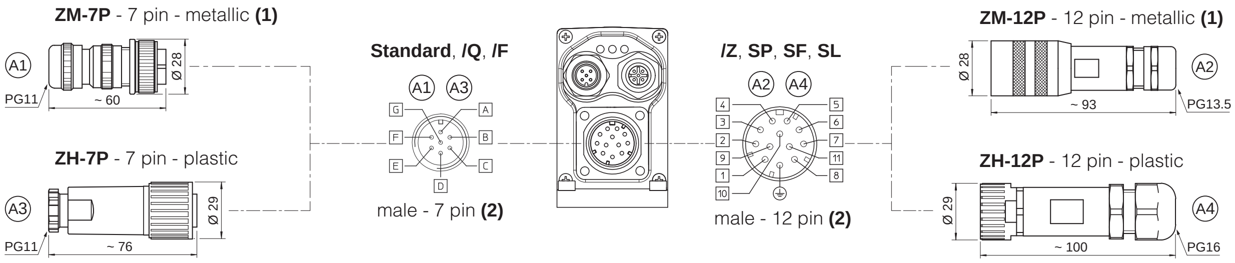


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

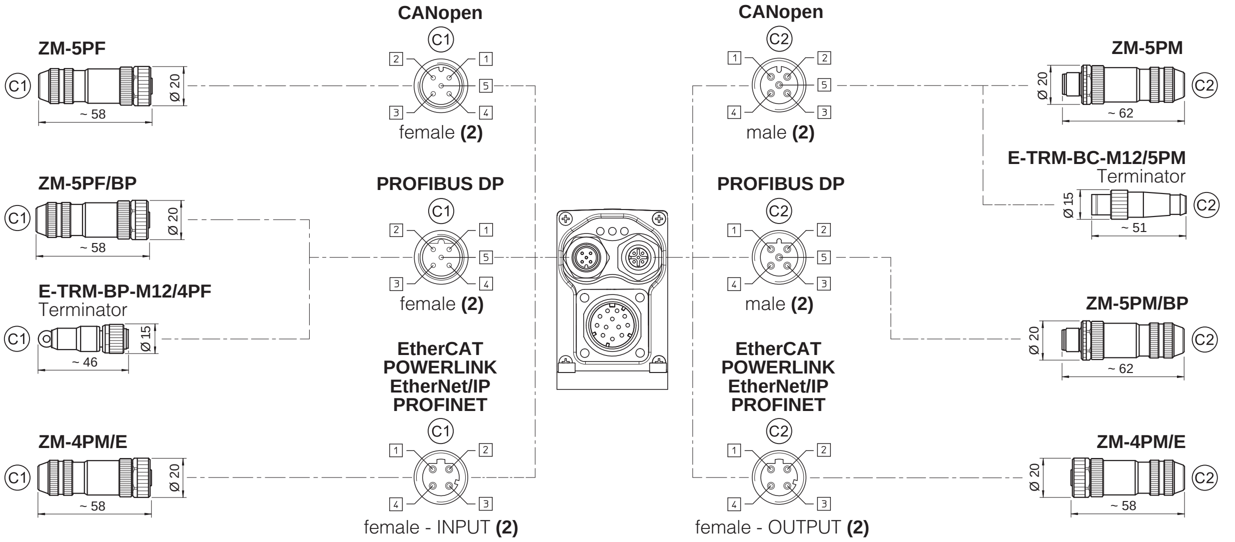
(2) Pin layout always referred to driver's view

17.6 TES connections layout

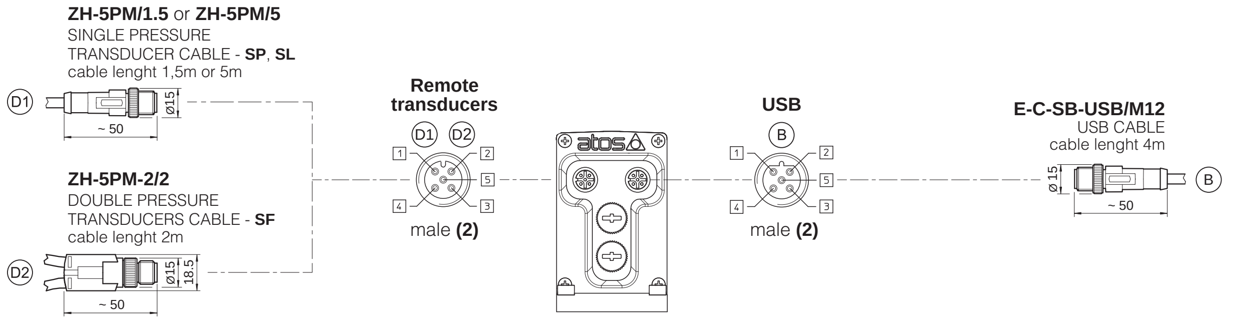
MAIN CONNECTORS



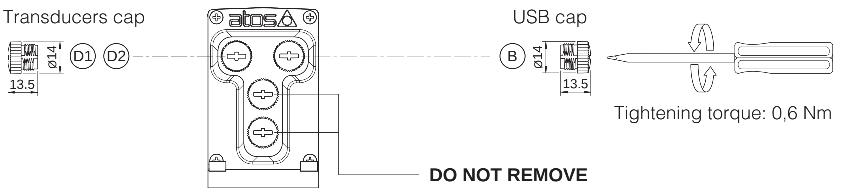
FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS



PLASTIC PROTECTION CAPS - supplied with the valves

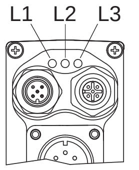


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

17.7 Diagnostic LEDs - only for TES

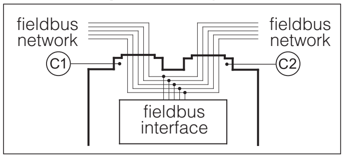
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3 
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	Ⓐ1 **ZM-7P**	Ⓐ3 **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 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	Ⓐ2 **ZM-12P**	Ⓐ4 **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 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	Ⓒ1 **ZM-5PF**	Ⓒ2 **ZM-5PM**	Ⓒ1 **ZM-5PF/BP**	Ⓒ2 **ZM-5PM/BP**	Ⓒ1 Ⓒ2 **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

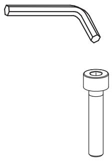
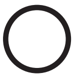
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	**SP, SL - Single transducer**		**SF - Double transducers**
CODE	Ⓓ1 **ZH-5PM/1.5**	Ⓓ1 **ZH-5PM/5**	Ⓓ2 **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm^2		3 x 0,25 mm^2 (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

20 FASTENING BOLTS AND SEALS

	DHZO	**DKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

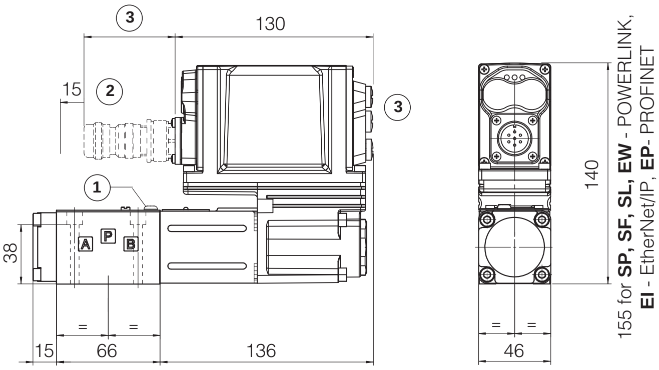
21 INSTALLATION DIMENSIONS [mm]

DHZO-TEB, DHZO-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

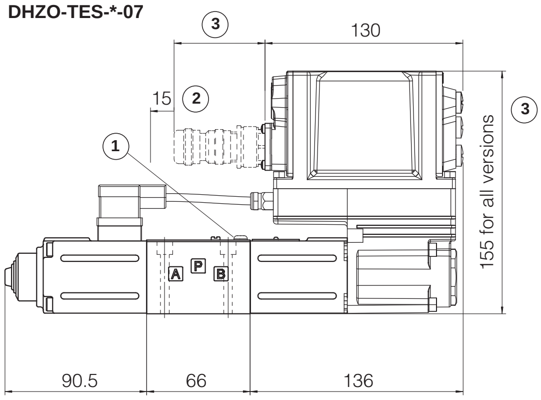
Mass [kg]	
DHZO-*-05	2,3
DHZO-*-07	3,1

DHZO-TEB-*-05
DHZO-TES-*-05



③
130
15 ②
③
①
A P B
38
= =
15
66
136
140
= =
46
155 for **SP, SF, SL, EW** - POWERLINK,
EI - EtherNet/IP, **EP**- PROFINET

DHZO-TEB-*-07
DHZO-TES-*-07



① = Air bleeding 3

② = Space to remove the connectors

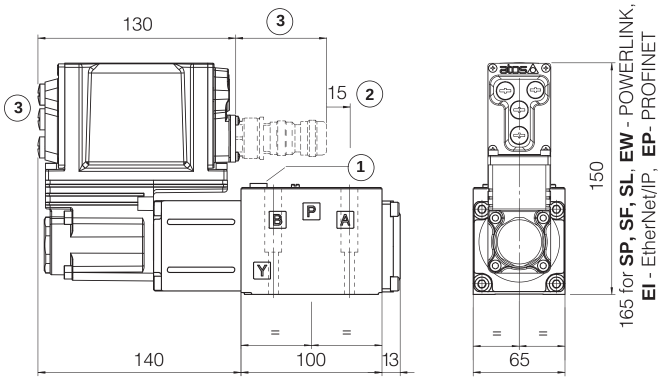
③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

DKZOR-TEB, DKZOR-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

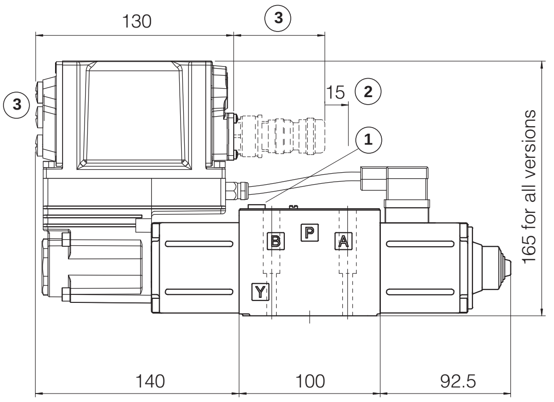
Mass [kg]	
DKZOR-*-15	4,3
DKZOR-*-17	5,0

DKZOR-TEB-*-15
DKZOR-TES-*-15



130
③
③
15 ②
①
B P A
Y
= =
140
100
13
150
= =
65
165 for **SP, SF, SL, EW** - POWERLINK,
EI - EtherNet/IP, **EP**- PROFINET

DKZOR-TEB-*-17
DKZOR-TES-*-17



① = Air bleeding 4 13

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

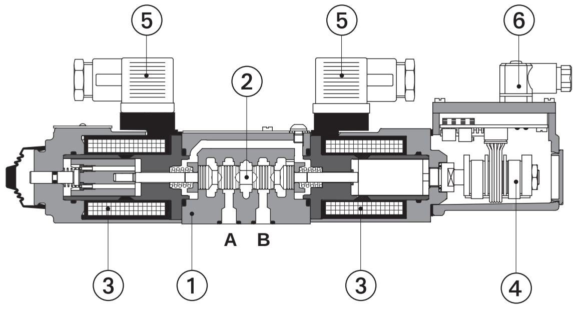
22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS500	Digital proportional valves with P/Q control	**P005**	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	**QB300**	Quickstart for TEB valves commissioning
FY100	Safety proportional valves - option /U	**QF300**	Quickstart for TES valves commissioning
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		
GS510	Fieldbus		

Proportional directional valves high performance

direct, with LVDT transducer and positive spool overlap

CE



DHZO-T-071

① Valve body
② Spool
③ Proportional solenoid
④ LVDT transducer
⑤ Solenoid connector
⑥ Transducer connector

DHZO-T, DKZOR-T

Proportional directional valves, direct, with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section 3.

The LVDT transducer grants very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:
L = linear
S = progressive, for fine low flow control
D = differential-progressive, for control of actuators with area ratio 1:2
Q5 and Q6 = for P/Q control

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **180 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE OF STANDARD SPOOLS

DHZO - **T** - **0** **71** - **L** **5** / ***** ***** / *****

DHZO = size 06
DKZOR = size 10

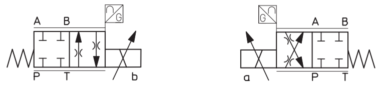
T = with LVDT transducer

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

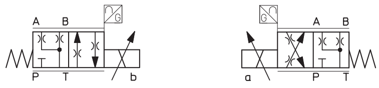
Configuration:

Standard   Option **/B**

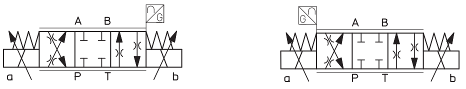
51 =



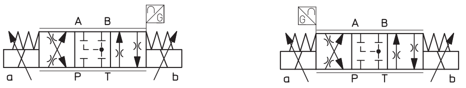
53 =



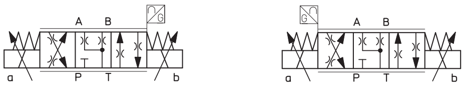
71 =



72 =
(1)



73 =



Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR

Series number

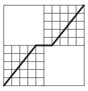
Hydraulic options (2):
B = solenoid and LVDT transducer at side of port A
Y = external drain

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	17	28
DKZOR =	-	-	-	45	75

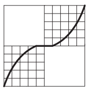
Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics **(3)**:

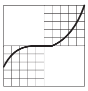
L = linear



S = progressive



D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

---

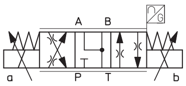
(1) Only for **DKZOR-*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas
(2) Possible combined options: /BY
(3) Spools for P/Q control, see section 2

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section 1

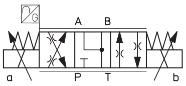
DHZO - **T** - **0** **73 - V9** / * * / *

Configuration and spool:

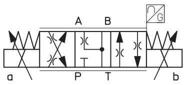
73-Q5



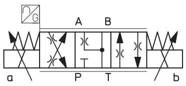
73-Q5/B



73-V9



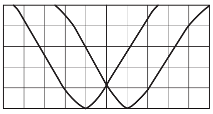
73-V9/B



Spool size:		**Q5**	**V9**
DHZO	=	30	30
DKZOR	=	75	75

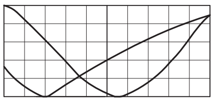
Nominal flow (l/min) at Δp 10 bar P-T

Q5



For alternated P/Q control
see 8.1 - diagram 16

V9



For alternated P/Q control of injection cycle in plastic machinery
see 8.1 - diagram 17

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHZO**						**DKZOR**			
Pressure limits	[bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10						ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10			
Configuration		**51, 53, 71, 73**					**73**	**51, 53, 71, 73**		**72**	**73**
Spool type	standard	**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**		**L3,S3,D3**	**L5,S5,D5**	**S5**	
	P/Q						**Q5,V9**				**Q5,V9**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	1	4,5	8	18	28	30	45	75	75	75
	Δp= 30 bar	1,7	8	14	30	50	52	80	130	130	130
	Δp= 70 bar	2,6	12	21	45	75	80	120	170	170	170
Max permissible flow **(2)**		4	18	30	50	80	80	130	180	180	180
Leakage	[cm^3/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)			
Response time **(3)**	[ms]	≤ 15						≤ 20			
Hysteresis		≤ 0,2 [% of max regulation]									
Repeatability		± 0,1 [% of max regulation]									
Thermal drift		zero point displacement < 1% at ΔT = 40°C									

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2
(2) See detailed diagrams in section 8.3
(3) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

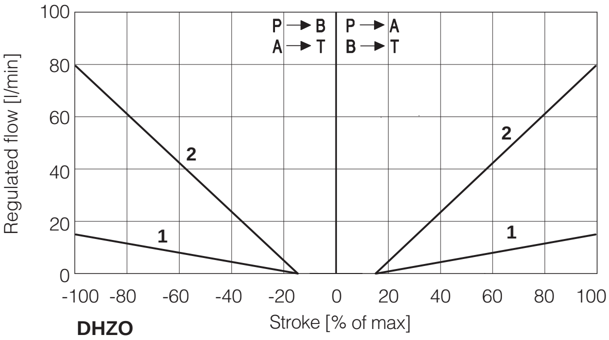
Max power consumption	30 W
Max. solenoid current	**DHZO** = 2,6 A **DKZOR** = 3 A
Coil resistance R at 20°C	**DHZO** = 3 ÷ 3,3 Ω **DKZOR** = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

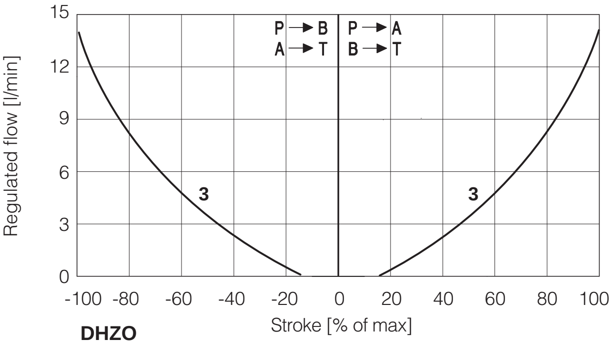
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level: normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

8 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

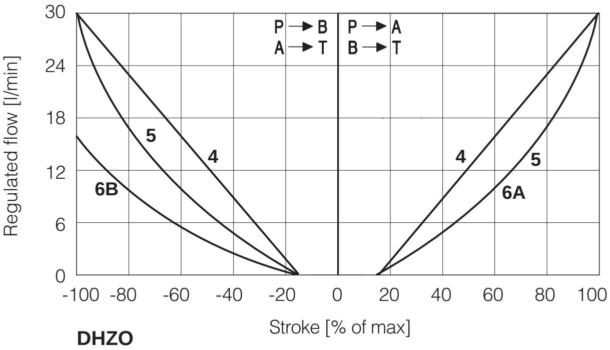
8.1 Regulation diagrams - values measure at Δp 30 bar P-T



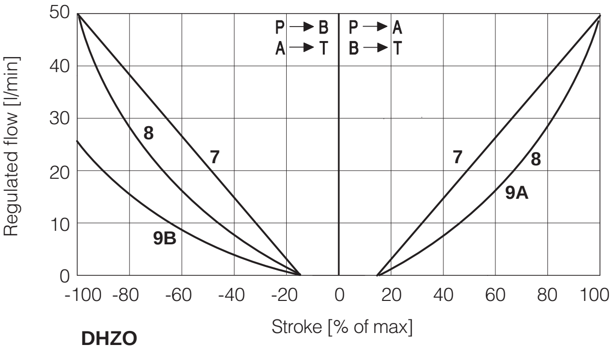
DHZO
1 = L14 **2** = L1



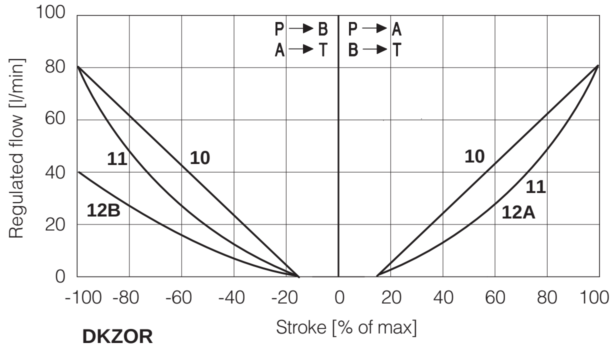
DHZO
3 = S2



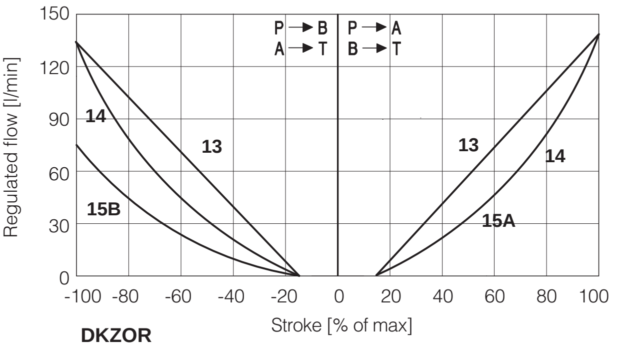
DHZO
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZO
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZOR
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)

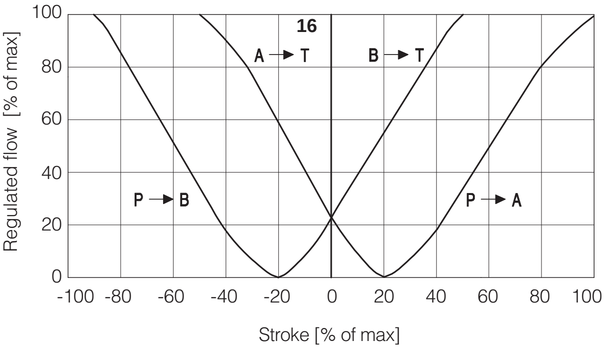


DKZOR
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

Note:
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

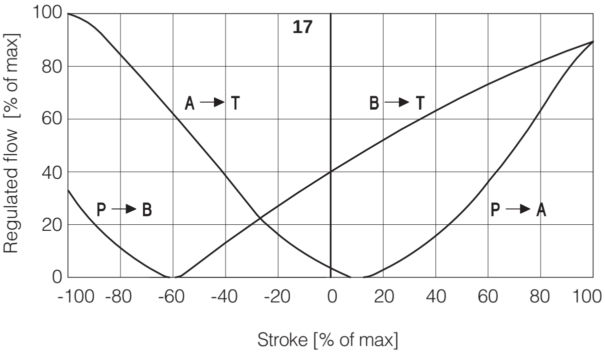
$$\text{Reference signal } \left.\begin{array}{c} 0 \div +10\text{ V} \\ 12 \div 20\text{ mA} \end{array}\right\} P \rightarrow A / B \rightarrow T$$

$$\text{Reference signal } \left.\begin{array}{c} 0 \div -10\text{ V} \\ 12 \div 4\text{ mA} \end{array}\right\} P \rightarrow B / A \rightarrow T$$



16 = linear spool **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



17 = differential - progressive spool **V9**

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**). This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank

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

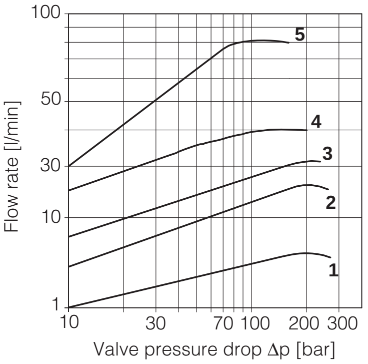
DHZO

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

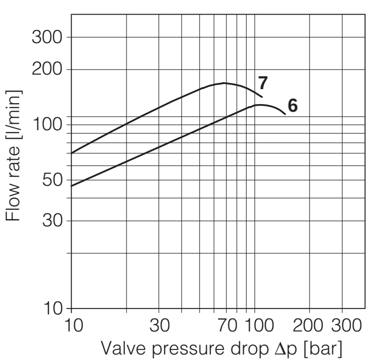
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO



DKZOR



8.3 Operating limits

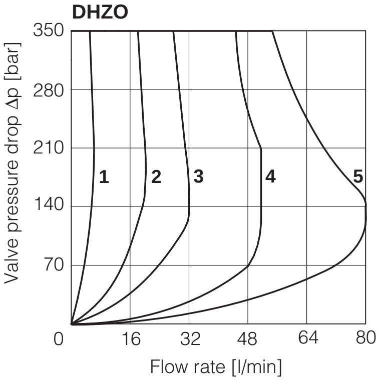
DHZO

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

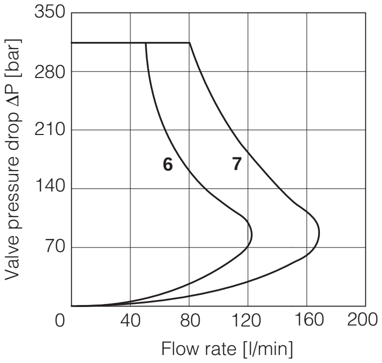
DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5, V9

DHZO

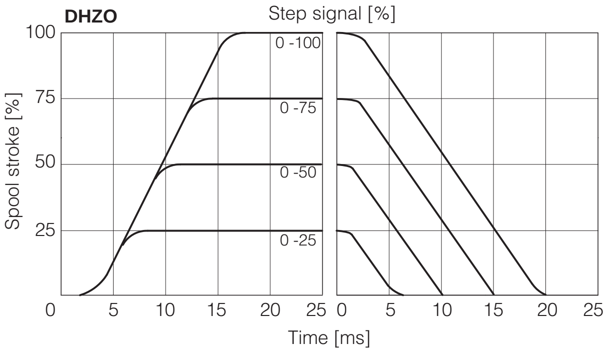


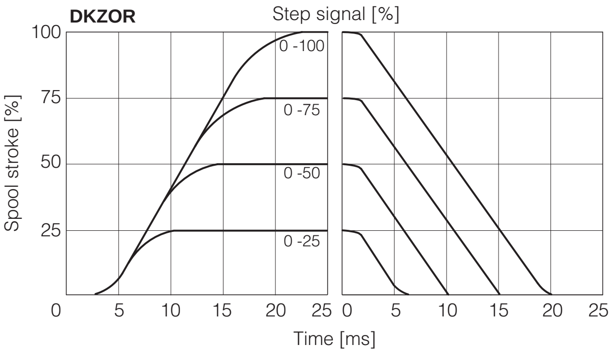
DKZOR



8.4 Response time

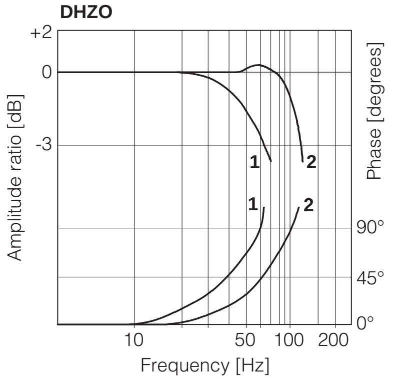
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

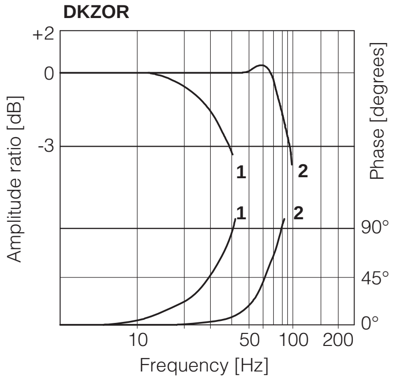




8.5 Bode diagrams

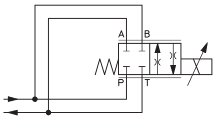
1 = 10% ⟷ 90% nominal stroke
2 = 50% ± 5% nominal stroke





8.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow Δp= 15bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3** **S3**	**L5** **S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

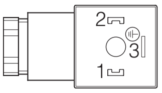
9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 8.1

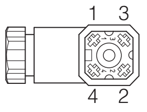
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

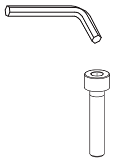
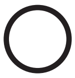
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

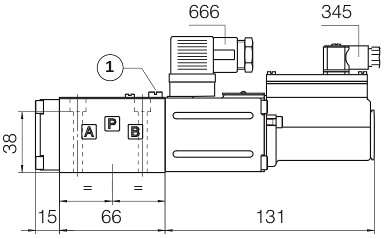
12 INSTALLATION DIMENSIONS [mm]

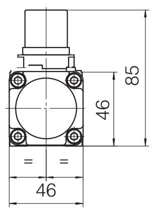
DHZO-T

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

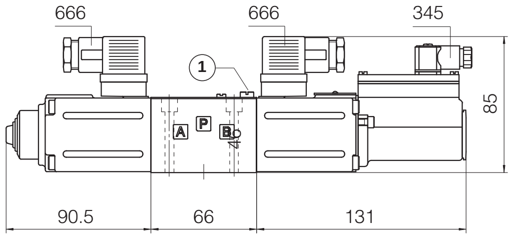
Mass [kg]	
DHZO-T-05	1,9
DHZO-T-07	2,6

DHZO-T-05





DHZO-T-07



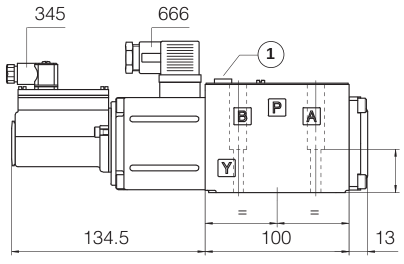
① = Air bleeding

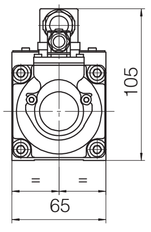
DKZOR-T

Mass [kg]	
DKZOR-T-15	3,8
DKZOR-T-17	4,5

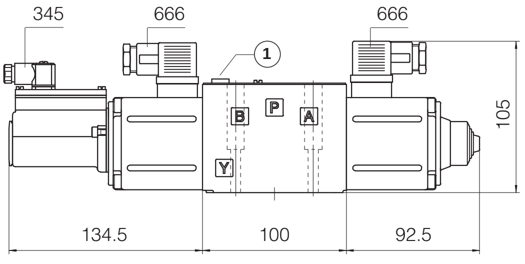
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

DKZOR-T-15





DKZOR-T-17



① = Air bleeding

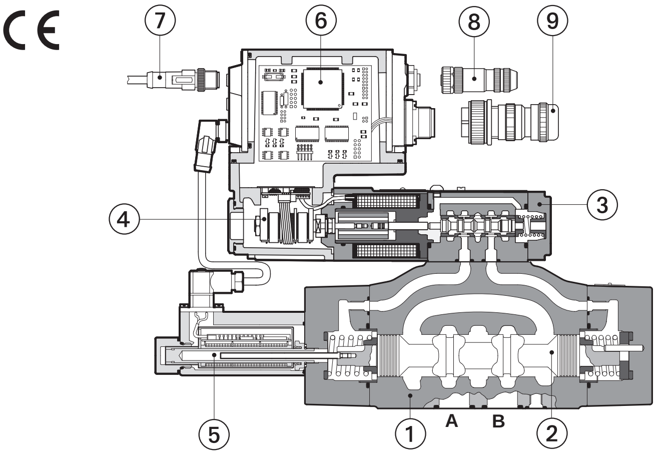
Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS230	E-BM-TEB digital driver
GS235	E-BM-TID digital driver
GS240	E-BM-TES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional directional valves high performance

piloted with on-board driver, two LVDT transducers and positive spool overlap



DPZO-LES-SN-BP-271

① Valve body	④ Pilot valve LVDT transducer	⑦ USB connector
② Main stage Spool	⑤ Main stage LVDT transducer	⑧ Fieldbus connectors
③ Pilot valve	⑥ On-board digital driver	⑨ Main connector

DPZO-LEB, DPZO-LES

Digital proportional directional valves high performance, piloted, specifically designed for high speed closed loop controls.

They are equipped with two LVDT position transducers (pilot valve and main stage) and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

LEB basic execution with analog reference signals and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** ÷ **35** - ISO 4401
Max flow: **180** ÷ **3500 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZO	-	LES	-	SN	-	NP	-	2	71	-	L	5	/	*	*	/	*

Proportional directional valve, piloted

LEB = basic on-board digital driver **(1)**
LES = full on-board digital driver

Alternated P/Q controls, see section 6 :
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:

NP = Not present	
BC = CANopen	**EW** = POWERLINK
BP = PROFIBUS DP	**EI** = EtherNet/IP
EH = EtherCAT	**EP** = PROFINET RT/IRT

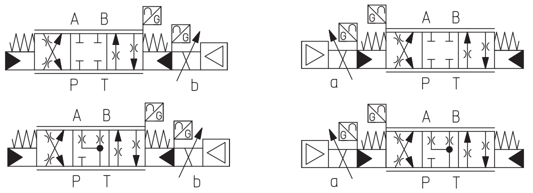
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

Configuration:

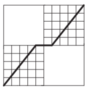
Standard Option **/B**

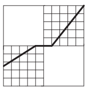
71 =
(4)

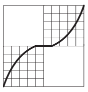
73 =

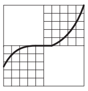


Spool type, regulating characteristics **(5)**:

L =

linear

DL =

differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

S =

progressive

D =

differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Series number

Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **LES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Safety options TÜV certified - only **LES (2)**:
U = safe double power supply
K = safe on/off signals
See section 7

SAFETY CERTIFIED

Spool size:	**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1 =	-	100	-
DPZO-2 =	160	250	-
DPZO-4 =	-	480	-
DPZO-4M =	-	550	-
DPZO-6 =	-	-	640
DPZO-8 =	-	-	1200

Nominal flow (l/min) at Δp 10bar P-T

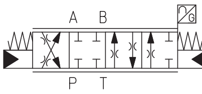
(1) Only in version **SN-NP**
(2) For possible combined options, see section 15
(3) Double power supply only for **LES**
(4) Do not use for P/Q control
(5) Spools for regenerative circuit or alternated P/Q control, see section 2

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT OR ALTERNATED P/Q CONTROL - for valve model code and options, see sect. 1

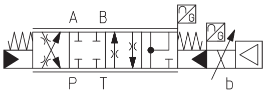
DPZO - **LES** - **SN** - **NP** - **2** **71 - L9** / ***** ***** / *****

Configuration and spool for regenerative circuit:

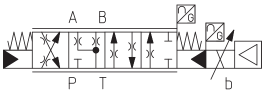
71-D9



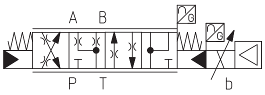
71-L9



73-D9

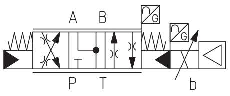


73-L9

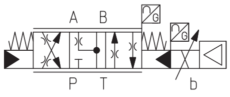


Configuration and spool for alternated P/Q control:

73-Q5



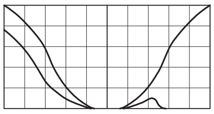
73-V9



Spool size:	**D9**	**L9**	**V9**	**Q5**
DPZO-1 =	100	-	100	100
DPZO-2 =	250	250	250	250
DPZO-4 =	480	-	480	480
DPZO-4M =	550	-	550	550
DPZO-6 =	-	-	640	-
DPZO-8 =	-	-	1200	-

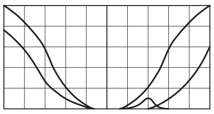
Nominal flow (l/min) at Δp 10bar P-T

D9



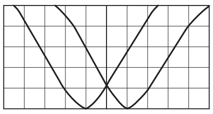
For regenerative circuit (additional external check valve required)
see 12.1 - diagram 26

L9



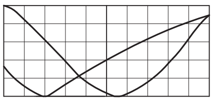
For regenerative circuit internal to the valve
see 12.1 - diagram 27

Q5



For alternated P/Q control
see 12.1 - diagram 28

V9



For alternated P/Q control of injection cycle in plastic machinery
see 12.1 - diagram 29

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

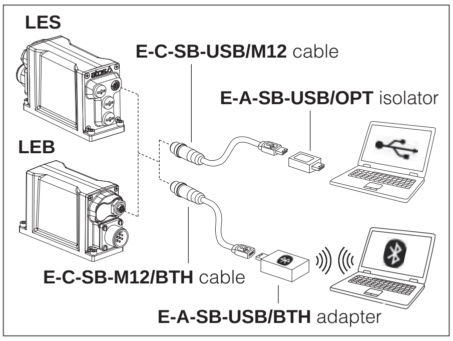
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 ALTERNATED P/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.
An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.
Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

7 SAFETY OPTIONS - only for LES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** ,
designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DPZO-*-1**	**DPZO-*-2**		**DPZO-*-4**	**DPZO-*-4M**	**DPZO-*-6**	**DPZO-*-8**
Pressure limits [bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;						
Spool type standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**			**L5, S5, D5**	
Spool type regenerative or P/Q	**D9, V9, Q5**		**D9, L9, V9, Q5**	**D9, V9, Q5**		**V9**	
Nominal flow Δp P-T [l/min] **(1)** Δp= 10 bar	100	160	250	480	550	640	1200
Δp= 30 bar	160	270	430	830	950	1100	2000
Max permissible flow	180	400	550	1000	1100	1600	3500
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)						
Piloting volume [cm^3]	1,4	3,7		9,0	11,3	21,6	39,8
Piloting flow **(2)** [l/min]	1,7	3,7		6,8	8	14,4	20
Leakage **(3)** Pilot [cm^3/min]	100 / 300	100 / 300		200 / 500	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	0,3 / 1,0	1,0 / 3,0	1,2 / 3,6
Response time **(4)** [ms]	≤ 50	≤ 60		≤ 80	≤ 85	≤ 90	≤ 120
Hysteresis	≤ 0,1 [% of max regulation]						
Repeatability	± 0,1 [% of max regulation]						
Thermal drift	zero point displacement < 1% at ΔT = 40°C						

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2

(2) With step reference input signal 0 ÷100 %

(3) At p = 100/350 bar

(4) 0-100% step signal see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

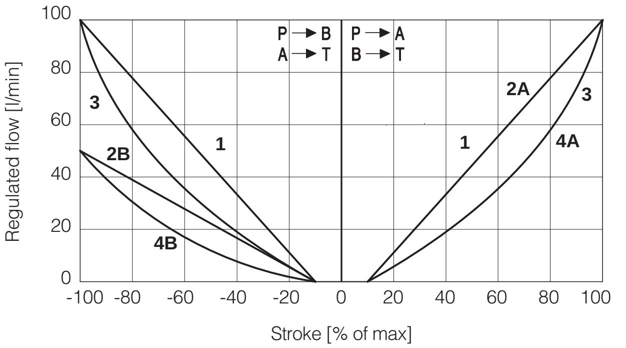
11 **SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

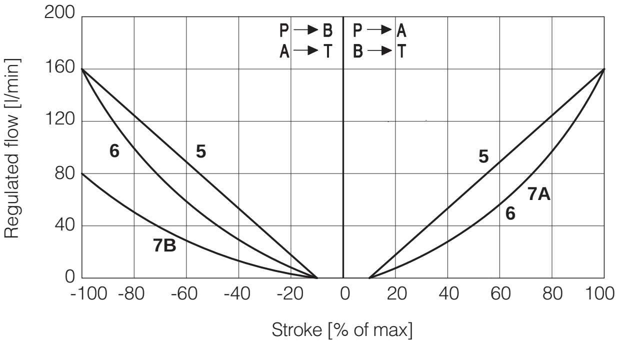
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

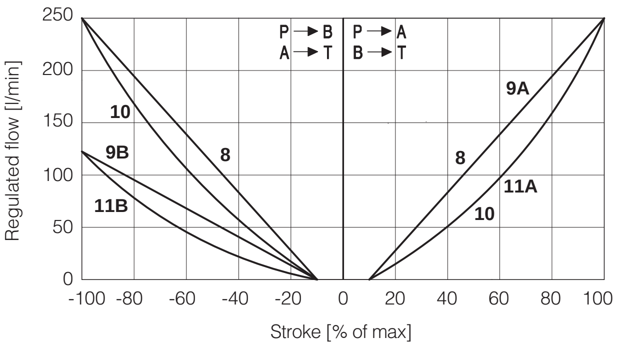
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



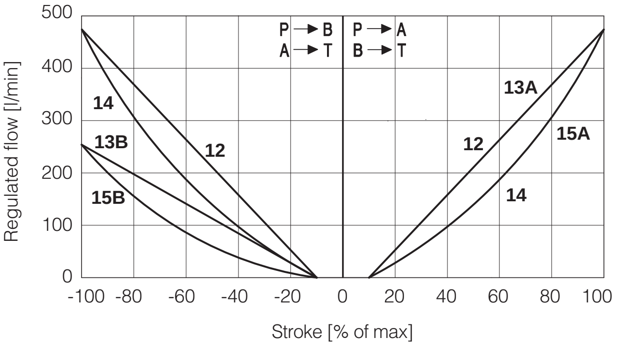
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T)
4A = D5 (P → A, A → T)
4B = D5 (P → B, B → T)



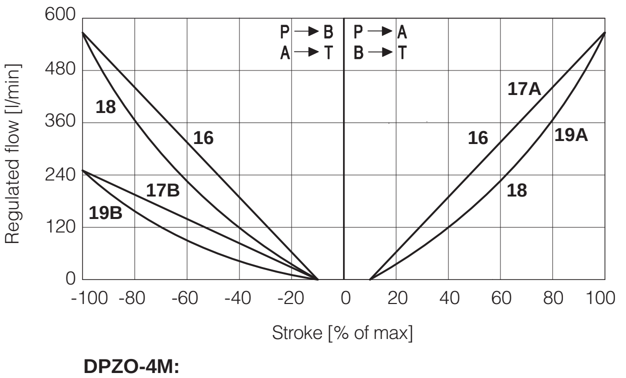
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



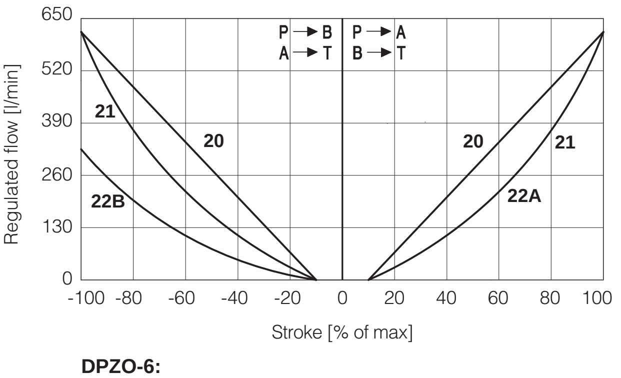
DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T)
11A = D5 (P → A, A → T)
11B = D5 (P → B, B → T)



DPZO-4:
12 = L5 **13A** = DL5 (P → A, A → T)
14 = S5 **13B** = DL5 (P → B, B → T)
15A = D5 (P → A, A → T)
15B = D5 (P → B, B → T)



DPZO-4M:
16 = L5 **17A** = DL5 (P → A, A → T)
18 = S5 **17B** = DL5 (P → B, B → T)
19A = D5 (P → A, A → T)
19B = D5 (P → B, B → T)

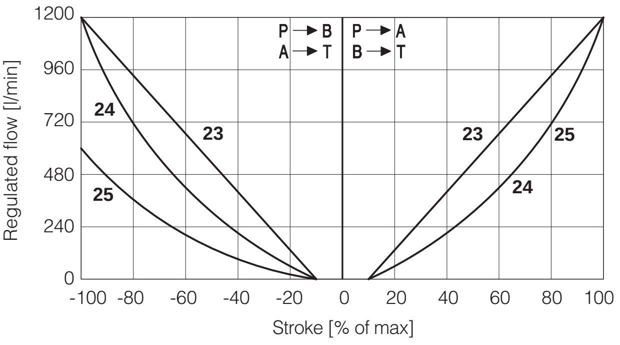


DPZO-6:
20 = L5 **22A** = D5 (P → A, A → T)
21 = S5 **22B** = D5 (P → B, B → T)

Note:
Hydraulic configuration vs. reference signal (standard and option /B)

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

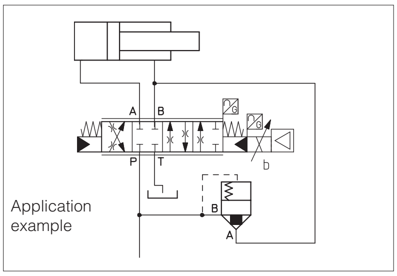
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

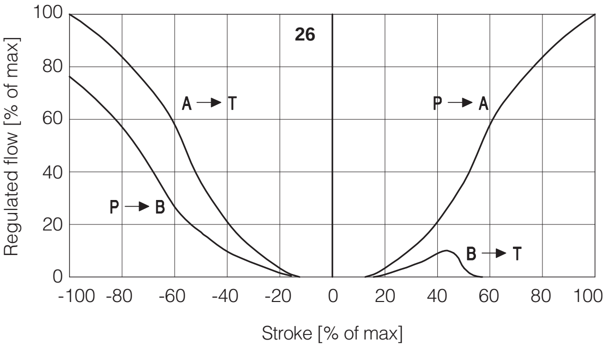


DPZO-8:
23 = L5 **24** = S5
25 = D5

26 = differential - regenerative spool **D9**
(not available for valve size 32 and 35)

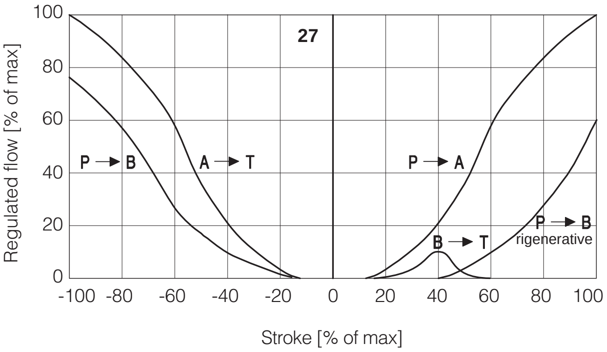
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





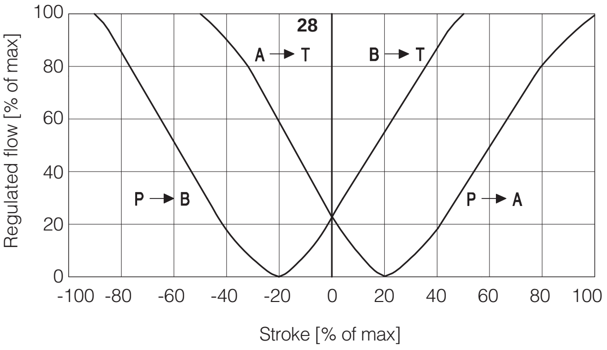
27 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



28 = linear spool **Q5**
(not available for valve size 32 and 35)

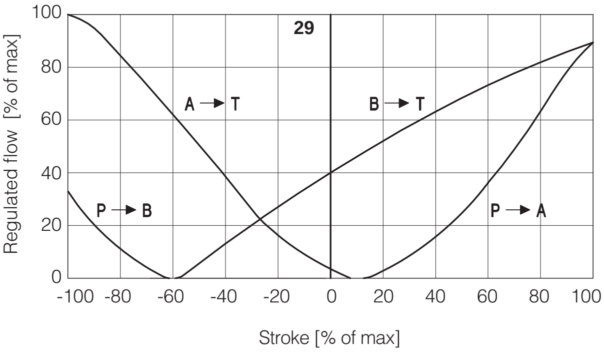
Q5 spool type is specific for alternate P/Q controls in combination with /S* option of digital on-board drivers, (see tech. table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



29 = differential - progressive spool **V9**

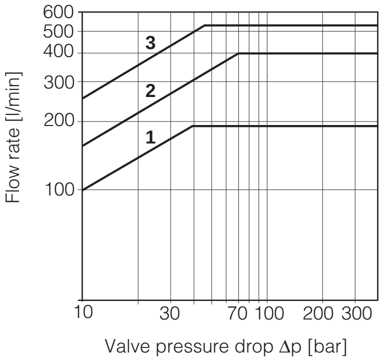
V9 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers, (see tech. table **FS500**).
This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

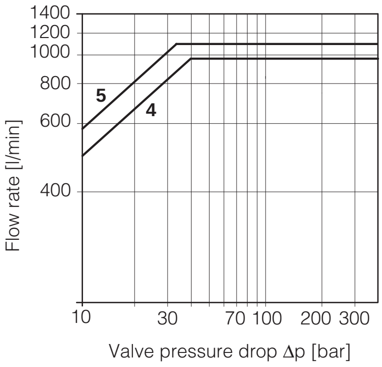
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank

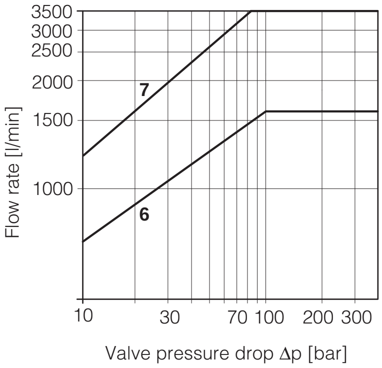


12.2 Operating diagrams

Flow /Δp diagram
stated at 100% of spool stroke







DPZO-1:
1 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5

DPZO-4:
4 = spools L5, S5, D5, DL5, D9, V9, Q5

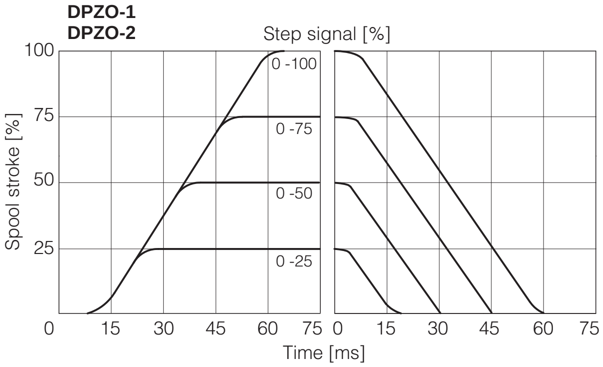
DPZO-4M:
5 = spools L5, S5, D5,DL5, D9, V9, Q5

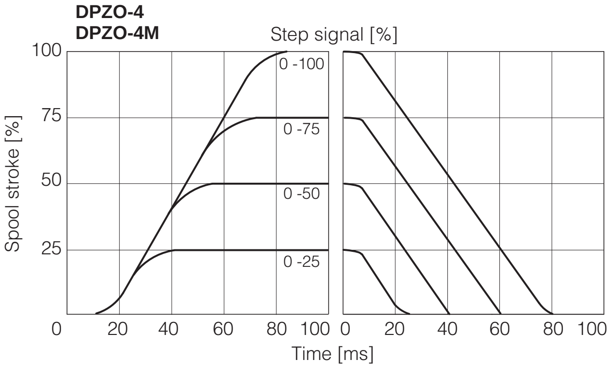
DPZO-6:
6 = L5, S5, D5, V9

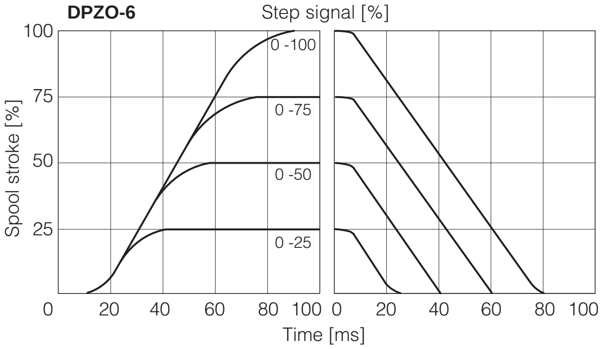
DPZO-8:
7 = L5, S5, D5, V9

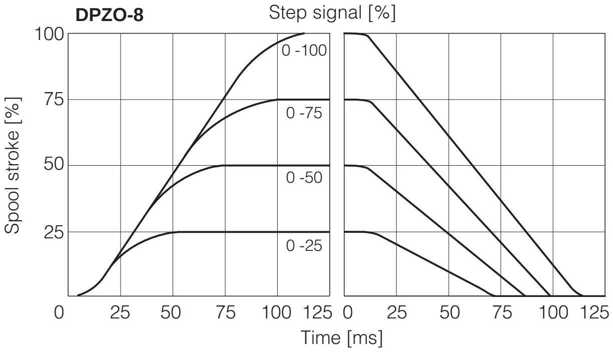
12.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.


DPZO-1
DPZO-2


DPZO-4
DPZO-4M


DPZO-6


DPZO-8

13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 20
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 20
The valve's standard configuration provides internal pilot and external drain.

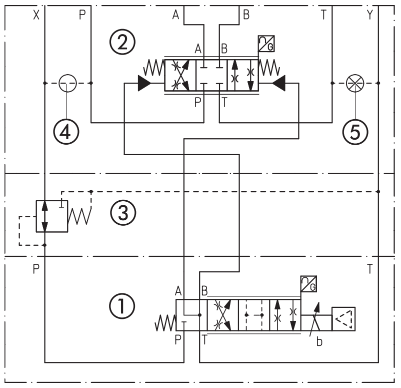
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 71



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 16.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 16.8)
Power supply for driver's logics and communication - only for **LES** (see 16.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:

LEB-SN, **LES-SN**	**LES-SP, SF, SL**
/FI, /IQ, /IZ	/CI

Electronics options - Safety certified versions:

LES-SN	**LES-SP, SF, SL**
/IU, /IK	/CU, /IU, /CIU, /CK, /IK, /CIK

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and LES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Pressure or force reference input signal (F_INPUT+) - only for LES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.6 Pressure or force monitor output signal (F_MONITOR) - only for LES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.8 Repeat enable output signal (R_ENABLE) - only for LEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 16.7).

16.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.10 Remote pressure/force transducer input signal - only for LES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 17.4).
Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

16.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for LES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.
Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
9	0	24 VDC	0	24 VDC
10	0	0	24 VDC	24 VDC

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option and LES-SP, SF, SL

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SF, SL		TECHNICAL SPECIFICATIONS	NOTES
			Fieldbus	NP		
1	**V+**				Power supply 24 VDC	Input - power supply
2	**V0**				Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	VL0	V0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**				Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	VL0	V0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**				Analog ground	Gnd - analog signal
		NC			Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**R_ENABLE**				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
			F_MONITOR referred to: VL0	V0	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**NC**				Do not connect	
		VL+			Power supply 24 VDC for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	**NC**				Do not connect	
		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	**FAULT** referred to: V0	VL0	VL0	V0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

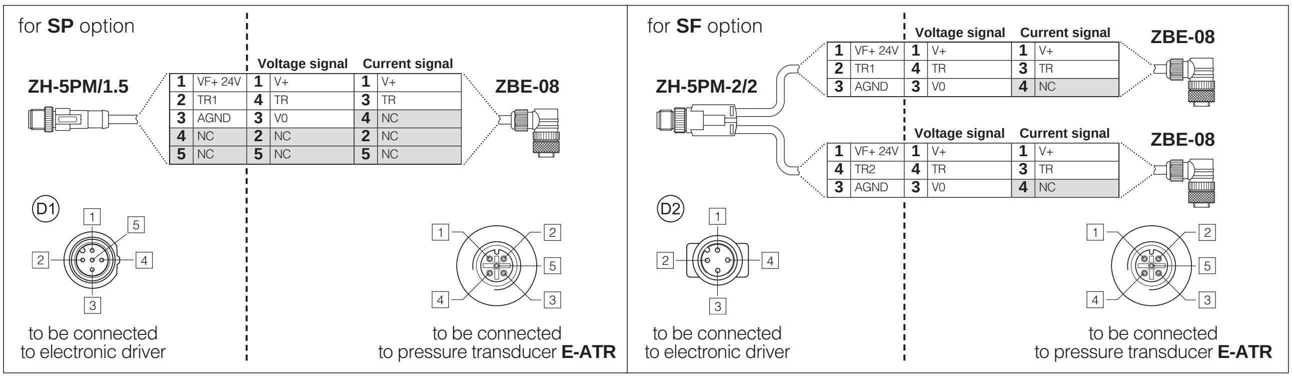
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL Ⓓ

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	D1 SP, SL - Single transducer (1)		D2 SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
3	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
5	**NC**	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

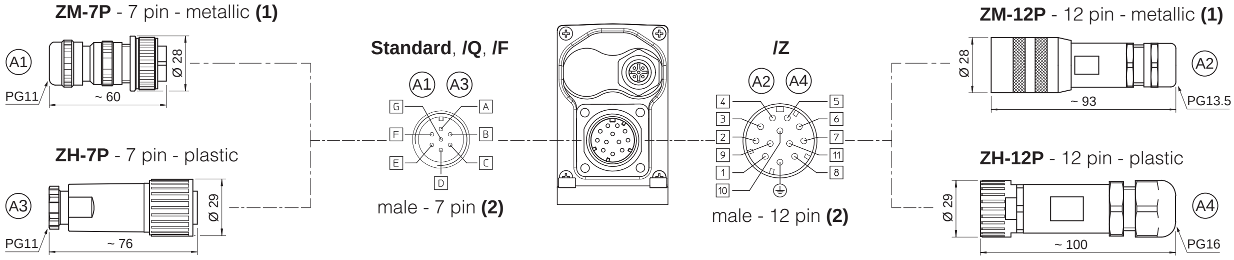
Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

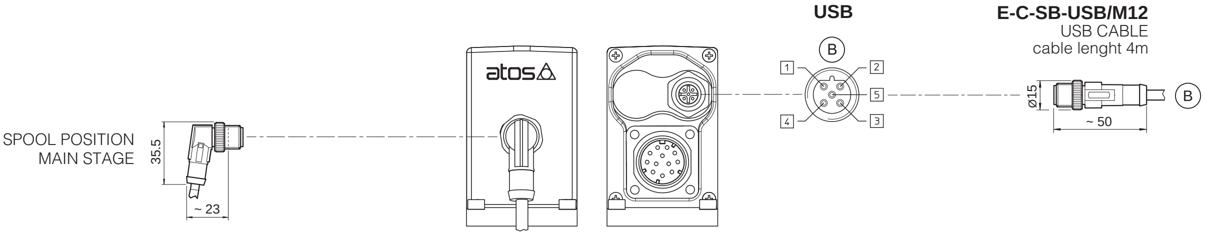
17.5 LEB connections layout

MAIN CONNECTORS

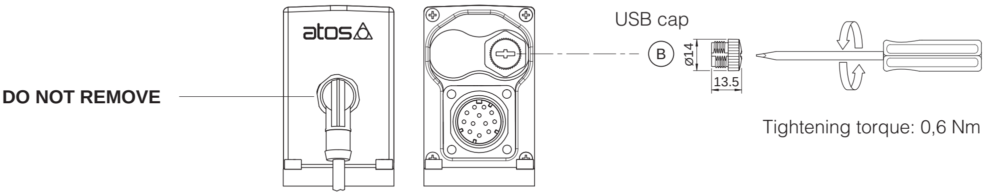


ZM-7P - 7 pin - metallic **(1)**
A1
PG11
~ 60
Ø 28
ZH-7P - 7 pin - plastic
A3
PG11
~ 76
Ø 29
Standard, **/Q**, **/F**
A1
A3
G
A
F
B
E
C
D
male - 7 pin **(2)**
/Z
A2
A4
4
3
2
9
1
10
5
6
7
11
8
male - 12 pin **(2)**
ZM-12P - 12 pin - metallic **(1)**
A2
Ø 28
~ 93
PG13.5
ZH-12P - 12 pin - plastic
A4
Ø 29
~ 100
PG16

TRANSDUCER AND USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves

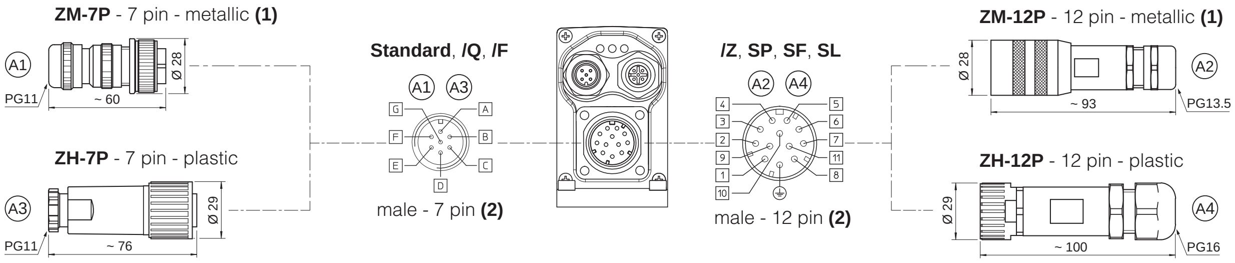


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

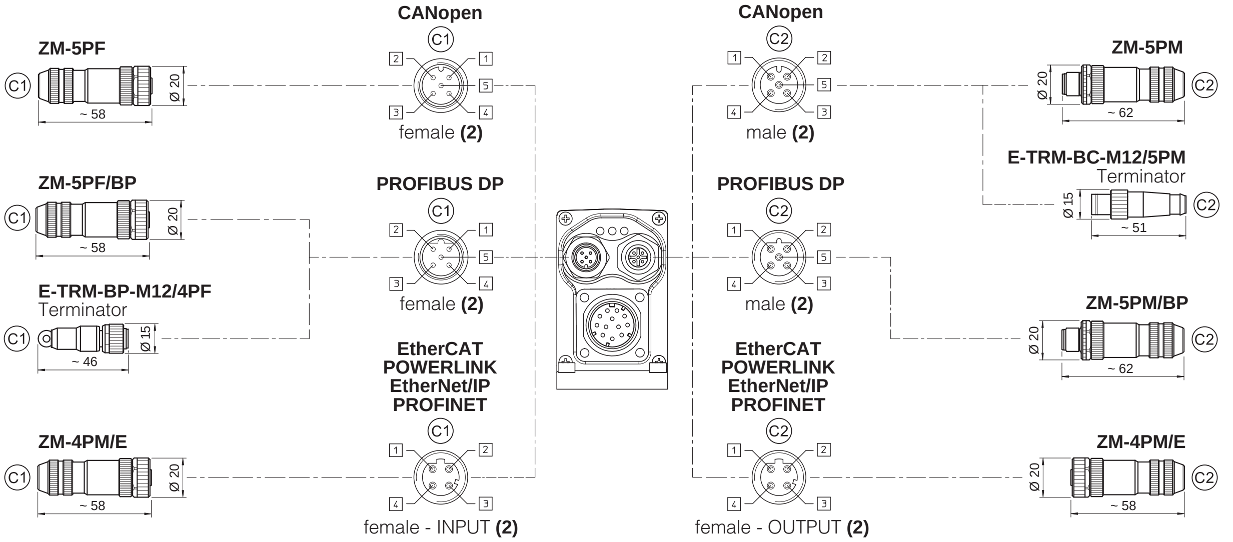
(2) Pin layout always referred to driver's view

17.6 LES connections layout

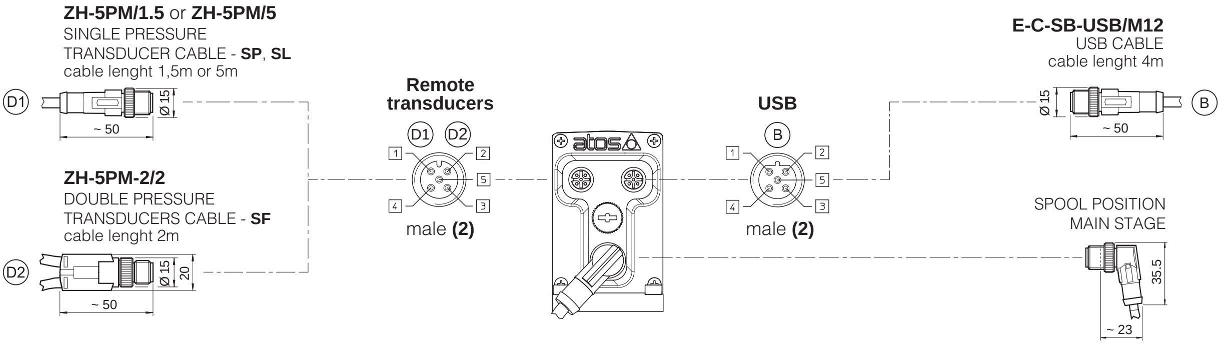
MAIN CONNECTORS



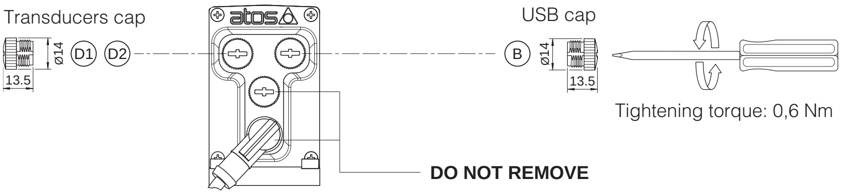
FIELDBUS CONNECTORS



TRANSDUCERS AND USB CONNECTORS



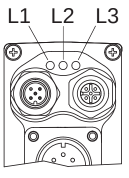
PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.7 Diagnostic LEDs - only for LES

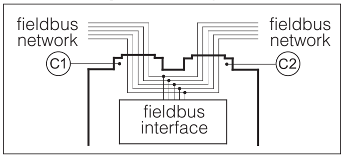
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	**NP** Not Present	**BC** CANopen	**BP** PROFIBUS DP	**EH** EtherCAT	**EW** POWERLINK	**EI** EtherNet/IP	**EP** PROFINET	
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

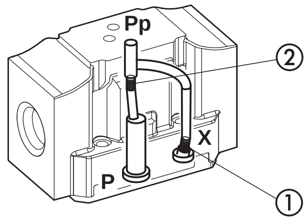
19.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	**SP, SL - Single transducer**		**SF - Double transducers**
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**	(D2) **ZH-5PM-2/2**
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght	Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm^2		3 x 0,25 mm^2 (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

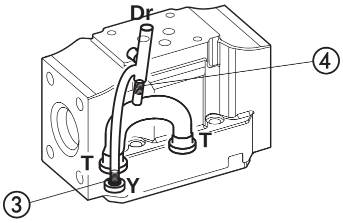
20 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels**

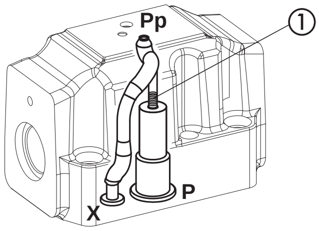


Drain channels

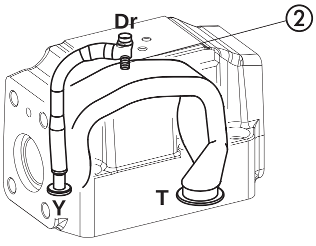


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels**

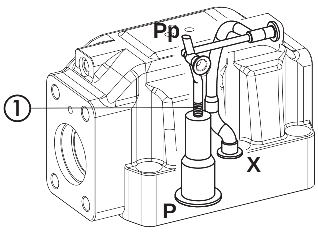


Drain channels

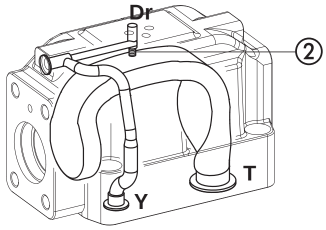


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels**

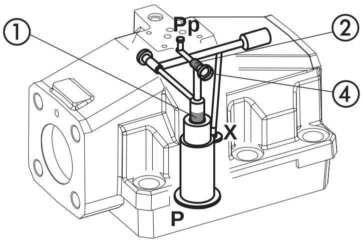


Drain channels

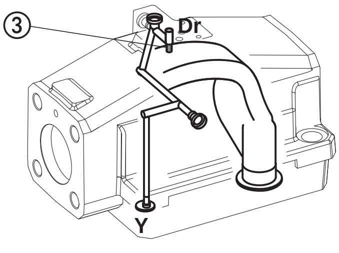


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels**

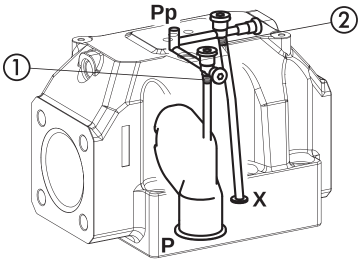


Drain channels

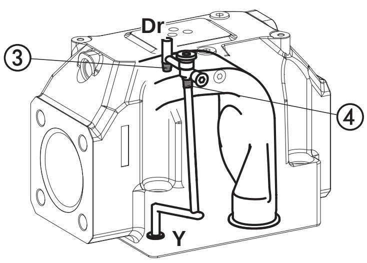


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 **Pilot channels**



Drain channels



Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

21 FASTENING BOLTS AND SEALS

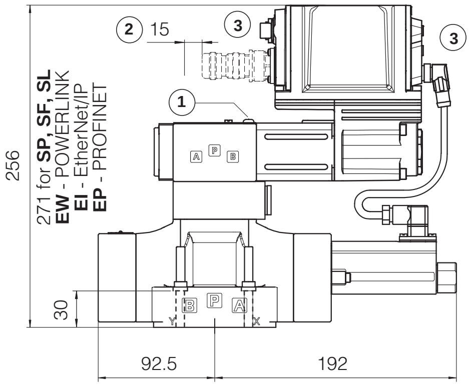
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

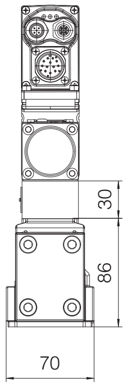
22 INSTALLATION DIMENSIONS [mm]

DPZO-LEB-*-1
DPZO-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-*-1	9,5

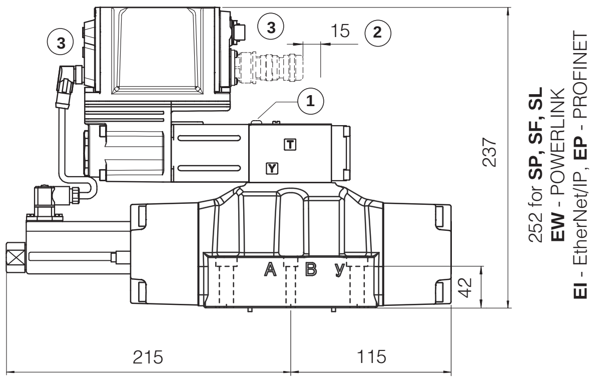


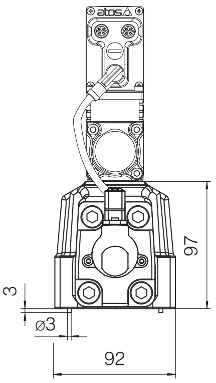


DPZO-LEB-*-2
DPZO-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-*-2	14





① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

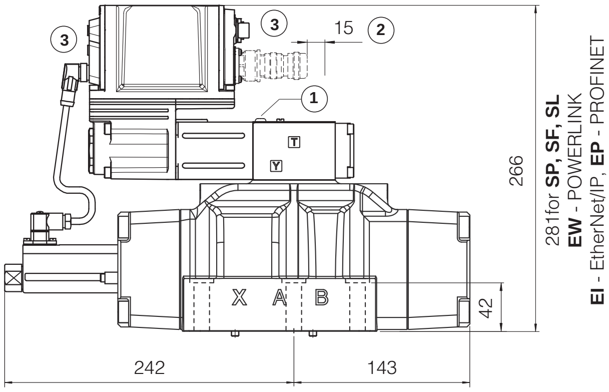
DPZO-LEB-*-4
DPZO-LES-*-4

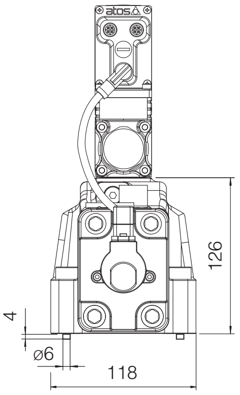
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-LEB-*-4M
DPZO-LES-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm

Mass [kg]	
DPZO-*-4	19

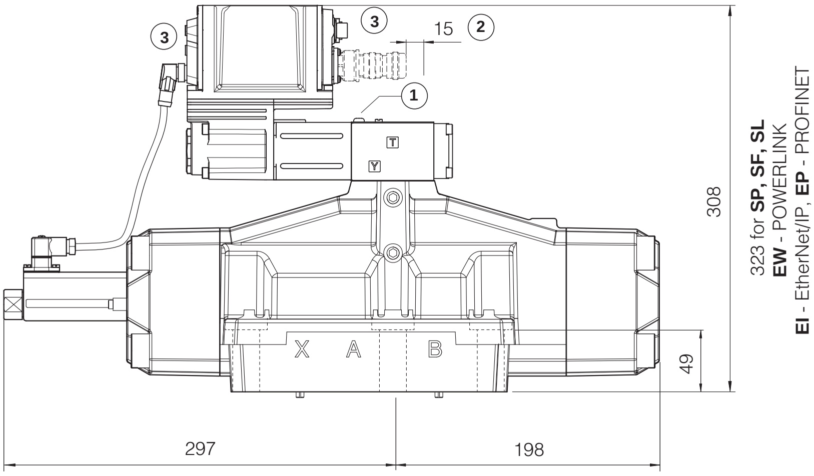


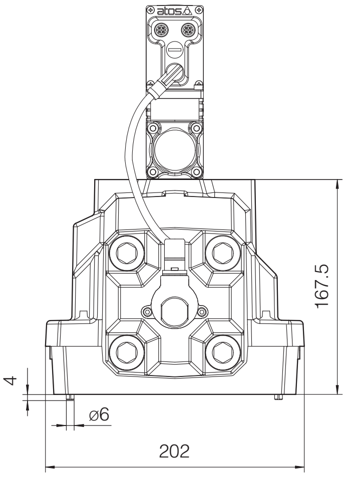


DPZO-LEB-*-6
DPZO-LES-*-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-6	43





① = Air bleeding 3

② = Space to remove the connectors

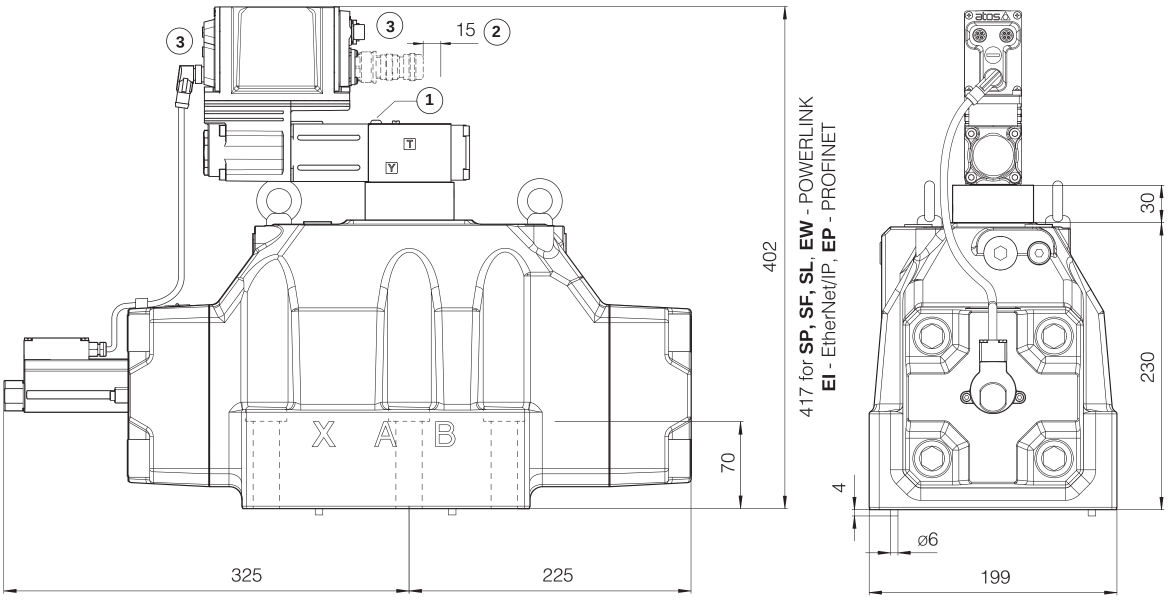
③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-8
DPZO-LES-*-8

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80


3
3
15
2
1
T
Y
X
A
B
402
417 for **SP, SF, SL, EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET
70
325
225
atos
30
230
4
ø6
199

① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

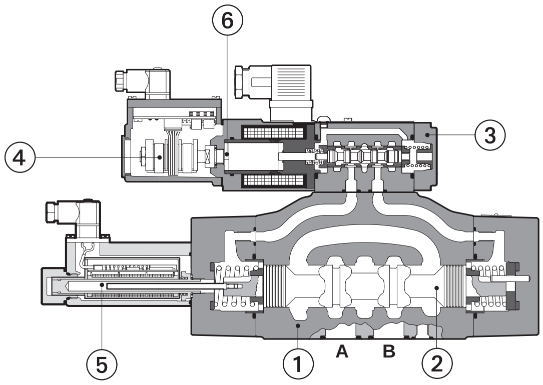
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS500	Digital proportional valves with P/Q control	**P005**	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	**QB320**	Quickstart for LEB valves commissioning
FY100	Safety proportional valves - option /U	**QF320**	Quickstart for LES valves commissioning
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		
GS510	Fieldbus		

Proportional directional valves high performance

piloted, with two LVDT transducers and positive spool overlap



DPZO-L-271

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot valve LVDT transducer
⑤ Main stage LVDT transducer
⑥ Pilot valve solenoid

DPZO-L

Proportional directional valves, piloted, with two LVDT position transducers and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section 3.

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs

Spools regulation characteristics:
L = linear
S = progressive for fine low flow control
D and DL = differential, for control of actuators with area ratio 1:2
D9 and L9 = for regenerative circuit
Q5 and V9 = for alternate P/Q control

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

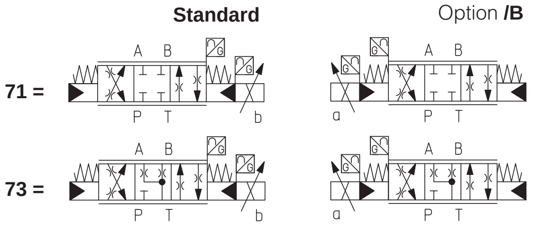
DPZO	-	L	-	2	71	-	L	5	/	*	*	/	*

Proportional directional valve, piloted

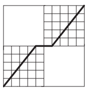
L = two LVDT transducers

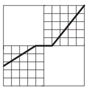
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32

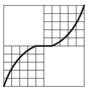
Configuration:

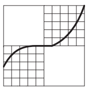


Spool type, regulating characteristics **(1)**:

L =

linear

DL =

differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

S =

progressive

D =

differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Hydraulic options (2):
B = solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Spool size:		**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1	=	-	100	-
DPZO-2	=	160	250	-
DPZO-4	=	-	480	-
DPZO-4M	=	-	550	-
DPZO-6	=	-	-	640

Nominal flow (l/min) at Δp 10bar P-T

Series number

Seals material,
see section 7 :
- = NBR
PE = FKM
BT = HNBR

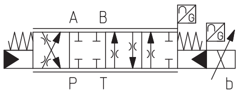
(1) Spools for regenerative circuit or alternated P/Q control, see section 2
(2) All combination possible

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT OR ALTERNATED P/Q CONTROL - for valve model code and options, see sect. 1

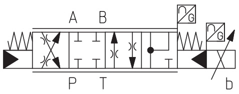
DPZO	-	L	-	2	71 - L9	/	*	*	/	*

Configuration and spool for regenerative circuit:

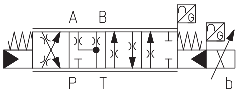
71-D9



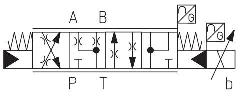
71-L9



73-D9

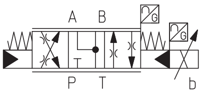


73-L9

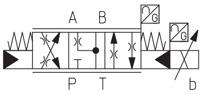


Configuration and spool for alternated P/Q control:

73-Q5



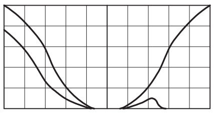
73-V9



Spool size:	**D9**	**L9**	**V9**	**Q5**
DPZO-1 =	100	-	100	100
DPZO-2 =	250	250	250	250
DPZO-4 =	480	-	480	480
DPZO-4M =	550	-	550	550
DPZO-6 =	-	-	640	-

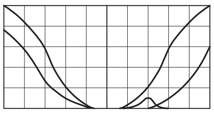
Nominal flow (l/min) at Δp 10bar P-T

D9



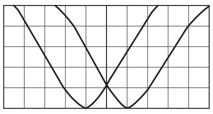
For regenerative circuit (additional external check valve required)
see 8.1 - diagram 26

L9



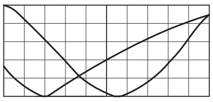
For regenerative circuit internal to the valve
see 8.1 - diagram 27

Q5



For alternated P/Q control
see 8.1 - diagram 28

V9



For alternated P/Q control of injection cycle in plastic machinery
see 8.1 - diagram 29

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-L-1	DPZO-L-2		DPZO-L-4	DPZO-L-4M	DPZO-L-6
Pressure limits [bar]		ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;					
Spool type	standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**			**L5, S5, D5**
	regenerative or P/Q	**D9, V9, Q5**		**D9, L9, V9, Q5**	**D9, V9, Q5**		**V9**
Nominal flow Δp P-T [l/min] **(1)**	Δp= 10 bar	100	160	250	480	550	640
	Δp= 30 bar	160	270	430	830	950	1100
Max permissible flow [l/min]		180	400	550	1000	1100	1600
Piloting pressure [bar]		min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)					
Piloting volume [cm³]		1,4	3,7		9,0	11,3	21,6
Piloting flow **(2)** [l/min]		1,7	3,7		6,8	8	14,4
Leakage **(3)**	Pilot [cm³/min]	100 / 300	100 / 300		200 / 500	200 / 600	900 / 2800
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	0,3 / 1,0	1,0 / 3,0
Response time **(4)** [ms]		≤ 50	≤ 60		≤ 80	≤ 85	≤ 90
Hysteresis		≤ 0,1 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

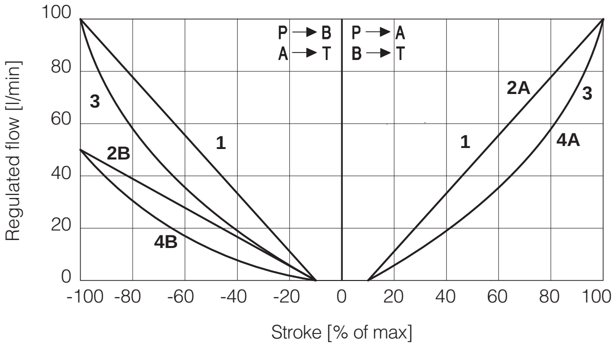
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

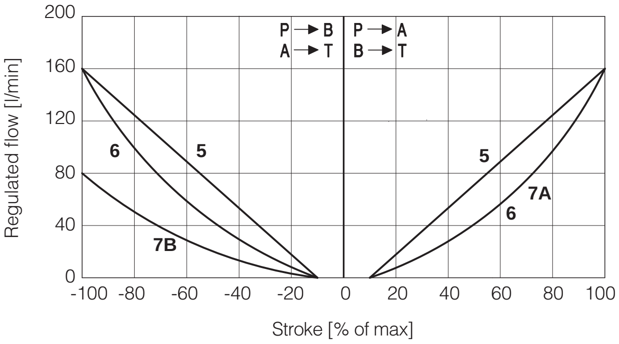
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

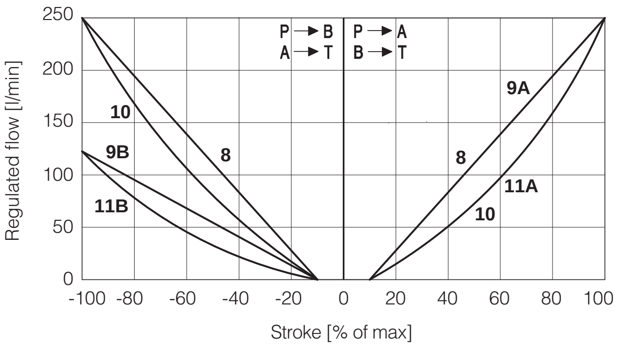
8.1 Regulation diagrams (values measure at Δp 10 bar P-T)



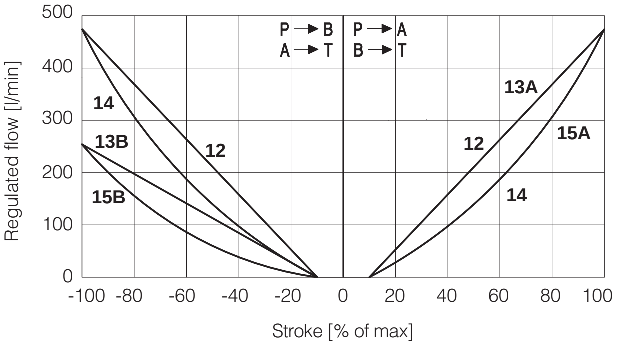
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T)
4A = D5 (P → A, A → T)
4B = D5 (P → B, B → T)



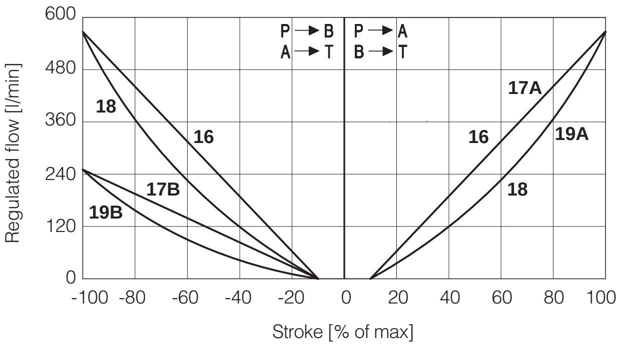
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



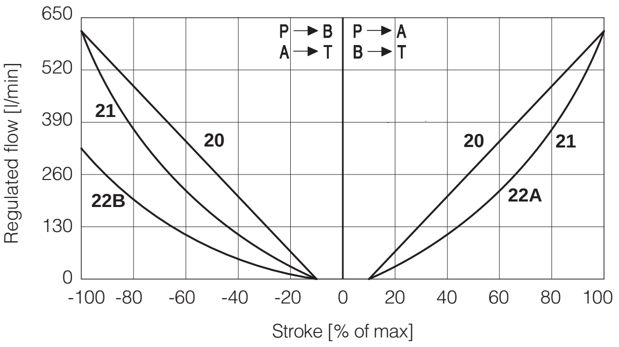
DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T)
11A = D5 (P → A, A → T)
11B = D5 (P → B, B → T)



DPZO-4:
12 = L5 **13A** = DL5 (P → A, A → T)
14 = S5 **13B** = DL5 (P → B, B → T)
15A = D5 (P → A, A → T)
15B = D5 (P → B, B → T)



DPZO-4M:
16 = L5 **17A** = DL5 (P → A, A → T)
18 = S5 **17B** = DL5 (P → B, B → T)
19A = D5 (P → A, A → T)
19B = D5 (P → B, B → T)



DPZO-6:
20 = L5 **22A** = D5 (P → A, A → T)
21 = S5 **22B** = D5 (P → B, B → T)

Note:

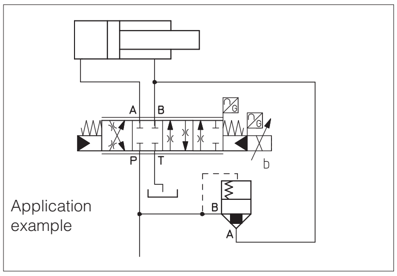
Hydraulic configuration vs. reference signal (standard and option /B)

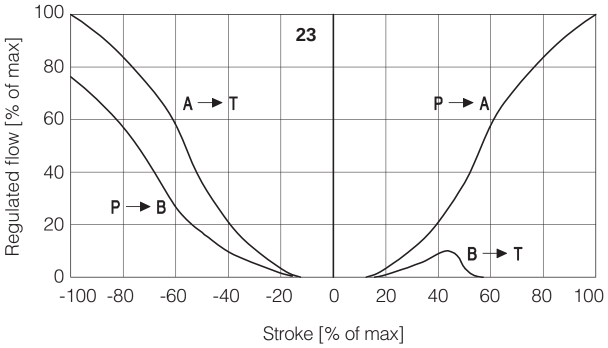
Reference signal $\left.\begin{array}{l}0 \div +10\text{ V}\\ 12 \div 20\text{ mA}\end{array}\right\}$ P → A / B → T

Reference signal $\left.\begin{array}{l}0 \div -10\text{ V}\\ 12 \div 4\text{ mA}\end{array}\right\}$ P → B / A → T

23 = differential - regenerative spool **D9**
(not available for valve size 32 and 35)

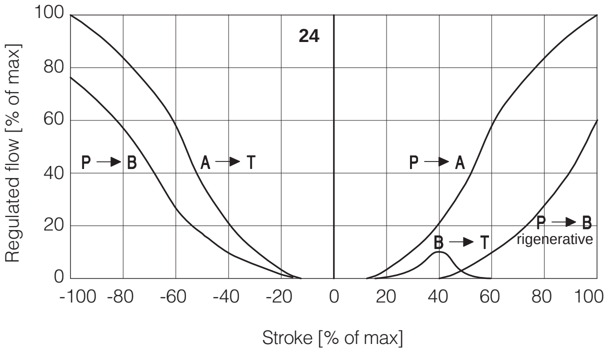
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





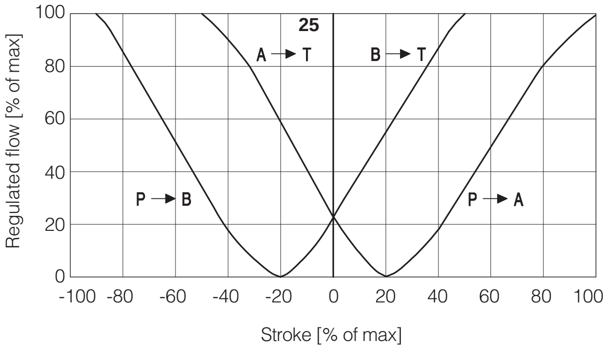
24 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



25 = linear spool **Q5**
(not available for valve size 32 and 35)

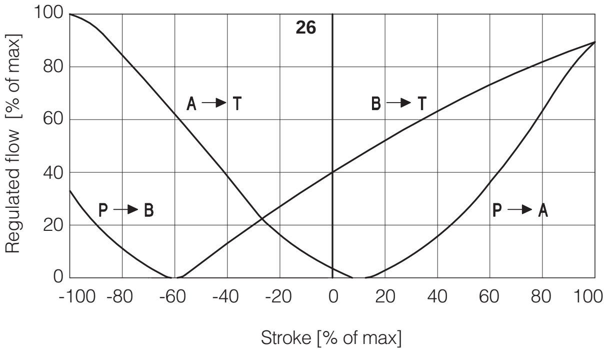
Q5 spool type is specific for alternate P/Q controls in combination with /S* option of digital integral drivers, (see tech. table **FS500**).
It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.
The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



26 = differential - progressive spool **V9**

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).
This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

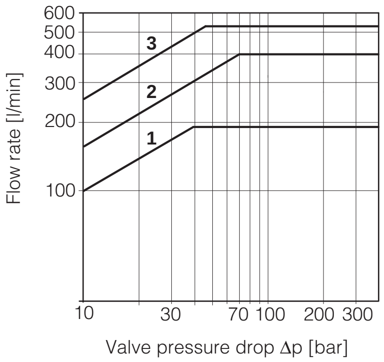
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank

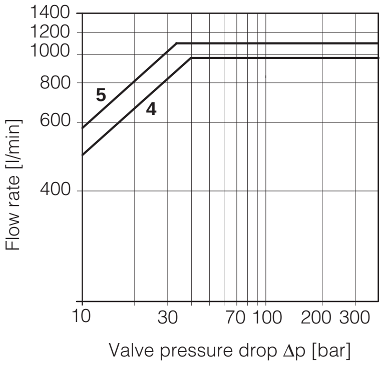


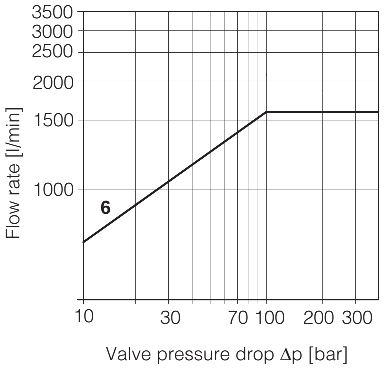
8.2 Operating diagrams

Flow /Δp diagram

stated at 100% of spool stroke







DPZO-1:
1 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5

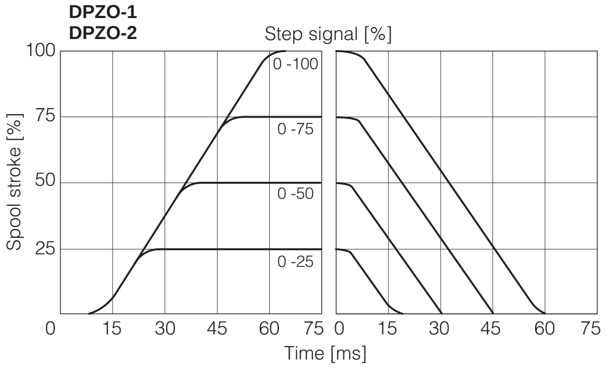
DPZO-4:
4 = spools L5, S5, D5, DL5, D9, V9, Q5

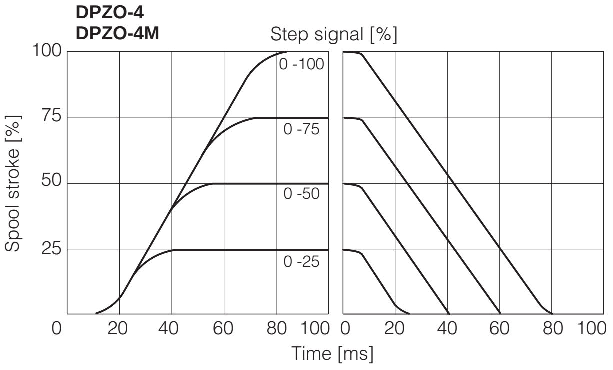
DPZO-4M:
5 = spools L5, S5, D5,DL5, D9, V9, Q5

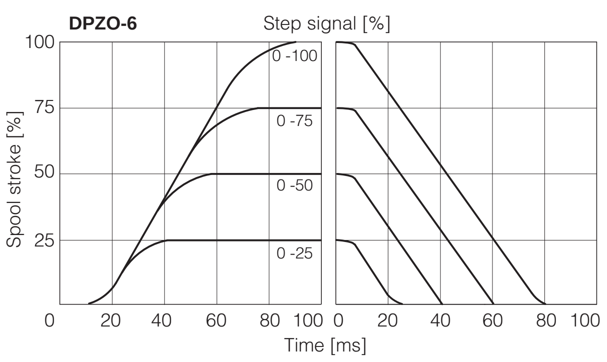
DPZO-6:
6 = L5, S5, D5, V9

8.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.







9 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 8.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.

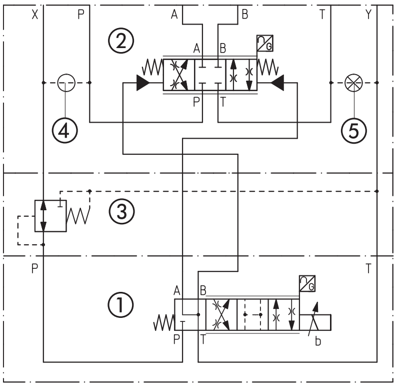
G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = **28 bar**

DPZO-1, DPZO-4(M) and DPZO-6 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

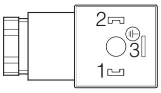
Functional Scheme - example of configuration 71



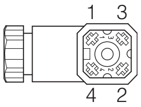
① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

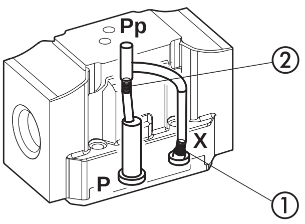
11 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

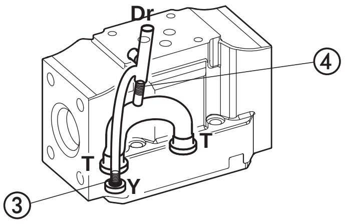
12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain.

DPZO-1 **Pilot channels**

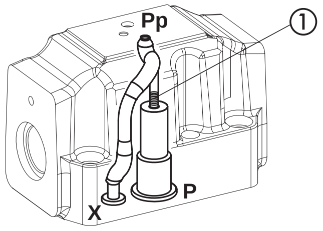


Drain channels

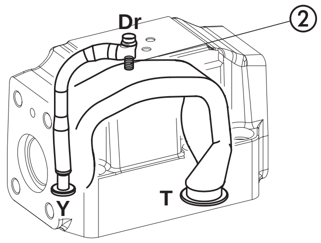


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels**

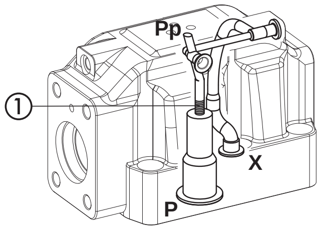


Drain channels

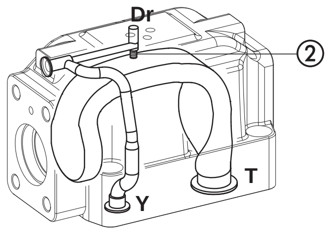


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels**

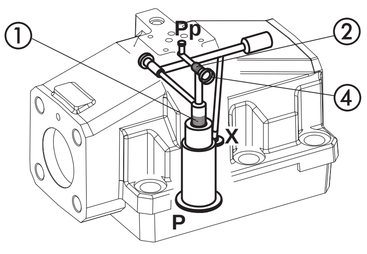


Drain channels

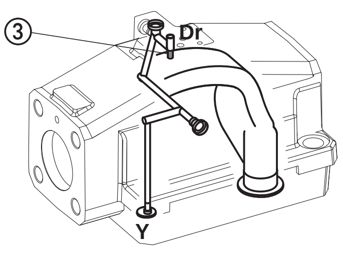


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels**



Drain channels



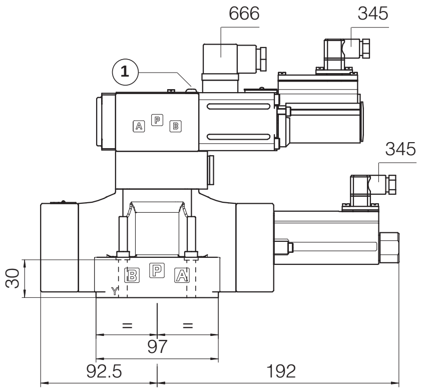
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

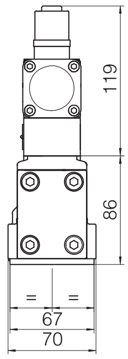
13 INSTALLATION DIMENSIONS [mm]

DPZO-L-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-L-1	9



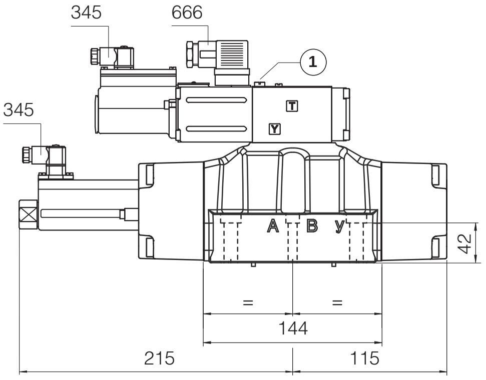


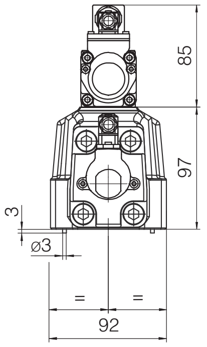
① = Air bleeding

DPZO-L-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-L-2	13,5





① = Air bleeding

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

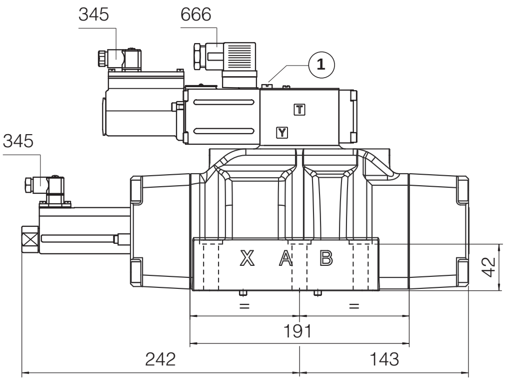
DPZO-L-4

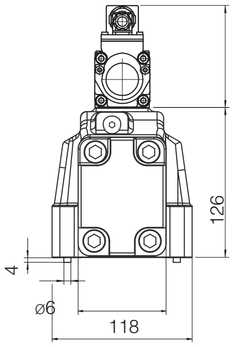
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-L-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm

Mass [kg]	
DPZO-L-4	17,5



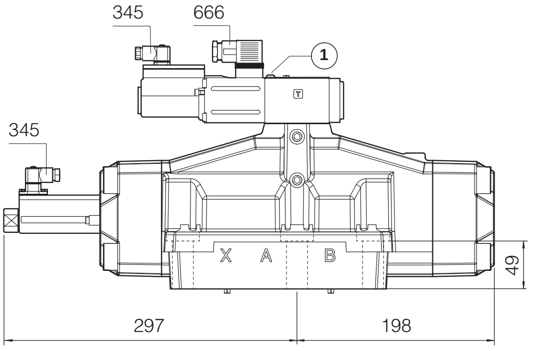


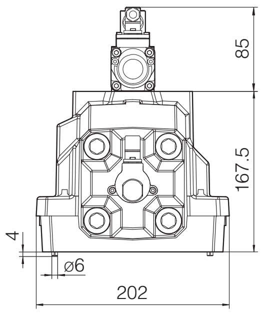
① = Air bleeding

DPZO-L-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-L-6	42,5





① = Air bleeding

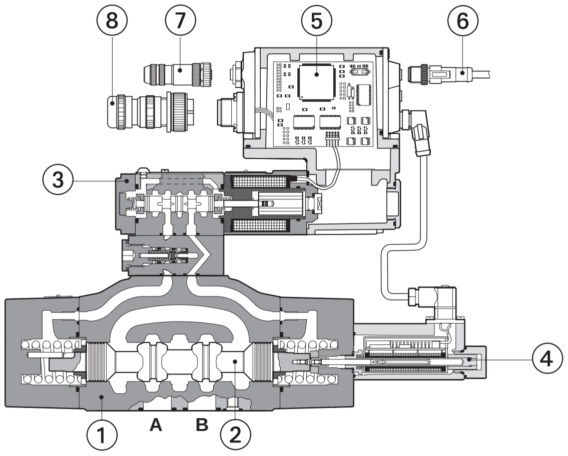
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
GS230	E-BM-LEB digital driver	**K800**	Electric and electronic connectors
GS235	E-BM-LID digital driver	**P005**	Mounting surfaces for electrohydraulic valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves

piloted, with on-board driver, LVDT transducer and positive spool overlap



DPZO-TES-SN-BP-251

① Valve body
② Main stage Spool
③ Pilot valve
④ Main stage LVDT transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DPZO-TEB, DPZO-TES

Digital proportional directional valves, piloted, specifically designed for directional and speed controls.

They are equipped with one LVDT position transducer (main stage) and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZO	-	TES	-	SN	-	NP	-	2	71	-	L	5	/	*	*	/	*

Proportional directional valve, piloted

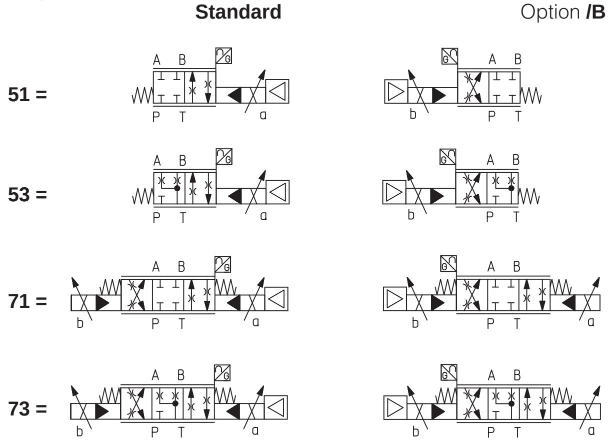
TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls:
SN = none

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

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration:



Seals material, see sect. 10:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (2):
B = solenoid with on-board digital driver and LVDT transducer at side of port A of the main stage (side B of pilot valve)
D = internal drain
E = external pilot pressure

Electronics options (2):
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

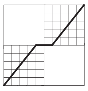
Safety options TÜV certified - only **TES (2)**:
U = safe double power supply
K = safe on/off signals
See section 6

SAFETY CERTIFIED

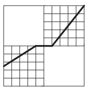
Spool size:		**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1	=	-	100	-
DPZO-2	=	160	250	-
DPZO-4	=	-	480	-
DPZO-6	=	-	-	640

Nominal flow (l/min) at Δp 10 bar P-T

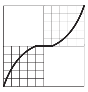
Spool type, regulating characteristics **(4)**:



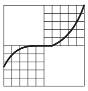
L
linear



DL
differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q



S
progressive



D
differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

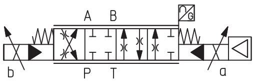
(1) Only in version **SN-NP**
(2) For possible combined options, see section 14
(3) Double power supply only for **TES**
(4) Spools for regenerative circuit , see section 2

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1

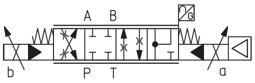
DPZO - TES - SN - NP - 2 71 - L9 / * * / *

Configuration and spool:

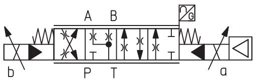
71-D9



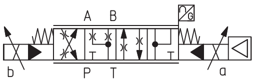
71-L9



73-D9



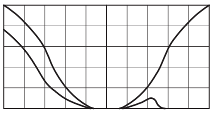
73-L9



Spool size:	**D9**	**L9**
DPZO-1 =	100	-
DPZO-2 =	250	250
DPZO-4 =	480	-

Nominal flow (l/min) at Δp 10bar P-T

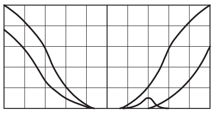
D9



For regenerative circuit (additional external check valve required)

see 11.1 - diagram 19

L9



For regenerative circuit internal to the valve

see 11.1 - diagram 20

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

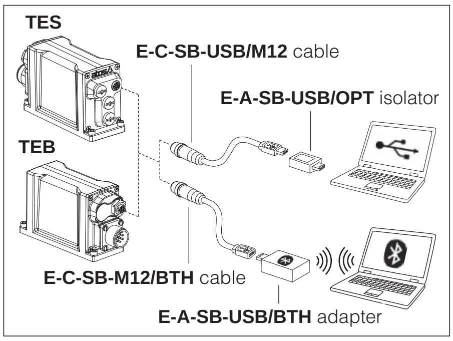
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 SAFETY OPTIONS - only for TES

SAFETY CERTIFIED

TÜV SÜD

Atos range of proportional directional valves, provides functional safety options **/U** and **/K** , designed to accomplish a safety function, intended to reduce the risk in process control systems.
They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-*-1	DPZO-*-2		DPZO-*-4	DPZO-*-6
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type	standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**		**L5, S5, D5**
	regenerative	**D9**		**D9, L9**	**D9**	
Nominal flow Δp P-T **(1)**	[l/min]					
	Δp= 10 bar	100	160	250	480	640
	Δp= 30 bar	160	270	430	830	1100
	Max permissible flow	180	400	550	1000	1600
Piloting pressure	[bar]	min. = 25; max = 350				
Piloting volume	[cm³]	1,4	3,7		9,0	21,6
Piloting flow **(2)**	[l/min]	1,7	3,7		6,8	14,4
Leakage **(3)**	Pilot [cm³]	100 / 300	100 / 300		200 / 500	900 / 2800
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(4)**	[ms]	≤ 60	≤ 75		≤ 90	≤ 120
Hysteresis		≤ 1 [% of max regulation]				
Repeatability		± 0,5 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

(1) For different Δp, the max flow is in accordance to the diagrams in section 11.2

(2) With step reference input signal 0 ÷100 %

(3) At p = 100/350 bar

(4) 0-100% step signal see detailed diagrams in section 11.3

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

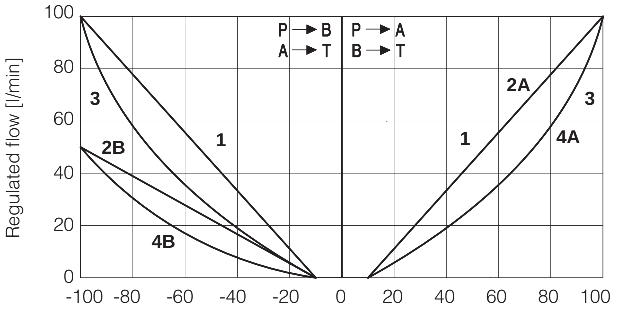
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

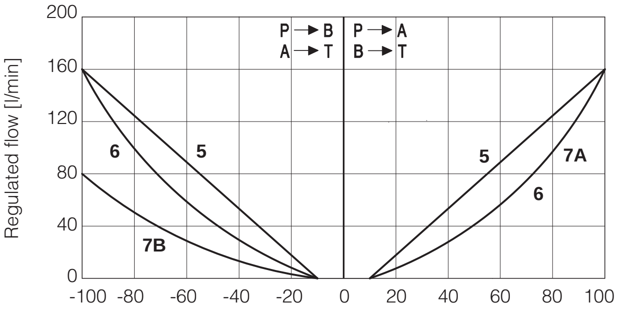
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level — normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
Max fluid contamination level — longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

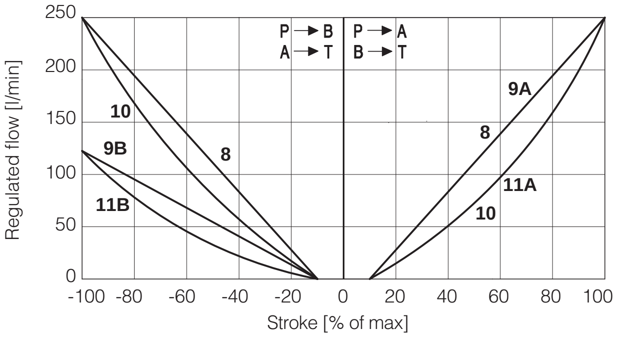
11.1 Regulation diagrams (values measure at p 10 bar P-T)



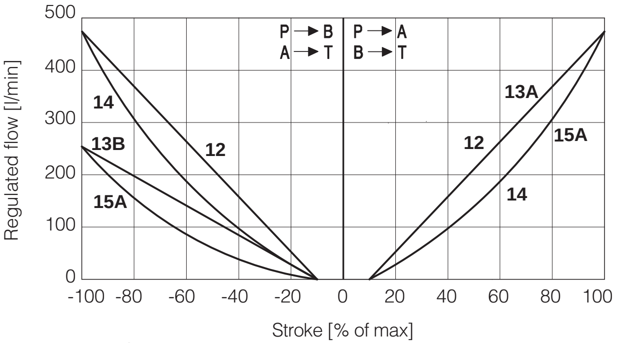
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T) **4A** = D5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T) **4B** = D5 (P → B, B → T)



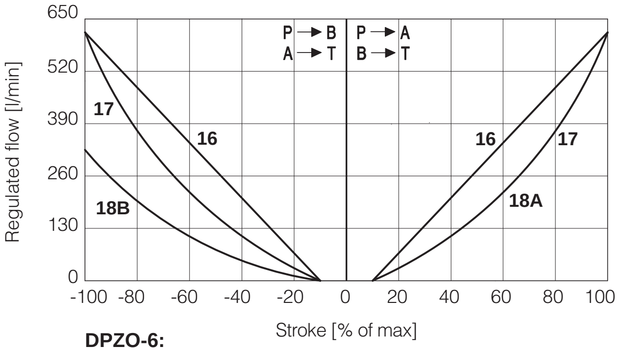
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T) **11A** = D5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T) **11B** = D5 (P → B, B → T)



DPZO-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



DPZO-6:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

Note:

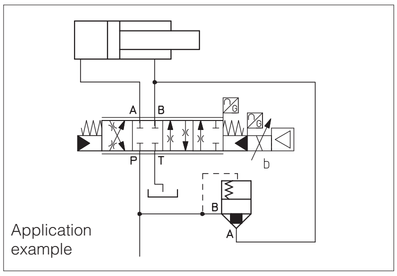
Hydraulic configuration vs. reference signal (standard and option /B)

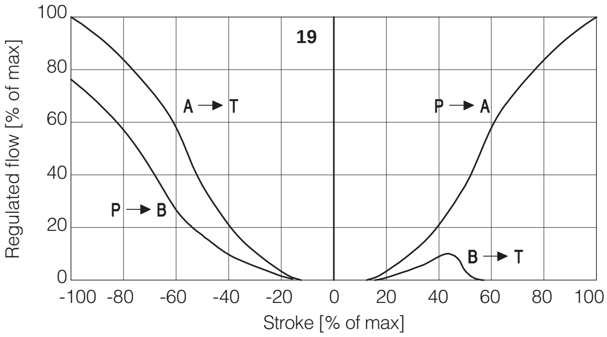
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

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

19 = differential - regenerative spool **D9**
(not available for valve size 32)

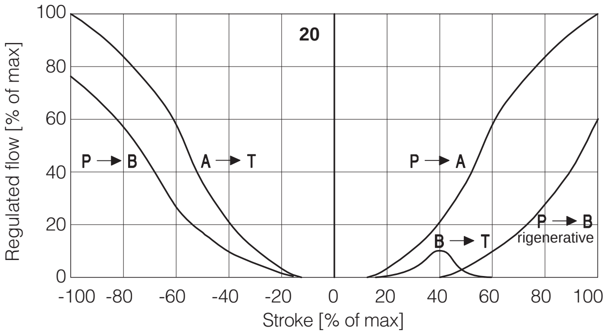
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





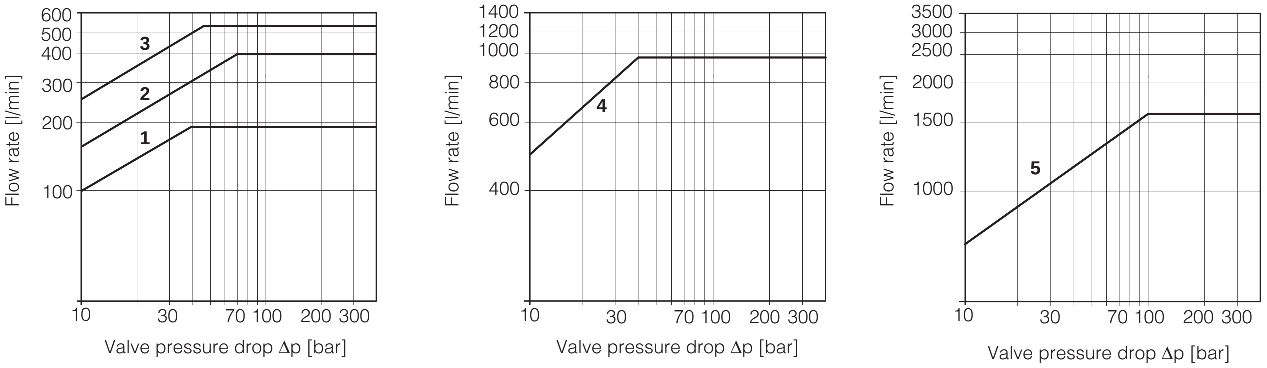
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



11.2 Operating diagrams

Flow /Δp diagram stated at 100% of spool stroke



DPZO-1:
1 = spools L5, S5, D5, DL5, D9

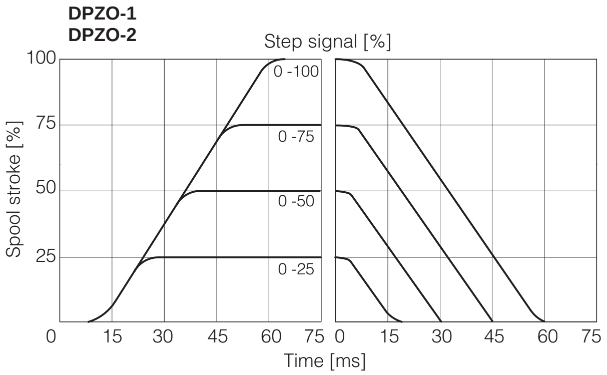
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9

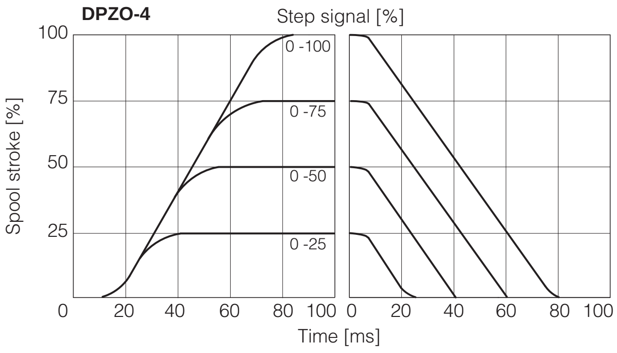
DPZO-4:
4 = spools L5, S5, D5, DL5, D9

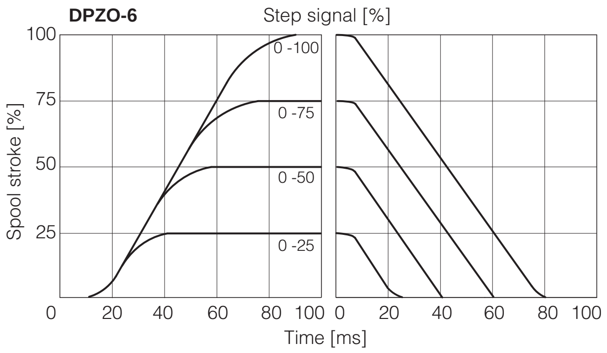
DPZO-6:
6 = L5, S5, D5

11.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.
For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

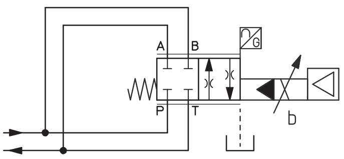






11.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] Δp = 15 bar	320	860	1600	2200

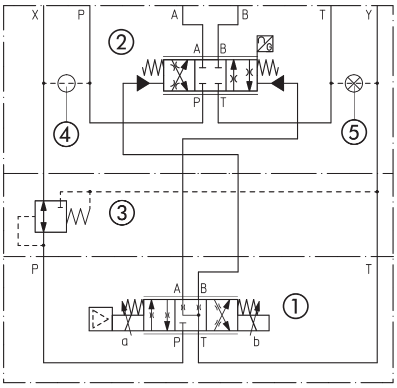
12 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 19
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 19
The valve's standard configuration provides internal pilot and external drain.

Functional Scheme - example of configuration 71



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

13 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 15.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 15.8)
Power supply for driver's logics and communication - only for **TES** (see 15.2)

C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

14 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:	**Electronics options** - Safety certified versions:
TEB-SN, **TES-SN**	**TES-SN**
/FI, /IQ, /IZ	/IU, /IK

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

15.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 15.5).

15.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16 ELECTRONIC CONNECTIONS AND LEDS

16.1 Main connector signals - 7 pin Ⓐ1 Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

16.2 Main connector signals - 12 pin Ⓐ2 /Z option

PIN	TEB /Z	TES /Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**AGND**		Analog ground	Gnd - analog signal
		NC	Do not connect	
8	**R_ENABLE**		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	**NC**		Do not connect	
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**NC**		Do not connect	
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT** referred to: V0	VL0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

16.3 Communications connectors (B) - (C)

(B)	USB connector - M12 - 5 pin always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2)	BC fieldbus execution, connector - M12 - 5 pin	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2)	BP fieldbus execution, connector - M12 - 5 pin	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

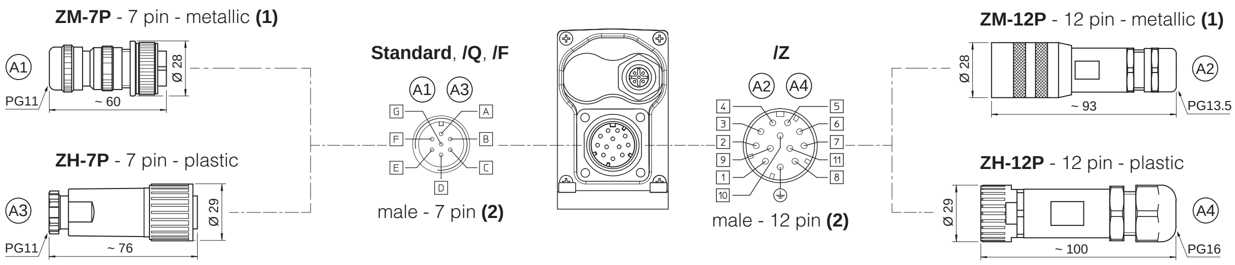
(C1) (C2)	EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

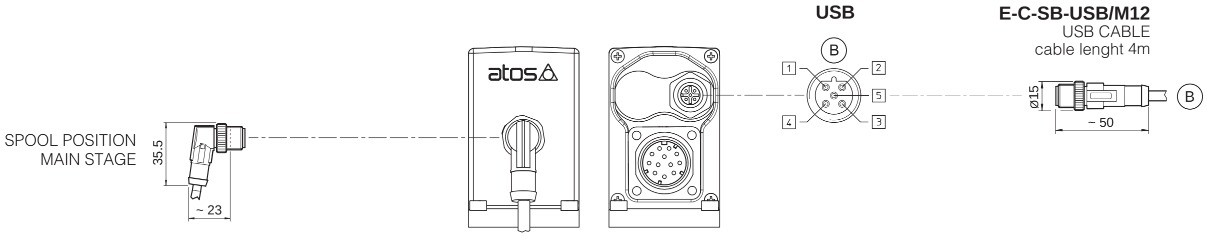
(2) Pin 2 can be fed with external +5V supply of CAN interface

16.4 TEB connections layout

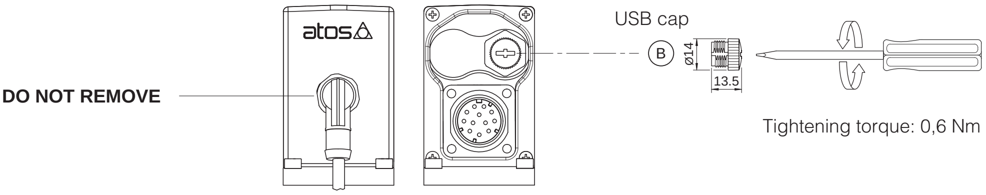
MAIN CONNECTORS


ZM-7P - 7 pin - metallic **(1)**
A1
Ø 28
PG11
~ 60
ZH-7P - 7 pin - plastic
A3
Ø 29
PG11
~ 76
Standard, **/Q**, **/F**
A1 A3
G
A
F
B
E
C
D
male - 7 pin **(2)**
/Z
A2 A4
4
5
3
6
2
7
9
11
1
8
10
male - 12 pin **(2)**
ZM-12P - 12 pin - metallic **(1)**
Ø 28
A2
~ 93
PG13.5
ZH-12P - 12 pin - plastic
Ø 29
A4
~ 100
PG16

TRANSDUCER AND USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves

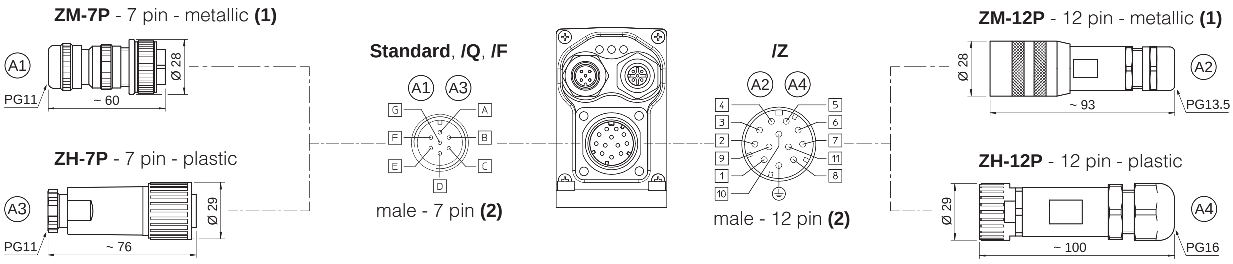


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

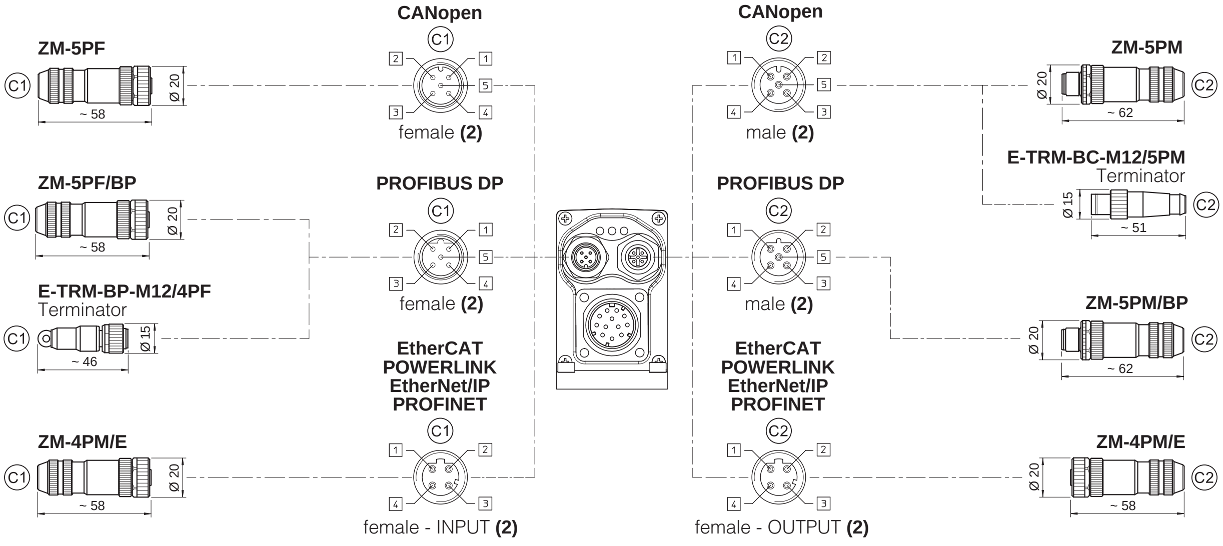
(2) Pin layout always referred to driver's view

16.5 TES connections layout

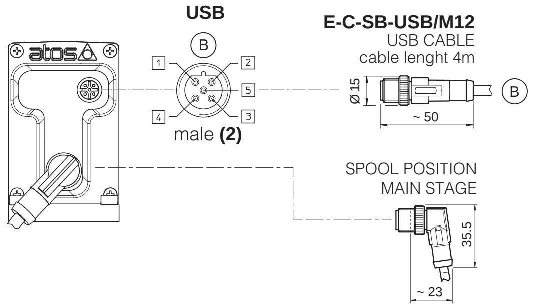
MAIN CONNECTORS



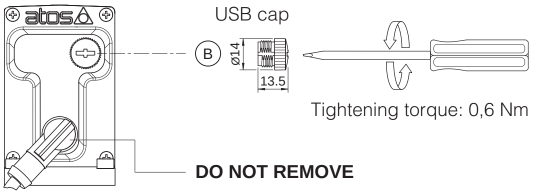
FIELDBUS CONNECTORS



TRANSDUCER AND USB CONNECTORS



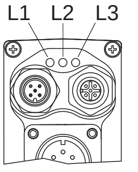
PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.6 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	**NP** Not Present	**BC** CANopen	**BP** PROFIBUS DP	**EH** EtherCAT	**EW** POWERLINK	**EI** EtherNet/IP	**EP** PROFINET	
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

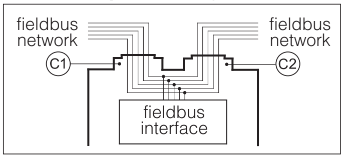
17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

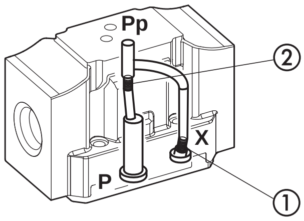
(2) Internally terminated

19 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

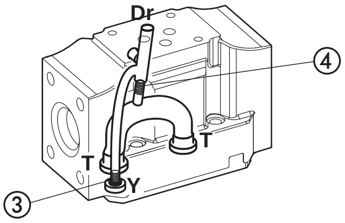
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1

Pilot channels



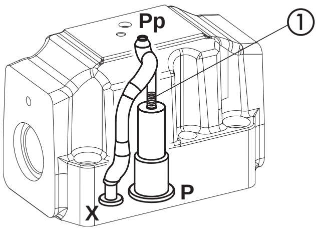
Drain channels



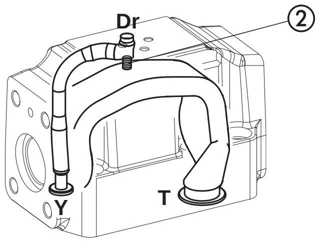
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2

Pilot channels



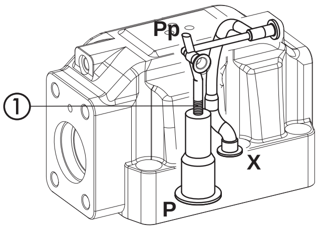
Drain channels



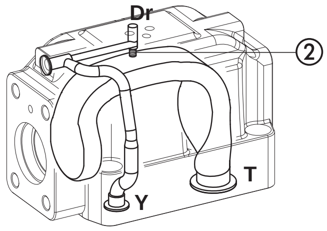
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4

Pilot channels



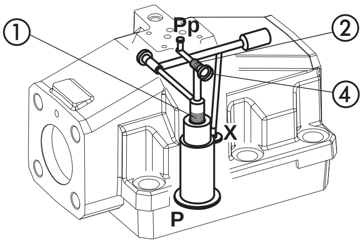
Drain channels



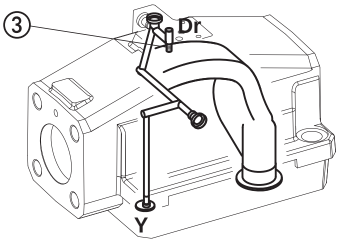
Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6

Pilot channels



Drain channels

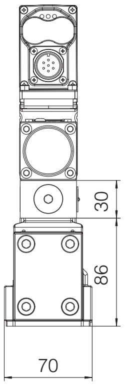


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

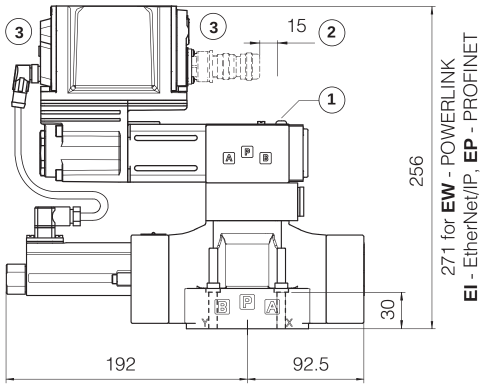
20 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

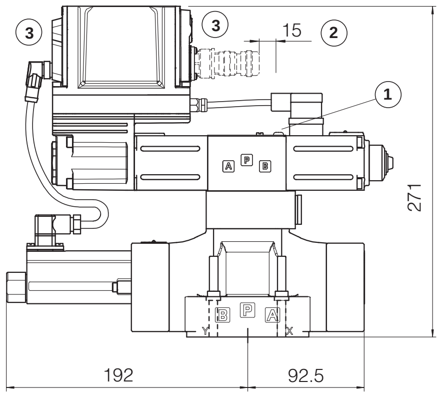
21 INSTALLATION DIMENSIONS [mm]



DPZO-TEB-*-15*
DPZO-TES-*-15*



DPZO-TEB-*-17*
DPZO-TES-*-17*



ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

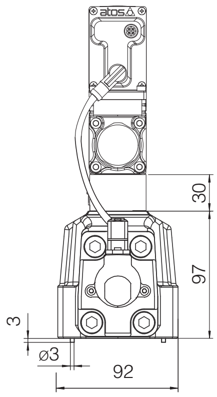
Mass [kg]	
DPZO-*-15	9
DPZO-*-17	9,8

① = Air bleeding 3

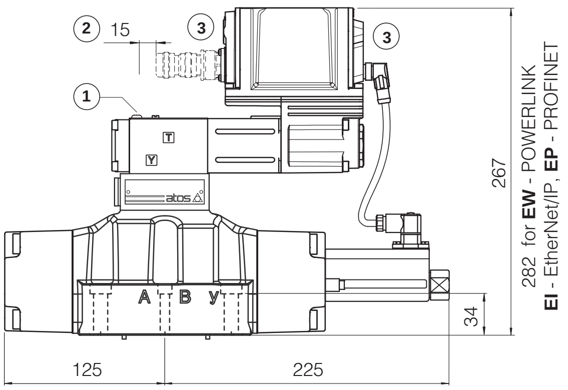
② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

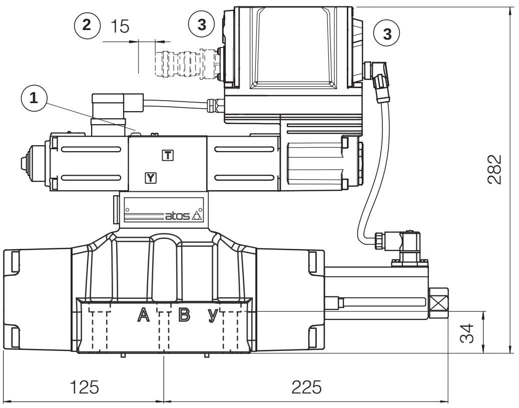
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage



DPZO-TEB-*-25*
DPZO-TES-*-25*

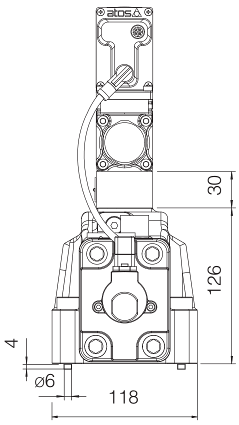


DPZO-TEB-*-27*
DPZO-TES-*-27*

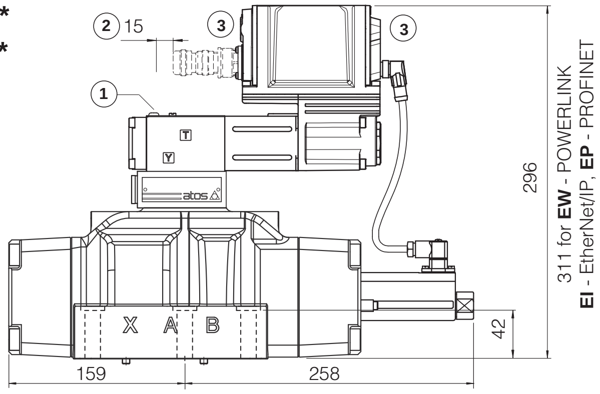


ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)

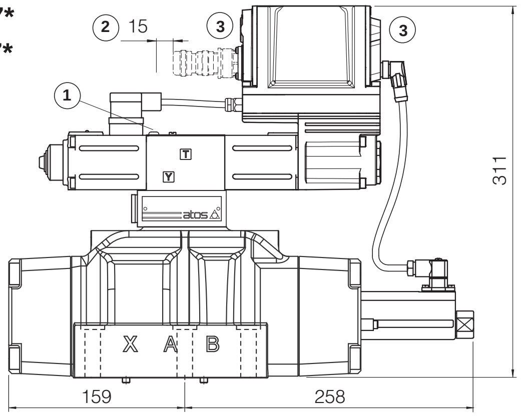
Mass [kg]	
DPZO-*-25	14
DPZO-*-27	14,8



DPZO-TEB-*-45*
DPZO-TES-*-45*



DPZO-TEB-*-47*
DPZO-TES-*-47*



ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)

Mass [kg]	
DPZO-*-45	18,5
DPZO-*-47	19,3

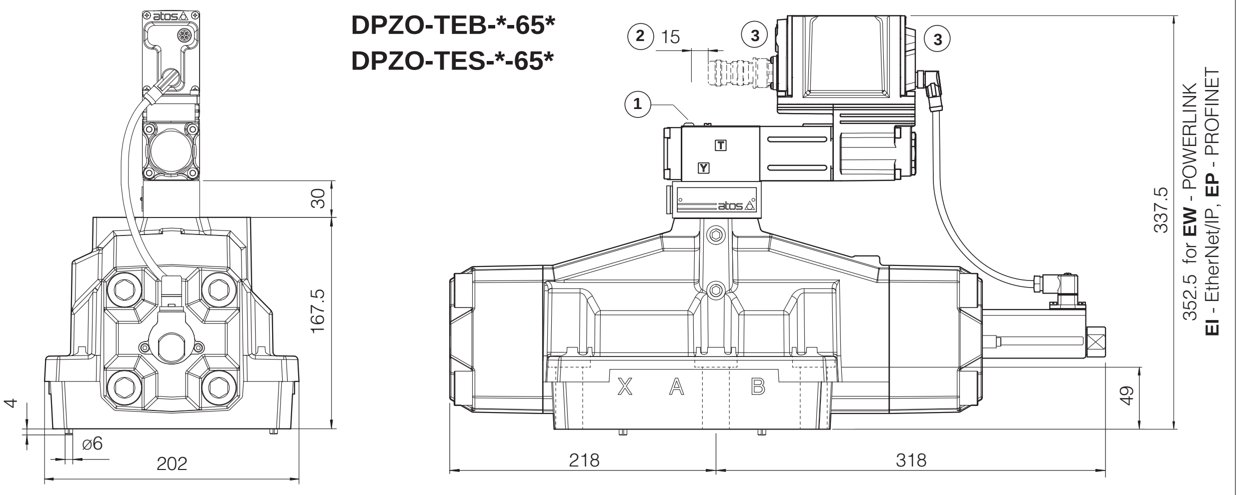
① = Air bleeding

② = Space to remove the connectors

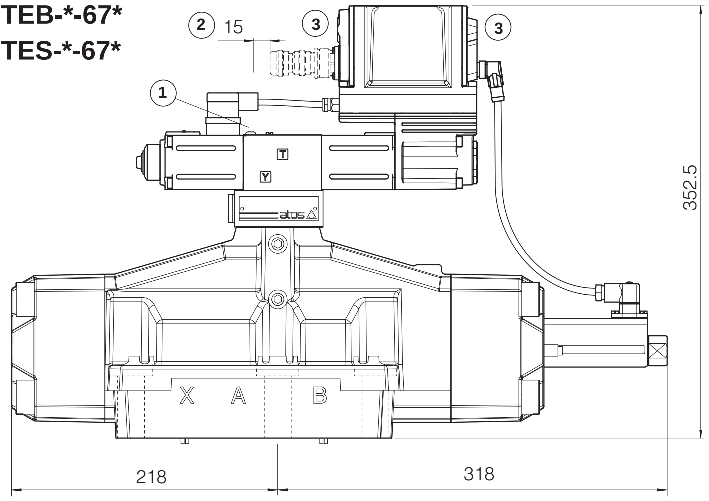
③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

DPZO-TEB-*-65*
DPZO-TES-*-65*



DPZO-TEB-*-67*
DPZO-TES-*-67*



ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(see table P005)

Mass [kg]	
DPZO-*-65	42,5
DPZO-*-67	43,3

① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

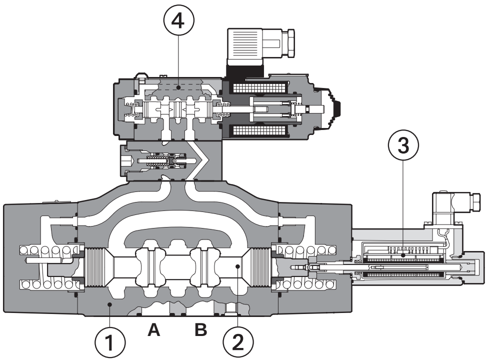
22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS500	Digital proportional valves with P/Q control	**P005**	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	**QB320**	Quickstart for LEB valves commissioning
FY100	Safety proportional valves - option /U	**QF320**	Quickstart for LES valves commissioning
FY200	Safety proportional valves - option /K	**Y010**	Basics for safety components
GS500	Programming tools		
GS510	Fieldbus		

Proportional directional valves

piloted, with LVDT transducer and positive spool overlap

CE



DPZO-T-251

① Valve body
② Main stage Spool
③ Main stage LVDT transducer
④ Pilot valve

DPZO-T

Proportional directional valves, piloted, with LVDT position transducer (main stage) and positive spool overlap for directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section 3.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:
L = linear
S = progressive for fine low flow control
D and DL = differential-progressive, for control of actuators with area ratio 1:2
D9 and L9 = for regenerative circuit

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZO - T - 2 71 - L 5 / * * / *

DPZO: Proportional directional valve, piloted

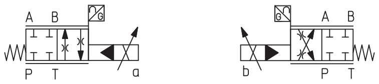
T = with LVDT transducer

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

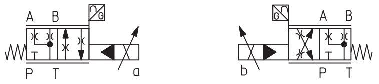
Configuration:

Standard — Option **/B**

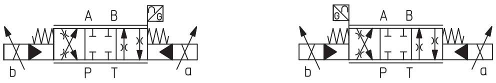
51 =



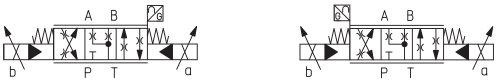
53 =



71 =



73 =



Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR

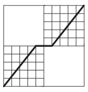
Series number

Hydraulic options (1):
B = solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve)
D = internal drain
E = external pilot pressure

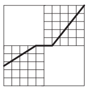
Spool size		**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZO-1	=	-	100	-
DPZO-2	=	160	250	-
DPZO-4	=	-	480	-
DPZO-6	=	-	-	640

Nominal flow (l/min) at Δp 10 bar P-T

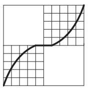
Spool type, regulating characteristics **(2)**:



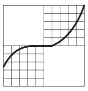
L
linear



DL
differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q



S
progressive



D
differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

---

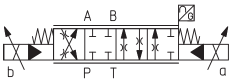
(1) All combination possible
(2) Spools for regenerative circuit, see section 2

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1

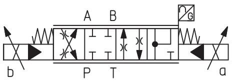
DPZO	-	T	-	2	71 - L9	/	*	*	/	*

Configuration and spool:

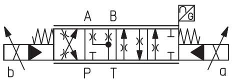
71-D9



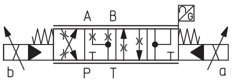
71-L9



73-D9



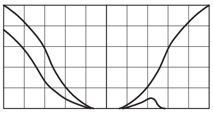
73-L9



Spool size:		**D9**	**L9**
DPZO-1	=	100	-
DPZO-2	=	250	250
DPZO-4	=	480	-

Nominal flow (l/min) at Δp 10bar P-T

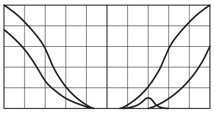
D9



For regenerative circuit (additional external check valve required)

see 11.1 - diagram 19

L9



For regenerative circuit internal to the valve

see 11.1 - diagram 20

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DPZO-T-1**	**DPZO-T-2**		**DPZO-T-4**	**DPZO-T-6**
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type	standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**		**L5, S5, D5**
	regenerative	**D9**		**D9, L9**	**D9**	
Nominal flow Δp P-T **(1)**	[l/min]					
	Δp= 10 bar	100	160	250	480	640
	Δp= 30 bar	160	270	430	830	1100
	Max permissible flow	180	400	550	1000	1600
Piloting pressure	[bar]	min. = 25; max = 350				
Piloting volume	[cm³]	1,4	3,7		9,0	21,6
Piloting flow **(2)**	[l/min]	1,7	3,7		6,8	14,4
Leakage **(3)**	Pilot [cm³]	100 / 300	100 / 300		200 / 500	900 / 2800
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(4)**	[ms]	≤ 60	≤ 75		≤ 90	≤ 120
Hysteresis		≤ 1 [% of max regulation]				
Repeatability		± 0,5 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2

(2) With step reference input signal 0 ÷100 %

(3) At p = 100/350 bar

(4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

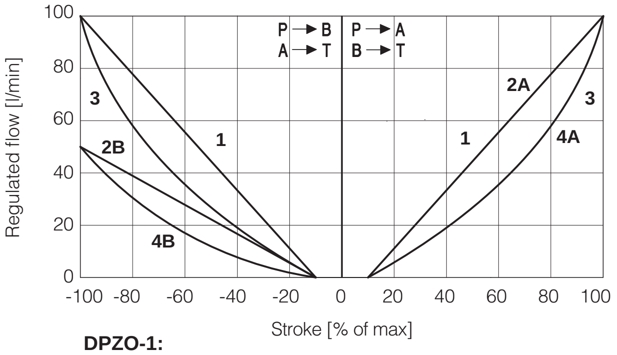
7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

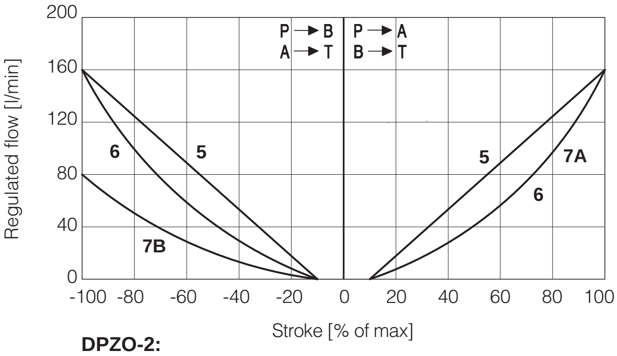
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

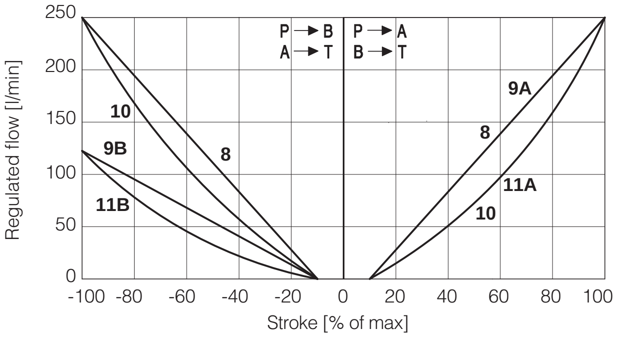
8.1 Regulation diagrams (values measure at p 10 bar P-T)



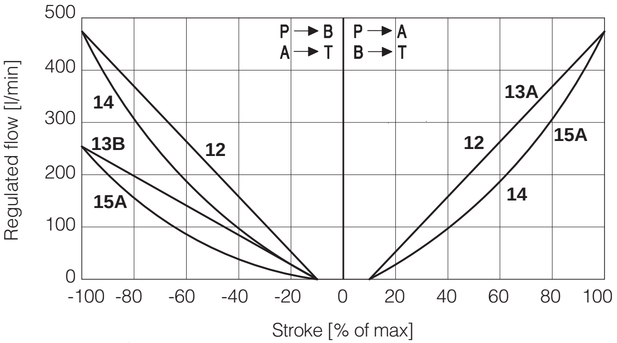
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T) **4A** = D5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T) **4B** = D5 (P → B, B → T)



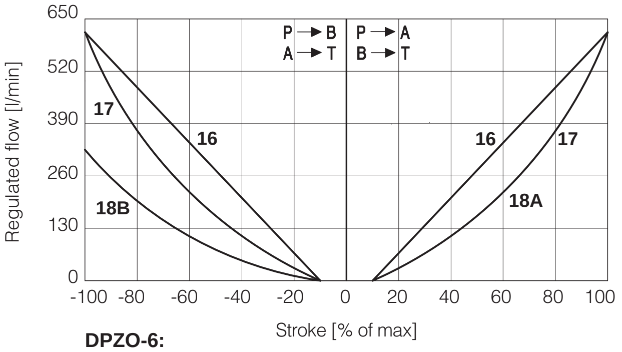
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T) **11A** = D5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T) **11B** = D5 (P → B, B → T)



DPZO-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



DPZO-6:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

Note:

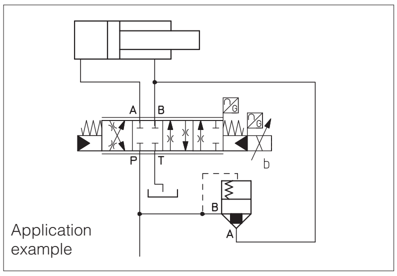
Hydraulic configuration vs. reference signal (standard and option /B)

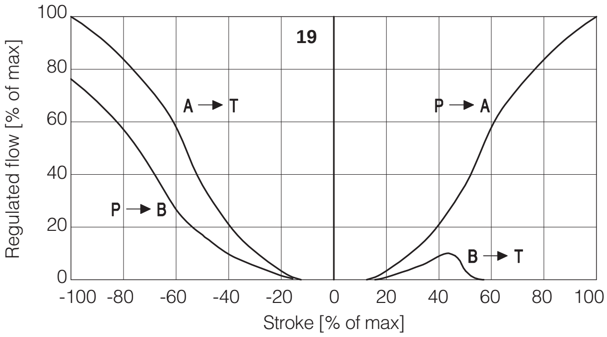
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

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

19 = differential - regenerative spool **D9**
(not available for valve size 32)

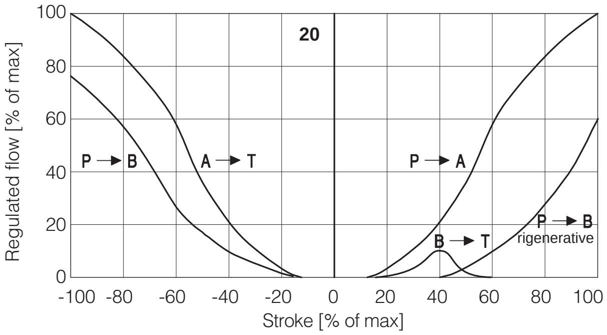
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





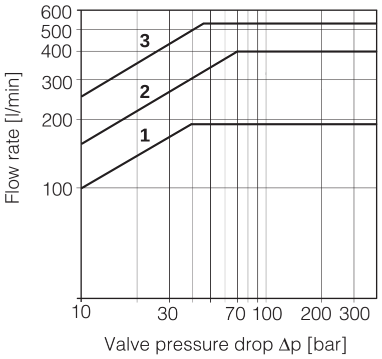
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

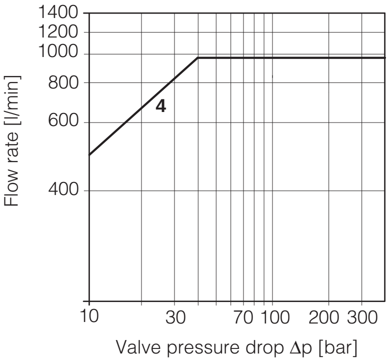
L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.

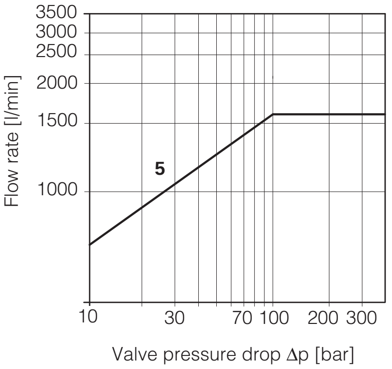


8.2 Operating diagrams

Flow /Δp diagram stated at 100% of spool stroke







DPZO-1:
1 = spools L5, S5, D5, DL5, D9

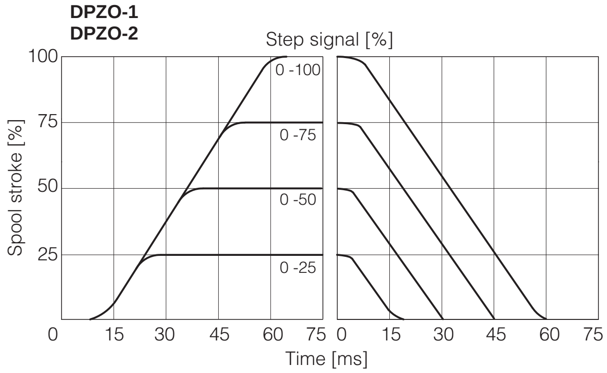
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9

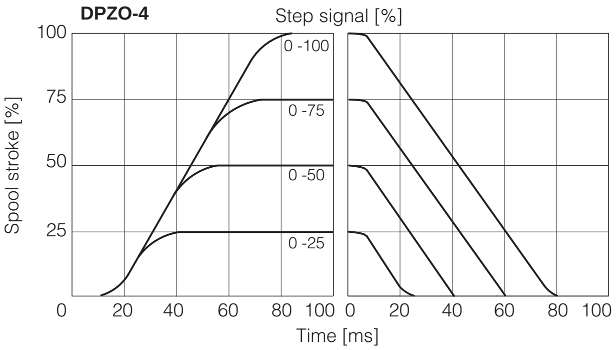
DPZO-4:
4 = spools L5, S5, D5, DL5, D9

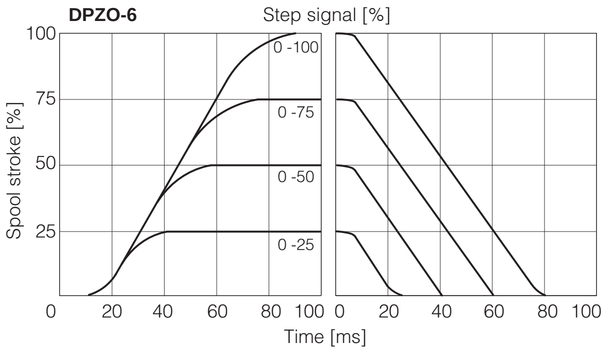
DPZO-6:
6 = L5, S5, D5

8.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.
For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

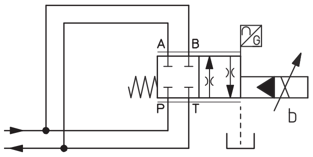






8.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] Δp = 15 bar	320	860	1600	2200

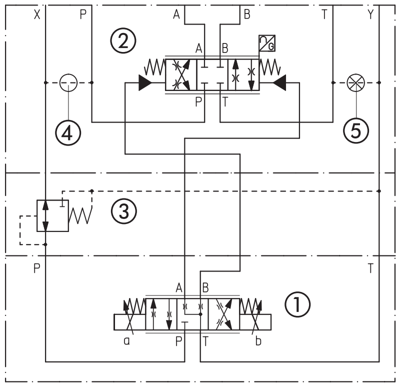
9 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 8.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

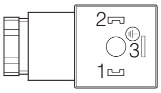
Functional Scheme - example of configuration 71



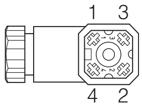
① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

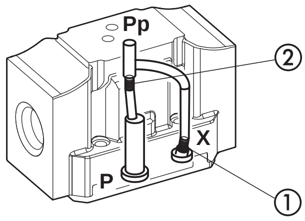
10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

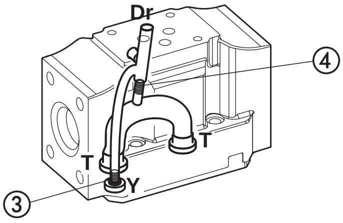
11 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1 **Pilot channels**

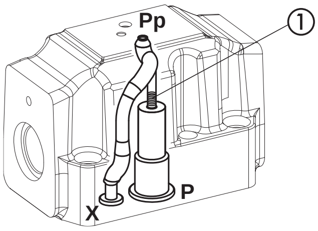


Drain channels

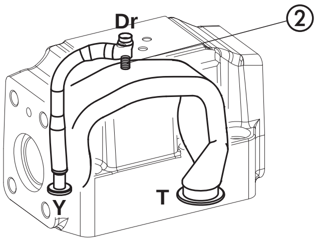


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 **Pilot channels**

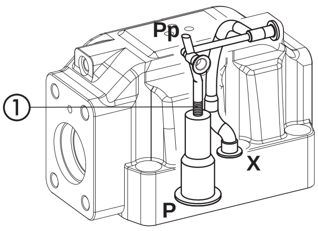


Drain channels

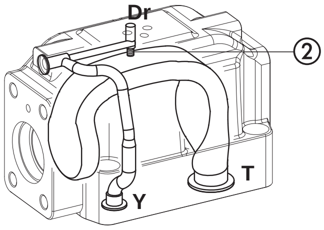


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 **Pilot channels**

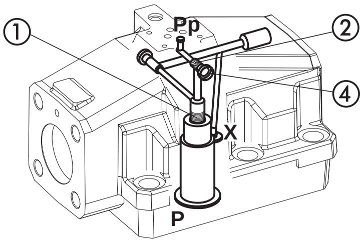


Drain channels

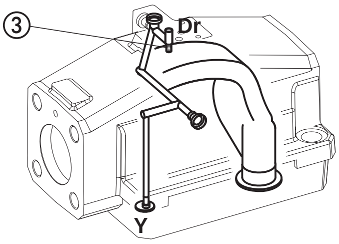


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 **Pilot channels**



Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

12 FASTENING BOLTS AND SEALS

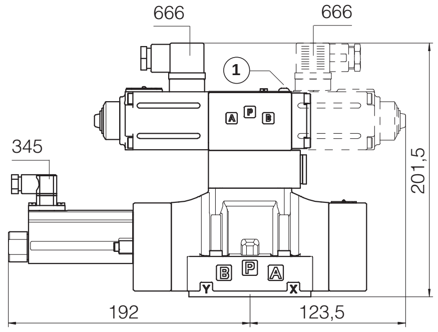
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

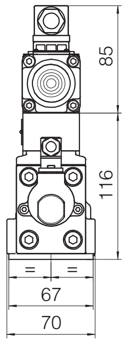
13 INSTALLATION DIMENSIONS [mm]

DPZO-T-1 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-T-15	8,5
DPZO-T-17	9,4



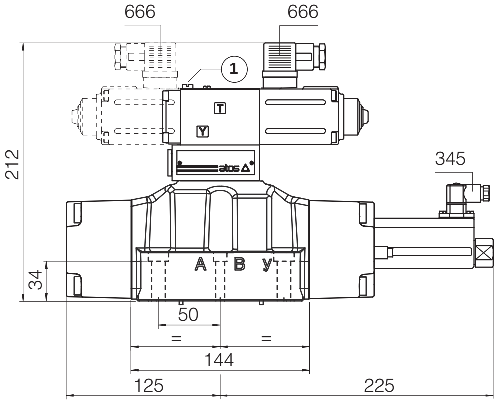


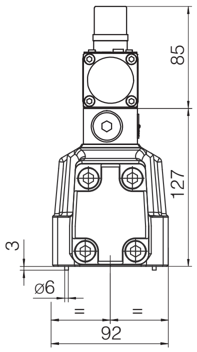
① = Air bleeding 3

DPZO-T-2 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-T-25	13,5
DPZO-T-27	14,4





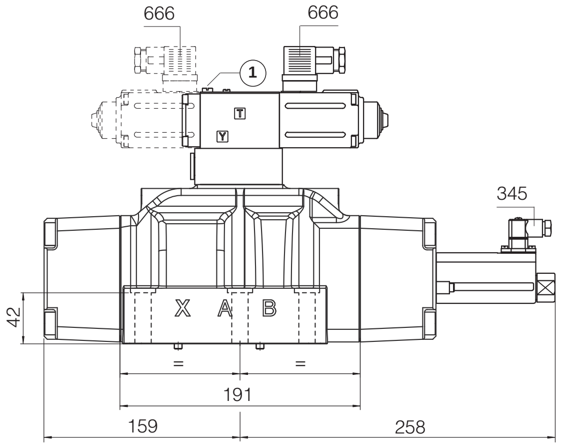
① = Air bleeding 3

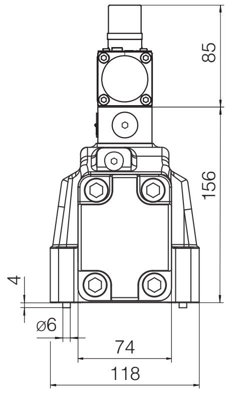
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

DPZO-T-4 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)

Mass [kg]	
DPZO-T-45	17,6
DPZO-T-47	18,5



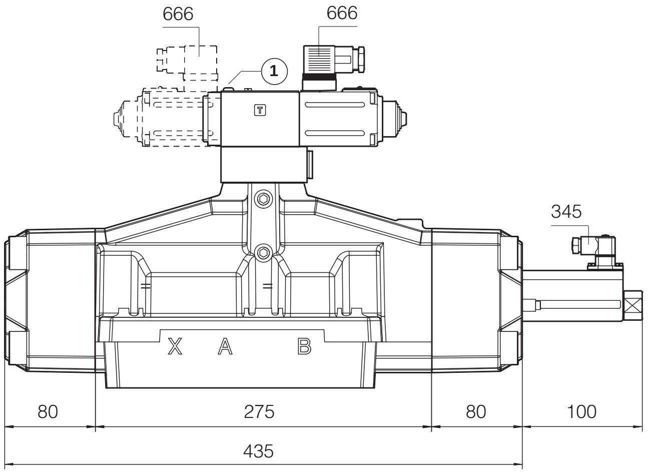


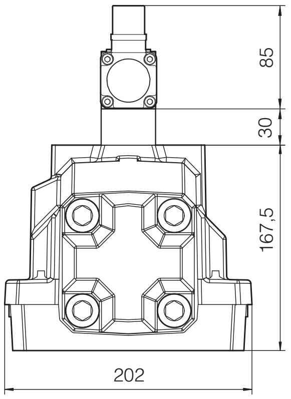
① = Air bleeding 3

DPZO-T-6 (dotted line = double solenoid version)

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-T-65	42,3
DPZO-T-67	43,1





① = Air bleeding 3

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

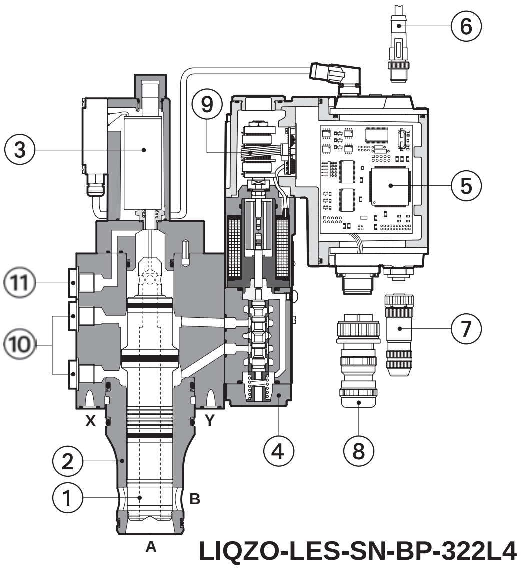
14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS230	E-BM-TEB digital driver
GS235	E-BM-TID digital driver
GS240	E-BM-TES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional 2-way cartridges high performance

piloted, with on-board driver and two LVDT transducers

CE



① Poppet
② Sleeve
③ Main stage LVDT transducer
④ Pilot valve
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector
⑨ Pilot valve LVDT transducer
⑩ Air bleeding
⑪ Air suction port

LIQZO-LES-SN-BP-322L4

LIQZO-LEB, LIQZP-LEB
LIQZO-LES, LIQZP-LES

Digital high performance 2-way proportional cartridges specifically designed for high speed closed loop controls. They are equipped with two LVDT position transducers for best dynamics in not compensated flow regulations. The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

LEB basic execution with analog reference signal and USB port for software functional parameters setting.

LES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

LIQZO: Size: **16** ÷ **40** - ISO 7368
Max flow: **600** ÷ **2500 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50** ÷ **100** - ISO 7368
Max flow: **4000** ÷ **16000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	LES	-	SN	-	NP	-	25	2	L4	/	*	*	/	*

Proportional 2-way cartridge, piloted
LIQZO = size 16 to 40, Pmax 350 bar
LIQZP = size 50 to 100, Pmax 420 bar

LEB = basic on-board digital driver **(1)**
LES = full on-board digital driver

Alternated P/Q controls:
SN = none

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

Valve size ISO 7368, see section 6 :

LIQZO =	**16**	**25**	**32**	**40**
l/min	250	500	800	1200
LIQZP =	**50**	**63**	**80**	**100**
l/min	2000	3000	4500	7200

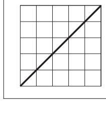
Nominal flow (l/min) at Δp 5 bar

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

Series number

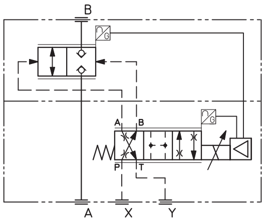
Electronics options (2):
F = fault signal
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Poppet type, regulating characteristics:
L4 = linear

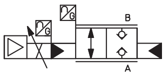


Configuration:
2 = 2 way

functional symbol



simplified symbol



(1) Only in version **SN-NP**
(2) Possible combined options: /FI, /IQ, /IZ
(3) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

⚠ **WARNING**

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage.
In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z).
A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also power supply note at sections 13 .

⚠ **WARNING**

The loss of the pilot pressure causes the undefined position of the main poppet.
The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet.
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

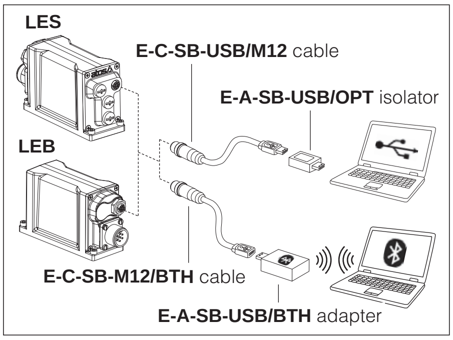
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		16	25	32	40	50	63	80	100
Nominal flow Δp A-B [l/min]	Δp = 5 bar	250	500	800	1200	2000	3000	4500	7200
	Δp = 10 bar	350	700	1100	1700	2800	4250	6350	10200
	Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	**LIQZO**	Ports A, B = **350** X = 350 Y ≤ 10							
	LIQZP	Ports A, B = **420** X = 350 Y ≤ 10							
Nominal flow of pilot valve at Δp = 70 bar [l/min]		4	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]		0,2	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure [bar]		min: 40% of system pressure max 350 recommended 140 ÷ 160							
Piloting volume [cm^3]		1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)** [l/min]		4	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)** [ms]		24	25	28	30	30	35	40	50
Hysteresis [% of the max regulation]		≤ 0,1							
Repeatability [% of the max regulation]		± 0,1							
Thermal drift		zero point displacement < 1% at ΔT = 40°C							

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 9.2

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 16			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

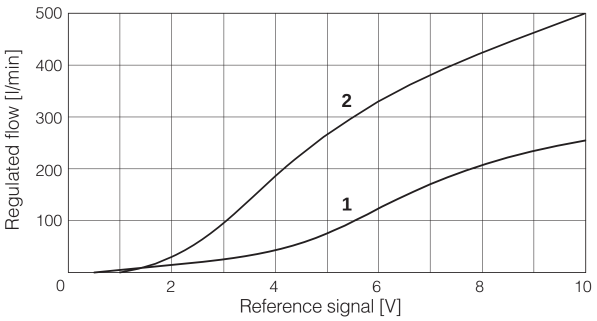
8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

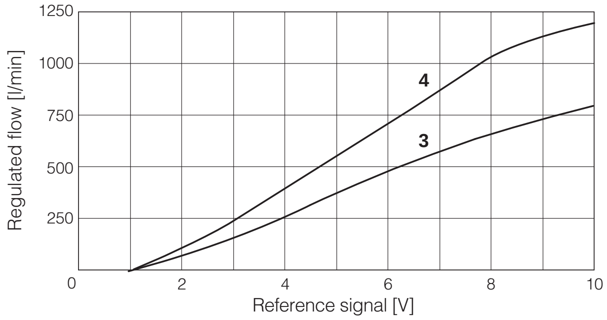
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

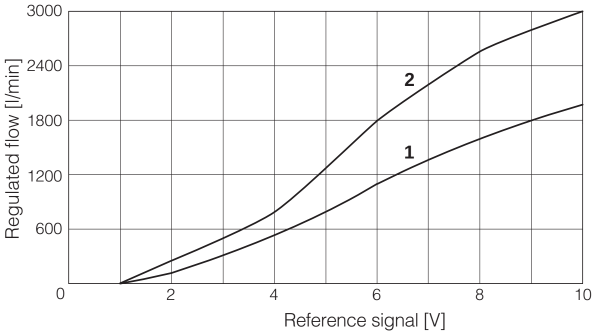
9.1 Regulation diagrams (values measured at Δp 5 bar)



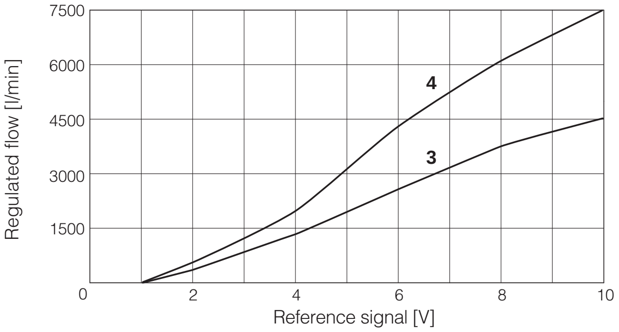
1 = LIQZO-L*-162L4
2 = LIQZO-L*-252L4



3 = LIQZO-L*-322L4
4 = LIQZO-L*-402L4



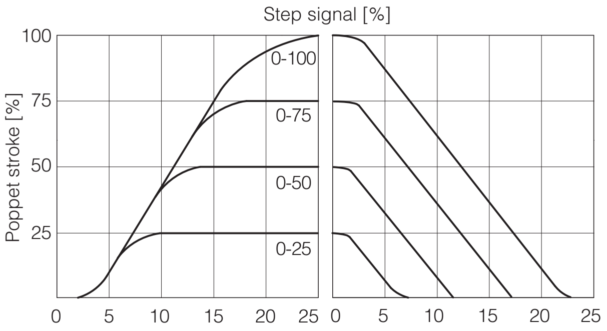
1 = LIQZP-L*-502L4
2 = LIQZP-L*-632L4



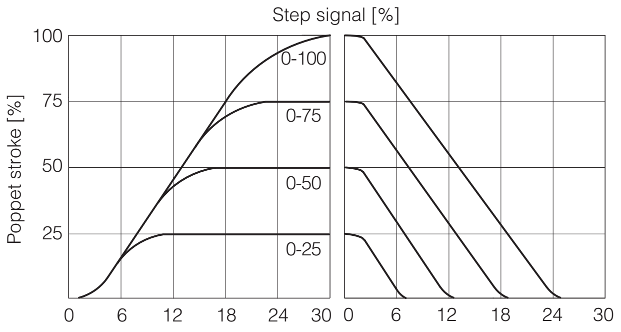
3 = LIQZP-L*-802L4
4 = LIQZP-L*-1002L4

9.2 Response time

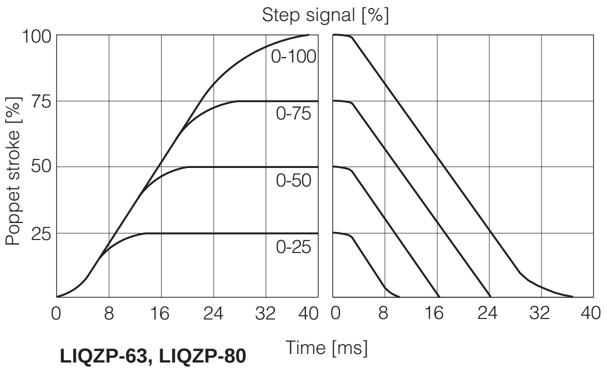
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



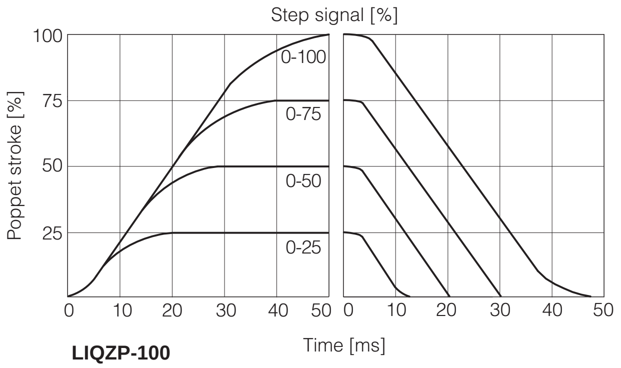
LIQZO-16, LIQZO-25



LIQZO-32, LIQZO-40
LIQZP-50

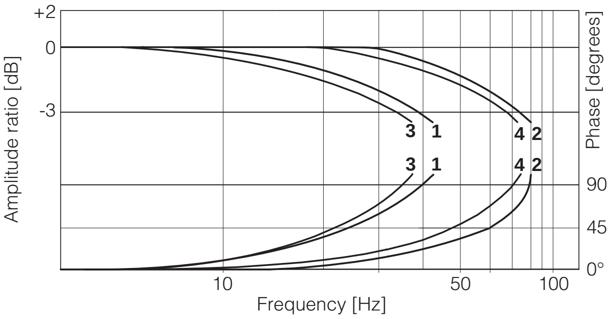


LIQZP-63, LIQZP-80

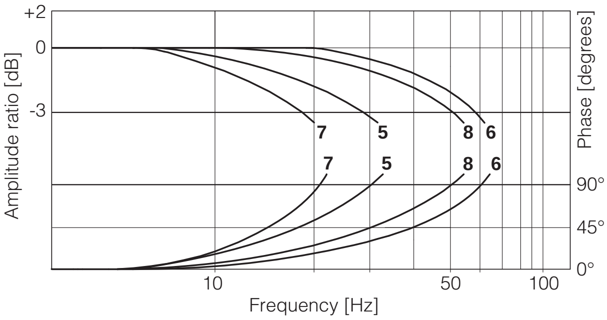


LIQZP-100

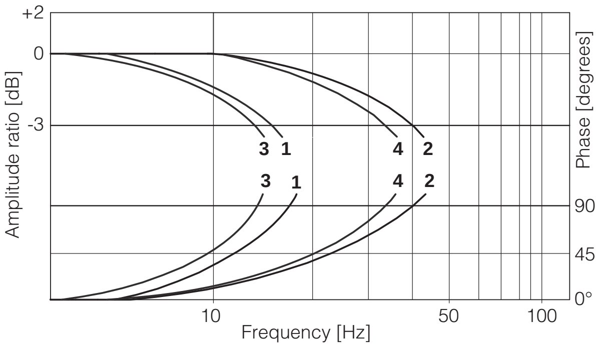
9.3 **Bode diagrams** - stated at nominal hydraulic conditions



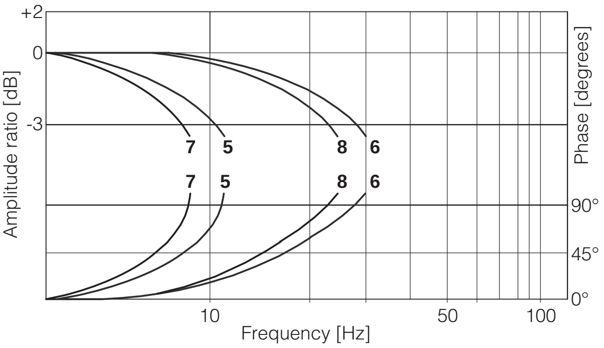
1 = LIQZO-L*-162L4: 10% ↔ 90%
2 = LIQZO-L*-162L4: 50% ± 5%
3 = LIQZO-L*-252L4: 10% ↔ 90%
4 = LIQZO-L*-252L4: 50% ± 5%



5 = LIQZO-L*-322L4: 10% ↔ 90%
6 = LIQZO-L*-322L4: 50% ± 5%
7 = LIQZO-L*-402L4: 10% ↔ 90%
8 = LIQZO-L*-402L4: 50% ± 5%



1 = LIQZP-L*-502L4: 10% ↔ 90%
2 = LIQZP-L*-502L4: 50% ± 5%
3 = LIQZP-L*-632L4: 10% ↔ 90%
4 = LIQZP-L*-632L4: 50% ± 5%



5 = LIQZP-L*-802L4: 10% ↔ 90%
6 = LIQZP-L*-802L4: 50% ± 5%
7 = LIQZP-L*-1002L4: 10% ↔ 90%
8 = LIQZP-L*-1002L4: 50% ± 5%

10 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 13.7 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

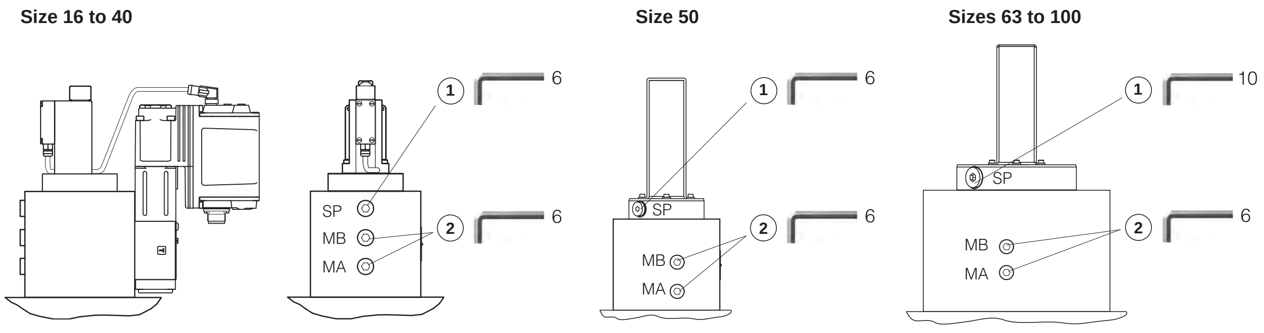
Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 13.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB** (see 13.6)
Power supply for driver's logics and communication - only for **LES** (see 13.2)

11 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

12 AIR BLEEDING



① **Air suction port:**

N° 1 plug G1/4” for sizes 16 to 50
N° 1 plug G1/2” for sizes 63 to 100

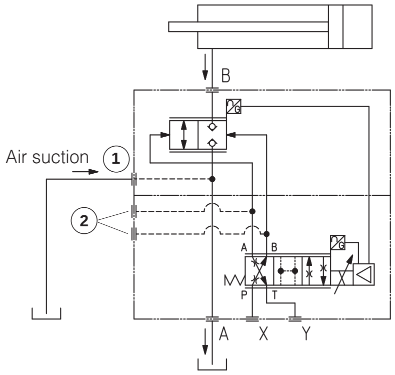
To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

② **Air bleeding:**

N° 2 plugs G1/4”

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.



13 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine’s safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

13.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 13.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

13.2 Power supply for driver’s logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver’s logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver’s logic and communication power supply: 500 mA fast fuse.

13.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

13.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

13.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

13.6 Repeat enable output signal (R_ENABLE) - only for LEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 13.5).

13.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.).

14 ELECTRONIC CONNECTIONS

14.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

14.2 Main connector signals - 12 pin (A2) /Z option

PIN	LEB-SN /Z	LES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE** referred to: V0	VL0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
7	**AGND**		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
8	**R_ENABLE**		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	**NC**		Do not connect	
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**NC**		Do not connect	
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT** referred to: V0	VL0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
PE	**EARTH**		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

14.3 Communications connectors (B) - (C)

(B)	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2)	**BC fieldbus execution, connector - M12 - 5 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2)	**BP fieldbus execution, connector - M12 - 5 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

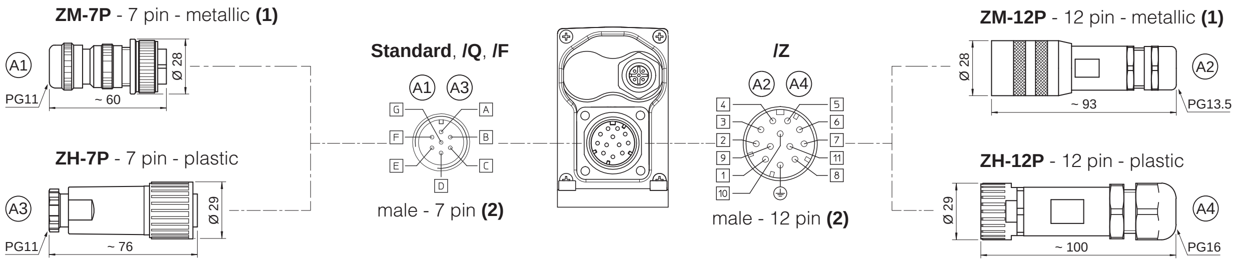
(C1) (C2)	**EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

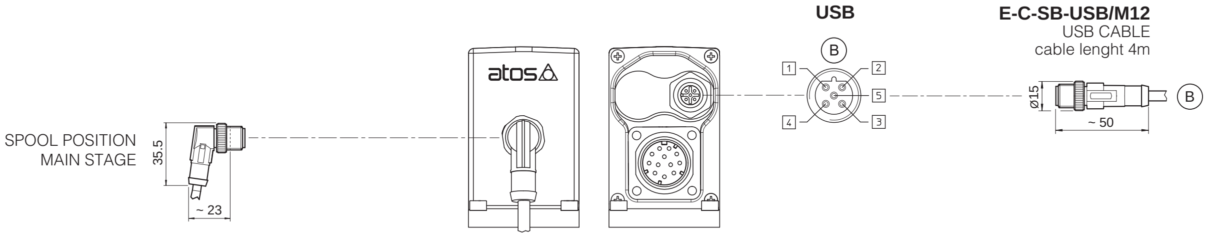
(2) Pin 2 can be fed with external +5V supply of CAN interface

14.4 LEB connections layout

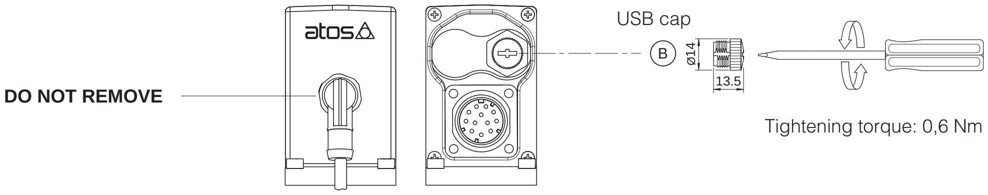
MAIN CONNECTORS



TRANSDUCER AND USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves

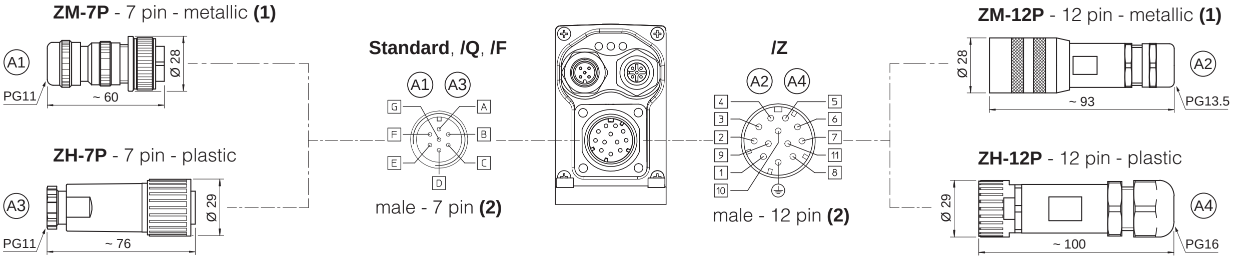


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

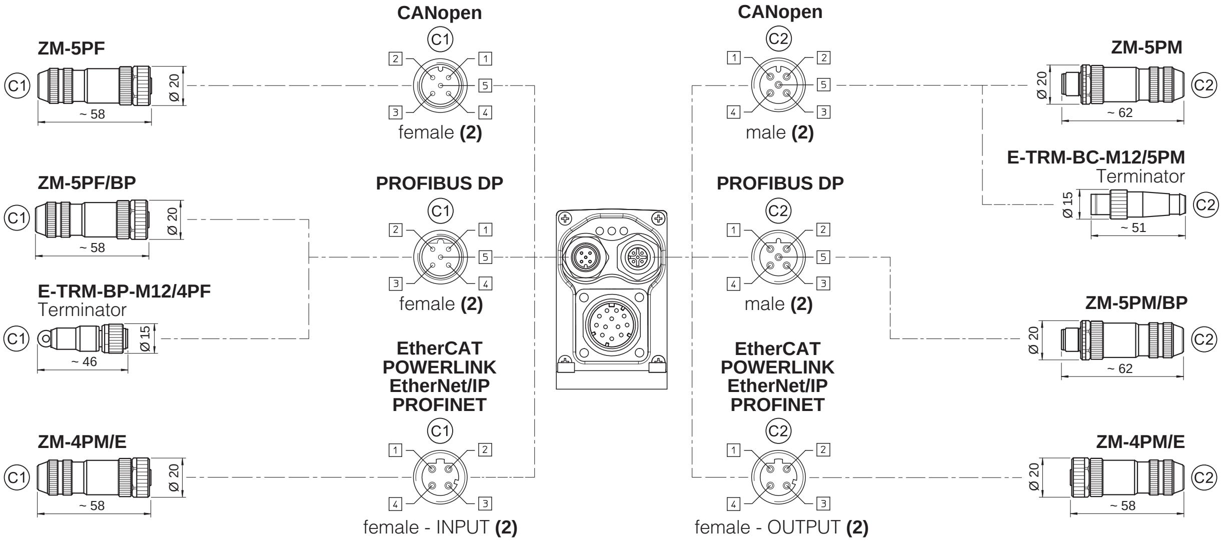
(2) Pin layout always referred to driver's view

14.5 LES connections layout

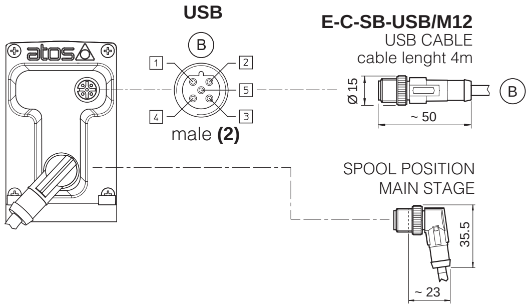
MAIN CONNECTORS



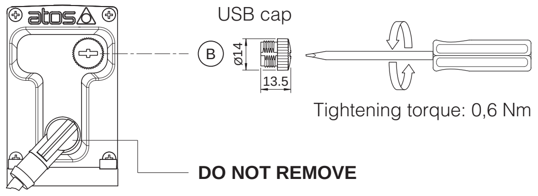
FIELDBUS CONNECTORS



TRANSDUCER AND USB CONNECTORS



PLASTIC PROTECTION CAP - supplied with the valves

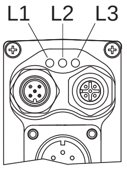


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

14.6 Diagnostic LEDs - only for LES

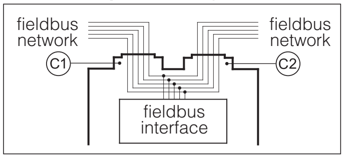
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

15 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



16 CONNECTORS CHARACTERISTICS - to be ordered separately

16.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

16.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

16.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

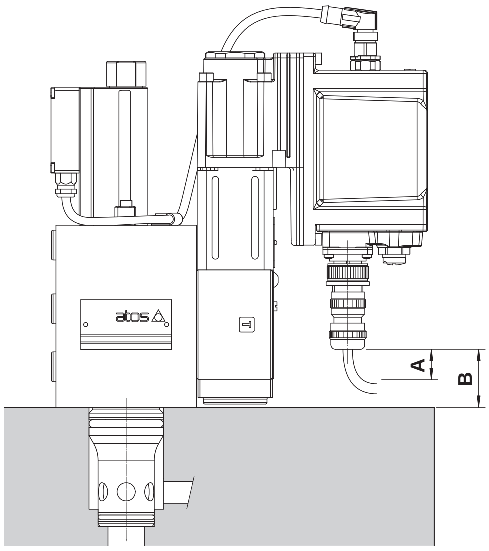
17 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	16	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5

(1) Fastening bolts supplied with the valve

18 MAIN CONNECTORS INSTALLATION DIMENSIONS

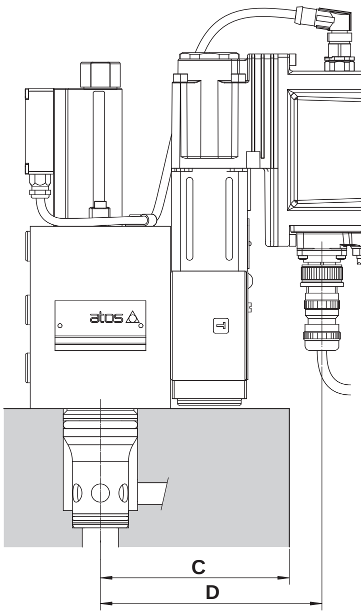
Installation 1 - possible interference between manifold and main connector



A = 15 mm space to remove the 7 or 12 pin main connectors

B = Clearance between main connector to valve's mounting surface. See the below table to verify eventual interferences, depending to the valve size and connector type

Installation 2 - no interference



C = Max manifold dimension to avoid interference with the main connector, see below table

Reference dimension	Main connector code	Valve size							
		16	25	32	40	50	63	80	100
B	ZM-7P	32	32	32	32	45	68	68	80
	ZH-7P	**(1)**	**(1)**	**(1)**	**(1)**	29	52	52	64
	ZM-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	35	35	47
	ZH-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(2)**	40
C (max)	-	104	114	121	134	141	172	202	229
D	-	124	134	141	154	161	192	222	249

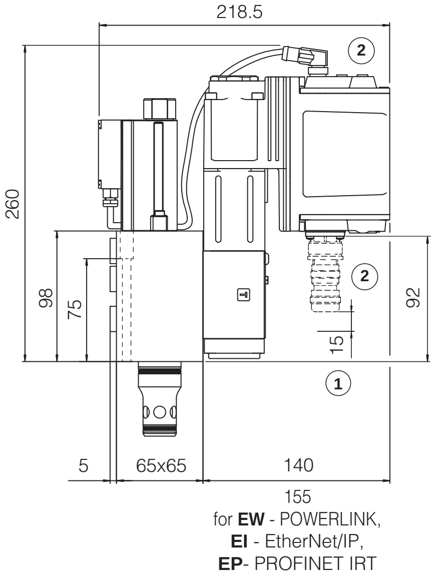
Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered

(1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as rapresented in above "Installation 2"

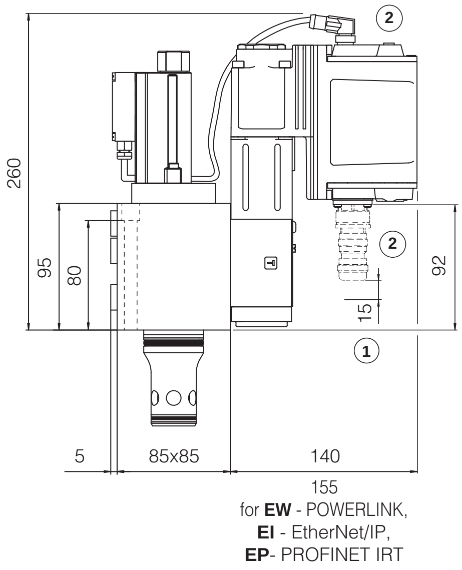
(2) The connector installation may be critic, depending to the cable size and bending radius

19 INSTALLATION DIMENSIONS [mm]

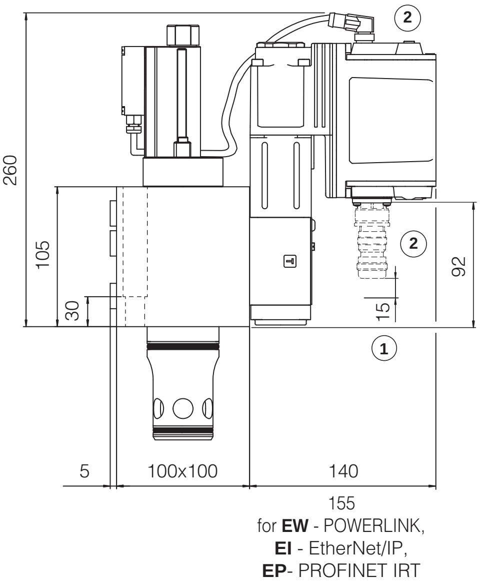
LIQZO-LEB-162
LIQZO-LES-162



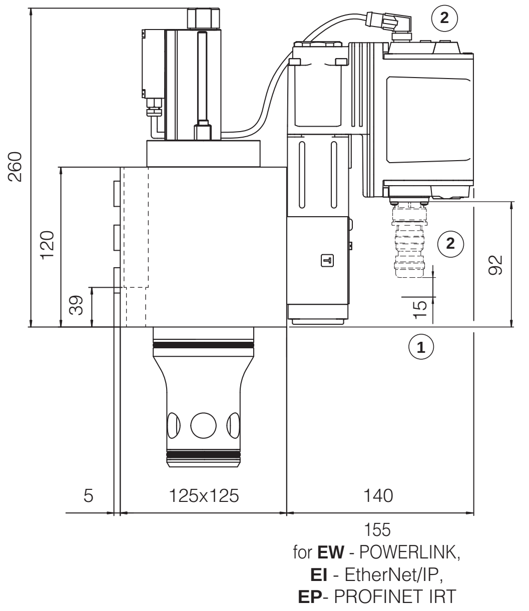
LIQZO-LEB-252
LIQZO-LES-252



LIQZO-LEB-322
LIQZO-LES-322



LIQZO-LEB-402
LIQZO-LES-402

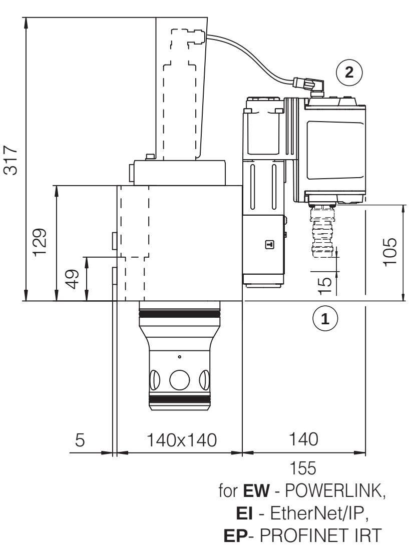


① = Space to remove the connectors

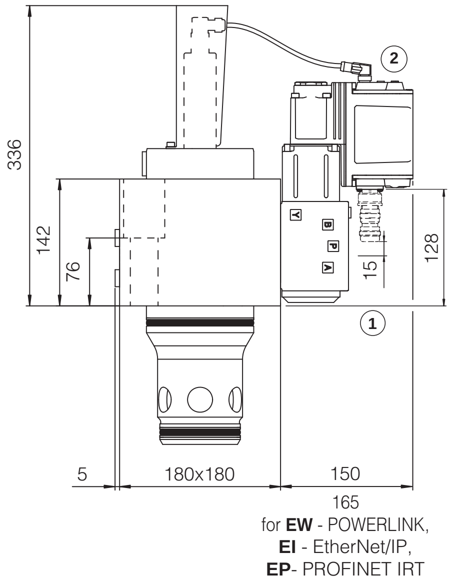
② = The dimensions of all connectors must be considered, see section 14.4 and 14.5
For main connectors installation, see also section 18 .

Note: for mounting surface and cavity dimensions, see table P006

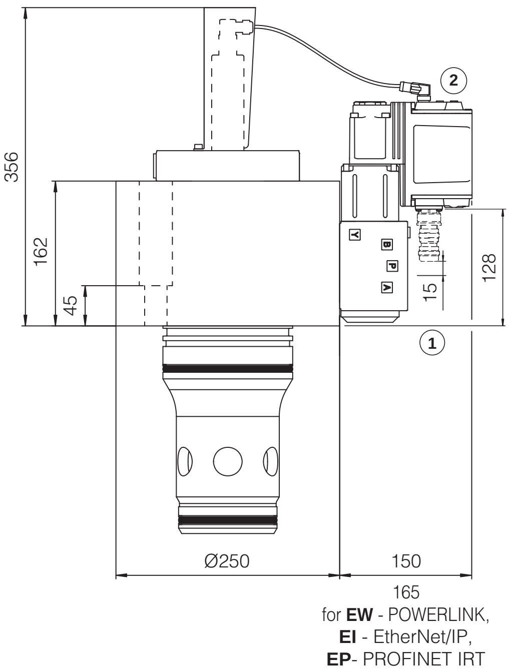
LIQZP-LEB-502
LIQZP-LES-502



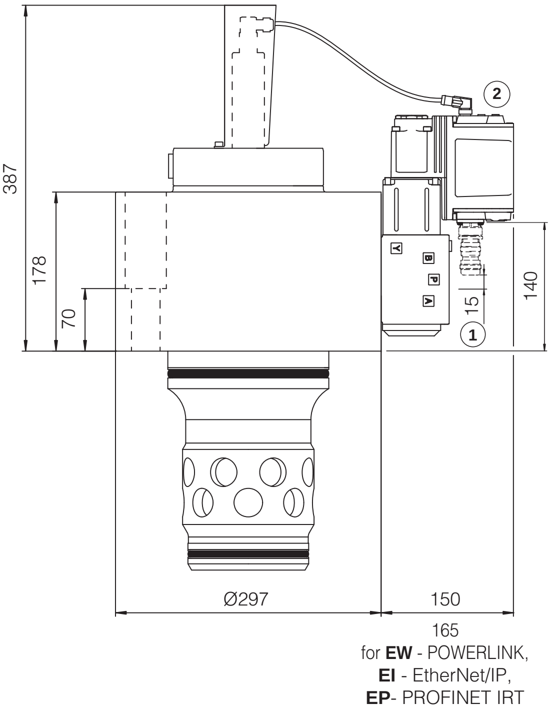
LIQZP-LEB-632
LIQZP-LES-632



LIQZP-LEB-802
LIQZP-LES-802



LIQZP-LEB-1002
LIQZP-LES-1002



① = Space to remove the connectors

② = The dimensions of all connectors must be considered, see section 14.4 and 14.5
For main connectors installation, see also section 18 .

Note: for mounting surface and cavity dimensions, see table P006

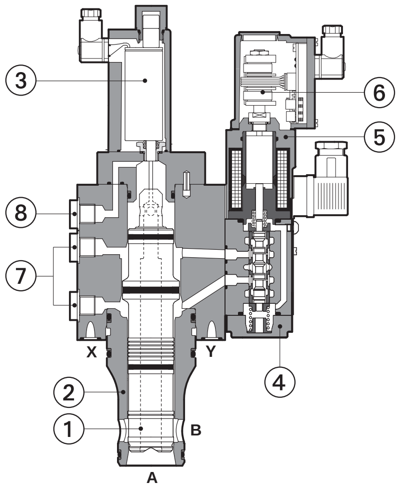
20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS500	Programming tools	**QB340**	Quickstart for LEB valves commissioning
GS510	Fieldbus	**QF340**	Quickstart for LES valves commissioning

Proportional 2-way cartridges high performance

piloted, with two LVDT transducers, ISO 7368 sizes from 16 to 100

CE



① Poppet
② Sleeve
③ Main stage LVDT transducer
④ Pilot valve
⑤ Proportional solenoid
⑥ Pilot valve LVDT transducer
⑦ Air bleeding
⑧ Air suction port

LIQZO-L-322L4

LIQZO-L, LIQZP-L

High performance 2-way proportional cartridge valves specifically designed for high speed closed loop controls.

The valves operate in association with digital off-board divers, see section 2.

They are equipped with two LVDT position transducers for best dynamics in not compensated flow regulations.

The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

Spool regulation characteristics: L = linear

LIQZO: Size: **16** ÷ **40** - ISO 7368
Max flow: **600** ÷ **2500 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50** ÷ **100** - ISO 7368
Max flow: **4000** ÷ **16000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	L	-	32	2	L4	/	*	/	*

Proportional cartridge, piloted
LIQZO = size 16 to 40, Pmax 350 bar
LIQZP = size 50 to 100, Pmax 420 bar

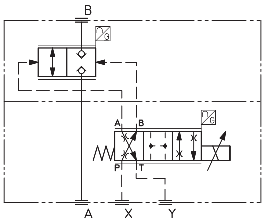
L = two LVDT transducers

Valve size ISO 7368, see section 4 :

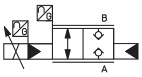
LIQZO =	**16**	**25**	**32**	**40**
l/min	250	500	800	1200
LIQZP =	**50**	**63**	**80**	**100**
l/min	2000	3000	4500	7200

Nominal flow (l/min) at Δp 5 bar

Configuration: **2** = 2 way



functional symbol



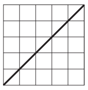
simplified symbol

Seals material,
see section 6 :
- = NBR
PE = FKM
BT = HNBR

Series number

Spool type, regulating characteristics:

L4 = linear



2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

⚠ **WARNING**

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		**16**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
Nominal flow Δp A-B [l/min]	Δp = 5 bar	250	500	800	1200	2000	3000	4500	7200
	Δp = 10 bar	350	700	1100	1700	2800	4250	6350	10200
	Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	**LIQZO**	Ports A, B = **350** X = 350 Y ≤ 10							
	LIQZP	Ports A, B = **420** X = 350 Y ≤ 10							
Nominal flow of pilot valve at Δp = 70 bar [l/min]		4	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]		0,2	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure [bar]		min: 40% of system pressure max 350 recommended 140 ÷ 160							
Piloting volume [cm^3]		1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)** [l/min]		4	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)** [ms]		24	25	28	30	30	35	40	50
Hysteresis [% of the max regulation]		≤ 0,1							
Repeatability [% of the max regulation]		± 0,1							
Thermal drift		zero point displacement < 1% at ΔT = 40°C							

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 7.2

⚠ **WARNING**

The loss of the pilot pressure causes the undefined position of the main spool.
The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).
This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

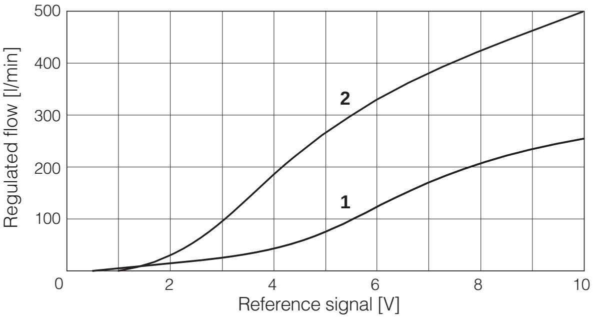
6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

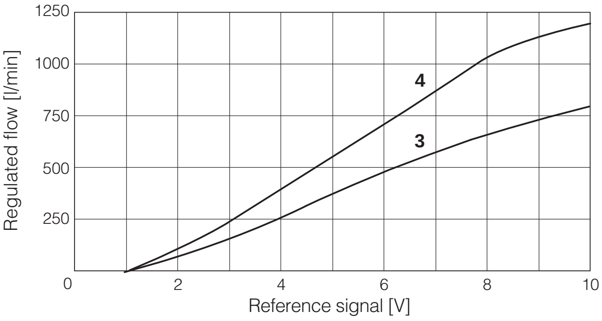
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

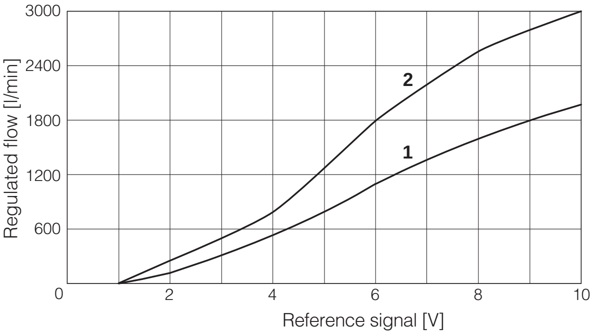
7.1 Regulation diagrams (values measured at Δp 5 bar)



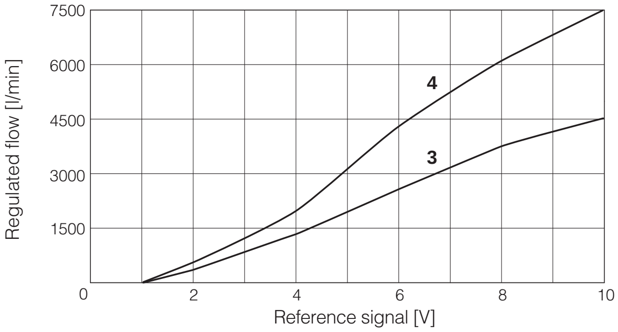
1 = LIQZO-L-162L4
2 = LIQZO-L-252L4



3 = LIQZO-L-322L4
4 = LIQZO-L-402L4



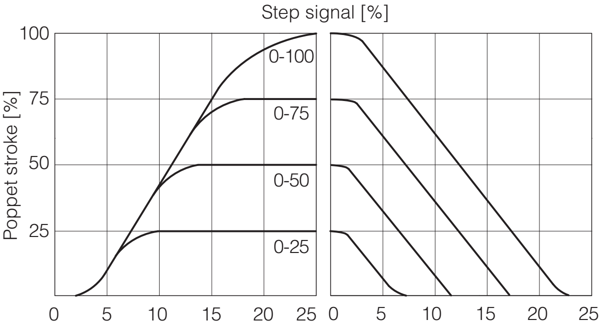
1 = LIQZP-L-502L4
2 = LIQZP-L-632L4



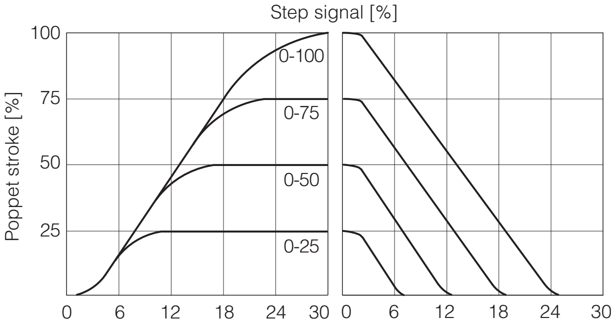
3 = LIQZP-L-802L4
4 = LIQZP-L-1002L4

7.2 Response time

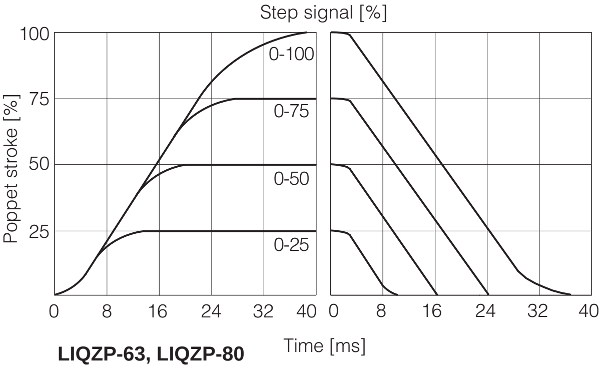
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



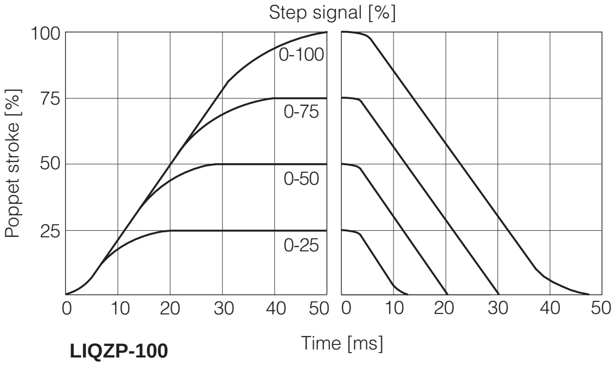
LIQZO-16, LIQZO-25



LIQZO-32, LIQZO-40
LIQZP-50

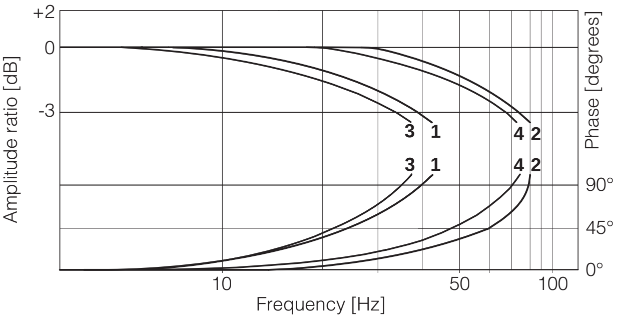


LIQZP-63, LIQZP-80

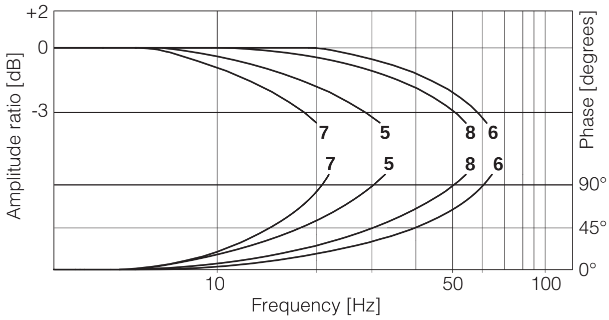


LIQZP-100

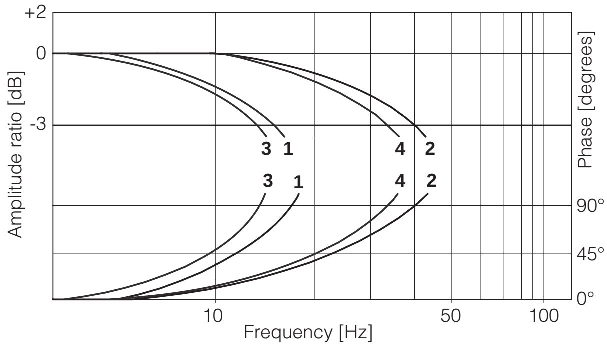
7.3 Bode diagrams - stated at nominal hydraulic conditions



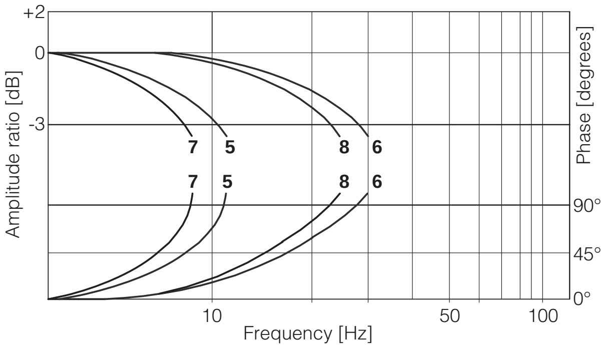
1 = LIQZO-L-162L4: 10% ↔ 90%
2 = LIQZO-L-162L4: 50% ± 5%
3 = LIQZO-L-252L4: 10% ↔ 90%
4 = LIQZO-L-252L4: 50% ± 5%



5 = LIQZO-L-322L4: 10% ↔ 90%
6 = LIQZO-L-322L4: 50% ± 5%
7 = LIQZO-L-402L4: 10% ↔ 90%
8 = LIQZO-L-402L4: 50% ± 5%



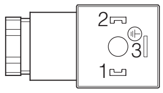
1 = LIQZP-L-502L4: 10% ↔ 90%
2 = LIQZP-L-502L4: 50% ± 5%
3 = LIQZP-L-632L4: 10% ↔ 90%
4 = LIQZP-L-632L4: 50% ± 5%



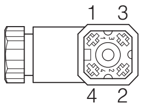
5 = LIQZP-L-802L4: 10% ↔ 90%
6 = LIQZP-L-802L4: 50% ± 5%
7 = LIQZP-L-1002L4: 10% ↔ 90%
8 = LIQZP-L-1002L4: 50% ± 5%

8 ELECTRICAL CONNECTION - connectors supplied with the valve

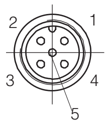
8.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

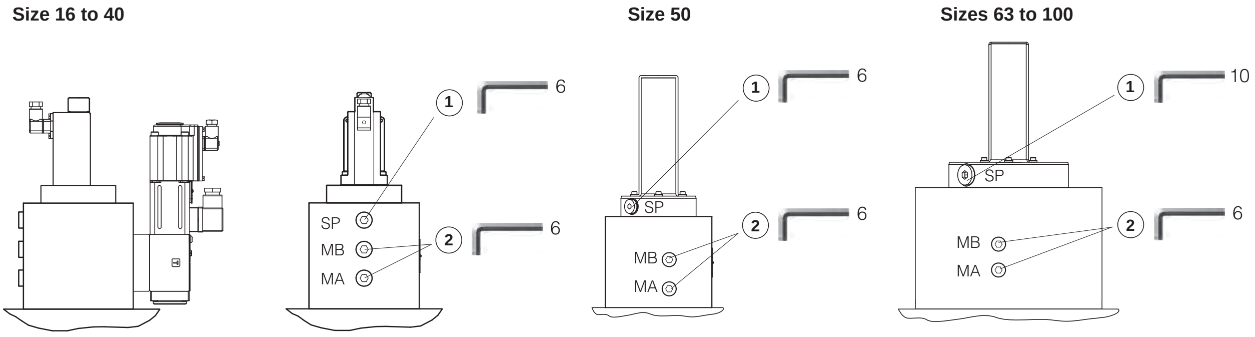
8.2 LVDT transducer connector - for LIQZO

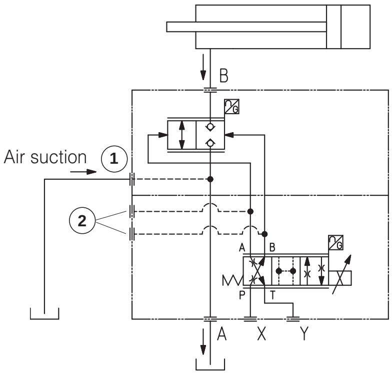
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

8.3 LVDT transducer connector - for LIQZP

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**PROG**	Do not connect	
2	**VT+**	Power supply +15VDC	
3	**AGND**	Ground	
4	**TR**	Output signal	
5	**VT-**	Power supply -15VDC	

9 AIR BLEEDING





① **Air suction port:**

N° 1 plug G1/4” for sizes 16 to 50
N° 1 plug G1/2” for sizes 63 to 100

To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

② **Air bleeding:**

N° 2 plugs G1/4”

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.

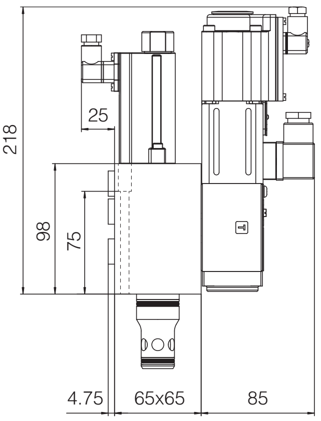
10 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	**16**	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7
LIQZP	**50**	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5

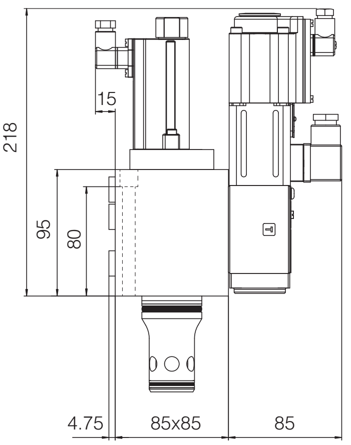
(1) Fastening bolts supplied with the valve

11 INSTALLATION DIMENSIONS [mm]

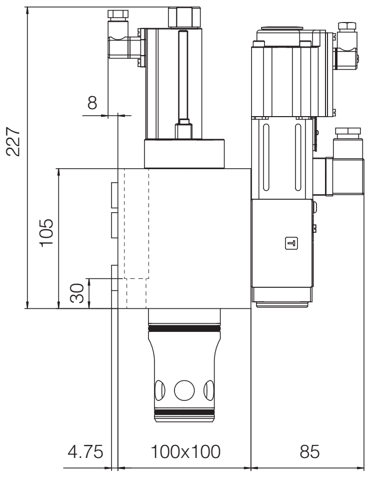
LIQZO-L-162



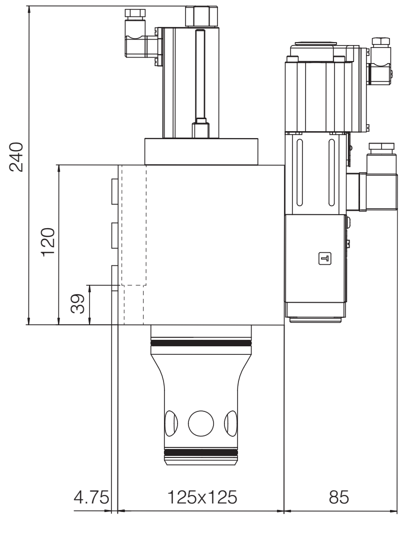
LIQZO-L-252



LIQZO-L-322

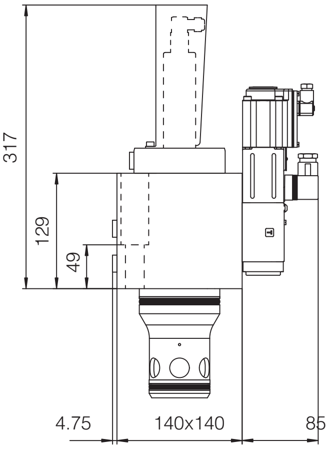


LIQZO-L-402

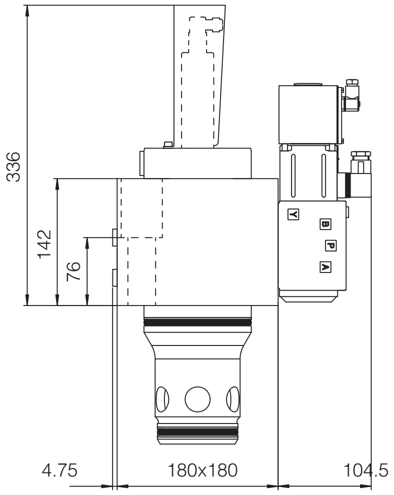


Note: for mounting surface and cavity dimensions, see table P006

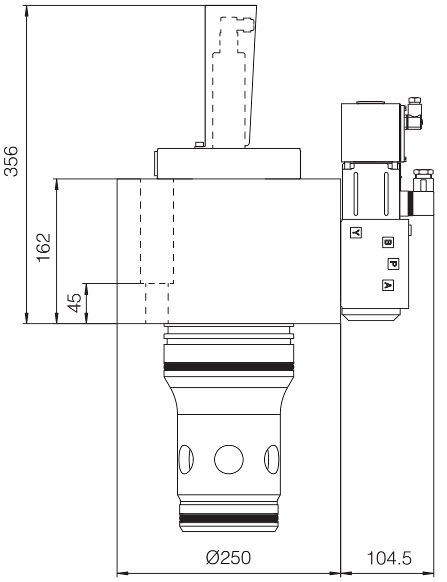
LIQZP-L-502



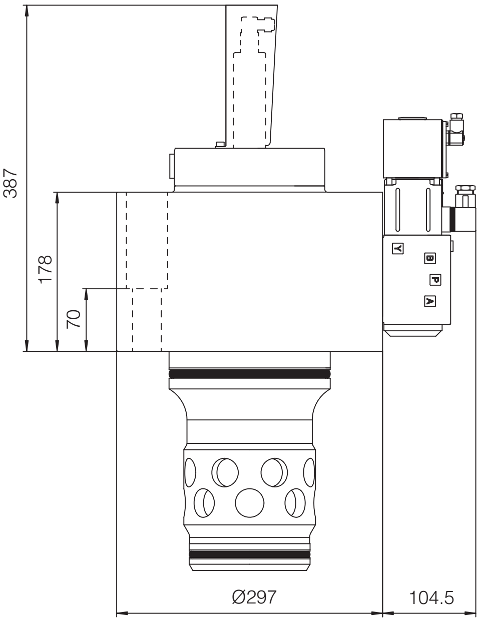
LIQZP-L-632



LIQZP-L-802



LIQZP-L-1002



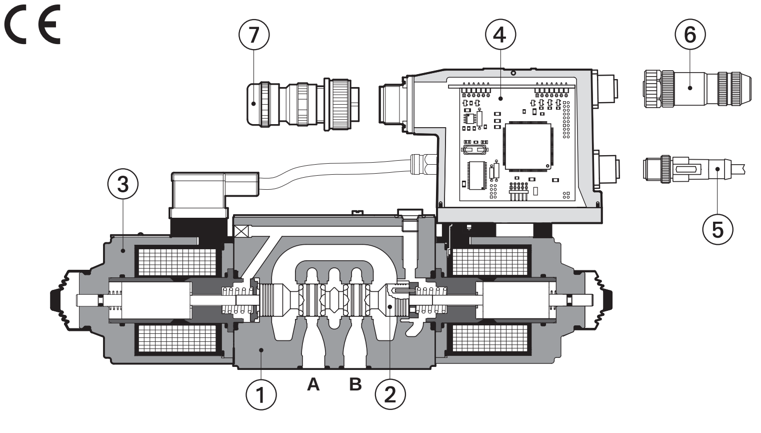
Note: for mounting surface and cavity dimensions, see table P006

12 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
GS230	E-BM-LEB digital driver	**K800**	Electric and electronic connectors
GS235	E-BM-LID digital driver	**P006**	Mounting surfaces and cavities for cartridge valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves

direct, without transducer, with positive spool overlap



DKZOR-AES-BC-171

① Valve body
② Spool
③ Proportional solenoid
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector

DHZO-A, DHZO-AEB, DHZO-AES
DKZOR-A, DKZOR-AEB, DKZOR-AES

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

DHZO:	**DKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE for STANDARD SPOOLS

DHZO - **AES** - **BP** - **0** **71** - **L** **5** / * / * * / *

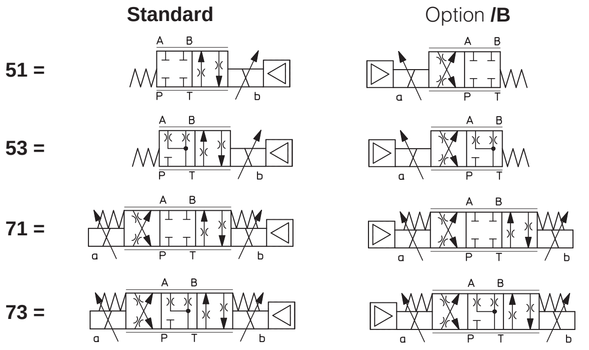
DHZO = size 06
DKZOR = size 10

A = for off-board driver, see section 2
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

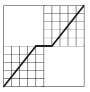
Valve size ISO 4401:
0 = 06 **1** = 10

Configuration (4):

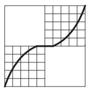


Spool type, regulating characteristics:

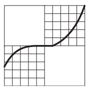
L = linear



S = progressive



D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 9:
- = NBR
PE = FKM
BT = HNBR

Series number

Coil voltage, only for **A** - see section 14:
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers

Hydraulic options (5):
B = solenoid and on-board digital driver at side of port A
Y = external drain

Hand lever options, only for **A**:
MO = horizontal hand lever
MV = vertical hand lever
BMO = horizontal hand lever installed at side of port A
BMV = vertical hand lever installed at side of port A

Electronic options, only for **AEB** and **AES (5)**:
C = current feedback for pressure transducer 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC) - only for **W**
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector
W = power limitation function - 12 pin connector

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZO =	1	4,5	8	18	28
DKZOR =	-	-	-	45	60

Nominal flow (l/min) at Δp 10bar P-T

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Hydraulic symbols are represented with on-board digital driver
(5) For possible combined options, see section 13

2 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Data sheet	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

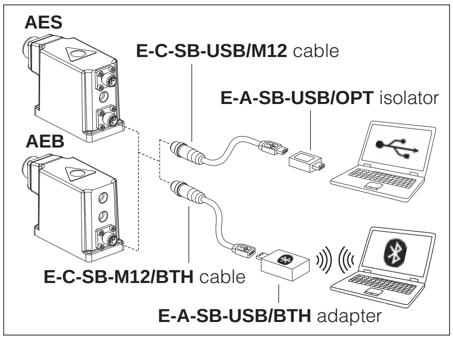
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DHZO**					**DKZOR**	
Pressure limits [bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with internal drain /Y) **Y** = 10					ports **P**, **A**, **B** = 315; **T** = 210 (250 with internal drain /Y) **Y** = 10	
Spool type	**L14**	**L1**	**S2**	**L3, S3, D3**	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**
Nominal flow Δp P-T [l/min] **(1)**							
Δp= 10 bar	1	4,5	8	18	28	45	60
Δp= 30 bar	1,7	8	14	30	50	80	105
Δp= 70 bar	2,6	12	21	45	70	120	160
Max permissible flow **(2)**	4	18	30	50	70	120	160
Leakage [cm^3/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)					<80 (at p = 100 bar); <600 (at p = 315 bar)	
Response time **(3)** [ms]	≤ 30					≤ 40	
Hysteresis	≤ 5 [% of max regulation]						
Repeatibility	± 1 [% of max regulation]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) For different Δp, the max flow is in accordance to the diagrams in section 10.2
(2) See detailed diagrams in section 10.3
(3) 0-100% step signal, see detailed diagrams in section 10.4

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	**DHZO**			**DKZOR**		
	A = 30 W	**AEB**, **AES** = 50 W		**A** = 35 W	**AEB**, **AES** = 50 W	
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω					
Monitor output	Output range: voltage ±5 VDC @ max 5 mA					
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ					
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)					
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 17					

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

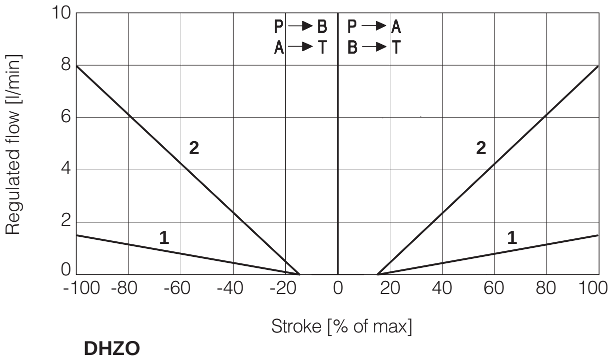
9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

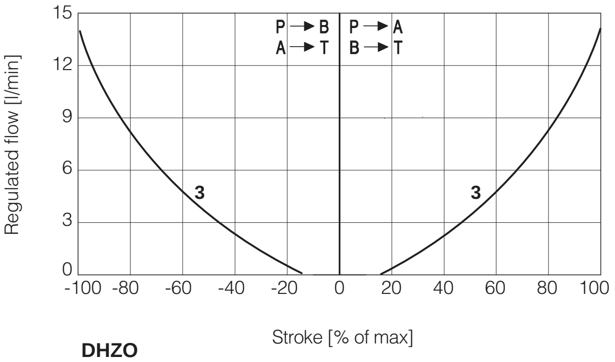
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

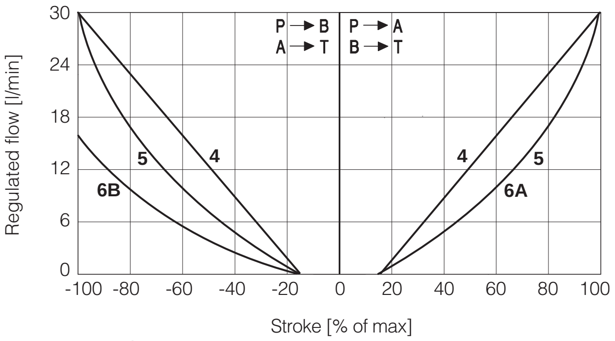
10.1 Regulation diagrams - values measure at Δp 30 bar P-T



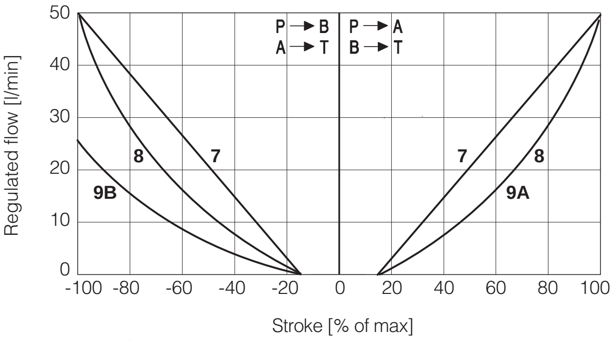
DHZO
1 = L14 **2** = L1



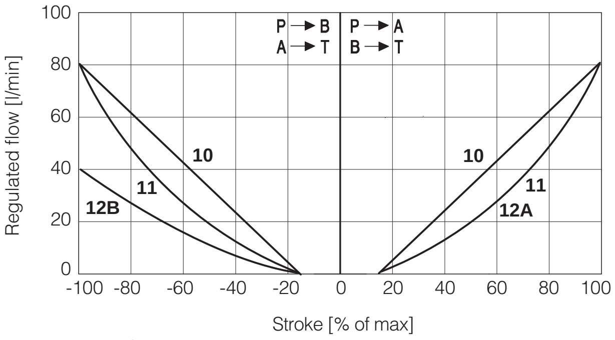
DHZO
3 = S2



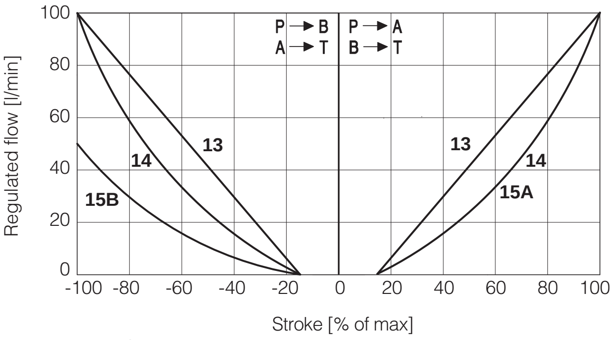
DHZO
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZO
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZOR
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



DKZOR
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\left.\begin{matrix}0 \div +10\text{ V}\\ 12 \div 20\text{ mA}\end{matrix}\right\}$ P → A / B → T

Reference signal $\left.\begin{matrix}0 \div -10\text{ V}\\ 12 \div 4\text{ mA}\end{matrix}\right\}$ P → B / A → T

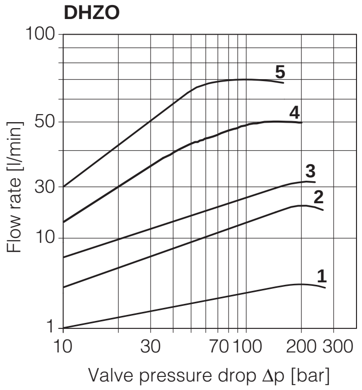
10.2 **Flow /Δp diagrams** - stated at 100% of valve stroke

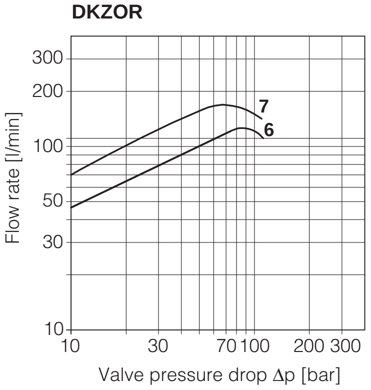
DHZO

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

DKZOR

6 = spool S3, L3, D3
7 = spool S5, L5, D5





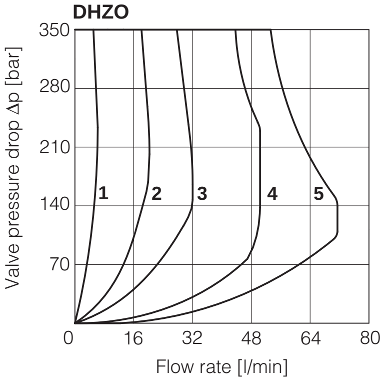
10.3 Operating limits

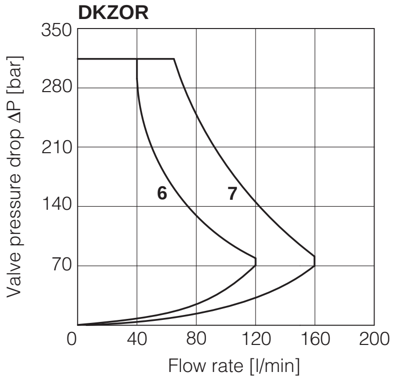
DHZO

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

DKZOR

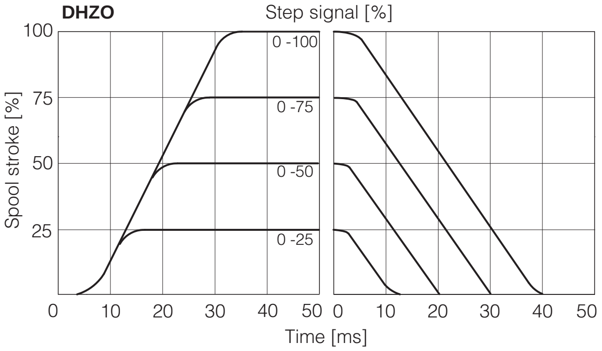
6 = spool S3, L3, D3
7 = spool S5, L5, D5

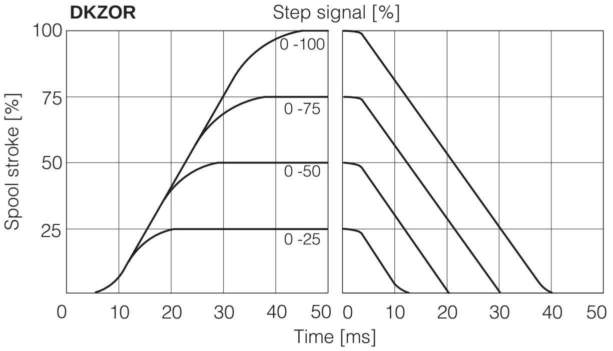




10.4 Response time

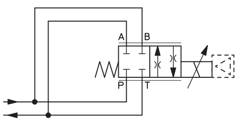
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.





10.5 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow Δp= 15 bar [l/min]	SPOOL TYPE				
	L14	**L1**	**S2**	**L3** **S3**	**L5** **S5**
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	200

11 HYDRAULIC OPTIONS

B = DHZO-05 and DKZOR-15 = solenoid and on-board digital driver at side of port A.
DHZO-07 and DKZOR-17 = on-board digital driver at side of port A.

Y = External drain advisable when the valve is used in double flow path, see section 10.5.
This option is mandatory if the pressure in port T exceeds 210 bar.

Hand lever option - only for **DHZO-A** with spool type S3, S5, D3, D5, L3, L5.

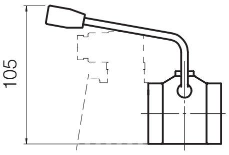
It allows to operate the valve in absence of electrical power supply.
For detailed description of DHZO-A with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

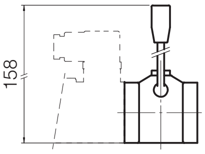
BMO = Horizontal hand lever installed at side of port A

MV = Vertical hand lever

BMV = Vertical hand lever installed at side of port A



MO option

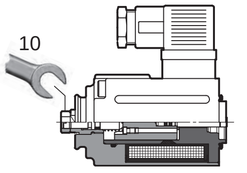


MV option

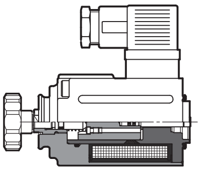
The following supplementary options allow to operate **DHZO-A** and **DKZOR-A** in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table **TK150**

N = Manual micrometric adjustment

NV = As option /N plus handwheel and graduated scale



N option



NV option

12 ELECTRONICS OPTIONS - only for AEB and AES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver.
Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.5 for signal specifications.

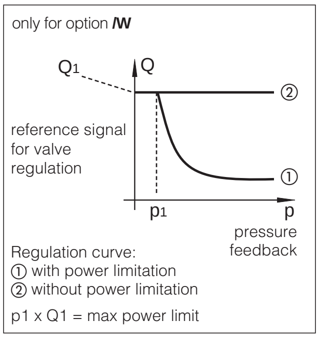
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 15.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 15.2

C = Only in combination with option **/W**
This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

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

Hydraulic Power Limitation



13 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ, /IW, /CW, /CWI

14 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

15 **POWER SUPPLY AND SIGNALS SPECIFICATIONS** - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

15.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT) - only for /Z and /W options

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

15.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 16.4).
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

16 ELECTRONIC CONNECTIONS

16.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

16.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**		Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, referred to VL0. Default is 0 ÷ 5 VDC	Output - analog signal
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

16.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

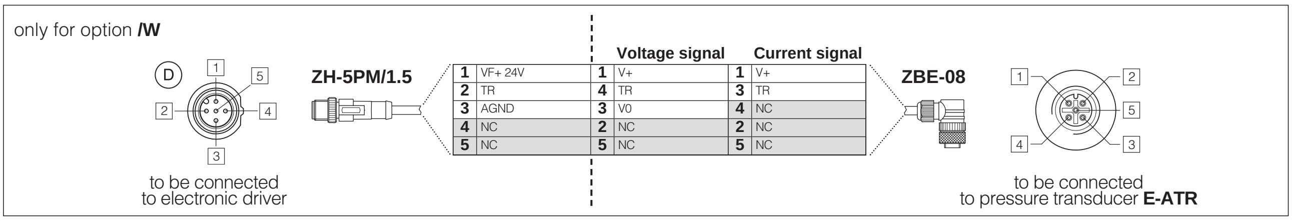
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

16.4 Remote pressure transducer connector - M12 - 5 pin - only for **/W** option - for **AEB** and **AES** Ⓓ

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer maximum range ±10 VDC / ±20 mA, software selectable Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

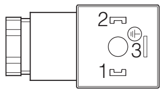
Remote pressure transducer connection - example



		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC
4	NC	**2**	NC	**2**	NC
5	NC	**5**	NC	**5**	NC

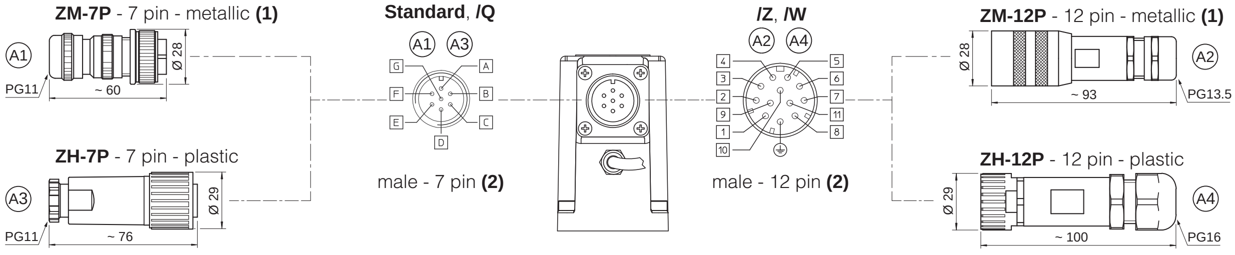
Note: connectors front view

16.5 Solenoid connection - only for **A**

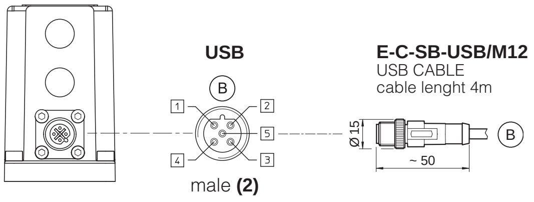
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

16.6 AEB connections layout

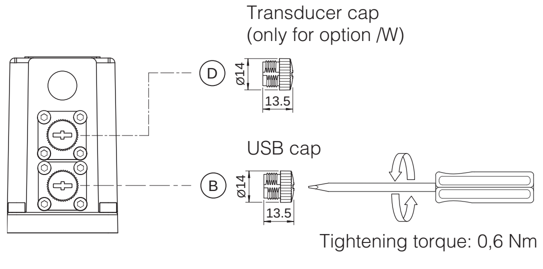
MAIN CONNECTORS



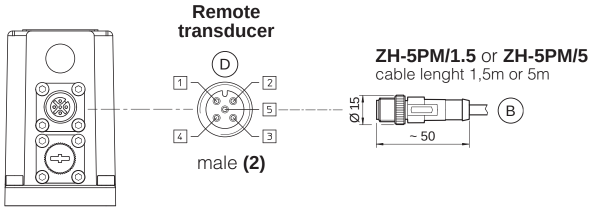
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



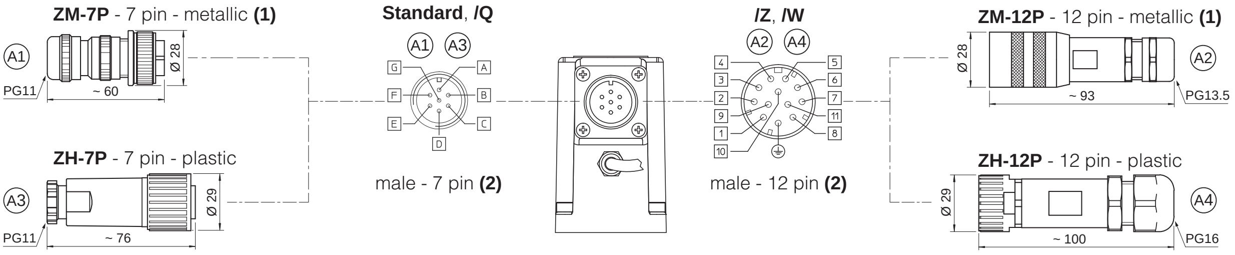
TRANSDUCER CONNECTOR - only for option **/W**



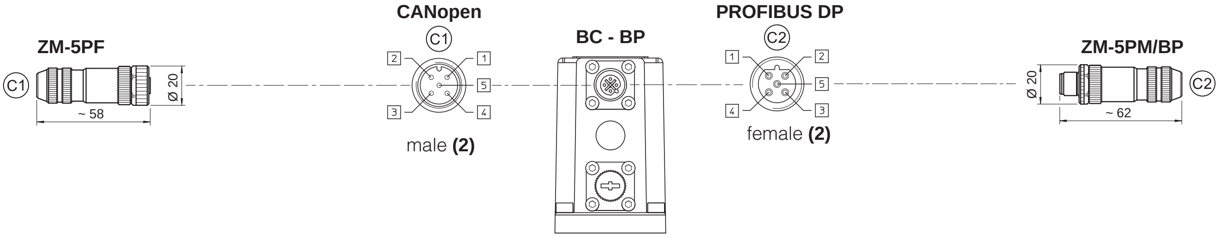
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

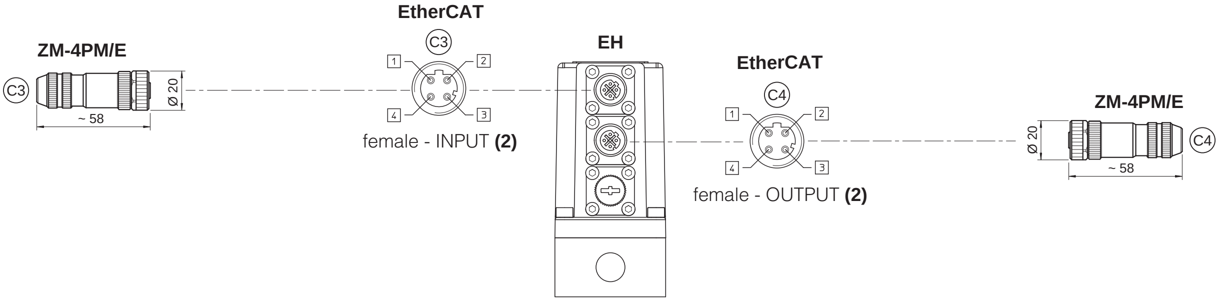
16.7 AES connections layout

MAIN CONNECTORS

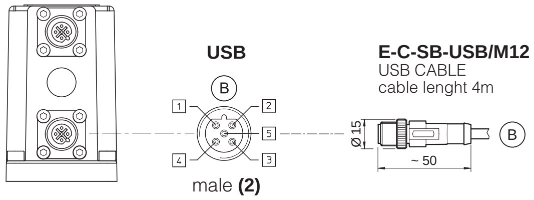


FIELDBUS CONNECTORS

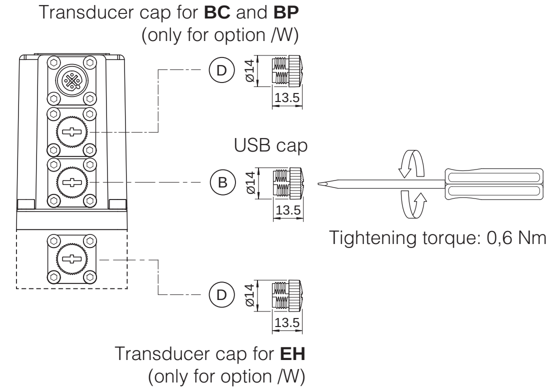




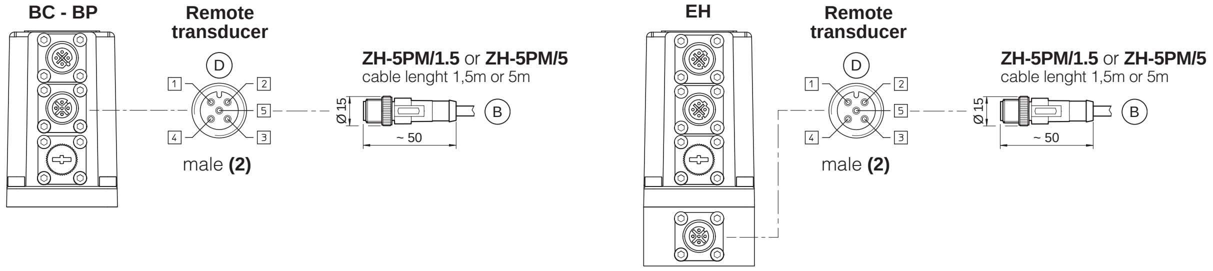
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

17.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

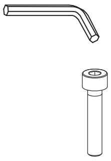
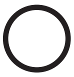
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

17.4 Pressure transducer connectors - only for **/W** option

CONNECTOR TYPE	**TRANSDUCER**	
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm^2	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

18 FASTENING BOLTS AND SEALS

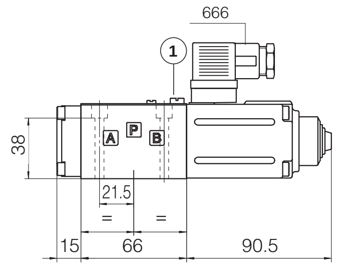
	DHZO	**DKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø 3,2 mm (only for /Y option)	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø 5 mm (only for /Y option)

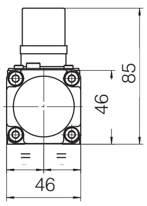
19 INSTALLATION DIMENSIONS FOR DHZO [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y version, surface 4401-03-03-0-05 without X port)

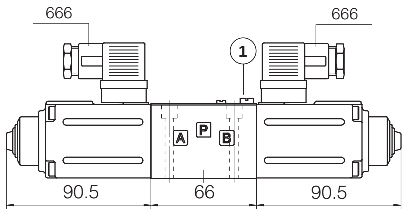
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DHZO-*-05	1,9	2,3	2,4
DHZO-*-07	2,6	3,1	3,2

DHZO-A-05

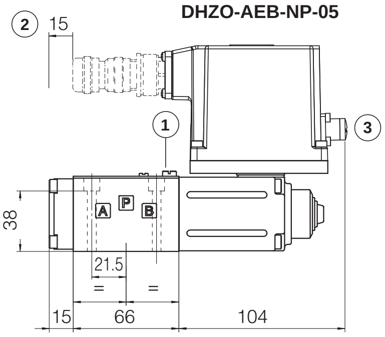


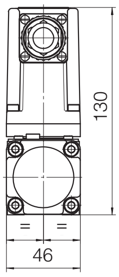


DHZO-A-07

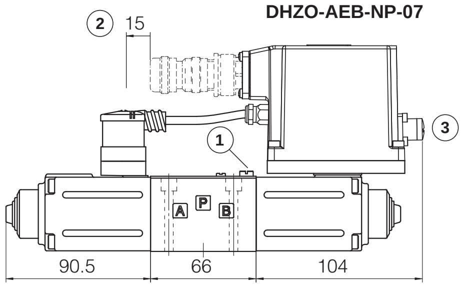


DHZO-AEB-NP-05

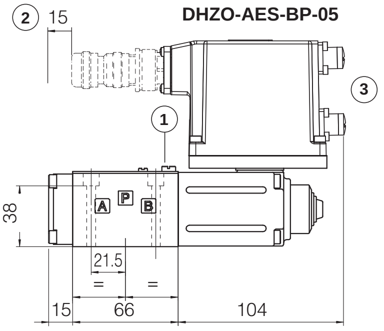


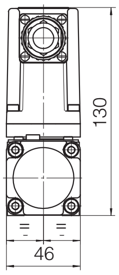


DHZO-AEB-NP-07

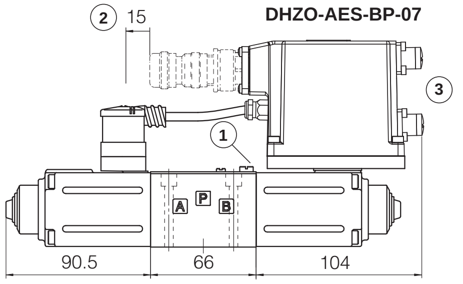


DHZO-AES-BC-05
DHZO-AES-BP-05

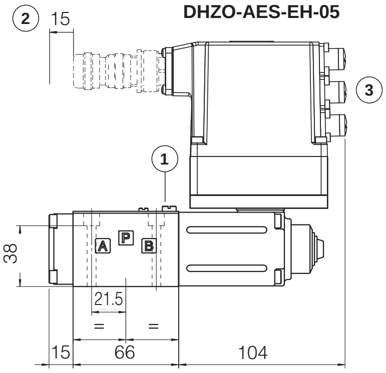


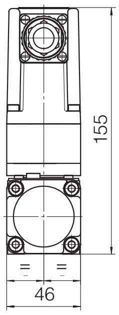


DHZO-AES-BC-07
DHZO-AES-BP-07

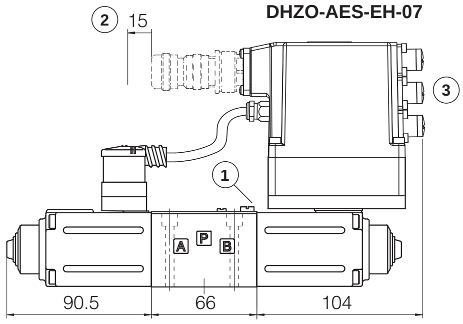


DHZO-AES-EH-05





DHZO-AES-EH-07



① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

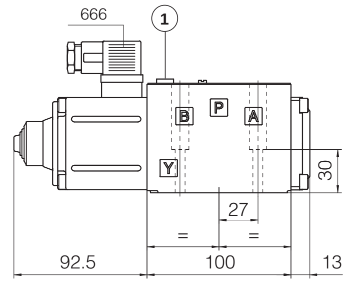
Note: for option /B the solenoid and the on-board digital driver are at side of port A

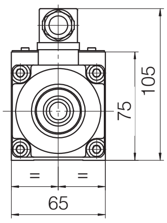
20 INSTALLATION DIMENSIONS FOR DKZOR [mm]

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y version, surface 4401-05-05-0-05 without X port)

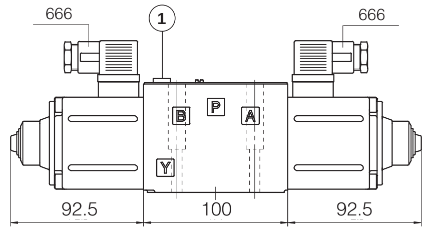
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DKZOR-*-15	3,8	4,3	4,4
DKZOR-*-17	4,5	5,0	5,1

DKZOR-A-15

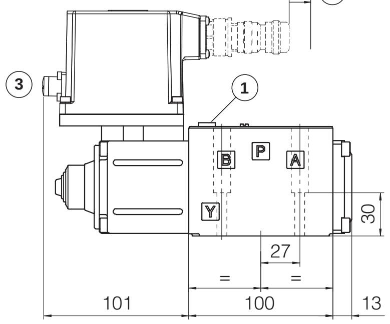


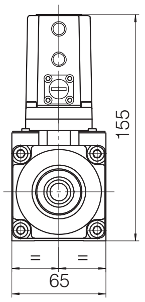


DKZOR-A-17

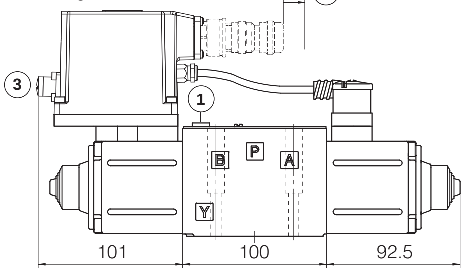


DKZOR-AEB-NP-15

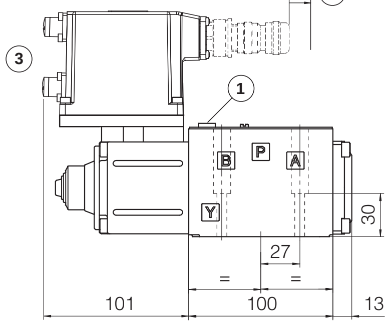


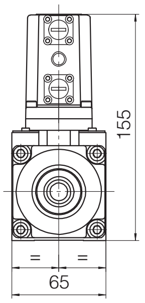


DKZOR-AEB-NP-17

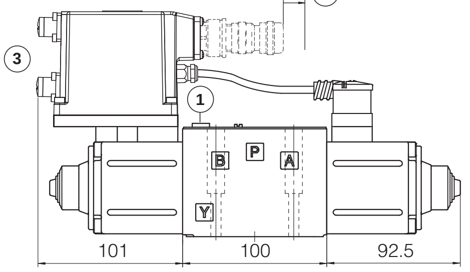


DKZOR-AES-BC-15
DKZOR-AES-BP-15





DKZOR-AES-BC-17
DKZOR-AES-BP-17



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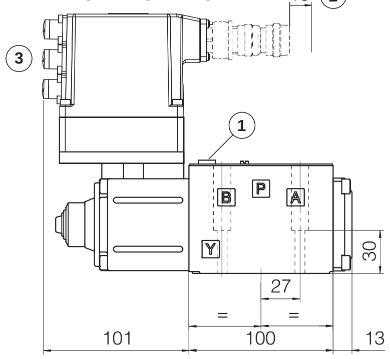
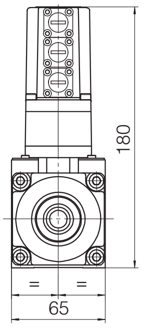
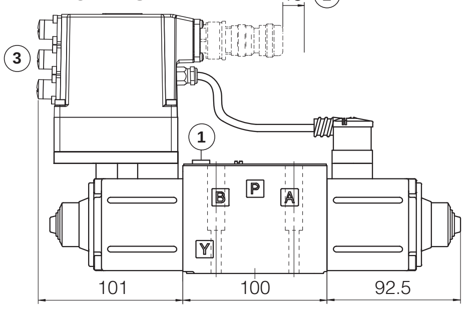




DKZOR-AES-EH-17



① = Air bleeding

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

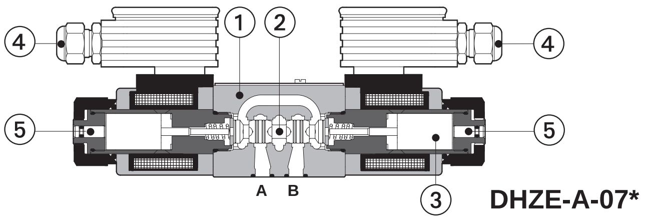
Note: for option /B the solenoid and the on-board digital driver are at side of port A

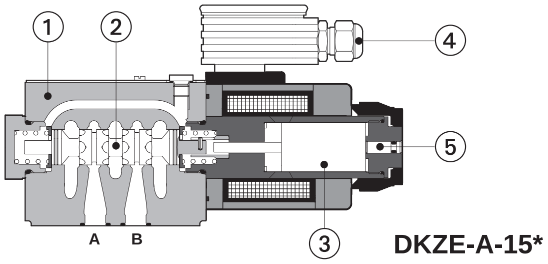
21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB100	Quickstart for AEB valves commissioning
QF100	Quickstart for AES valves commissioning

Proportional directional valves

direct, without transducer





① Valve body
② Spool
③ Proportional solenoid
④ E-MI-AS-IR digital driver (to be ordered separately)
⑤ Manual override

DHZE-A, DKZE-A

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

Spool regulation characteristics:
L =linear
S = progressive
D = differential-progressive

Valve body characteristics:
3 chambers type for DHZE
5 chambers type for DKZE

The solenoids are certified according to North American standard **cURus**.

DHZE:	**DKZE**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **70 l/min**	Max flow: **160 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZE - A - 0 71 - S 5 / * - * / * * / *

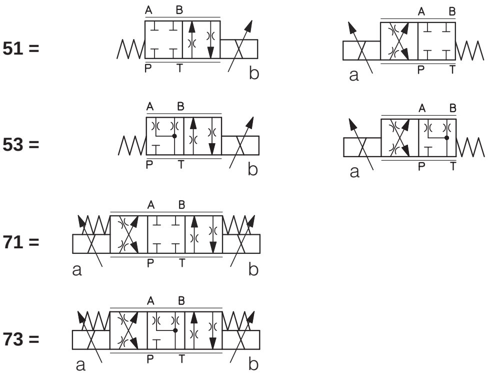
DHZE = size 06
DKZE = size 10

A = for off-board driver, see section 2

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

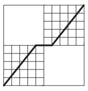
Configuration:

Standard Option **/B**

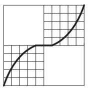


Spool type, regulating characteristics:

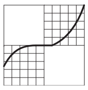
L = linear



S = progressive



D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR

Series number

Coil voltage, see section 10 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers

Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Hydraulic options:
B = solenoid at side of port A (only for valve configuration 5)

Hand lever options (1):
MO = horizontal hand lever
MV = vertical hand lever
BMO = horizontal hand lever installed at side of port A
BMV = vertical hand lever installed at side of port A

Spool size:	**14** (L)	**1** (L)	**3** (L,S,D)	**5** (L,S,D)
DHZE =	1	4,5	17	28
DKZE =	-	-	45	60

Nominal flow (l/min) at Δp 10 bar P-T

(1) Only for **DHZE** with spool type S3, S5, D3, D5, L3, L5

2 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS

Valve model	**DHZE**				**DKZE**	
Pressure limits [bar]	ports **P, A, B** = 350; **T** = 210				ports **P, A, B** = 315; **T** = 210	
Spool type and size	**L14**	**L1**	**S3, L3, D3**	**S5, L5, D5**	**S3, L3, D3**	**S5, L5, D5**
Nominal flow **(1)** [l/min] at Δp = 10 bar (P-T)	1	4,5	18	28	45	60
at Δp = 30 bar (P-T)	1,7	8	30	50	80	105
at Δp = 70 bar (P-T)	3	12	45	70	120	160
Response time **(2)** [ms]	≤ 30				≤ 40	
Hysteresis [%]	5 [% of max regulation]					
Repeatability [%]	± 1 [% of max regulation]					

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2;
the flow regulated by the directional proportional valves is not pressure compensated, thus it is affected by the load variations;
to keep costant the regulated flow under different load conditions, modular pressure compensators are available - see tech. table D150

(1) For different Δp, the max flow is in accordance to the diagrams in sections 8.2 and 9.2
(2) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

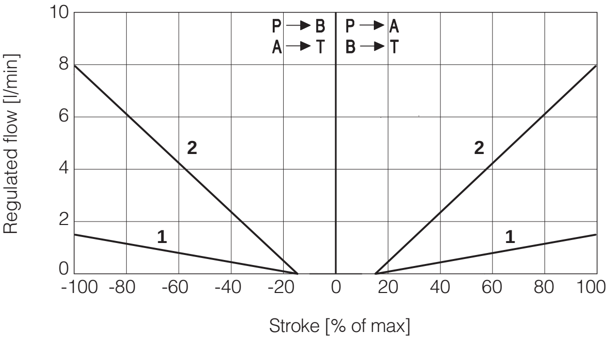
Max power consumption	**DHZE** 30 W			**DKZE** 35 W		
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	IP65 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Certification	**cURus** North American Standard					

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

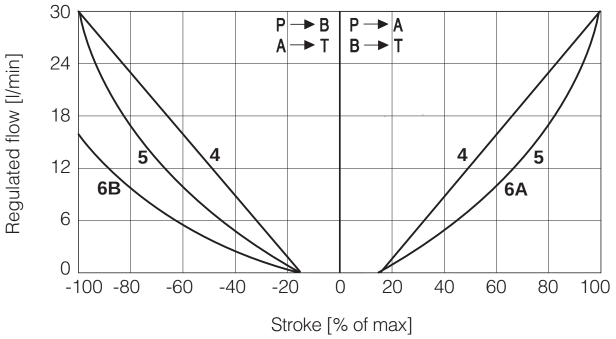
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level – normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
Max fluid contamination level – longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

8 DIAGRAMS FOR DHZE (based on mineral oil ISO VG 46 at 50 °C)

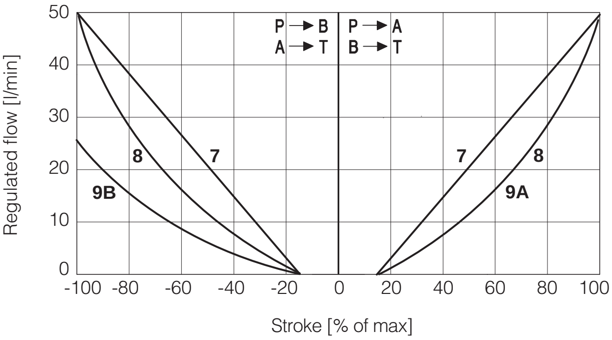
8.1 Regulation diagrams



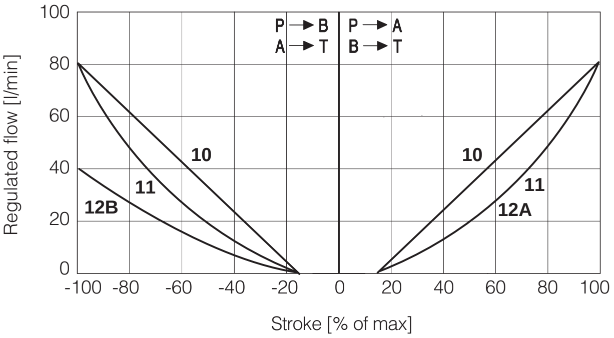
DHZE
1 = L14 **2** = L1



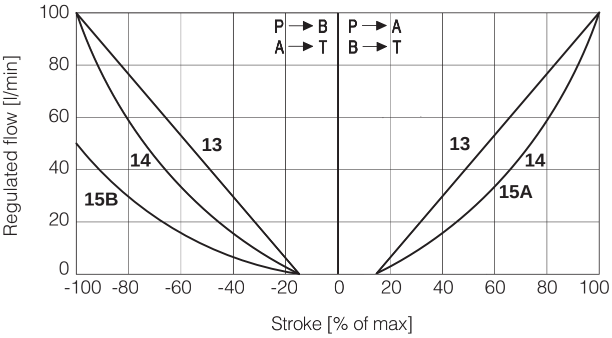
DHZE
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZE
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZE
10 = L3 **11** = S3 **12A** = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



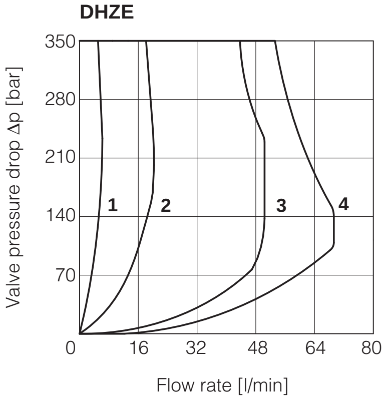
DKZE
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

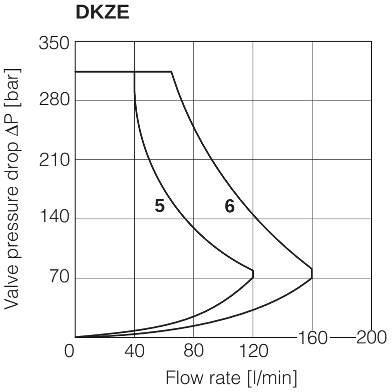
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

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

8.2 Operating limits



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



5 = spool S3, L3, D3
6 = spool S5, L5, D5

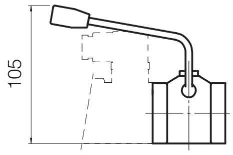
9 HYDRAULIC OPTIONS

B = DHZE-05 and DKZE-15 = solenoid at side of port A of the main stage.
DHZO-07 and DKZE-17 = E-MI-AS-IR electronics at side of port A of the main stage.

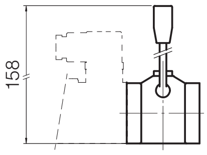
Hand lever option - only for **DHZE** with spool type S3, S5, D3, D5, L3, L5.

It allows to operate the valve in absence of electrical power supply.
For detailed description of DHZE with hand lever option see tech. table **E138**.

MO = Horizontal hand lever
BMO = Horizontal hand lever installed at side of port A
MV = Vertical hand lever
BMV = Vertical hand lever installed at side of port A



MO option



MV option

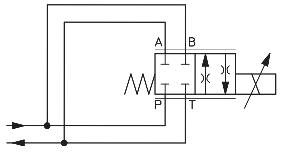
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

11 OPERATION AS THROTTLE VALVE

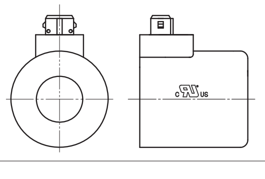
Single solenoid valves
DHZE-A-051 and DKZE-A-151
can be used as simple throttle valves:
Pmax = 210 bar

Max flow Δp= 15bar [l/min]	SPOOL TYPE					
	L14	L1	L3	S3	L5	S5
DHZE	4	16	60		100	
DKZE	-	-	160		200	

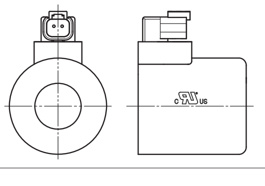


12 COILS WITH SPECIAL CONNECTORS

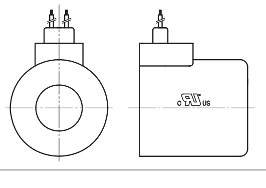
J option
Coil type COZEJ (DHZE)
Coil type CAZEJ (DKZE)
AMP Junior Timer connector
Protection degree IP67



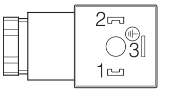
K option
Coil type COZEK (DHZE)
Coil type CAZEK (DKZE)
Deutsch connector, DT-04-2P male
Protection degree IP67



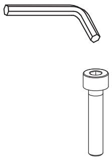
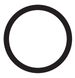
S option
Coil type COZES (DHZE)
Coil type CAZES (DKZE)
Lead Wire connection
Cable lenght = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

14 FASTENING BOLTS AND SEALS

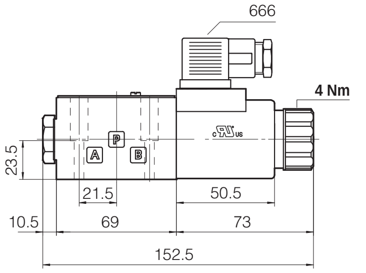
	DHZE	DKZE
	**Fastening bolts:** 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS FOR DHZE [mm]

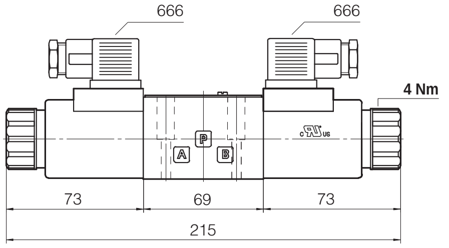
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

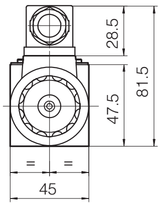
Mass [kg]	
DHZE-A-05	1,5
DHZE-A-07	2
DHZE-A-05 with E-MI-AS-IR	2
DHZE-A-07 with E-MI-AS-IR	3

DHZE-A-05

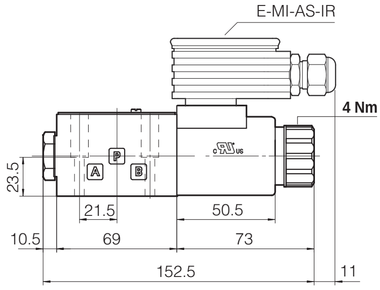


DHZE-A-07

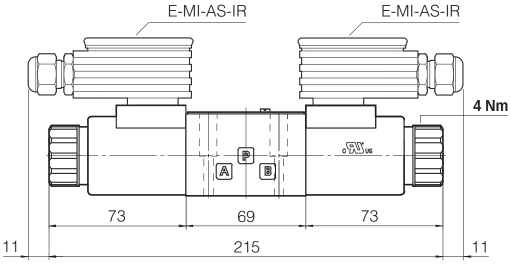


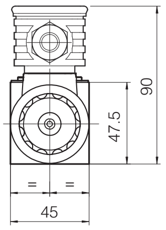


DHZE-A-05 with E-MI-AS-IR digital driver



DHZE-A-07 with E-MI-AS-IR digital drivers





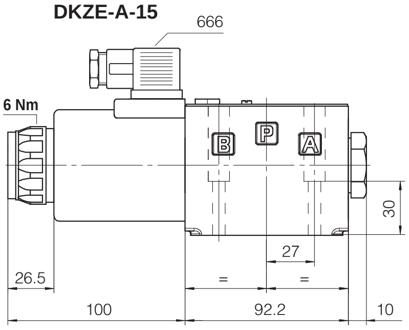
Note: for option /B the solenoid is at side of port A (only for DHZE-A-05 and DKZE-A-15)

16 INSTALLATION DIMENSIONS FOR DKZE [mm]

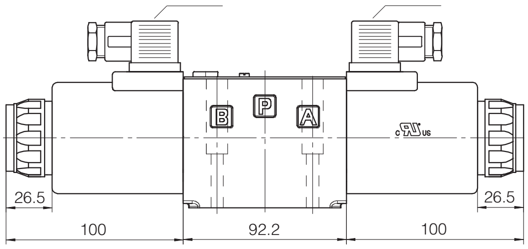
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)

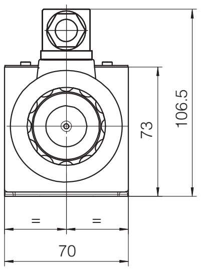
Mass [kg]	
DKZE-A-15	4,5
DKZE-A-17	6,1
DKZE-A-15 with E-MI-AS-IR	5
DKZE-A-17 with E-MI-AS-IR	7,1

DKZE-A-15

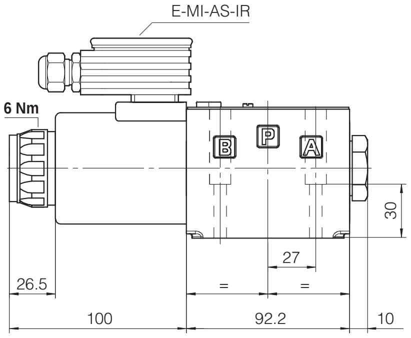


DKZE-A-17

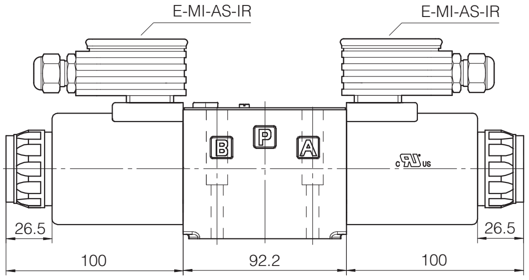


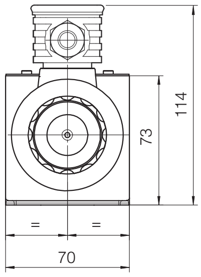


DKZE-A-15 with E-MI-AS-IR digital driver



DKZE-A-17 with E-MI-AS-IR digital drivers





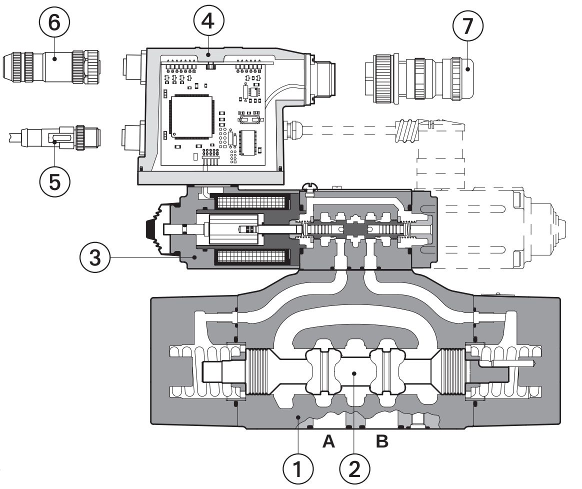
Note: for option /B the solenoid is at side of port A (only for DHZE-A-05 and DKZE-A-15)

17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		
GS050	E-BM-AES digital driver		

Digital proportional directional valves

piloted, without transducer, with positive spool overlap



① Valve body
② Main stage Spool
③ Pilot valve
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector

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

DPZO-A, DPZO-AEB, DPZO-AES

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** ÷ **32** - ISO 4401
Max flow: **180** ÷ **1500 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPZO - AES - BC - 2 71 - L 5 / * / * * / *

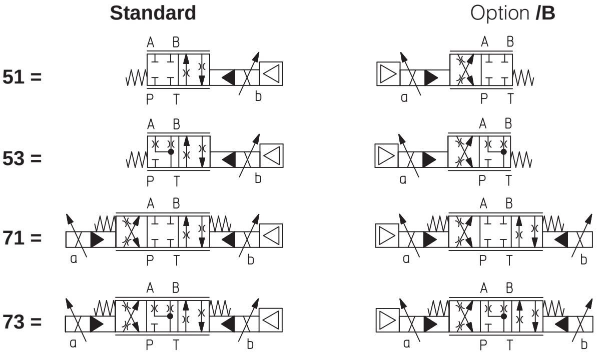
Proportional directional valve, piloted

A = for off-board driver, see section 2
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(5)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

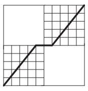
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration (3):

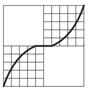


Spool type, regulating characteristics:

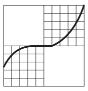
L = linear



S = progressive



D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

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

Hydraulic options (4):
B = solenoid and on-board digital driver at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options, only for **AEB** and **AES** **(4)**:
C = current feedback for pressure transducer 4÷20 mA (omit for std voltage 0÷10 VDC) - only for **W**
I = current reference input 4÷20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector
W = power limitation function - 12 pin connector

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Hydraulic symbols are represented with on-board digital driver
(4) For possible combined options, see section 13
(5) Omit for **A** execution

2 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

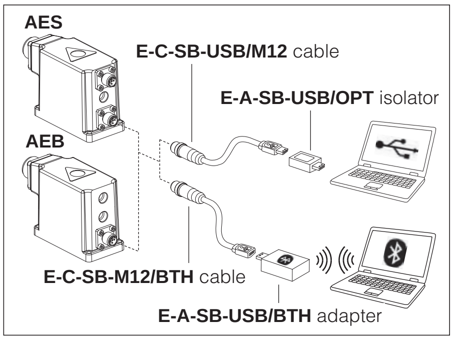
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**DPZO-*-1**	**DPZO-*-2**		**DPZO-*-4**	**DPZO-*-6**
Pressure limits [bar]	ports **P**, **A**, **B**, **X** = 350; **T** = 250 (10 with internal drain /D) **Y** = 10				
Spool type	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**		
Nominal flow Δp P-T [l/min] **(1)**					
Δp= 10 bar	100	160	250	480	640
Δp= 30 bar	160	270	430	830	1100
Max permissible flow	180	400	550	900	1500
Piloting pressure [bar]	min = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume [cm^3]	1,4	3,7		9,0	21,6
Piloting flow **(2)** [l/min]	1,7	3,7		6,8	14,4
Leakage **(3)** [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(4)** [ms]	≤ 80	≤ 100		≤ 120	≤ 180
Hysteresis	≤ 5 [% of max regulation]				
Repeatibility	± 1 [% of max regulation]				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) For different Δp, the max flow is in accordance to the diagrams in section 9.2
(2) With step reference input signal 0 ÷100 %
(3) At p = 100/350 bar
(4) 0-100% step signal

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,2 A	2,75 A	1 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 17			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

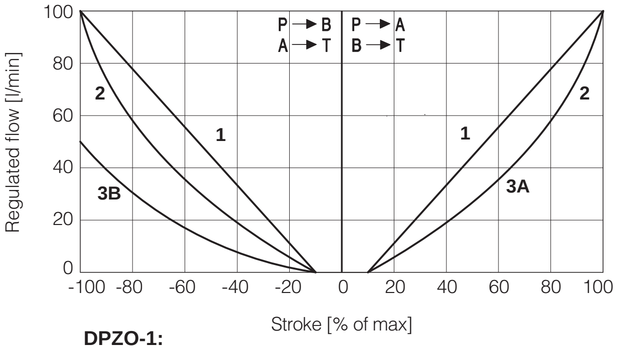
9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

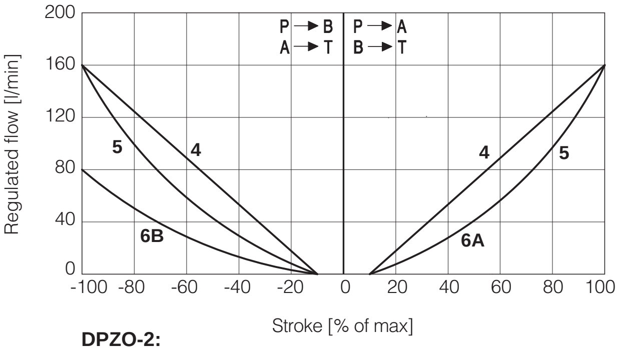
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

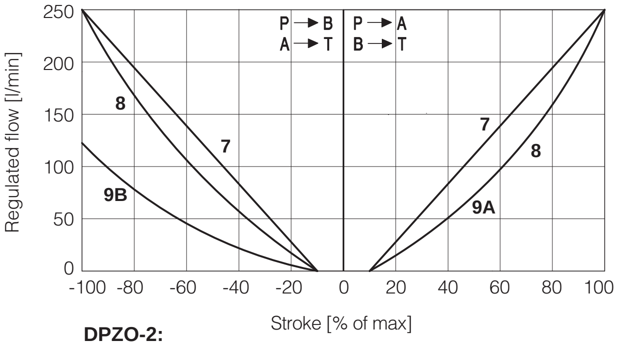
10.1 Regulation diagrams (values measure at Δp 10 bar P-T)



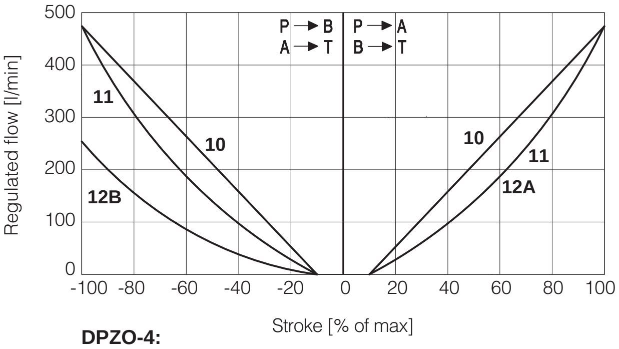
DPZO-1:
1 = L5 **2** = S5 **3A** = D5 (P → A, A → T)
3B = D5 (P → B, B → T)



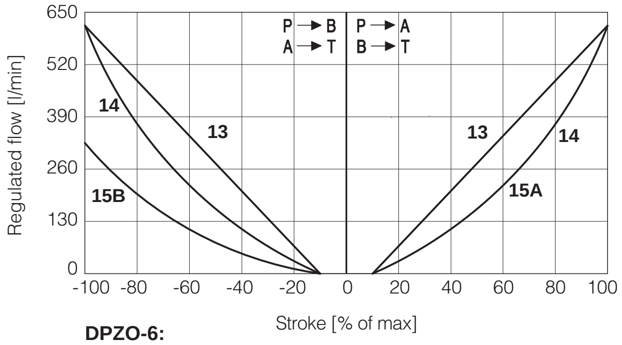
DPZO-2:
4 = L3 **5** = S3 **6A** = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DPZO-2:
7 = L5 **8** = S5 **9A** = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DPZO-4:
10 = L5 **11** = S5 **12A** = D5 (P → A, A → T)
12B = D5 (P → B, B → T)



DPZO-6:
13 = L5 **14** = S5 **15A** = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

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

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

10.2 Flow /∆p diagram

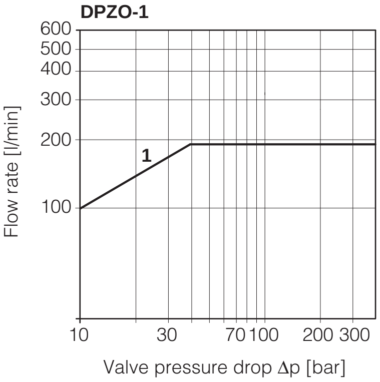
stated at 100% of spool stroke

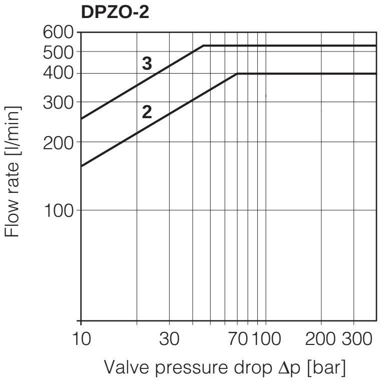
DPZO-1:
1 = spools L5, S5, D5

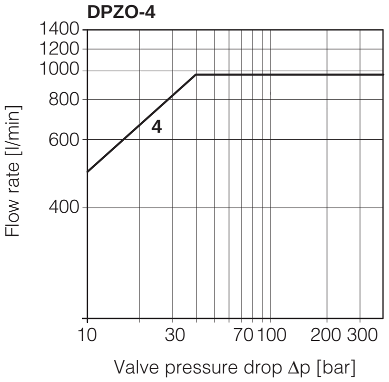
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5

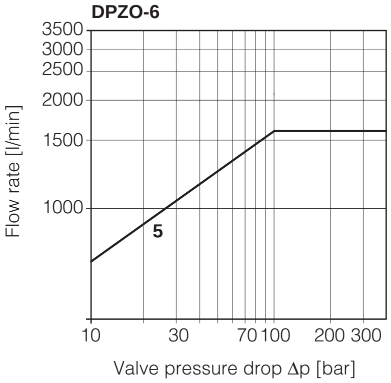
DPZO-4:
4 = spools L5, S5, D5

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



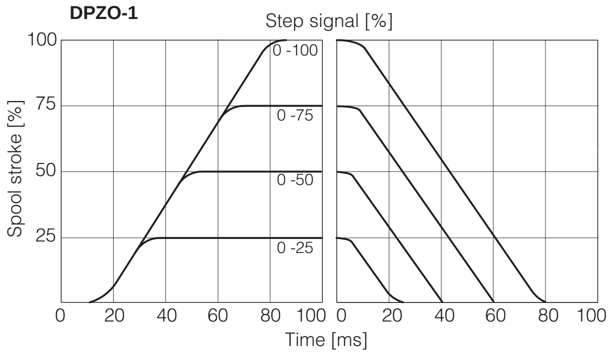


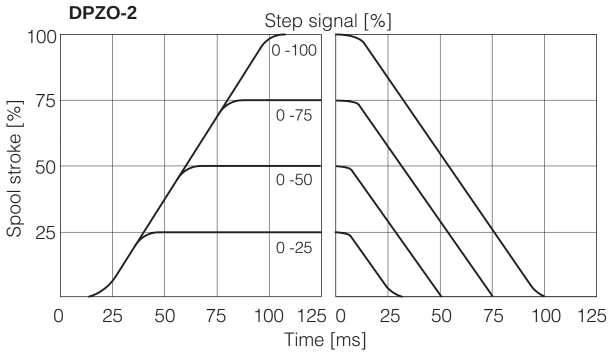


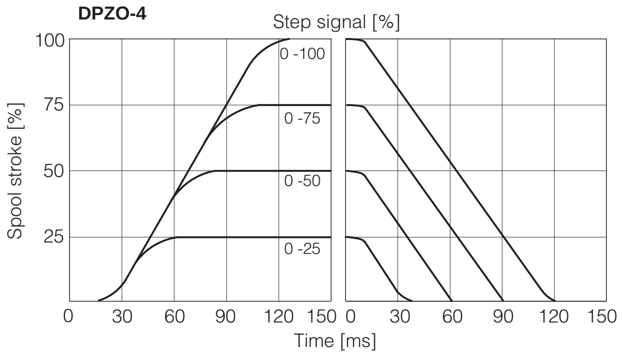


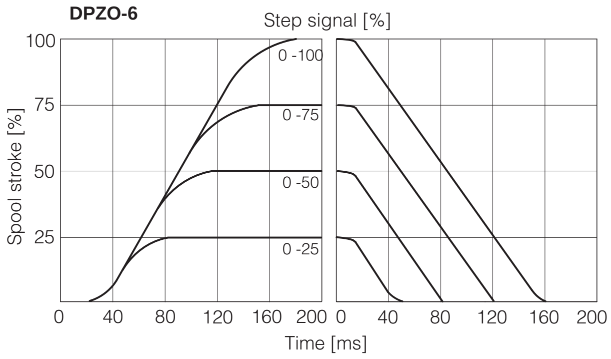
10.3 Response time (measured at pilot pressure = 100 bar)

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



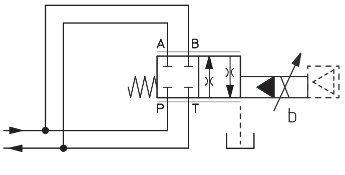






10.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar
For this application, the use of valve -TEB or -TES (see tab. FS172) is advisable (consult our technical office)



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] ∆p = 15 bar	320	860	1600	2200

11 HYDRAULIC OPTIONS

B = DPZO-*-*5 = solenoid and on-board digital driver at side B of the main stage (side A of pilot valve).
DPZO-*-*7 = on-board digital driver at side of port B of the main stage (side A of pilot valve).

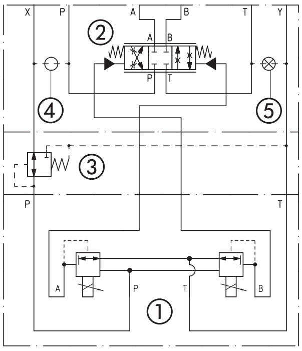
D = Internal drain.
Pilot and drain configuration can be modified as shown in section 18.
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in section 18.
The valve's standard configuration provides internal pilot and external drain.

G = Standard for size 10.
Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZO-1 and DPZO-2 = **40 bar**
DPZO-4 and DPZO-6 = **100 bar**
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

Functional Scheme

Example of configuration 7*
3 positions, spring centered



① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

12 ELECTRONICS OPTIONS - only for AEB and AES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver.
Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 15.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 15.2

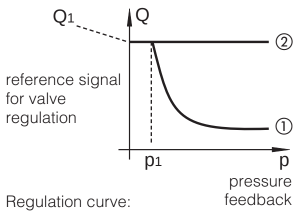
C = Only in combination with option **/W**
This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

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

Hydraulic Power Limitation

only for option **/W**



Regulation curve:
① with power limitation
② without power limitation
p1 x Q1 = max power limit

13 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ, /IW, /CW, /CWI

14 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

15.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT) - only for **/Z** and **/W** options

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

15.7 Remote pressure transducer input signal (TR+) - only for **/W** option

Analog pressure transducers can be directly connected to the driver (see 16.4).
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

16 ELECTRONIC CONNECTIONS

16.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

16.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**		Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is ± 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, referred to VL0. Default is 0 ÷ 5 VDC	Output - analog signal
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

16.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

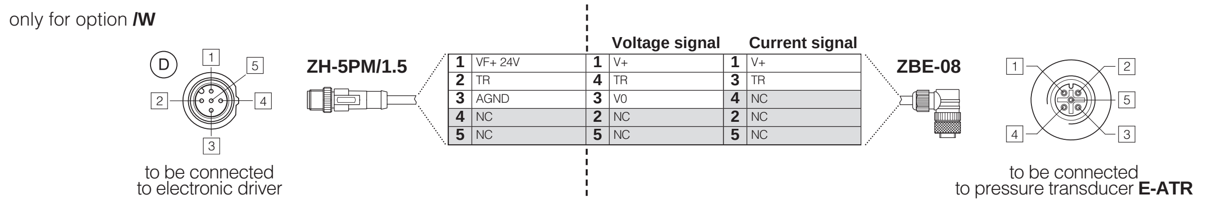
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

16.4 Remote pressure transducer connector - M12 - 5 pin - only for /W option - for AEB and AES (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer maximum range ±10 VDC / ±20 mA, software selectable Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

Remote pressure transducer connection - example



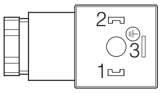
		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC
4	NC	**2**	NC	**2**	NC
5	NC	**5**	NC	**5**	NC

to be connected to electronic driver

to be connected to pressure transducer **E-ATR**

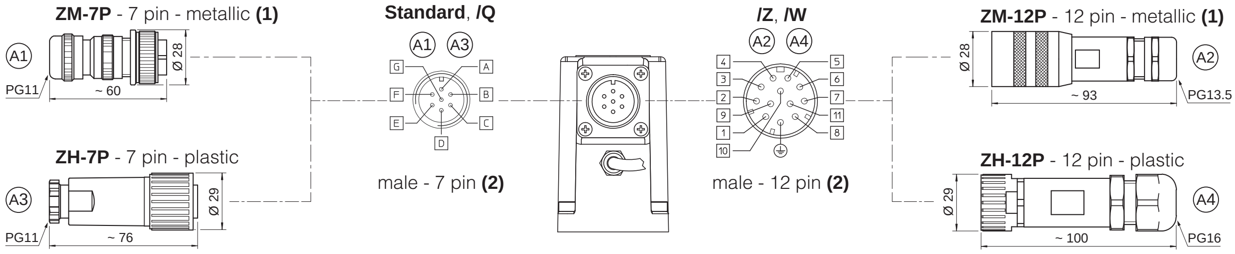
Note: connectors front view

16.5 Solenoid connection - only for A

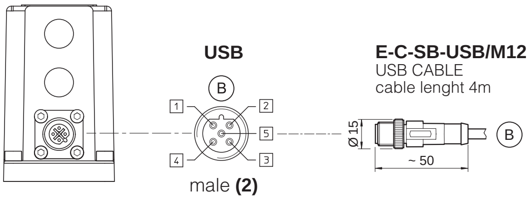
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

16.6 AEB connections layout

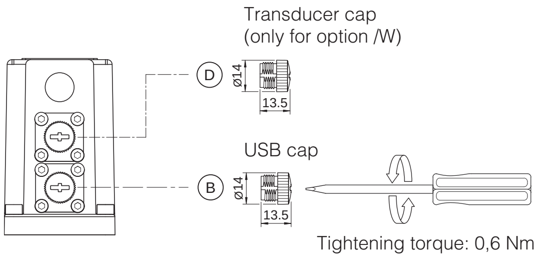
MAIN CONNECTORS



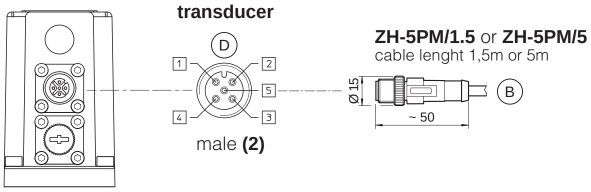
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



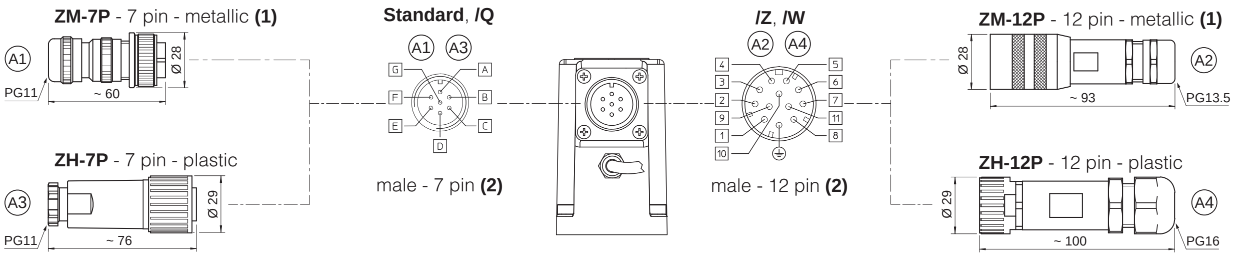
TRANSDUCER CONNECTOR - only for option /W



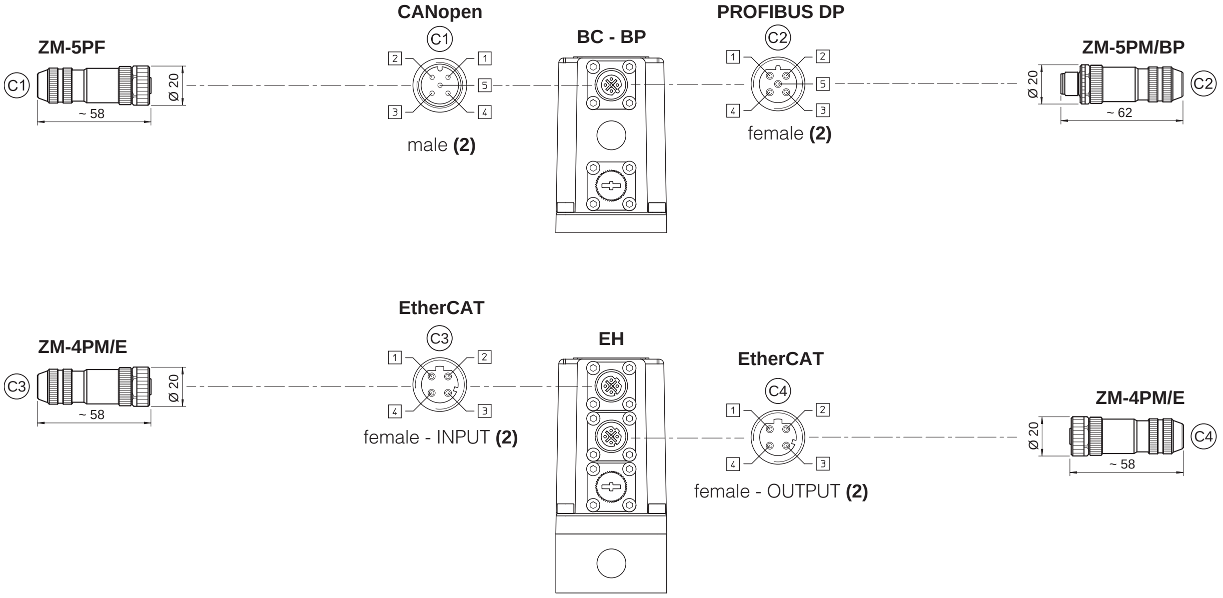
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

16.7 AES connections layout

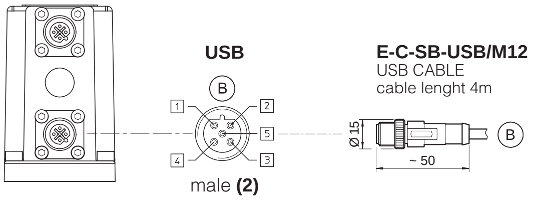
MAIN CONNECTORS



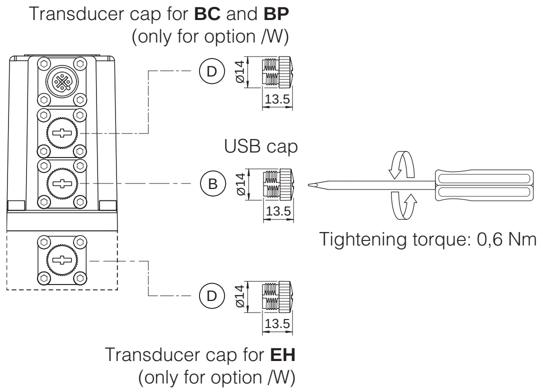
FIELDBUS CONNECTORS



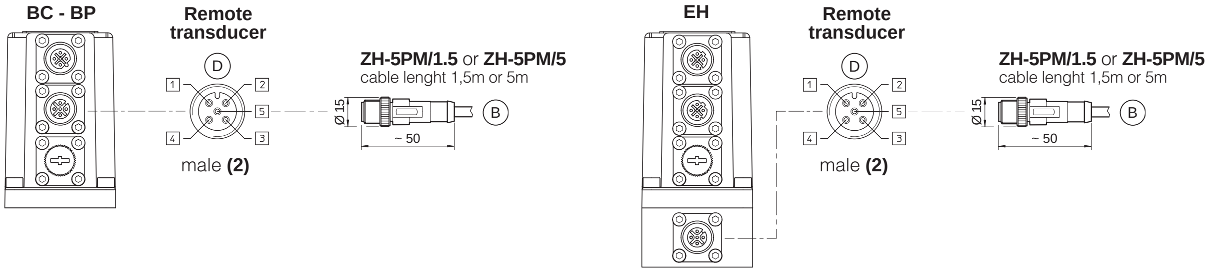
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17 **CONNECTORS CHARACTERISTICS** - to be ordered separately

17.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

17.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

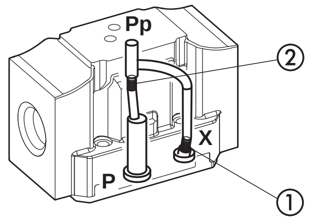
17.4 Pressure transducer connectors - only for **/W** option

CONNECTOR TYPE	**TRANSDUCER**	
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm^2	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

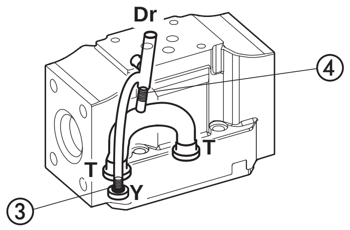
18 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1 Pilot channels

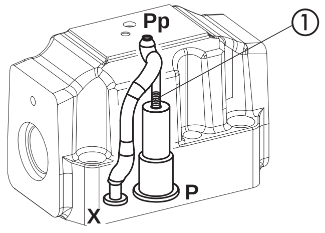


Drain channels

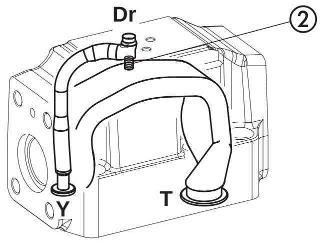


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

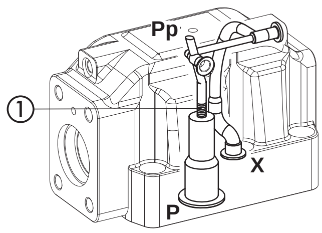


Drain channels

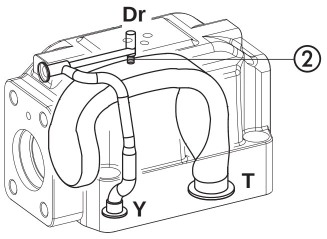


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

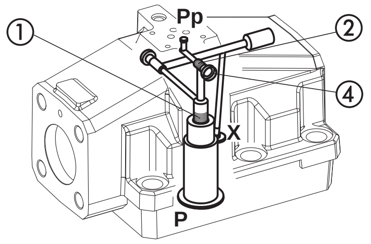


Drain channels

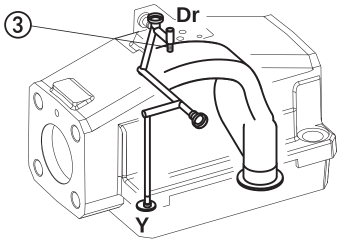


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels



Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Add plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orefice ② remove plug ④ = G1/8"

19 FASTENING BOLTS AND SEALS

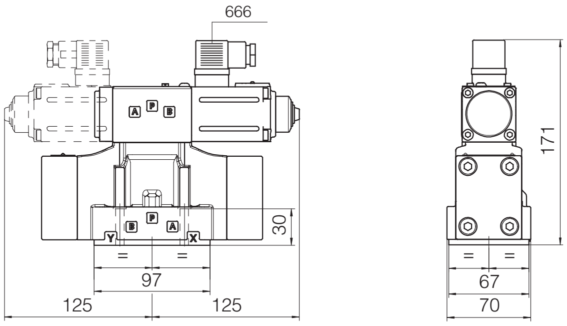
Type	Size	Fastening bolts	Seals
DPZO	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

20 INSTALLATION DIMENSIONS FOR DPZO-1 [mm]

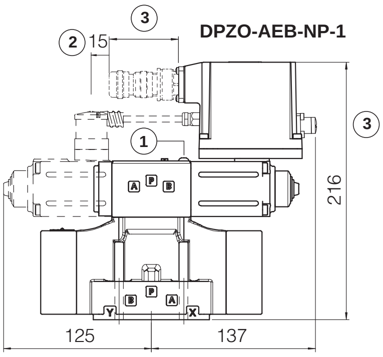
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-15	7,7	8,1	8,2
DPZO-*-17	8,6	9	9,1
Option /G	+0,9		

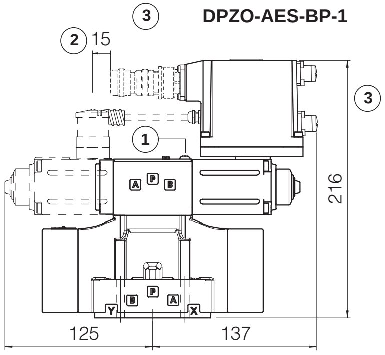
DPZO-A-1



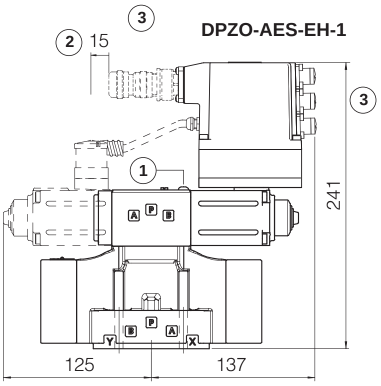
DPZO-AEB-NP-1



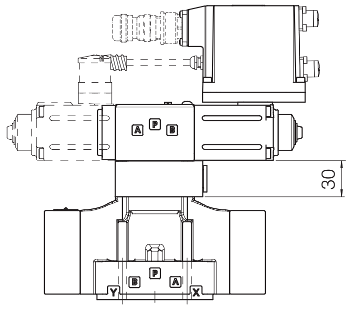
DPZO-AES-BC-1
DPZO-AES-BP-1



DPZO-AES-EH-1



option /G



Dotted line = double solenoid version

① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

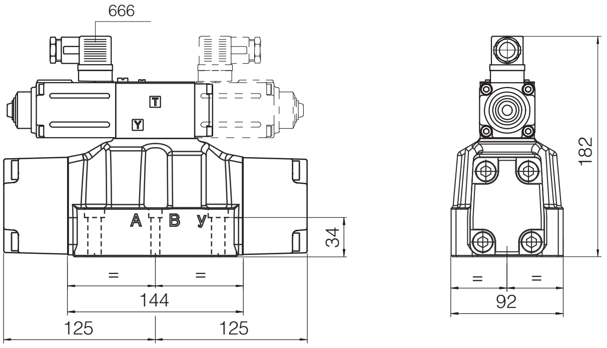
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

21 INSTALLATION DIMENSIONS FOR DPZO-2 [mm]

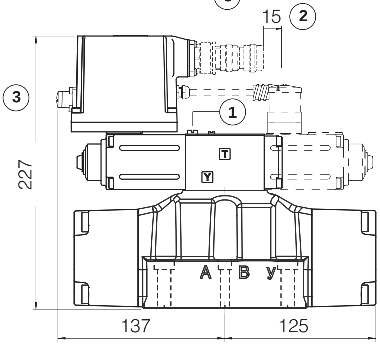
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-25	11,9	12,3	12,4
DPZO-*-27	12,8	13,2	13,3
Option /G	+0,9		

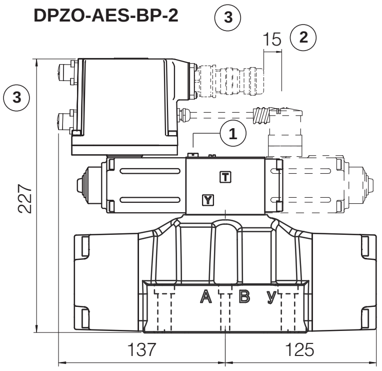
DPZO-A-2



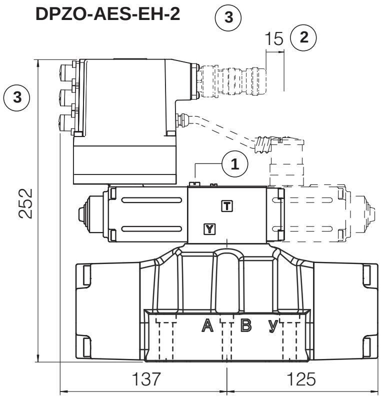
DPZO-AEB-NP-2 ③



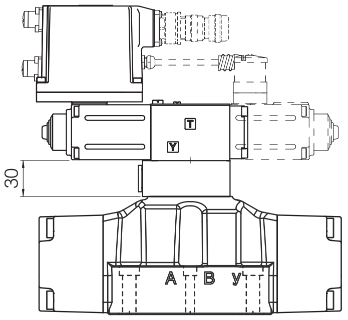
DPZO-AES-BC-2
DPZO-AES-BP-2 ③



DPZO-AES-EH-2 ③



option /G



Dotted line = double solenoid version

① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

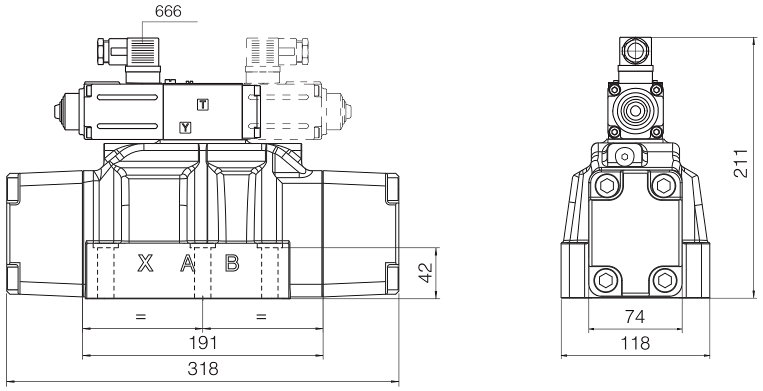
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

22 INSTALLATION DIMENSIONS FOR DPZO-4 [mm]

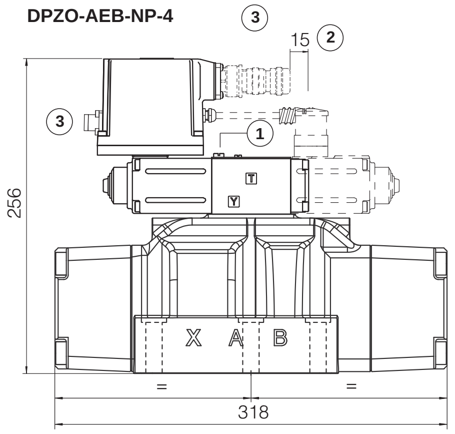
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-45	17,1	18	18,1
DPZO-*-47	18	18,9	19
Option /G	+0,9		

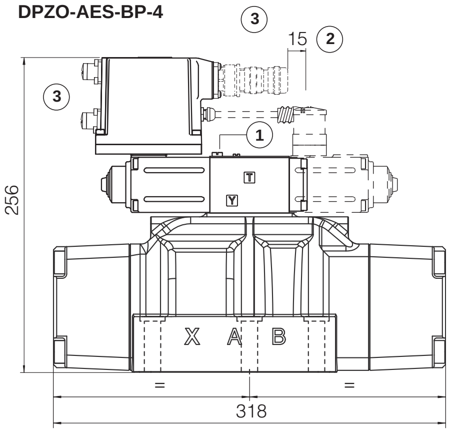
DPZO-A-4



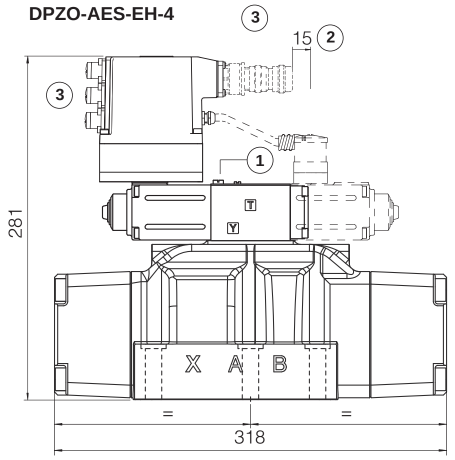
DPZO-AEB-NP-4



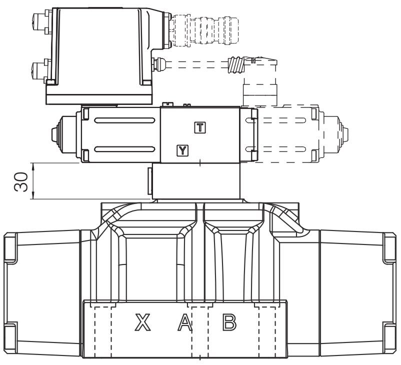
DPZO-AES-BC-4
DPZO-AES-BP-4



DPZO-AES-EH-4



option /G



Dotted line = double solenoid version

① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

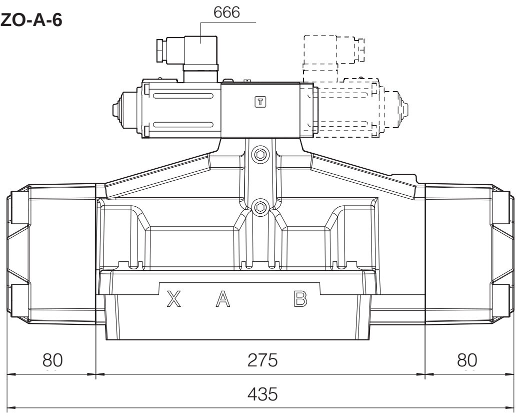
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

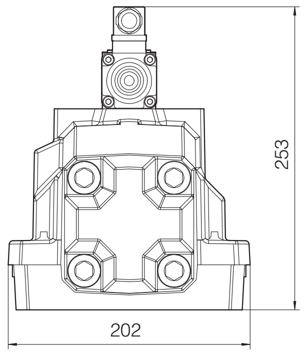
23 INSTALLATION DIMENSIONS FOR DPZO-6 [mm]

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05 (see table P005)

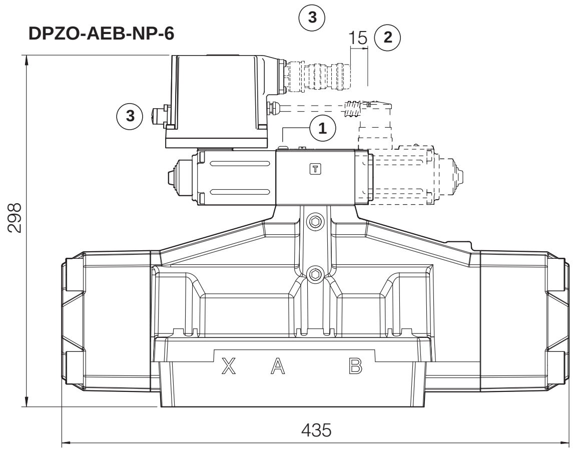
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
DPZO-*-65	42,1	42,5	42,6
DPZO-*-67	42,7	43,1	43,2
Option /G	+2,3		

DPZO-A-6

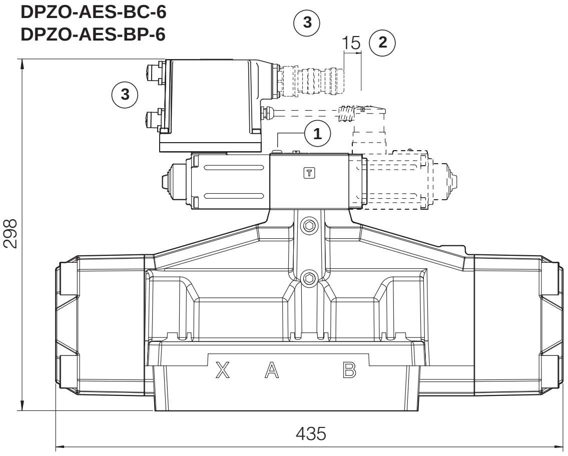




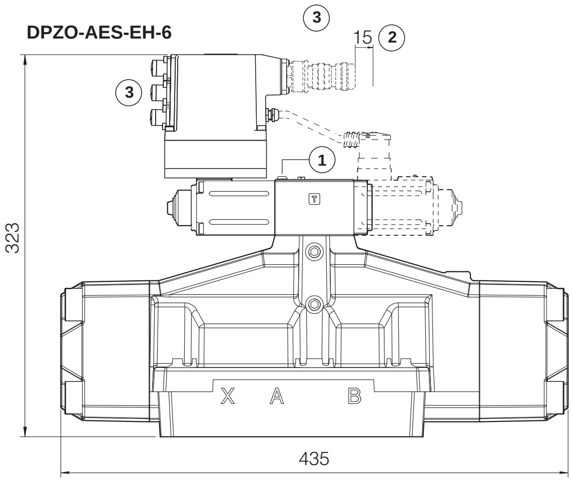
DPZO-AEB-NP-6



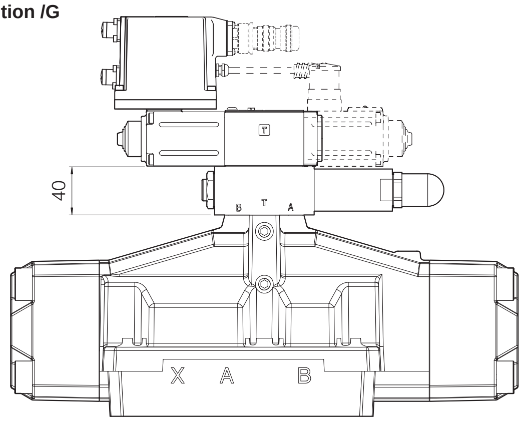
DPZO-AES-BC-6
DPZO-AES-BP-6



DPZO-AES-EH-6



option /G



Dotted line = double solenoid version

① = Air bleeding

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

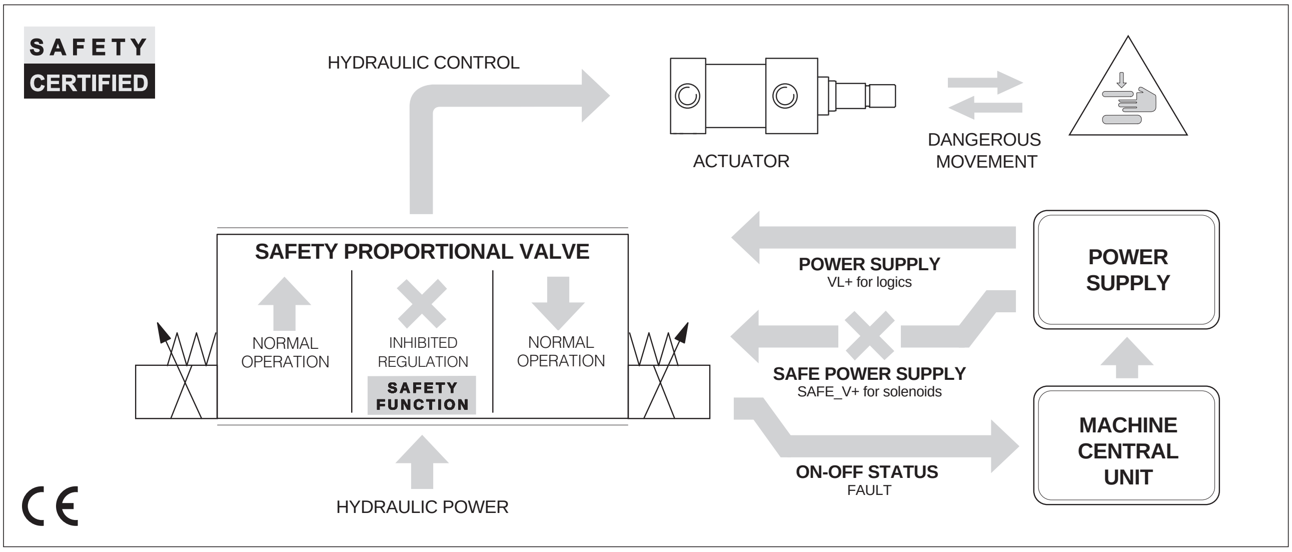
24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
G010	E-MI-AC analog driver	**P005**	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	**QB120**	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	**QF120**	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Safety proportional valves with double power supply

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and **ISO 13849** Performance Level - certified by



1 GENERAL DESCRIPTION

Safety proportional valves with double power supply are identified by option /U and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle.
It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /U by removing the safe power supply to the valve solenoids in case of emergency or for specific requirements along the working cycle.

Upon solenoid power supply interruption, the valve driver remains active thanks to the separated power supply for logics, thus providing fault signal and communication to the machine central unit (PLC) which manages these information as diagnostic signals.

Safety proportional valves with option /U are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max **SIL3**	See techinical table Y010 for details about SIL, PL and safety architetures
ISO 13849	**category 1, PL c** for **non-redundant** safety architecture **category 4, PL e** for **redundant** safety architecture	

3 VALVES RANGE

Option /U is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions).

Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High perfomance proportionals:
DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table **FS165**
DPZO-TES - piloted, positive spool overlap - technical table **FS172**
DPZO-LES - piloted, positive spool overlap - technical table **FS175**

Servoproportionals:
DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables **FS168**
DPZO-LES - piloted, zero spool overlap - technical table **FS178**
DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables **FS180**

Servoproportionals with TEZ/LEZ axis controller:
DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**
DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**
DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables **FS610**

4 FUNCTIONAL DESCRIPTION

Valves with option /U are designed to receive separated power supplies for logic VL+ and solenoids SAFE_V+.
When the solenoid power supply SAFE_V+ is removed, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited.
The valve's diagnostics and communication remain active thanks to the logic power supply VL+ and then the valve can continuously exchange spool position and status with the machine central unit.
The time required by the valve's spool to reach the safe position is detailed in section 5

Safe power supply - SAFE_V+

The SAFE_V+ feeds only the valve solenoids. It can be removed to cut-off the current to the solenoids in order to inhibit the valve's regulation:

- inhibited regulation: SAFE_V+ = **0 VDC**
- permitted regulation: SAFE_V+ = **24 VDC**

For double solenoids valves the power supply SAFE_V+ feeds both solenoids, then when it is removed the valve regulation is completely inhibited.

Power supply - VL+

The VL + feeds the logic and communication functions. It must always be kept ON = 24VDC to allow the real-time diagnostics of the valve status and spool position.

Fault output signal – FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve status.
This signal must be monitored by the machine central unit to intercept failures which may compromise the valve safety function.
The FAULT signal is switched OFF (0 VDC) when the internal diagnostics detects valve failures or incorrect behaviour (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for 4 ÷ 20 mA input, etc).
For piloted valves the FAULT signal = 0 VDC indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The switch-off time is the time between the power supply SAFE_V+ interruption and the achievement of the spool safety rest position.
It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:
- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm^2/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

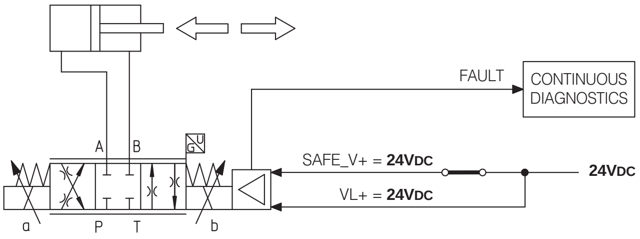
Valve model	**DHZO**	**DKZOR**	**DLHZO**	**DLKZOR**	**DPZO-1**	**DPZO-2**	**DPZO-4** **DPZO-4M**	**DPZO-6**	**DPZO-8**
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

Valve normal operation

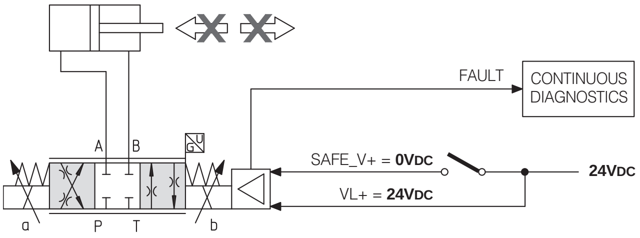
Safe Power Supply [VDC]	Power Supply [VDC]
SAFE_V+	**VL+**
24	24



normal operation

Valve safe operation with regulation completely inhibited

Safe Power Supply [VDC]	Power Supply [VDC]
SAFE_V+	**VL+**
0	24



regulation completely inhibited

▨ INHIBITED SPOOL POSITION SAFE_V+ = **0VDC**

☐ PERMITTED SPOOL POSITION SAFE_V+ = **24VDC**

⇍ ⇏ INHIBITED DIRECTION

⇦ ⇨ PERMITTED DIRECTION

7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_V+ status for all models of safety proportional valves.

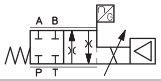
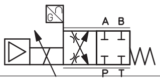
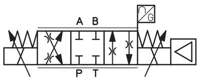
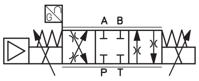
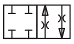
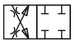
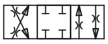
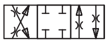
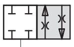
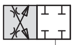
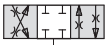
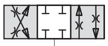
Note: the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /U is applied must be considered.

7.1 High performance proportionals

▨ INHIBITED SPOOL POSITION

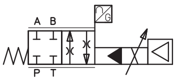
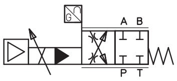
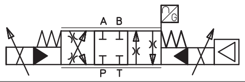
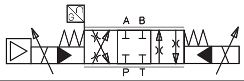
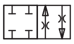
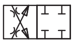
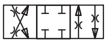
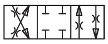
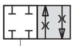
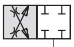
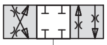
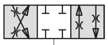
☐ PERMITTED SPOOL POSITION

DHZO-TES, DKZOR-TES - direct operated, positive spool overlap - technical table **FS165**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **51, 53** standard	Configuration **51, 53** option /B	Configuration **71, 72, 73** standard	Configuration **71, 72, 73** option /B
SAFE_V+	VL+				
24	24				
0	24				

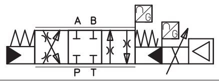
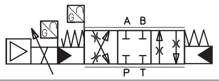
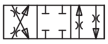
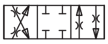
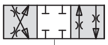
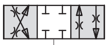
① ① ① ①

DPZO-TES - pilot operated, positive spool overlap - technical table **FS172**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **51, 53** standard	Configuration **51, 53** option /B	Configuration **71, 73** standard	Configuration **71, 73** option /B
SAFE_V+	VL+				
24	24				
0	24				

① ① ① ①

DPZO-LES - pilot operated, positive spool overlap - technical table **FS175**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **71, 73** standard	Configuration **71, 73** option /B
SAFE_V+	VL+		
24	24		
0	24		

① ①

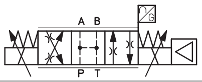
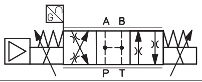
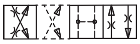
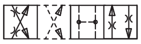
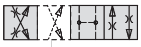
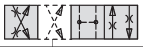
① = Spool safety rest position

7.2 Servoproportionals

▨ INHIBITED SPOOL POSITION

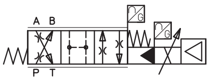
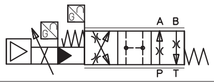
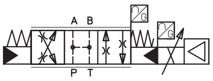
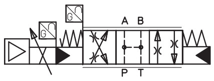
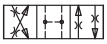
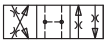
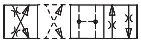
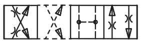
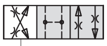
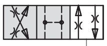
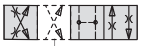
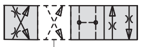
☐ PERMITTED SPOOL POSITION

DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS168**, **FS620**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **70**	
		standard	option /B
SAFE_V+	VL+		
24	24		
0	24		

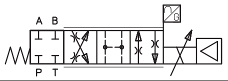
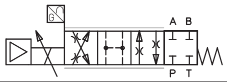
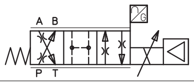
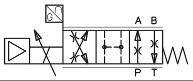
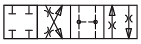
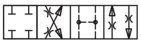
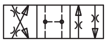
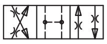
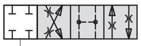
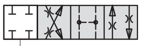
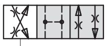
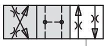
② ②

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table **FS178**, **FS630**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **60**		Configuration **70**	
		standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				

① ① ② ②

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS180, FS610**

Safe Power Supply [VDC]	Power Supply [VDC]	Configuration **40** with fail safe 1 or 3		Configuration **60** without fail safe	
		standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				

① ① ① ①

① = Spool safety rest position

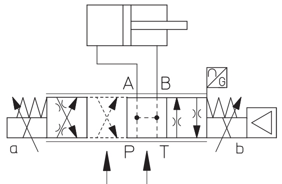
② = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_V+ = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



Spool position with solenoid power supply ON and reference signal = 0 (zero overlap position)

Spool offset position 1% to 6% of total stroke with solenoid power supply OFF (central safety rest position)

8 ELECTRONIC CONNECTIONS

8.1 Main connector signals - 12 pin - options /U

PIN	TES LES	TEZ LEZ	TECHNICAL SPECIFICATIONS	NOTES
1	**SAFE_V+**		Safe power supply 24 VDC for solenoid	Input - power supply
2	**SAFE_V0**		Safe power supply 0 VDC for solenoid	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**Q_INPUT+**		Flow (spool position) reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
		P_INPUT+	Position reference input signal: ±10 VDC / ±20 mA maximum range	
5	**INPUT-**		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal
6	**Q_MONITOR**		Flow (spool position) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0. Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
		P_MONITOR	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0	
7	**F_INPUT+ (1)**		Pressure/force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**F_MONITOR (1)**		Pressure/force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to VL0 Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

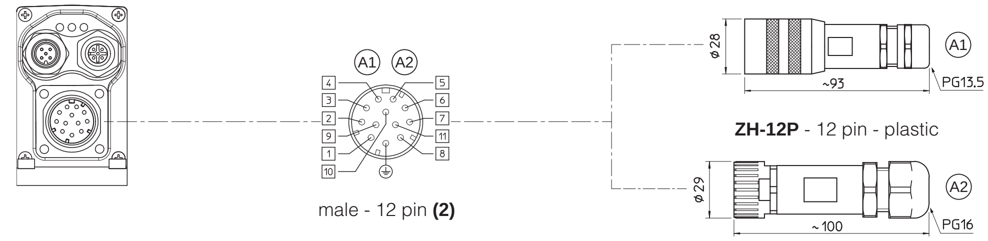
(1) Connection NOT available for **TES/LES** in **SN** execution

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_V+ **VL+**	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
FAULT	ON state depends on input power supply VL+: ON state > VL+ - 2V @ max 50 mA e.g. in case of VL+ = 24V, the ON state > 22V OFF state < 1 V; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

9.1 Connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements
(2) Pin layout always referred to driver's view
For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3

10 RELATED DOCUMENTATION

General tables:

Y010	Basics for safety components
FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Valves technical tables:

FS165	DHZO-TES, DKZOR-TES, direct operated
FS172	DPZO-TES, pilot operated
FS175	DPZO-LES, pilot operated
FS168	DHZO-TES, DKZOR-TES, direct operated, zero spool overlap
FS180	DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution
FS178	DPZO-LES, pilot operated, zero spool overlap
FS610	DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card
FS620	DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card
FS630	DPZO-LEZ digital proportional valves with on-board axis card

Commissioning and troubleshooting tables:

QF300	Quickstart for TES direct operated proportional valves (supplied with the valve)
QF320	Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)

Operating and fieldbus manuals for TES and LES:

E-MAN-RI-LES - TES and LES drivers user manual
E-MAN-RI-LES-S - TES and LES drivers with P/Q control user manual
E-MAN-S-BC - CANopen protocol programming manual
E-MAN-S-BP - PROFIBUS DP protocol programming manual
E-MAN-S-EH - EtherCAT protocol programming manual
E-MAN-S-EW - POWERLINK protocol programming manual
E-MAN-S-EI - EtherNet/IP protocol programming manual
E-MAN-S-EP - PROFINET IRT protocol programming manual

Operating and fieldbus manuals for TEZ and LEZ:

Z-MAN-RI-LEZ - TEZ and LEZ controllers user manual
Z-MAN-RI-LEZ-S - TEZ and LEZ controllers with P/Q control user manual
Z-MAN-S-BC - CANopen protocol programming manual
Z-MAN-S-BP - PROFIBUS DP protocol programming manual
Z-MAN-S-EH - EtherCAT protocol programming manual
Z-MAN-S-EW - POWERLINK protocol programming manual
Z-MAN-S-EI - EtherNet/IP protocol programming manual
Z-MAN-S-EP - PROFINET IRT protocol programming manual

SIL safety manuals for operating, installation and maintenance (on request):

TT366	DHZO-TES/TEZ, DKZOR-TES/TEZ
TT367	DLHZO-TES/TEZ, DLKZOR-TES/TEZ
TT368	DPZO-TES/LES/LEZ

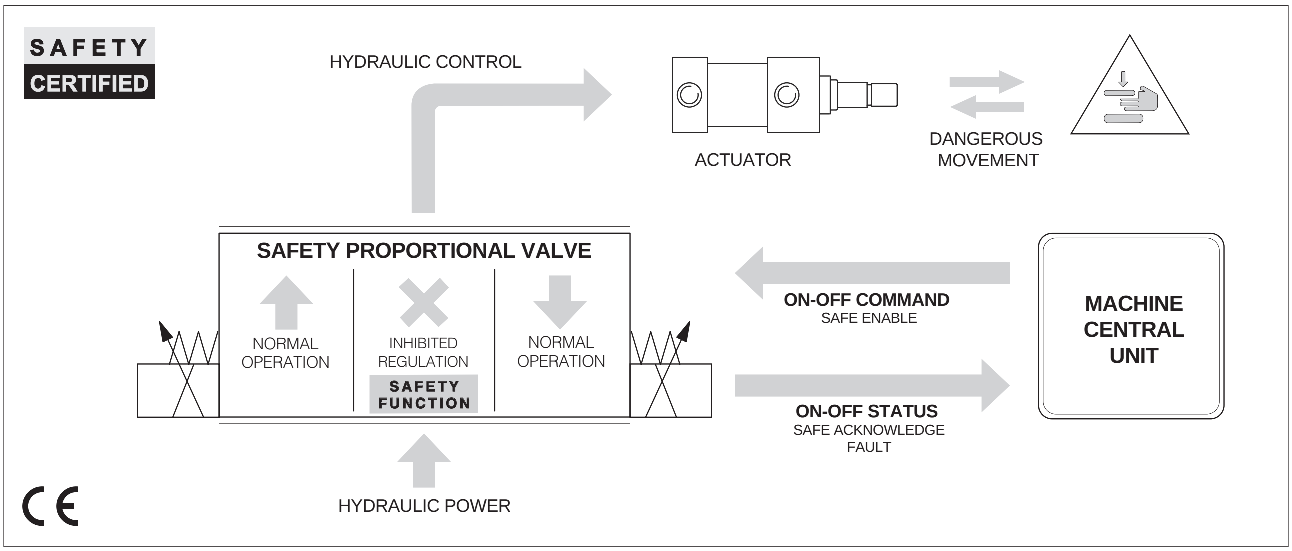
TÜV certificates (on request):

C-IS-722117697-01	Safety proportional valves, direct operated
C-IS-722117689-01	Safety proportional valves, piloted operated

Safety proportional valves with on-off signals

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and **ISO 13849** Performance Level - certified by



1 GENERAL DESCRIPTION

Safety proportional valves with on-off signals are identified by option /K and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle.
It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /K via on-off enable signals in case of emergency or for specific requirements along the working cycle.

Upon valve’s disable command input, the valve driver generates on-off output signals as soon the spool has reached the safety position, confirming that hydraulic regulation has been inhibited. The machine central unit (PLC) manages this information as “safe condition”.

Safety proportional valves with option /K are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max **SIL 2** for **non-redundant** safety architecture max **SIL 3** for **redundant** safety architecture	See techinical table Y010 for details about SIL, PL and safety architetures
ISO 13849	**category 1, PL c** for **non-redundant** safety architecture **category 4, PL e** for **redundant** safety architecture	

3 VALVES RANGE

Option /K is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions).

Valve’s performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High perfomance proportionals:

DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table **FS165**
DPZO-TES - piloted, positive spool overlap - technical table **FS172**
DPZO-LES - piloted, positive spool overlap - technical table **FS175**

Servoproportionals:

DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables **FS168**
DPZO-LES - piloted, zero spool overlap - technical table **FS178**
DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables **FS180**

Servoproportionals with TEZ/LEZ axis controller:

DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**
DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**
DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables **FS610**

4 FUNCTIONAL DESCRIPTION

Valves with option /K are designed to receive on-off enable signals from the machine central unit in order to inhibit the valve's regulation.
When this enable signal is switched OFF, the current to the valve's solenoid is safely cut-off, while the valve's diagnostics and communication remain active to continuously exchange its status with the machine central unit.
In consequence of the solenoid current cut-off, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited.
When the spool has reached the safe position, the valve's driver generates an on-off output signal confirming to the machine central unit that the valve is in SAFE condition.
The time required by the valve's spool to reach the safe position is detailed in section 5

Safe enable input signal - SAFE_ENABLE

The SAFE_ENABLE is the command signal to cut-off the current to the solenoids in order to inhibit the valve's regulation:

- inhibited regulation: SAFE_ENABLE = **0 VDC**
- permitted regulation: SAFE_ENABLE = **24 VDC**

Double solenoids valves are equipped with two independent enable circuits SAFE_ENABLE 1 and SAFE_ENABLE 2 permitting to:

a) cut-off the current to both solenoids when the valve regulation must be inhibited in both directions
b) cut-off the current to one solenoid when only one side of the valve regulation must be inhibited. This condition permits to intercept the actuator movement in one direction, permitting the actuator movement in the opposite direction (typical in motion/non-motion controls)

Safe enable acknowledge output signal - SAFE_ENABLE_ACK

The SAFE_ENABLE_ACK is the output signal generated by the driver to confirm that the valve has effectively reached the safe position in consequence of SAFE_ENABLE command switch-off.
SAFE_ENABLE_ACK is switched ON (24 VDC) when the internal diagnostics verifies that solenoid current has been cut-off and the spool, monitored by the LVDT transducer, has reached the safe position.

Fault output signal – FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve's status
This signal must be monitored by the machine central unit in addition to the SAFE_ENABLE_ACK signal, to intercept failures which may compromise the valve safety function.
The FAULT signal is switched OFF (0 VDC) when the internal diagnostics detects valve failures or incorrect behavior (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for 4 ÷ 20 mA input, etc)
For piloted valves the FAULT signal = 0 VDC indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The valve switch-off time is the time between the SAFE_ENABLE signal = 0 VDC and the SAFE_ENABLE ACK signal = 24 VDC.
It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:
- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm^2/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

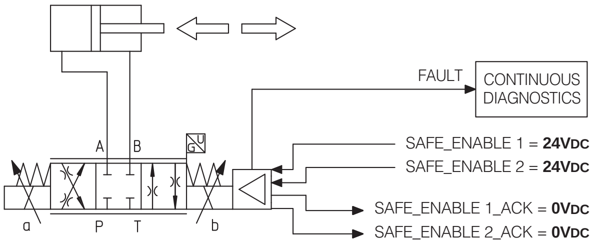
Valve model	**DHZO**	**DKZOR**	**DLHZO**	**DLKZOR**	**DPZO-1**	**DPZO-2**	**DPZO-4 DPZO-4M**	**DPZO-6**	**DPZO-8**
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

Valve normal operation

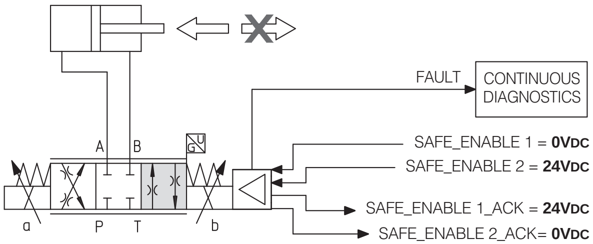
Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
24	24	0	0


FAULT
CONTINUOUS DIAGNOSTICS
SAFE_ENABLE 1 = **24VDC**
SAFE_ENABLE 2 = **24VDC**
SAFE_ENABLE 1_ACK = **0VDC**
SAFE_ENABLE 2_ACK = **0VDC**
A
B
a
P
T
b

normal operation

Valve safe operation with P-A/B-T regulation inhibited to prevent the actuator forward movement

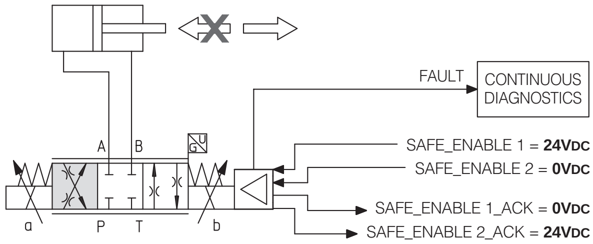
Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
0	24	24	0


FAULT
CONTINUOUS DIAGNOSTICS
SAFE_ENABLE 1 = **0VDC**
SAFE_ENABLE 2 = **24VDC**
SAFE_ENABLE 1_ACK = **24VDC**
SAFE_ENABLE 2_ACK= **0VDC**
A
B
a
P
T
b

P-A / B-T inhibited

Valve safe operation with P-B/A-T regulation inhibited to prevent the actuator backward movement

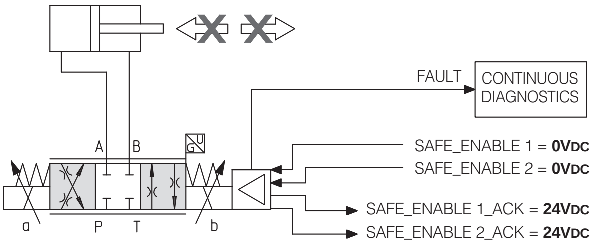
Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
24	0	0	24


FAULT
CONTINUOUS DIAGNOSTICS
SAFE_ENABLE 1 = **24VDC**
SAFE_ENABLE 2 = **0VDC**
SAFE_ENABLE 1_ACK = **0VDC**
SAFE_ENABLE 2_ACK = **24VDC**
A
B
a
P
T
b

P-B / A-T inhibited

Valve safe operation with regulation completely inhibited

Input signals [VDC]		Output signals [VDC]	
SAFE_ENABLE 1	**SAFE_ENABLE 2**	**SAFE_ENABLE 1_ACK**	**SAFE_ENABLE 2_ACK**
0	0	24	24



regulation completely inhibited

▨ INHIBITED SPOOL POSITION
SAFE_ENABLE = **0VDC**

☐ PERMITTED SPOOL POSITION
SAFE_ENABLE = **24VDC**

⇦✗ ✗⇨ INHIBITED DIRECTION

⇦ ⇨ PERMITTED DIRECTION

7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_ENABLE status for all models of safety proportional valves.

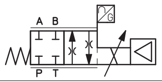
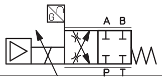
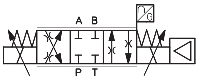
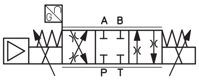
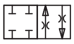
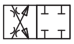
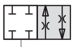
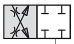
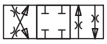
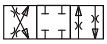
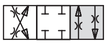
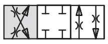
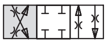
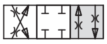
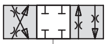
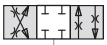
Note: the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /K is applied must be considered.

7.1 High performance proportionals

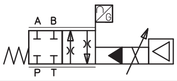
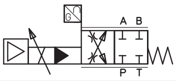
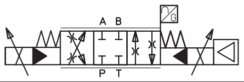
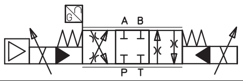
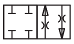
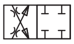
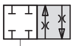
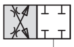
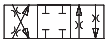
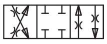
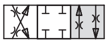
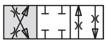
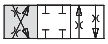
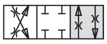
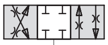
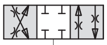
▨ INHIBITED SPOOL POSITION

☐ PERMITTED SPOOL POSITION

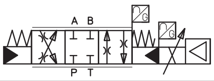
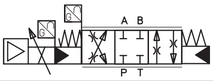
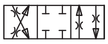
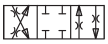
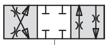
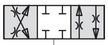
DHZO-TES, DKZOR-TES - direct operated, positive spool overlap - technical table **FS165**

Input signals [VDC]		Output signals [VDC]		Configuration **51, 53**		Configuration **71, 72, 73**	
				standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK				
24		0					
0		24					
24	24	0	0	①	①		
0	24	24	0				
24	0	0	24				
0	0	24	24			 ①	 ①

DPZO-TES - pilot operated, positive spool overlap - technical table **FS172**

Input signals [VDC]		Output signals [VDC]		Configuration **51, 53**		Configuration **71, 73**	
				standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK				
24		0					
0		24					
24	24	0	0	①	①		
0	24	24	0				
24	0	0	24				
0	0	24	24			 ①	 ①

DPZO-LES - pilot operated, positive spool overlap - technical table **FS175**

Input signals [VDC]	Output signals [VDC]	Configuration **71, 73**	
		standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK		
24	0		
0	24	 ①	 ①

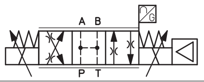
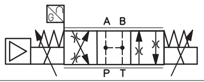
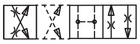
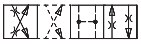
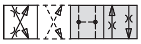
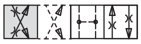
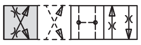
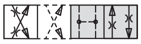
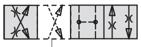
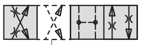
① = Spool safety rest position

7.2 Servoproportionals

▨ INHIBITED SPOOL POSITION

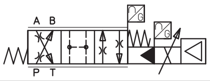
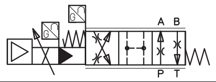
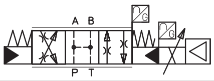
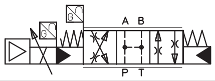
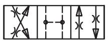
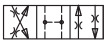
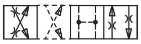
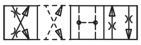
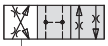
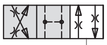
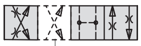
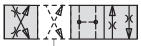
☐ PERMITTED SPOOL POSITION

DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS168**, **FS620**

Input signals [VDC]		Output signals [VDC]		Configuration **70**	
				standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK		
24	24	0	0		
0	24	24	0		
24	0	0	24		
0	0	24	24		

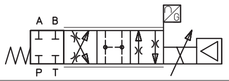
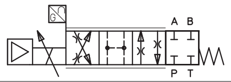
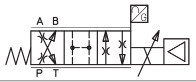
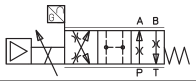
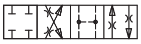
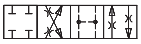
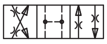
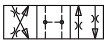
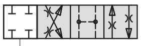
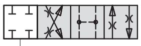
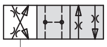
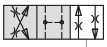
② ②

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table **FS178**, **FS630**

Input signals [VDC]	Output signals [VDC]	Configuration **60**		Configuration **70**	
		standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK				
24	0				
0	24				

① ① ② ②

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS180, FS610**

Input signals [VDC]	Output signals [VDC]	Configuration **40** with fail safe 1 or 3		Configuration **60** without fail safe	
		standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK				
24	0				
0	24				

① ① ① ①

① = Spool safety rest position

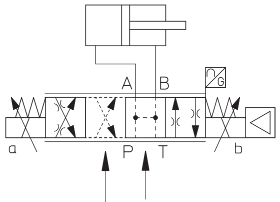
② = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_ENABLE1 = 0 and SAFE_ENABLE2 = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



Spool position with solenoid power supply ON and reference signal = 0 (zero overlap position)

Spool offset position 1% to 6% of total stroke with solenoid power supply OFF (central safety rest position)

8 ELECTRONIC CONNECTIONS

8.1 Main connector signals - 12 pin - options /K

PIN	TES LES	TEZ LEZ	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**SAFE_ENABLE1**		Enable (24 VDC) or disable (0 VDC) the solenoid at side of the driver and position transducer, referred to V0	Input - on/off signal
4	**Q_INPUT+**		Flow (spool position) reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
		P_INPUT+	Position reference input signal: ±10 VDC / ±20 mA maximum range	
5	**INPUT-**		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal
6	**Q_MONITOR**		Flow (spool position) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to V0. Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
		P_MONITOR	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to V0	
7	**F_INPUT+ (1)**		Pressure/force reference input signal: ±10 VDC / ±20 mA maximum range Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
8	**SAFE_ENABLE1_ACK**		Safe condition acknowledged (24 VDC) or unacknowledged (0 VDC) for solenoid at side of the driver and position transducer, referred to V0	Output - on/off signal
9	**SAFE_ENABLE2_ACK (2)**		Safe condition acknowledged (24 VDC) or unacknowledged (0 VDC) for solenoid at the opposite side of the driver and position transducer, referred to V0	Output - on/off signal
10	**SAFE_ENABLE2 (2)**		Enable (24 VDC) or disable (0 VDC) the solenoid at the opposite side of the driver and position transducer, referred to V0	Input - on/off signal
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to V0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

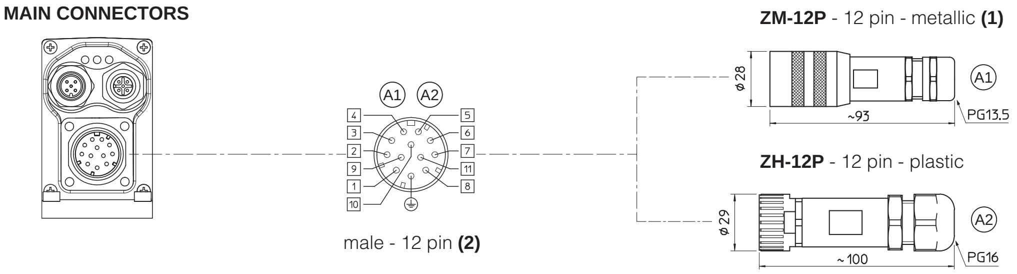
(1) Connection NOT available for **TES/LES** in **SN** execution
(2) Connections available only for double solenoid valves

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_ENABLE1 **SAFE_ENABLE2**	Input range: -3 ÷ 5 VDC (OFF state), 15 ÷ 30 VDC (ON state), 5 ÷ 15 VDC (not accepted) Input impedance: Ri > 10 kW	Input - on/off signal
SAFE_ENABLE1_ACK **SAFE_ENABLE2_ACK** **FAULT**	ON state depends on input power supply V+: ON state > V+ - 2V @ max 50 mA e.g. in case of V+ = 24V, the ON state > 22V OFF state < 1 V; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

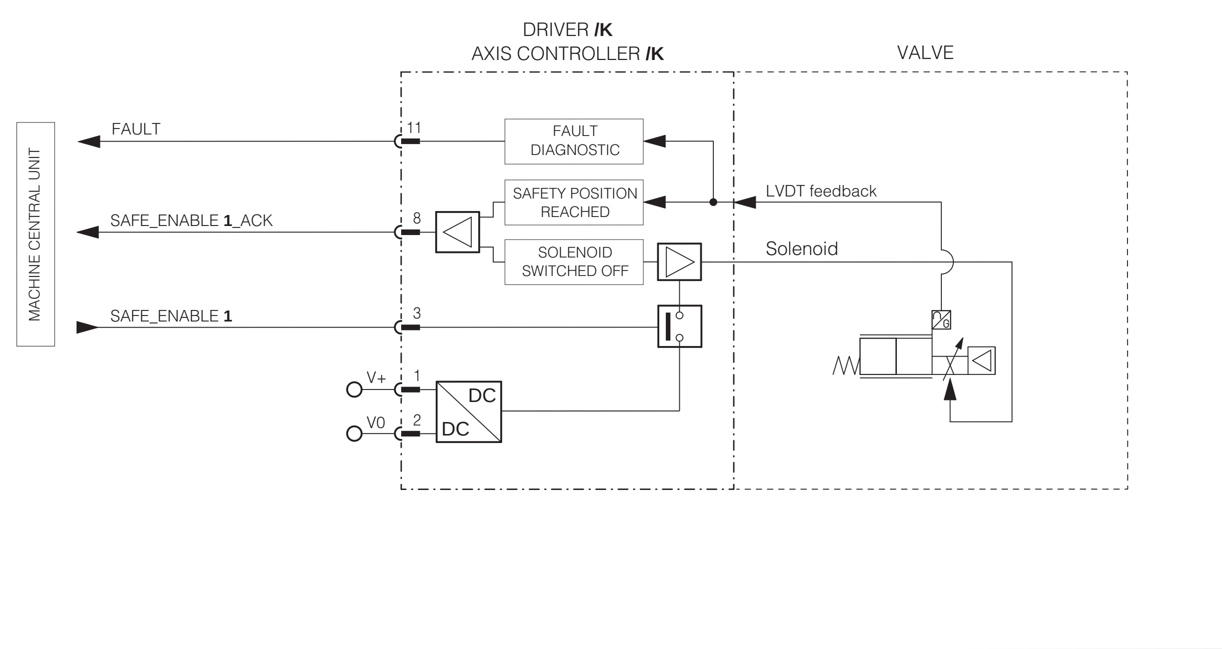
9.1 Connections layout



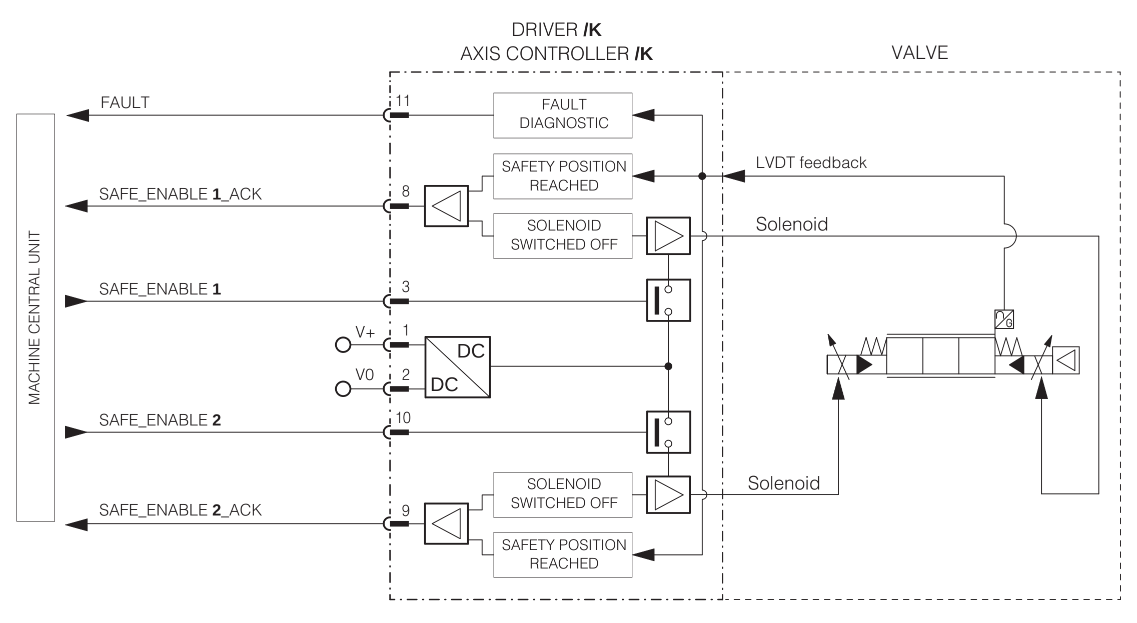
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements
(2) Pin layout always referred to driver's view
For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3

10 BLOCK DIAGRAMS

10.1 Single solenoid valves



10.2 Double solenoid valves



11 RELATED DOCUMENTATION

General tables:

Y010	Basics for safety components
FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Valves technical tables:

FS165	DHZO-TES, DKZOR-TES, direct operated
FS172	DPZO-TES, pilot operated
FS175	DPZO-LES, pilot operated
FS168	DHZO-TES, DKZOR-TES, direct operated, zero spool overlap
FS180	DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution
FS178	DPZO-LES, pilot operated, zero spool overlap
FS610	DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card
FS620	DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card
FS630	DPZO-LEZ digital proportional valves with on-board axis card

Commissioning and troubleshooting tables:

QF300	Quickstart for TES direct operated proportional valves (supplied with the valve)
QF320	Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)

Operating and fieldbus manuals for TES and LES:

E-MAN-RI-LES - TES and LES drivers user manual
E-MAN-RI-LES-S - TES and LES drivers with P/Q control user manual
E-MAN-S-BC - CANopen protocol programming manual
E-MAN-S-BP - PROFIBUS DP protocol programming manual
E-MAN-S-EH - EtherCAT protocol programming manual
E-MAN-S-EW - POWERLINK protocol programming manual
E-MAN-S-EI - EtherNet/IP protocol programming manual
E-MAN-S-EP - PROFINET IRT protocol programming manual

Operating and fieldbus manuals for TEZ and LEZ:

Z-MAN-RI-LEZ - TEZ and LEZ controllers user manual
Z-MAN-RI-LEZ-S - TEZ and LEZ controllers with P/Q control user manual
Z-MAN-S-BC - CANopen protocol programming manual
Z-MAN-S-BP - PROFIBUS DP protocol programming manual
Z-MAN-S-EH - EtherCAT protocol programming manual
Z-MAN-S-EW - POWERLINK protocol programming manual
Z-MAN-S-EI - EtherNet/IP protocol programming manual
Z-MAN-S-EP - PROFINET IRT protocol programming manual

SIL safety manuals for operating, installation and maintenance (on request):

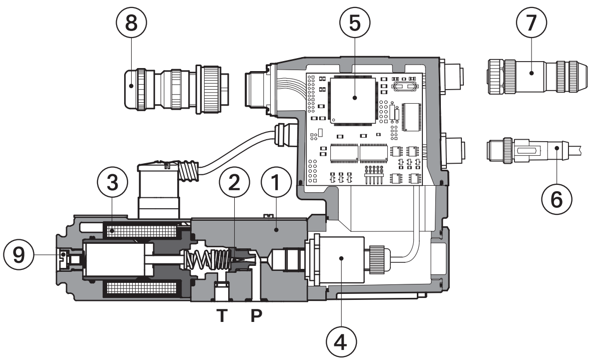
TT366	DHZO-TES/TEZ, DKZOR-TES/TEZ
TT367	DLHZO-TES/TEZ, DLKZOR-TES/TEZ
TT368	DPZO-TES/LES/LEZ

TÜV certificates (on request):

C-IS-722117697-01	Safety proportional valves, direct operated
C-IS-722117689-01	Safety proportional valves, piloted operated

Digital proportional relief valves high performance

direct, with on-board pressure transducer



① Valve body
② Poppet
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZMO-RES-P-BC-010

RZMO-R , RZMO-REB, RZMO-RES

Poppet type direct operated digital proportional relief valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **4 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO - **REB** - **P** - **NP** - **010** / **210** / * / * * / *

Proportional pressure relief valve, direct

R = for off-board driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
010 = regulation on port P, discharge in T (direct operated version)

Max regulated pressure:
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Electronic options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Dynamic response preset, see section 15 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

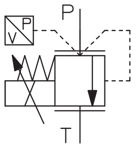
Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

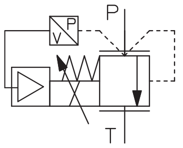
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZMO-R



RZMO-REB RZMO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

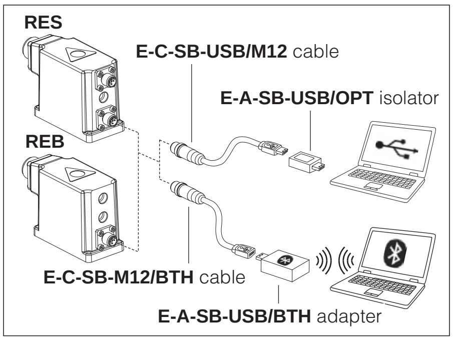
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-010**
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Max flow	[l/min]	4
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 55
Hysteresis		≤ 0,3 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,2 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

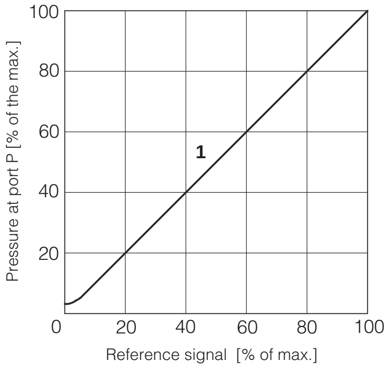
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

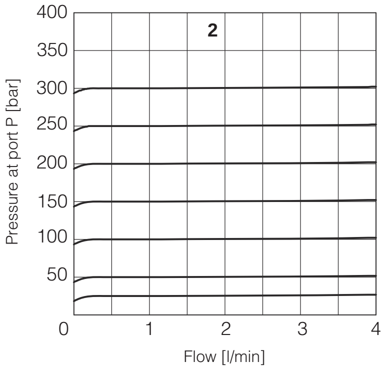
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

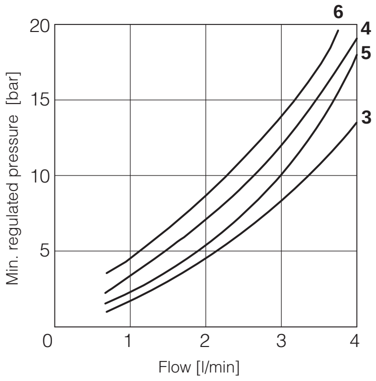
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-6 Min. pressure/flow diagrams
with zero reference signal



3 = RZMO/100 **4 =** RZMO/210
5 = RZMO/315 **6 =** RZMO/350

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

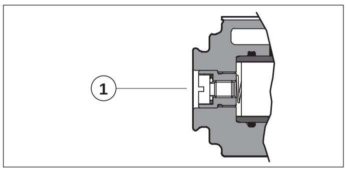
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

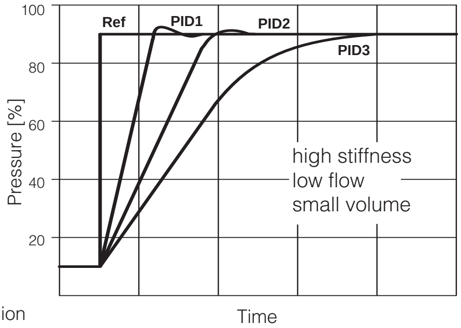


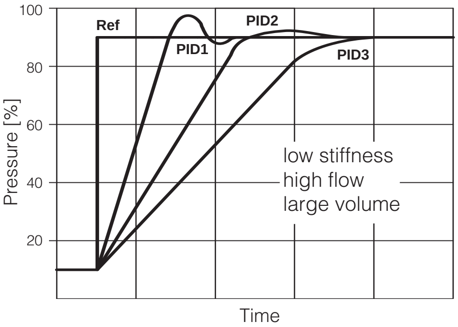
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z option

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

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B)	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1)	**BC fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

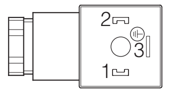
(C2)	**BP fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4)	**EH fieldbus execution, connector - M12 - 4 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

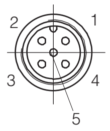
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for R

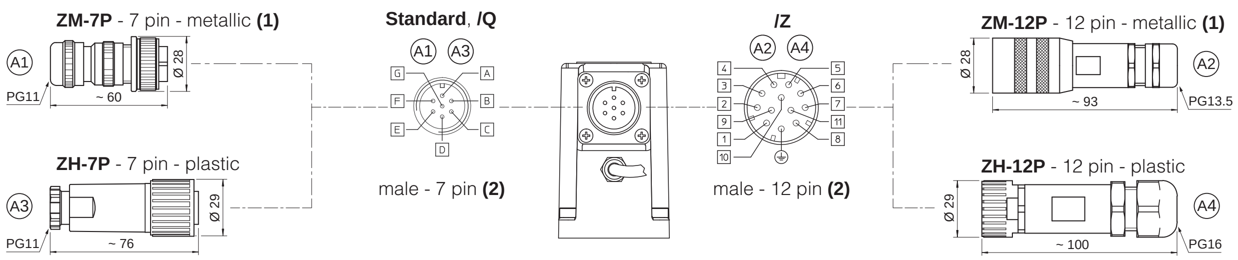
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for R

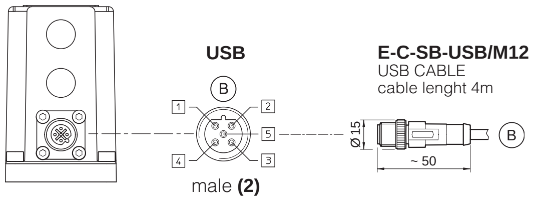
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

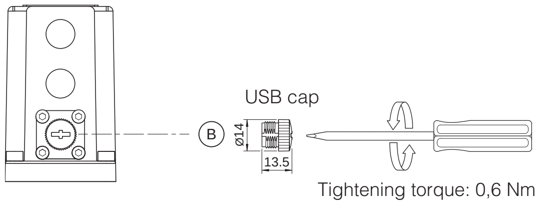
MAIN CONNECTORS



USB CONNECTOR



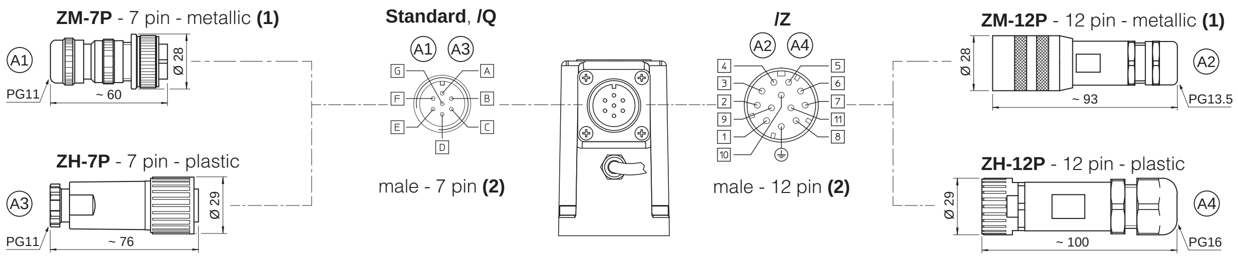
PLASTIC PROTECTION CAPS - supplied with the valves



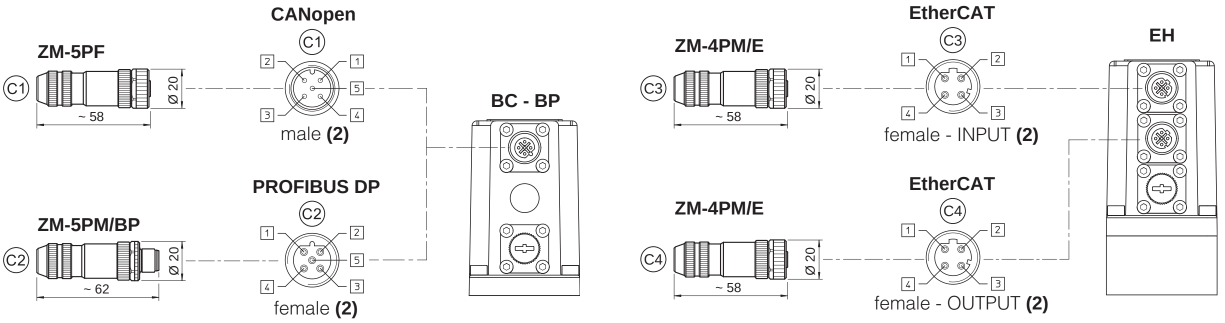
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 RES connections layout

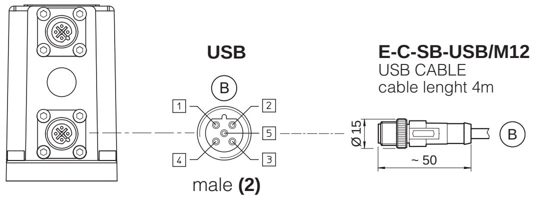
MAIN CONNECTORS



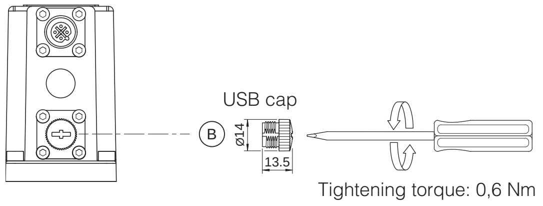
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

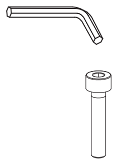
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

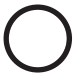
20 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm



Seals:

2 OR 108

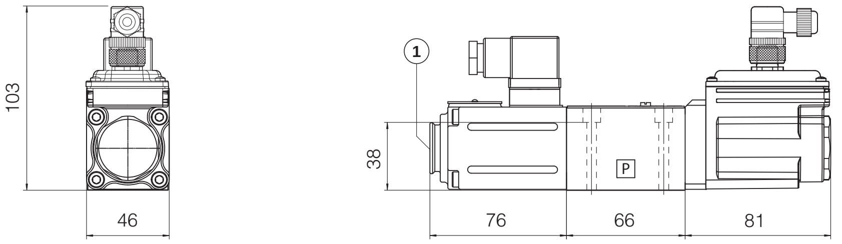
Diameter of ports P, T: Ø 5 mm

21 INSTALLATION DIMENSIONS [mm]

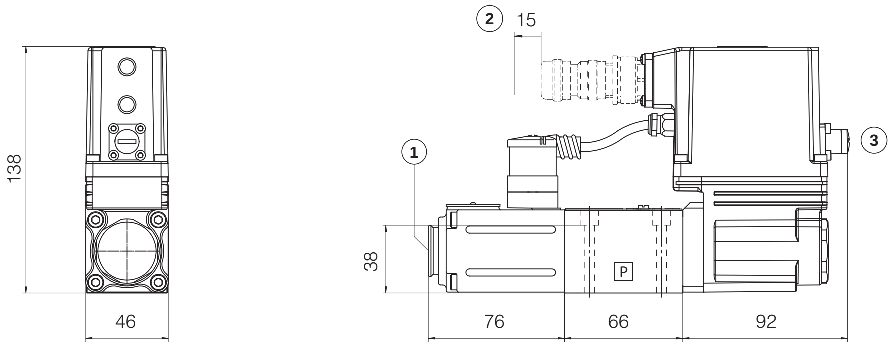
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

Mass [kg]		
R	**REB, RES**	**RES-EH**
2,1	2,6	2,7

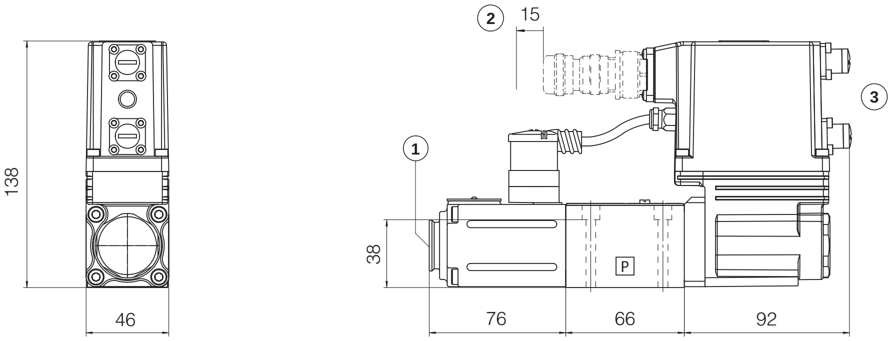
RZMO-R-P



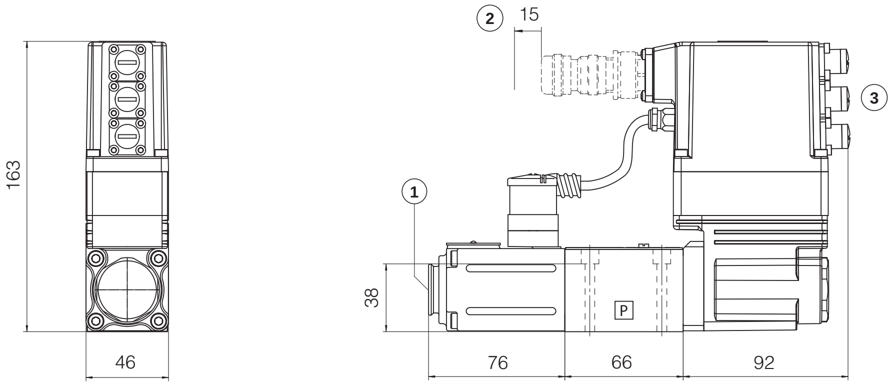
RZMO-REB-P-NP



RZMO-RES-P-BP
RZMO-RES-P-BC



RZMO-RES-P-EH



① = Air bleeding, see section 14

② = Space to remove the connectors

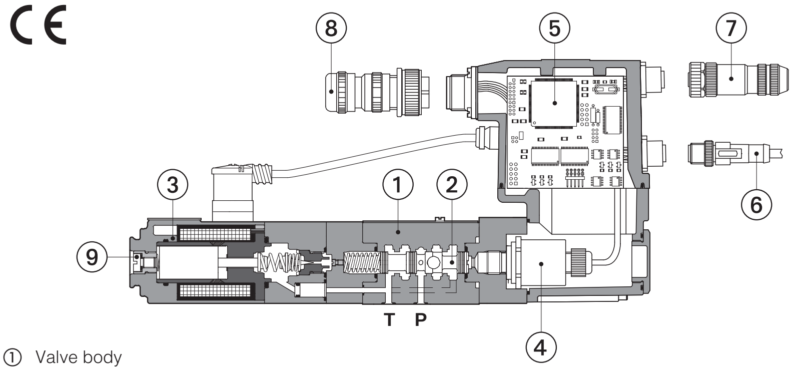
③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Digital proportional relief valves high performance

piloted, with on-board pressure transducer



① Valve body
② Poppet
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZMO-RES-P-BC-030

RZMO-R , RZMO-REB, RZMO-RES

Spool type piloted digital proportional relief valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **40 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO - REB - P - NP - 030 / 210 / * / * * / *

RZMO
Proportional pressure relief valve, piloted

R = for off-board driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
030 = regulation on port P, discharge in T (pilot operated version)

Max regulated pressure:
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Electronic options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Dynamic response preset, see section 15 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

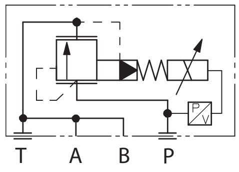
Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

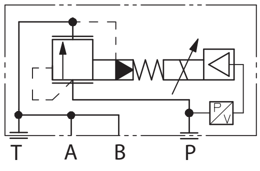
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZMO-R



RZMO-REB RZMO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

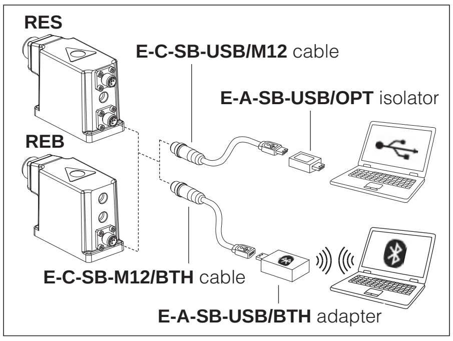
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-030**
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 45
Hysteresis		≤ 0,5 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,2 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

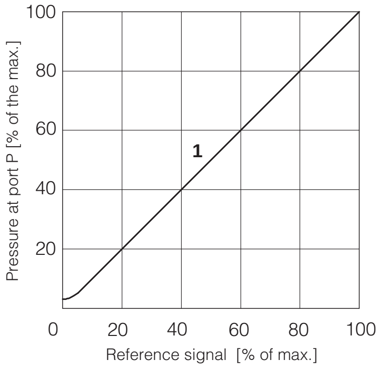
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

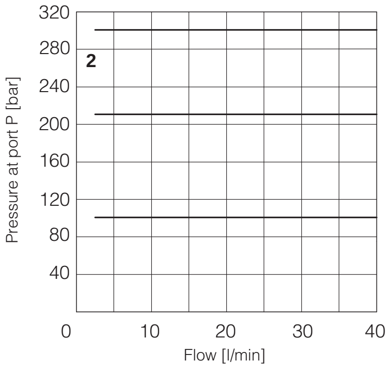
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

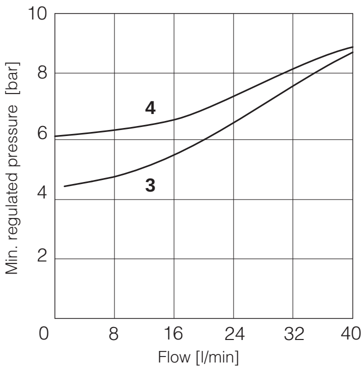
1 **Regulation diagrams**
with flow rate Q = 10 l/min



2 **Pressure/flow diagrams**
with reference signal set at Q = 10 l/min



3-4 **Minimum pressure/flow diagrams**
with zero reference signal



3 = All the models (except /350)
4 = All the models (only /350)

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

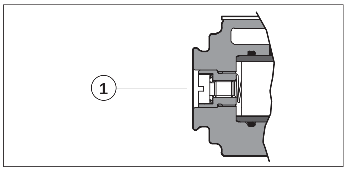
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

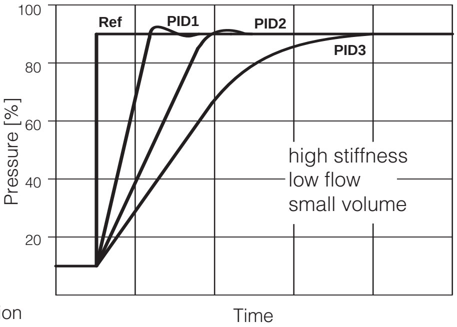


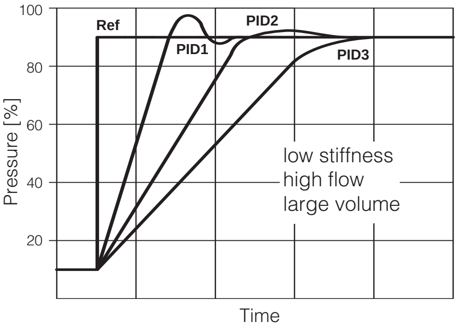
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for **/Z** option

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

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB Ⓑ and RES Ⓑ - Ⓒ

Ⓑ	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1)	**BC fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

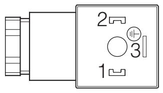
(C2)	**BP fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4)	**EH fieldbus execution, connector - M12 - 4 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

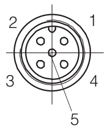
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for R

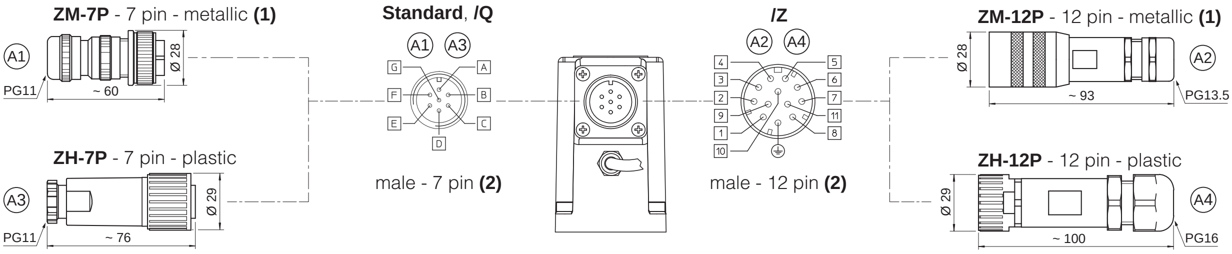
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for R

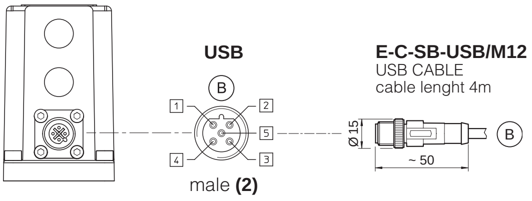
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

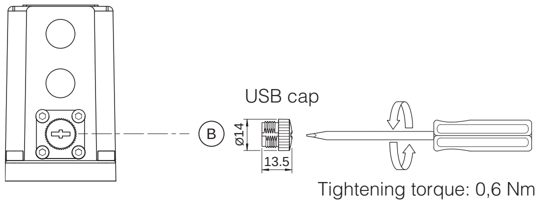
MAIN CONNECTORS



USB CONNECTOR



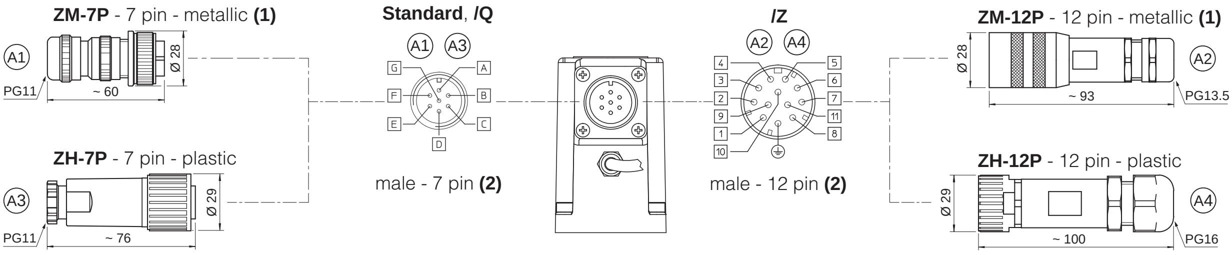
PLASTIC PROTECTION CAPS - supplied with the valves



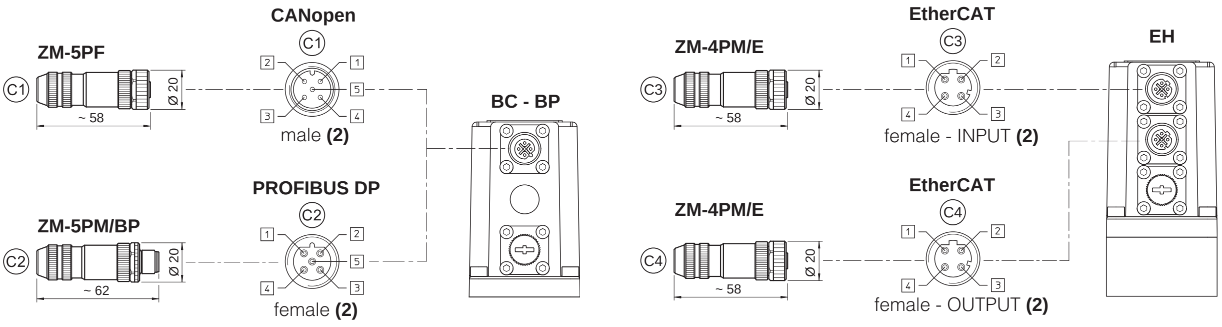
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18.7 RES connections layout

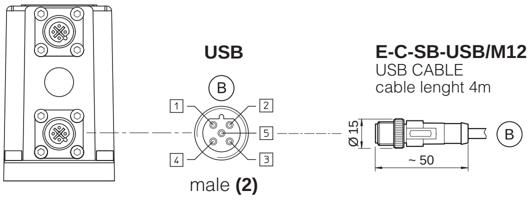
MAIN CONNECTORS



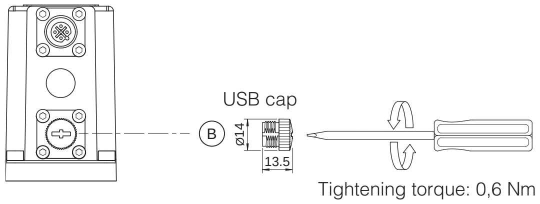
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

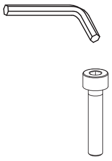
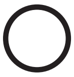
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS

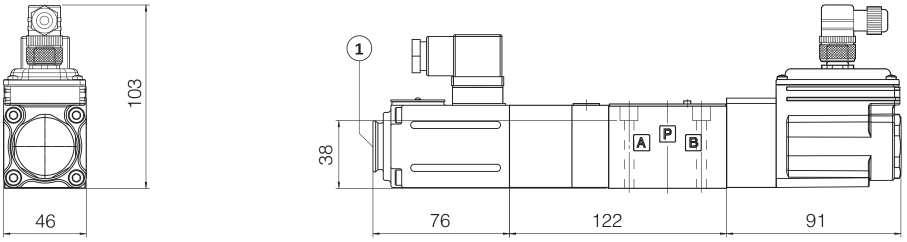
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 7,5 mm Ports A, B connected to port T

21 INSTALLATION DIMENSIONS [mm]

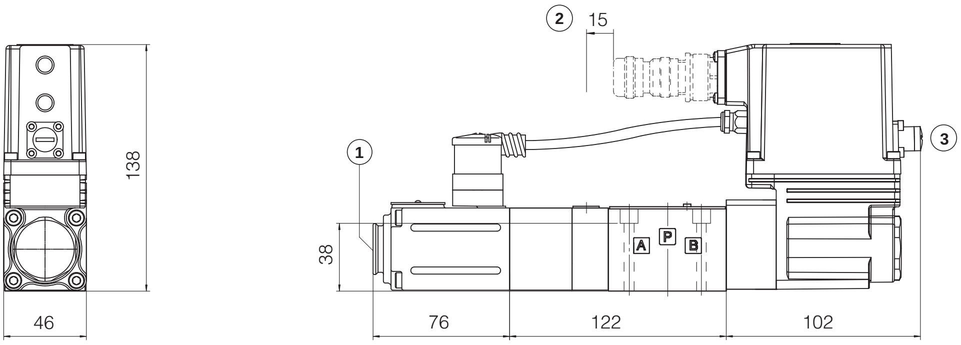
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	**REB, RES**	**RES-EH**
3,1	3,6	3,7

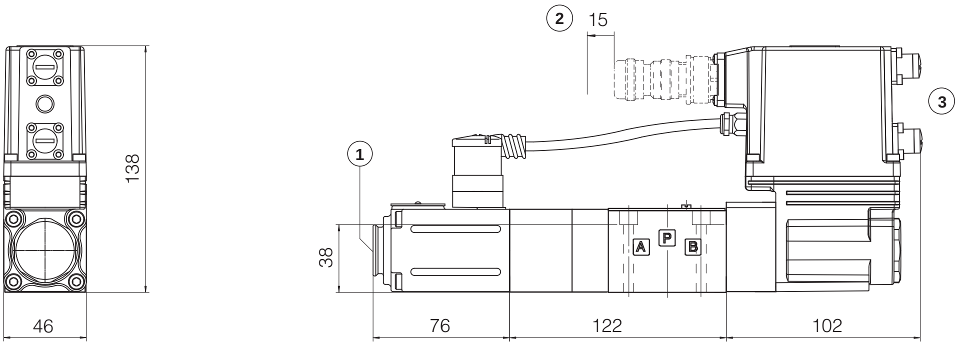
RZMO-R-P



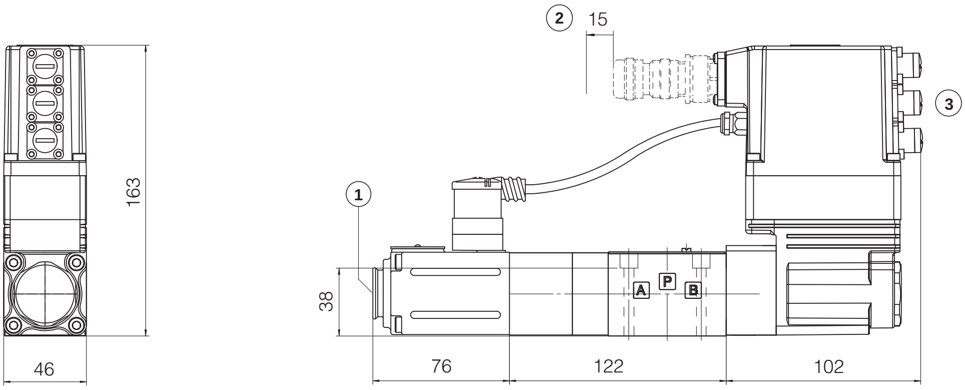
RZMO-REB-P-NP



RZMO-RES-P-BP
RZMO-RES-P-BC



RZMO-RES-P-EH



① = Air bleeding, see section 14

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

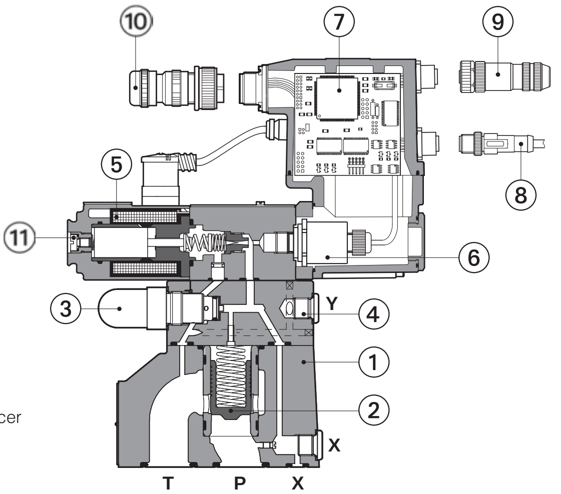
22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Digital proportional relief valves high performance

piloted, with on-board pressure transducer

CE



① Valve body
② Main poppet
③ Mechanical pressure limiter
④ Drain port G 1/4" (option /Y)
⑤ Proportional solenoid
⑥ On-board pressure transducer
⑦ On-board digital driver
⑧ USB connector
⑨ Fieldbus connector
⑩ Main connector
⑪ Screw for air bleeding

AGMZO-RES-P-BC-20

AGMZO-R, AGMZO-REB, AGMZO-RES

Poppet type, piloted, digital proportional relief valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10**, **20**, **32** - ISO 6264
Max flow: **200**, **400**, **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGMZO - RES - P - BC - 10 / 315 / * / * * / *

Proportional pressure relief valve, piloted

R = for separated driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Valve size ISO 6264: **10, 20, 32**

Max regulated pressure:
100 = 100 bar **210** = 210 bar **315** = 315 bar **350** = 350 bar

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Series number

Dynamic response preset, see section 18 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

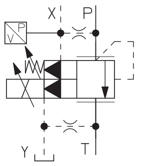
Hydraulic options (4):
E = external pilot
Y = external drain (only pipe connection G ¼")

Electronics options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

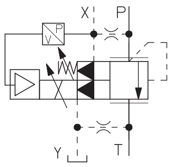
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

AGMZO-R



AGMZO-REB AGMZO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

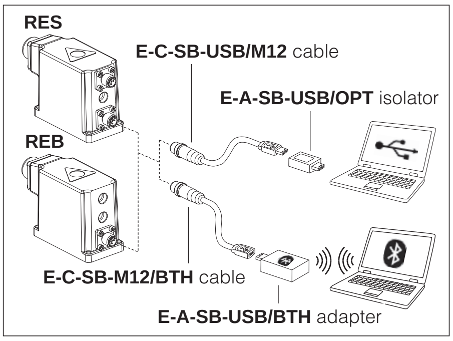
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**AGMZO-*-10**	**AGMZO-*-20**	**AGMZO-*-32**
Max regulated pressure [bar]	100; 210; 315; 350		
Max pressure at port P [bar]	350		
Max pressure at port T [bar]	210		
Min regulated pressure [bar]	see min. pressure / flow diagrams at section 11		
Max flow [l/min]	200	400	600
Response time 0-100% step signal (depending on installation) **(1)** [ms]	≤ 80	≤ 100	≤ 115
Hysteresis	≤ 0,5 [% of max pressure]		
Linearity	≤ 1,0 [% of max pressure]		
Repeatability	≤ 0,2 [% of max pressure]		
Thermal drift	zero point displacement < 1% at ΔT = 40°C		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 18

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 22			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

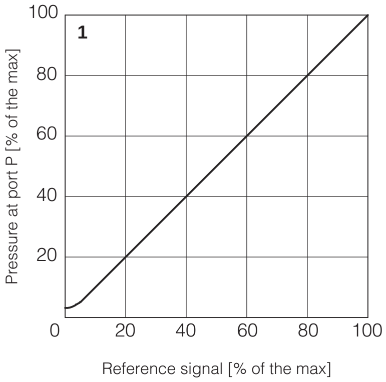
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

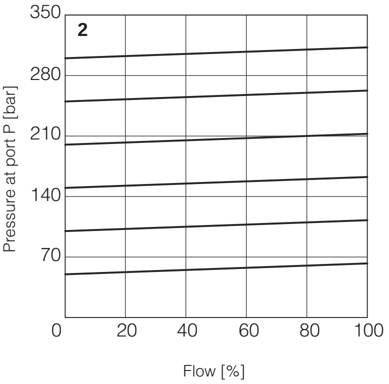
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

1 = Regulation diagrams
with flow rate Q = 50 l/min

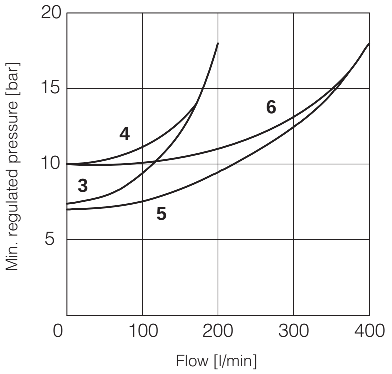
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min

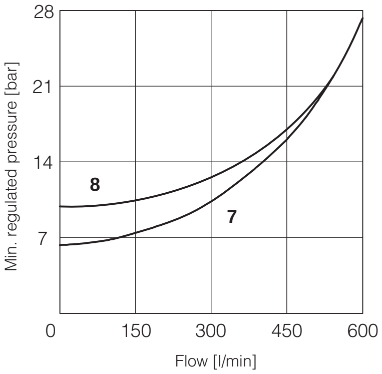




3-8 = Min. pressure/flow diagrams
with zero reference signal

3 = AGMZO-*-10/100, 210, 315
4 = AGMZO-*-10/350
5 = AGMZO-*-20/100, 210, 315
6 = AGMZO-*-20/350
7 = AGMZO-*-32/100, 210, 315
8 = AGMZO-*-32/350



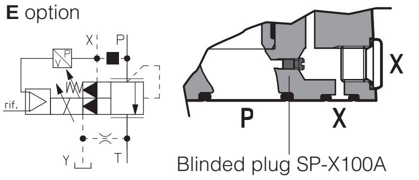


12 HYDRAULIC OPTIONS

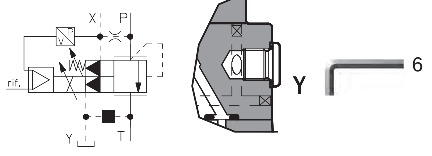
E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.

E option



Y option



13 ELECTRONICS OPTIONS - only for REB and RES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 20.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 20.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 20.2

14 POSSIBLE COMBINED OPTIONS

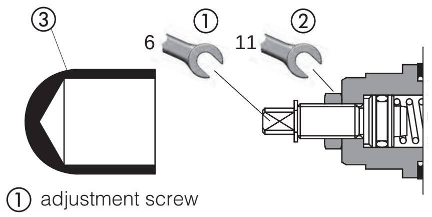
Hydraulic options: all combination possible

Electronics options: /IQ, /IZ

15 MECHANICAL PRESSURE LIMITER

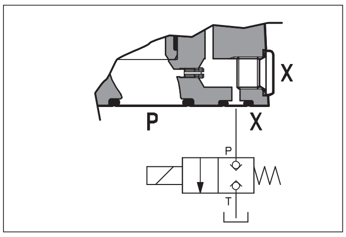
The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



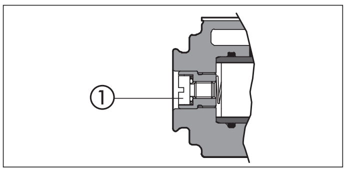
① adjustment screw
② locking nut
③ protection cap

16 REMOTE PRESSURE UNLOADING



The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.

17 AIR BLEEDING



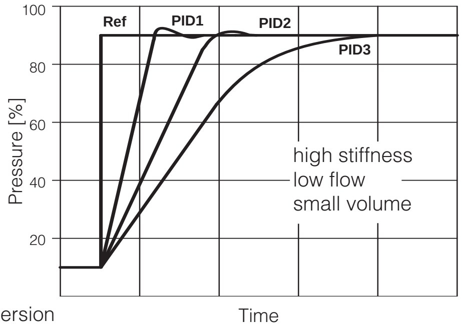
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

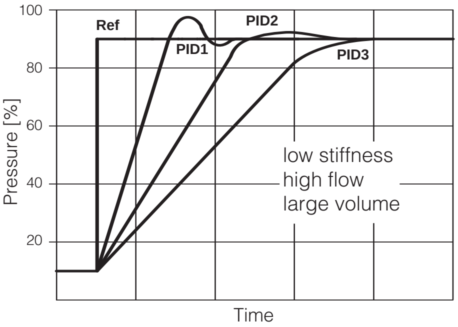
18 DYNAMIC RESPONSE - 4 pressure PIDs - only for REB and RES

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

19 PRESSURE TRANSDUCER FAILURE - only for REB and RES

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

20.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

20.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

20.6 Fault output signal (FAULT) - only for /Z option

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

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin Ⓐ1 **Standard** and **/Q** option - for **REB** and **RES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

21.2 Main connector signals - 12 pin Ⓐ2 **/Z** option - for **REB** and **RES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for P_INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 Communication connectors - for **REB** Ⓑ and **RES** Ⓑ - Ⓒ

Ⓑ **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 +

Ⓒ1 **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)

Ⓒ2 **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**	

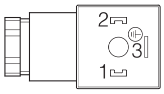
Ⓒ3 Ⓒ4 **EH fieldbus execution, connector - M12 - 4 pin** (2)

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

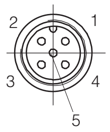
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

21.4 Solenoid connection - only for **R**

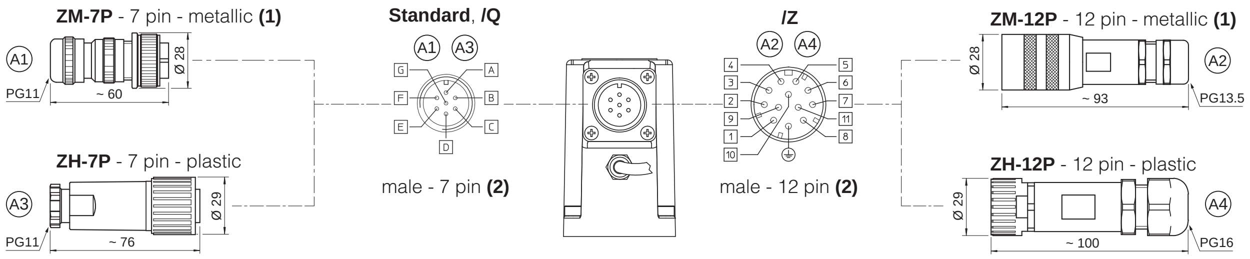
PIN	SIGNAL	TECHNICAL SPECIFICATION	**Connector code 666**
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

21.5 Pressure transducer connection - only for **R**

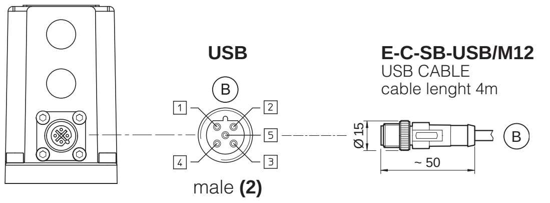
PIN	SIGNAL	TECHNICAL SPECIFICATION	**Connector code ZBE-08**
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

21.6 REB connections layout

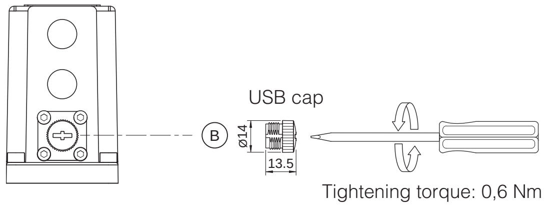
MAIN CONNECTORS



USB CONNECTOR



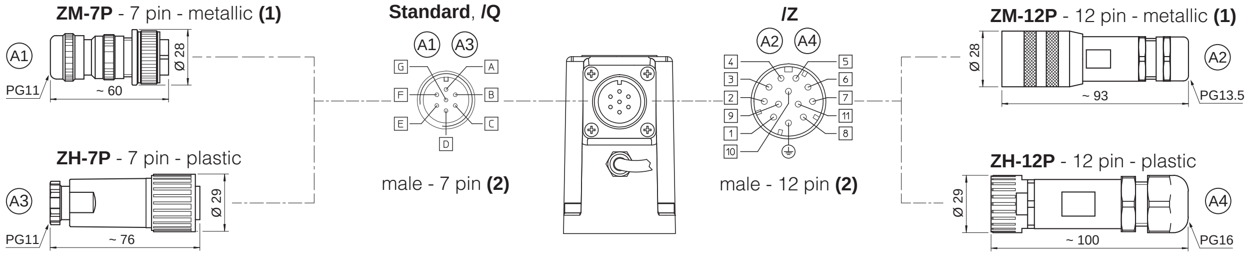
PLASTIC PROTECTION CAPS - supplied with the valves



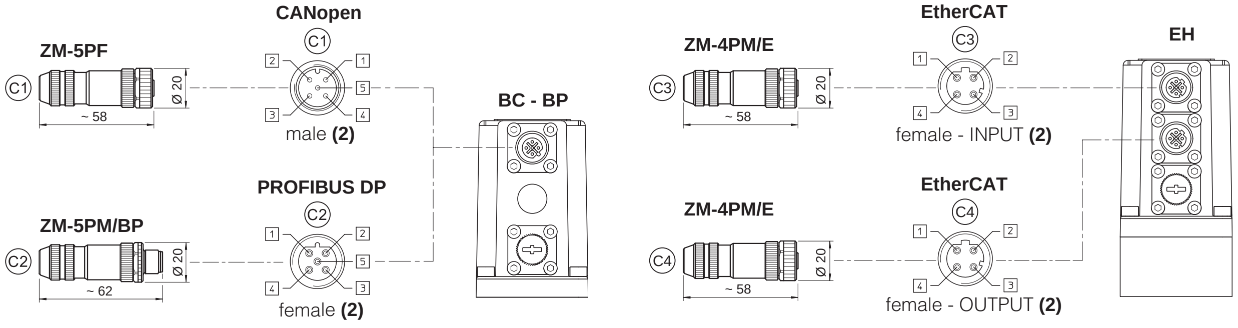
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

21.7 RES connections layout

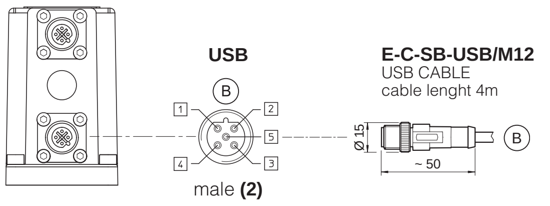
MAIN CONNECTORS



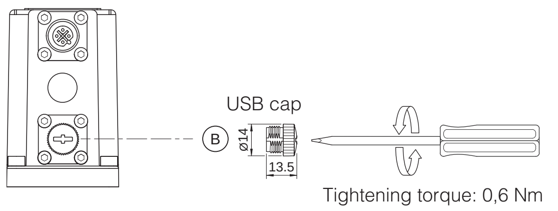
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

22 **CONNECTORS CHARACTERISTICS** - to be ordered separately

22.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

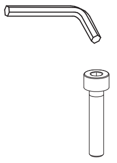
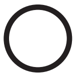
22.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

23 **FASTENING BOLTS AND SEALS**

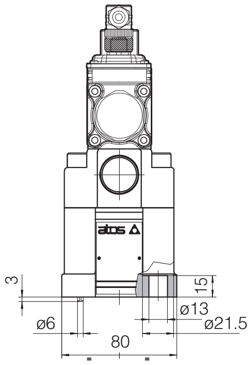
	AGMZO-*-10	**AGMZO-*-20**	**AGMZO-*-32**
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

24 INSTALLATION DIMENSIONS [mm]

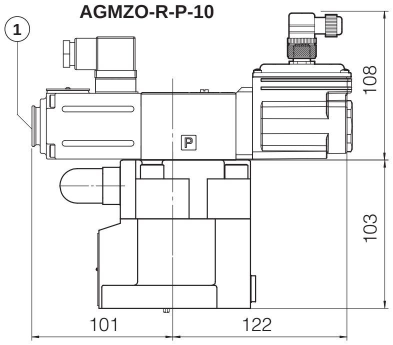
SIZE 10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

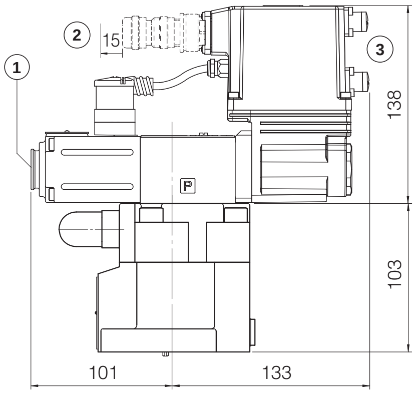
	Mass [kg]		
	R	**REB, RES**	**RES-EH**
AGMZO-*-10	5,7	6,2	6,3



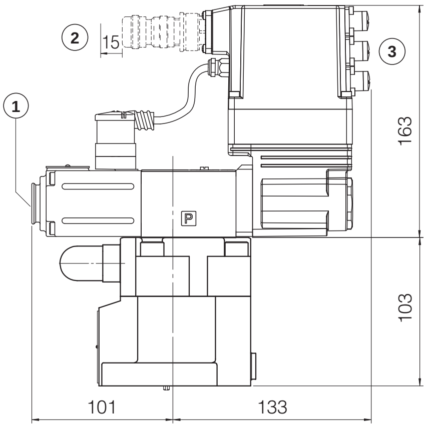
AGMZO-R-P-10



AGMZO-REB-P-NP-10
AGMZO-RES-P-BC-10
AGMZO-RES-P-BP-10



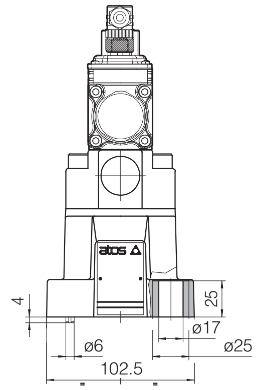
AGMZO-RES-P-EH-10



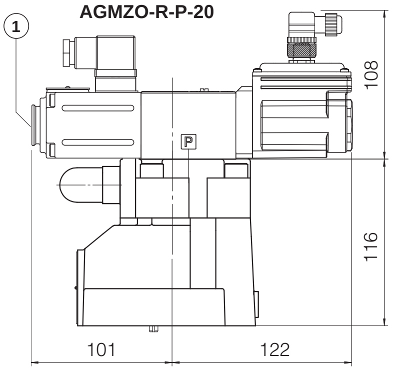
SIZE 20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

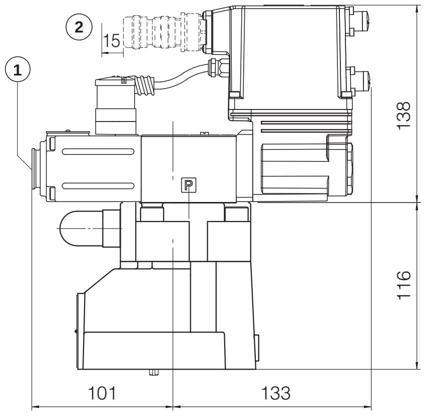
	Mass [kg]		
	R	**REB, RES**	**RES-EH**
AGMZO-*-20	6,9	7,4	7,5



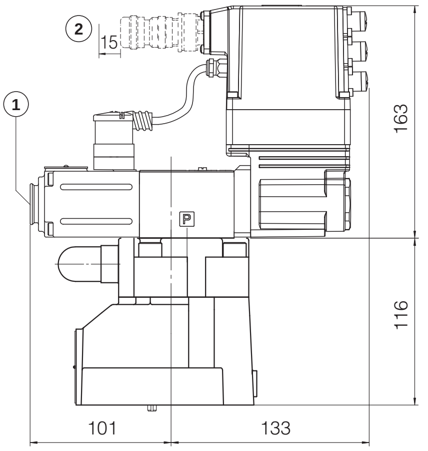
AGMZO-R-P-20



AGMZO-REB-P-NP-20
AGMZO-RES-P-BC-20
AGMZO-RES-P-BP-20



AGMZO-RES-P-EH-20



① = Air bleeding, see section 17

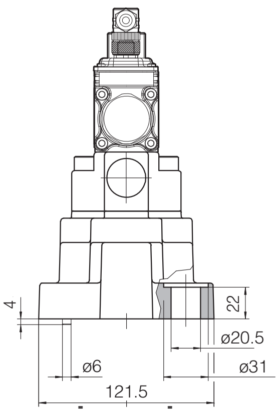
② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

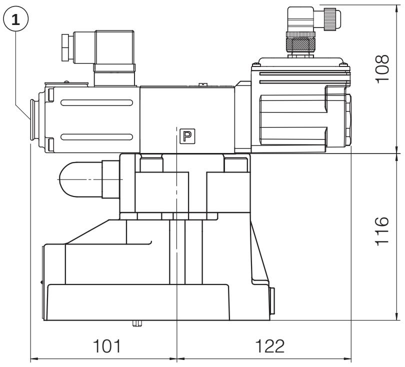
SIZE 32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)

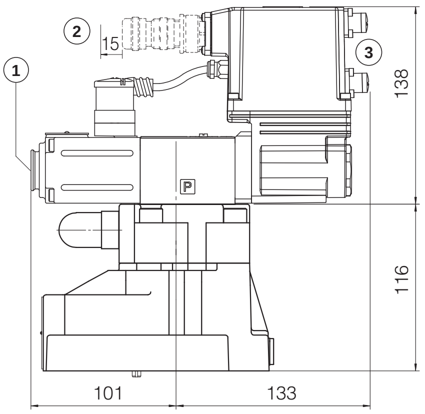
	Mass [kg]		
	R	**REB, AES**	**RES-EH**
AGMZO-*-32	8,3	8,8	8,9



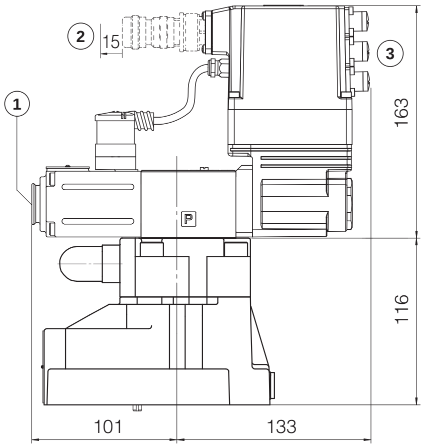
AGMZO-R-P-32



AGMZO-REB-P-NP-32
AGMZO-RES-P-BC-32
AGMZO-RES-P-BP-32



AGMZO-RES-P-EH-32



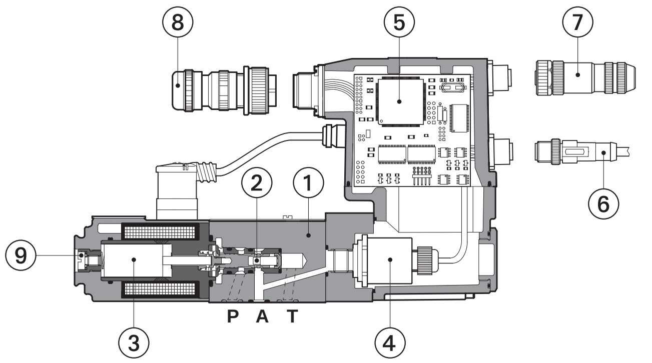
① = Air bleeding, see section 17
② = Space to remove the connectors
③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Digital proportional reducing valves high performance

direct, with on-board pressure transducer



① Valve body
② Poppet
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZGO-RES-P-BC-010

RZGO-R , RZGO-REB, RZGO-RES

Spool type, direct, digital proportional reducing valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **12 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO - REB - P - NP - 010 / 210 / * / * * / *

Proportional pressure reducing valve, direct

R = for off-board driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces, USB port always present **(3)**:

NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
010 = regulation on port A, discharge in T (direct operated version)

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Series number

Dynamic response preset, see section 15 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

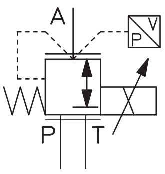
Electronic options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Max regulated pressure:
32 = 32 bar
100 = 100 bar
210= 210 bar

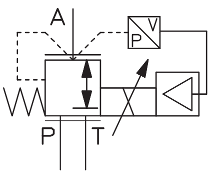
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZGO-R



RZGO-REB RZGO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

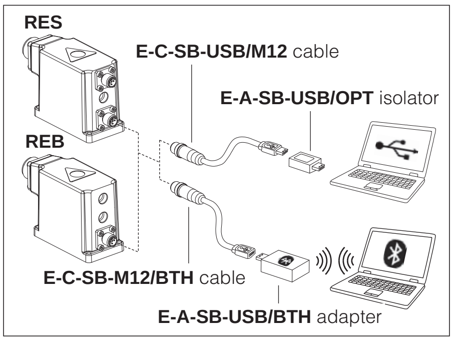
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO-*-010**
Max regulated pressure	[bar]	32; 100; 210
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure **(1)**	[bar]	0,8
Max flow	[l/min]	12
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 40
Hysteresis		≤ 0,3 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,2 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,4 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

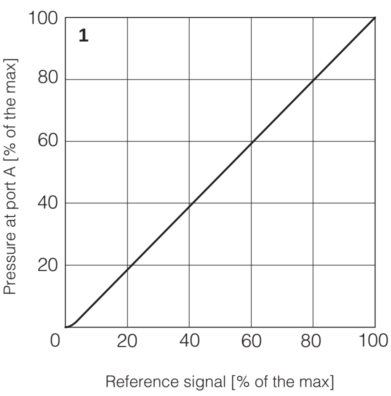
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

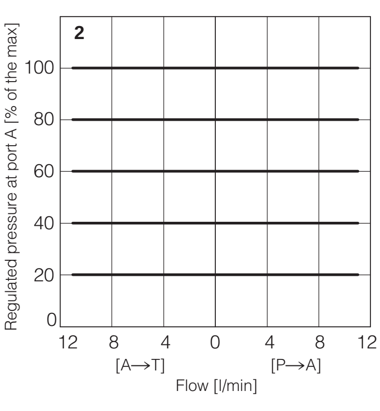
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

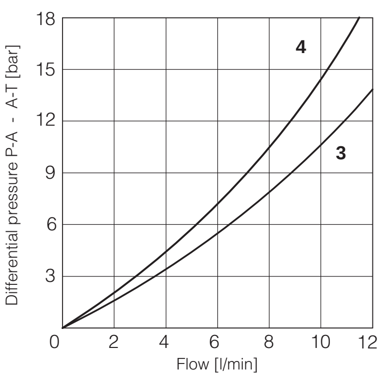
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

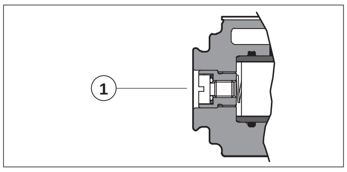
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

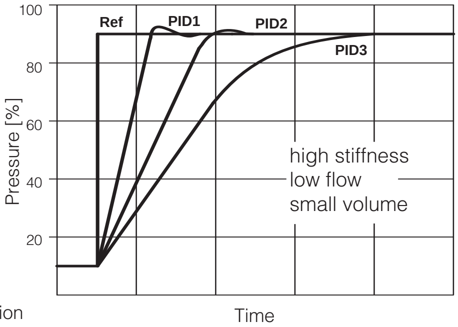


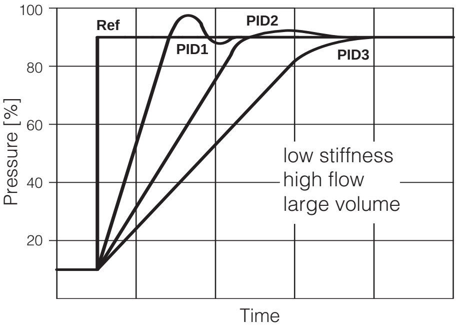
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for **/Z** option

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

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B)	USB connector - M12 - 5 pin always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1)	BC fieldbus execution, connector - M12 - 5 pin (2)	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

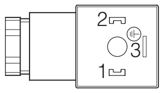
(C2)	BP fieldbus execution, connector - M12 - 5 pin (2)	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4)	EH fieldbus execution, connector - M12 - 4 pin (2)	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

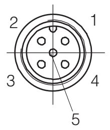
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for R

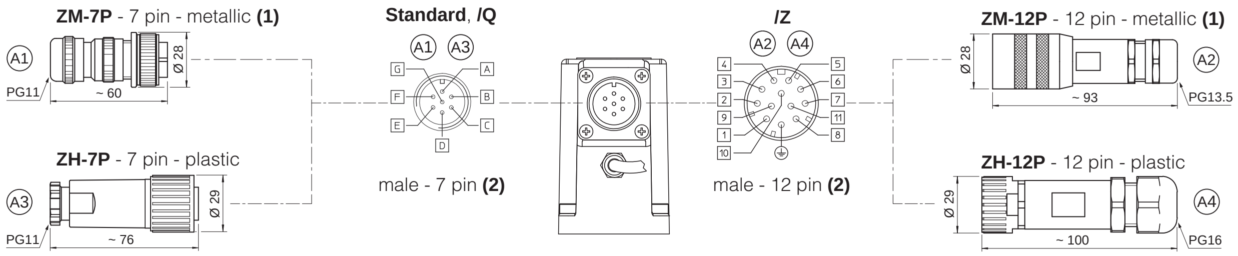
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for R

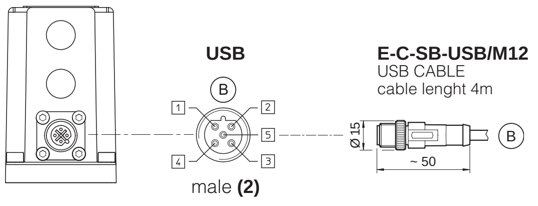
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

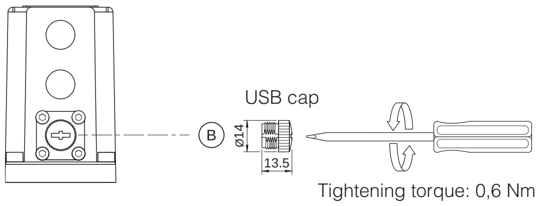
MAIN CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves

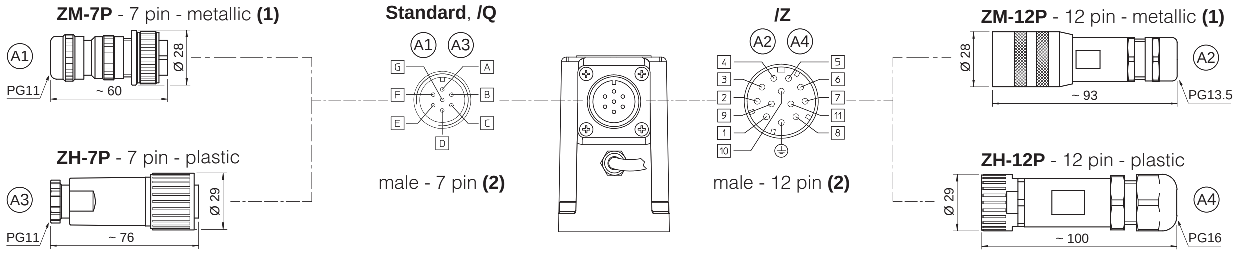


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

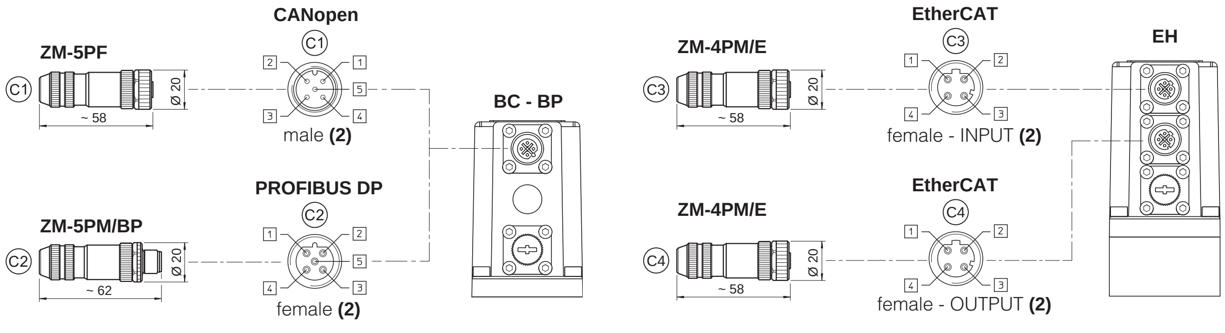
(2) Pin layout always referred to driver's view

18.7 RES connections layout

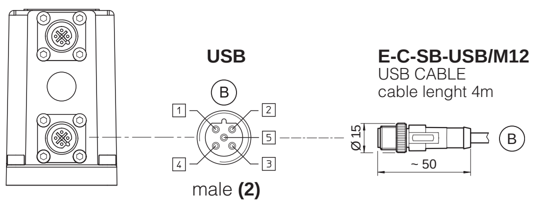
MAIN CONNECTORS



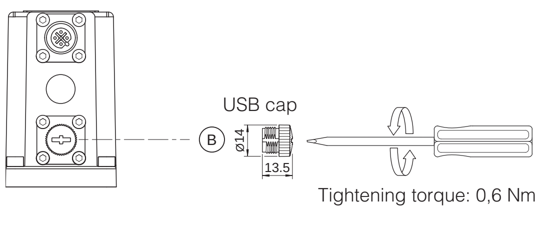
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

19 **CONNECTORS CHARACTERISTICS** - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	A1 **ZM-7P**	A3 **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	A2 **ZM-12P**	A4 **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

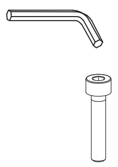
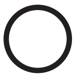
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	C1 **ZM-5PF**	C2 **ZM-5PM**	C1 **ZM-5PF/BP**	C2 **ZM-5PM/BP**	C1 C2 **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 **FASTENING BOLTS AND SEALS**

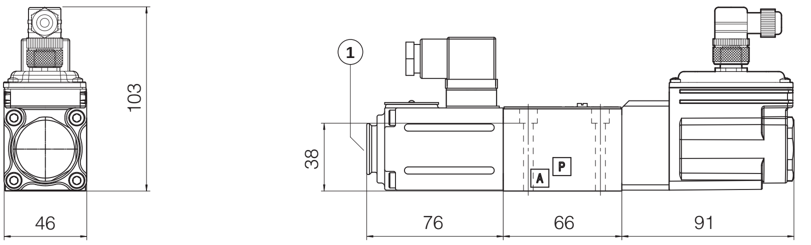
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 5 mm Port B not used

21 INSTALLATION DIMENSIONS [mm]

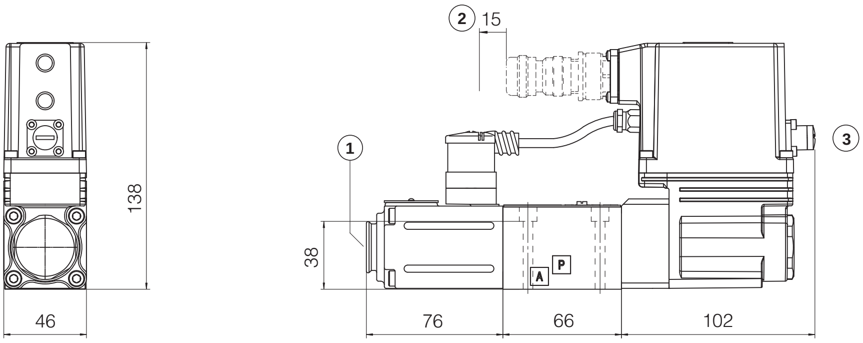
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	**REB, RES**	**RES-EH**
2,2	2,7	2,8

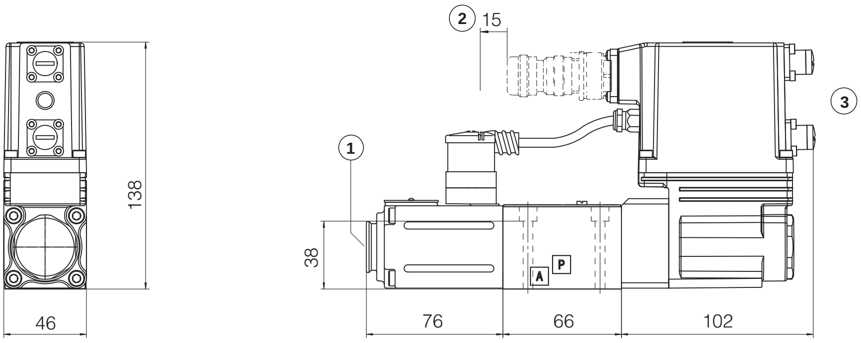
RZGO-R-P



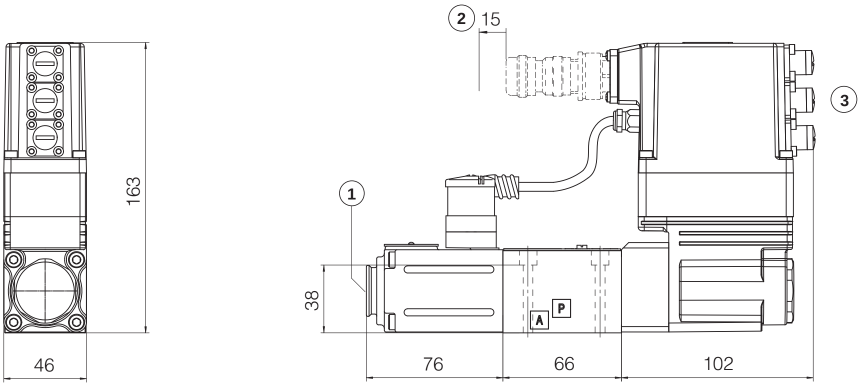
RZGO-REB-P-NP



RZGO-RES-P-BP
RZGO-RES-P-BC



RZGO-RES-P-EH



① = Air bleeding, see section 14

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

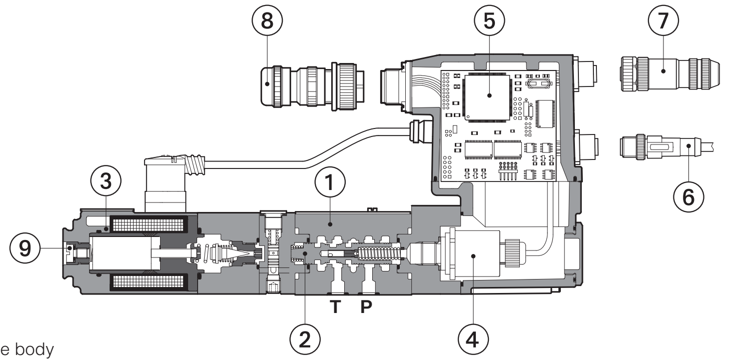
22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS203	E-BM-RES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB400	Quickstart for REB valves commissioning
QF400	Quickstart for RES valves commissioning

Table **FS075-3/E**

Proportional reducing valves high performance

piloted, with on-board pressure transducer



① Valve body
② Spool
③ Proportional solenoid
④ On-board pressure transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

RZGO-RES-P-BC-033

RZGO-R , RZGO-REB, RZGO-RES

Spool type, piloted, digital proportional reducing valves with integral pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **40 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO - REB - P - NP - 033 / 210 / * / * * / *

RZGO: Proportional pressure reducing valve, piloted

R = for off-board driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces, USB port always present **(3)**:

NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
033 = regulation on port A, discharge in T (pilot operated version)

Max regulated pressure:
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Electronic options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Dynamic response preset, see section 15 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

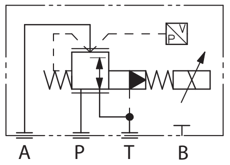
Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

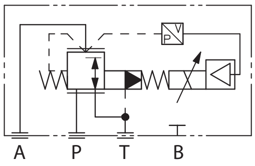
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZGO-R



RZGO-REB RZGO-RES



3 OFF-BOARD ELECTRONIC DRIVER - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

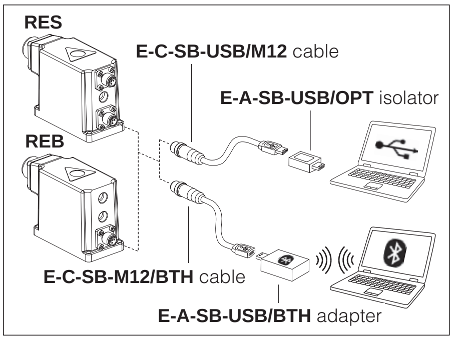
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO-*-033**
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 11
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 35
Hysteresis		≤ 0,5 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,5 [% of max pressure]
Thermal drift		zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

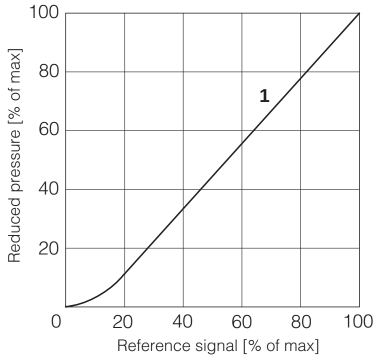
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13	NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11	NAS1638 class 5	

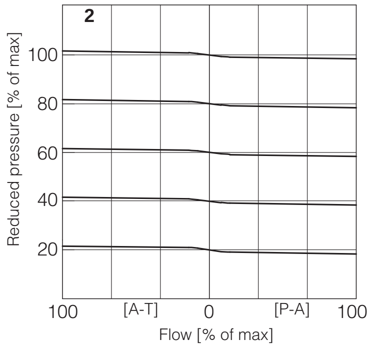
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

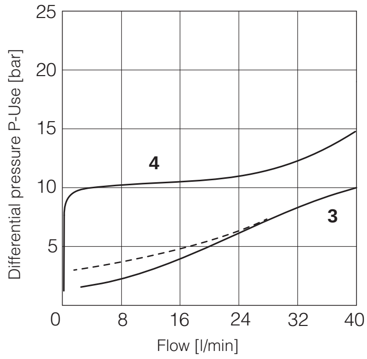
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = A → T (dotted line for pressure range /350)
4 = Pressure drops vs. flow P n A

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

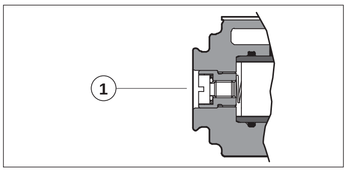
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

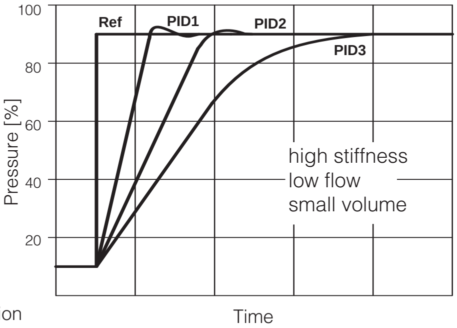


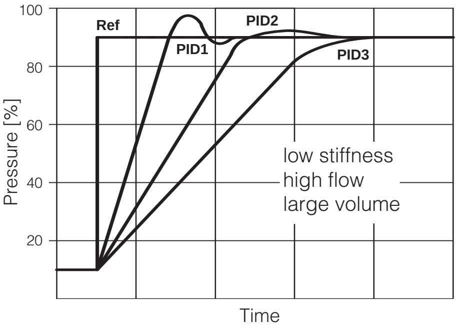
15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z option

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

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **REB** and **RES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) **/Z** option - for **REB** and **RES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for **REB** (B) and **RES** (B) - (C)

(B)	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1)	**BC fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

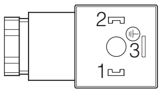
(C2)	**BP fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4)	**EH fieldbus execution, connector - M12 - 4 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

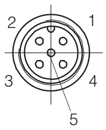
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

18.4 Solenoid connection - only for **R**

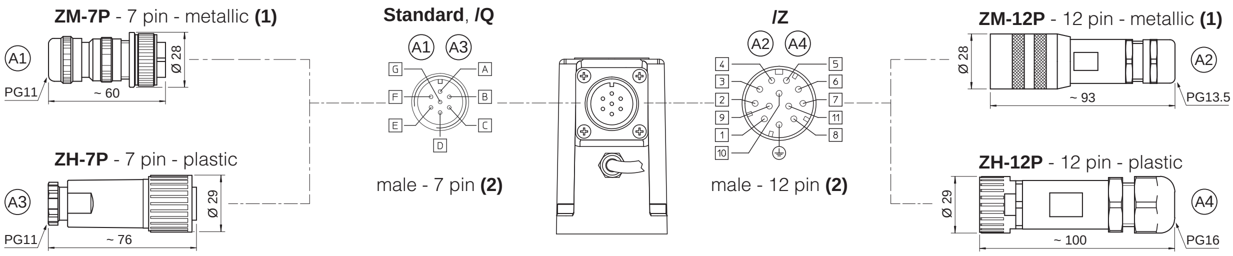
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.5 Pressure transducer connection - only for **R**

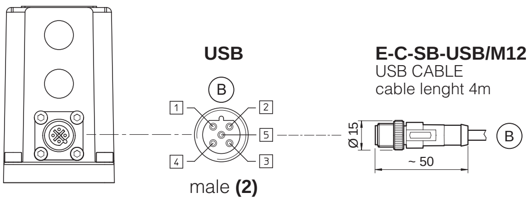
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

18.6 REB connections layout

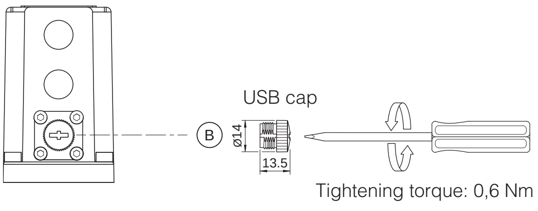
MAIN CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves

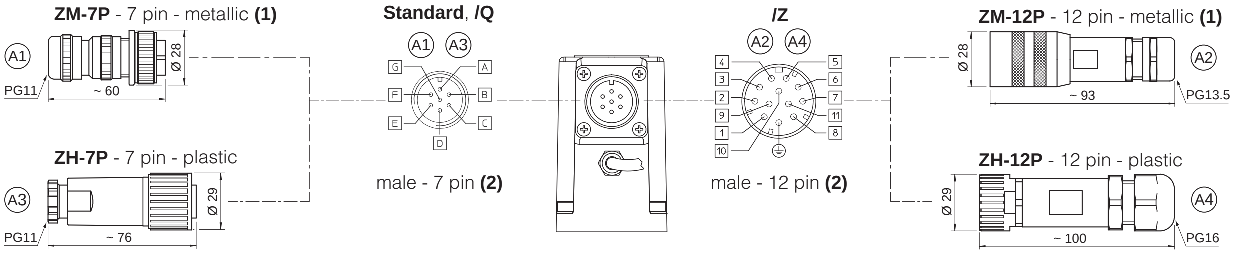


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

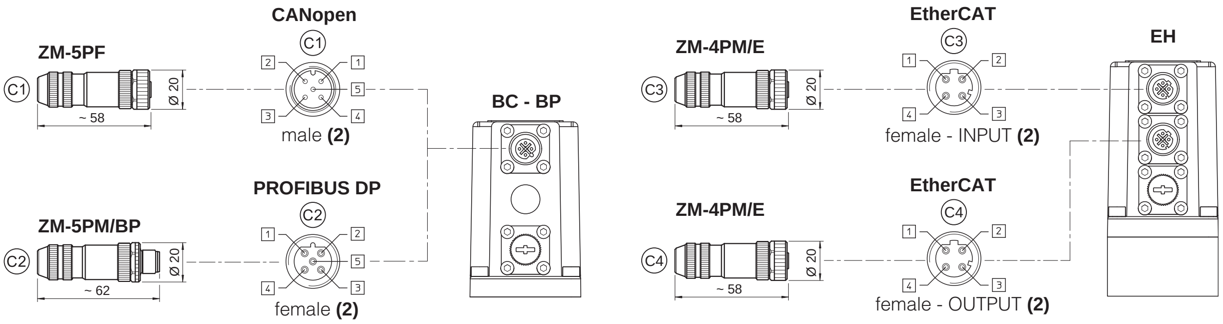
(2) Pin layout always referred to driver's view

18.7 RES connections layout

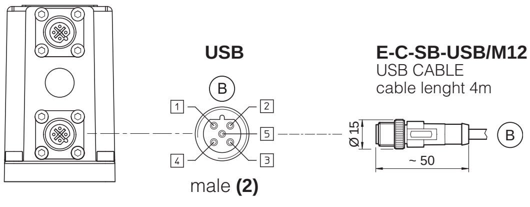
MAIN CONNECTORS



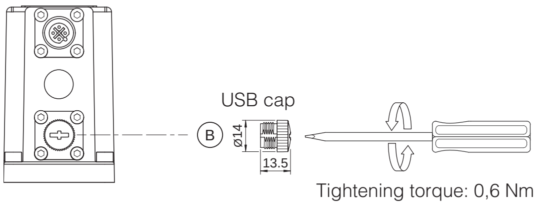
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

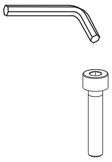
19.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

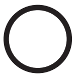
20 FASTENING BOLTS AND SEALS



Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm



Seals:

4 OR 108
Diameter of ports P, A, T: Ø 7,5 mm

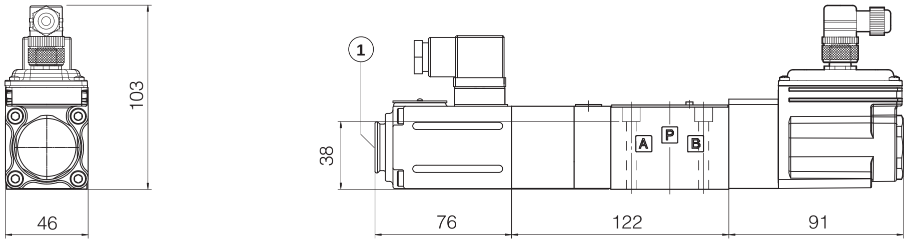
Port B not used

21 INSTALLATION DIMENSIONS [mm]

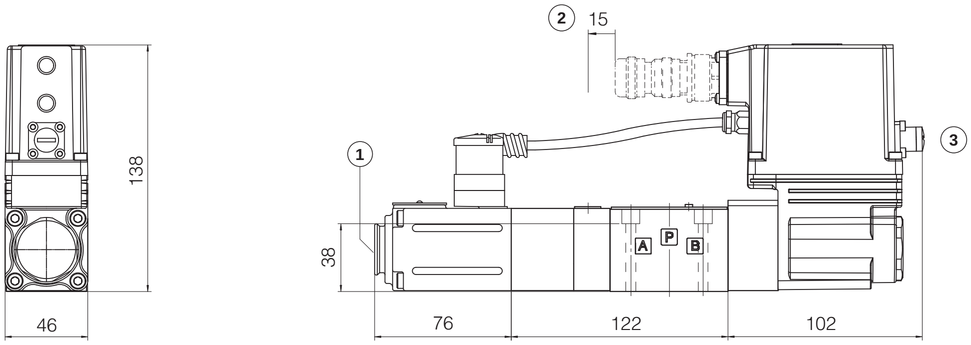
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	**REB, RES**	**RES-EH**
3,0	3,5	3,6

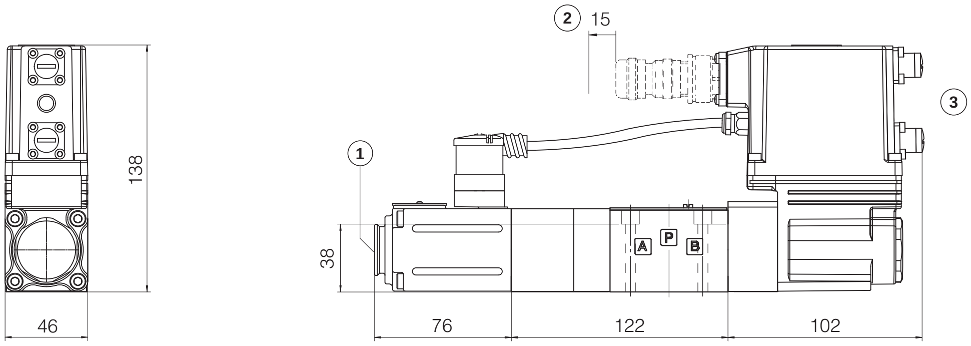
RZGO-R-P



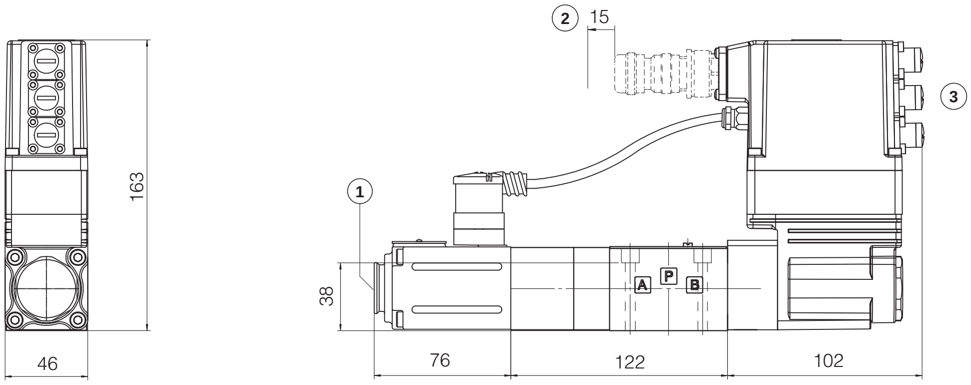
RZGO-REB-P-NP



RZGO-RES-P-BP
RZGO-RES-P-BC



RZGO-RES-P-EH



① = Air bleeding, see section 14

② = Space to remove the connectors

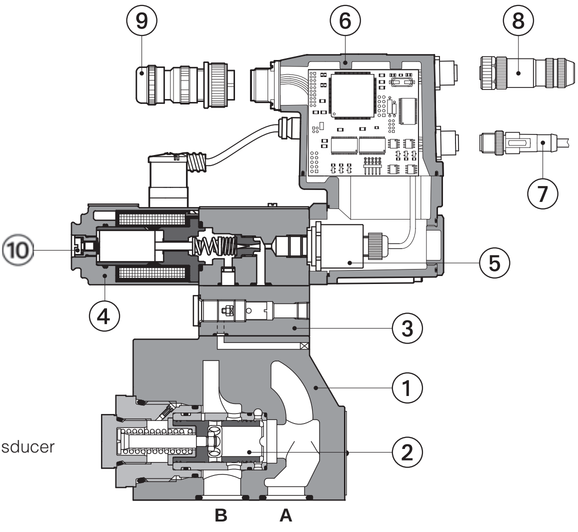
③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Proportional reducing valves high performance

piloted, with on-board pressure transducer



CE

① Valve body
② Main spool
③ Pilot flow compensator
④ Proportional solenoid
⑤ On-board pressure transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air bleeding

AGRCZO-RES-P-BC-20

AGRCZO-R, AGRCZO-REB, AGRCZO-RES

Piloted, digital proportional reducing valves with integral pressure transducer for pressure closed loop controls.

R without on-board digital driver, to be coupled with separated driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGRCZO - **RES** - **P** - **BC** - **10** / **315** / ***** / ***** ***** / *****

Proportional pressure reducing valve, piloted

R = for separated driver, see section 3
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Valve size ISO 5781: **10, 20**

Max regulated pressure:
100 = 100 bar **210** = 210 bar **315** = 315 bar **350** = 350 bar

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Series number

Dynamic response preset, see section 16 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

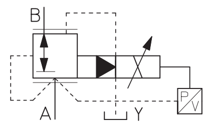
Hydraulic options (4):
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

Electronics options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

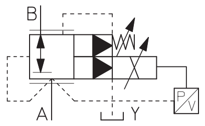
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

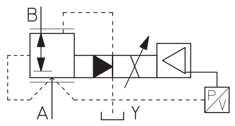
AGRCZO-R



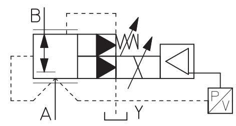
AGRCZO-R-*/P



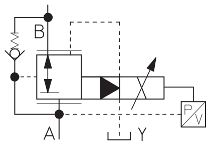
AGRCZO-REB
AGRCZO-RES



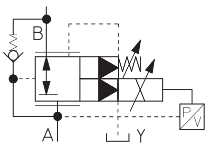
AGRCZO-REB-*/P
AGRCZO-RES-*/P



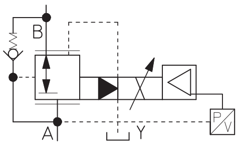
AGRCZO-R-*/R



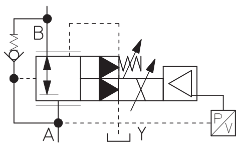
AGRCZO-R-*/PR



AGRCZO-REB-*/R
AGRCZO-RES-*/R



AGRCZO-REB-*/PR
AGRCZO-RES-*/PR



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

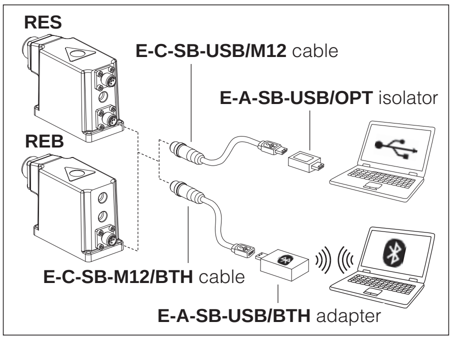
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**AGRCZO-*-10**	**AGRCZO-*-20**
Max regulated pressure [bar]	100; 210; 315; 350	
Min regulated pressure [bar]	1; 3 (only for /350)	
Max pressure at port A or B [bar]	350	
Max pressure at port Y [bar]	pilot drain always external, to be directly connected to tank at zero pressure	
Max flow [l/min]	160	300
Response time 0-100% step signal (depending on installation) **(1)** [ms]	≤ 45	≤ 50
Hysteresis	≤ 0,5 [% of max pressure]	
Linearity	≤ 1,0 [% of max pressure]	
Repeatability	≤ 0,2 [% of max pressure]	
Thermal drift	zero point displacement < 1% at ΔT = 40°C	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 16

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

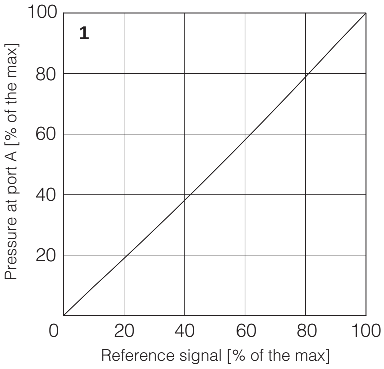
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

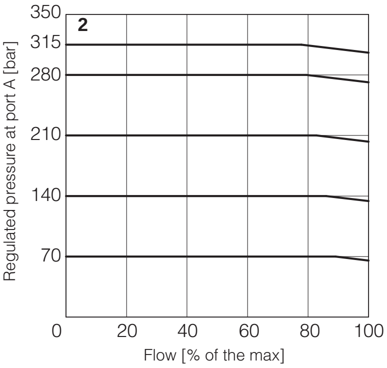
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

1 **Regulation diagrams**
with flow rate Q = 10 l/min

2 **Pressure/flow diagrams**
with reference pressure set with Q = 10 l/min

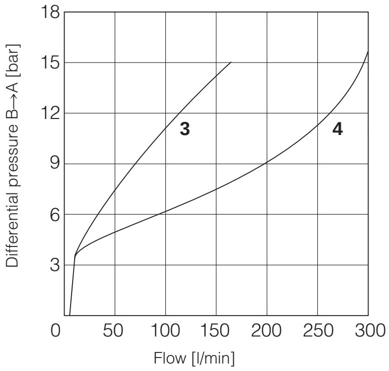


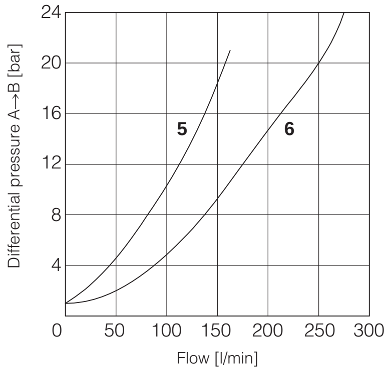


3-6 **Pressure drop/flow diagrams**
with zero reference signal

Differential pressure B→A
3 = AGRCZO-*-10
4 = AGRCZO-*-20

Differential pressure A→B (through check valve)
5 = AGRCZO-*-10/*/R
6 = AGRCZO-*-20/*/R

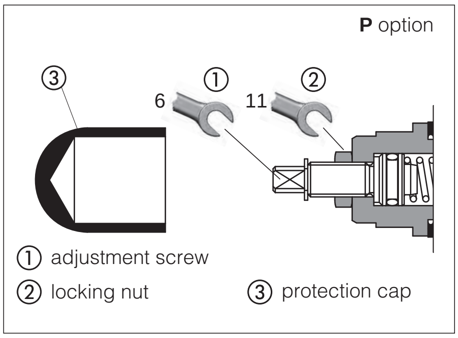




12 HYDRAULIC OPTIONS

P = This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working

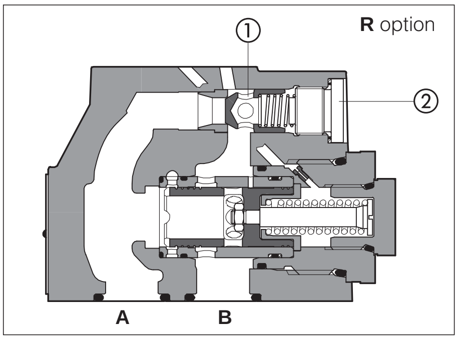


① adjustment screw
② locking nut
③ protection cap

R = This option provides a integral check valve for free reverse flow A→B

① Check valve - cracking pressure = 0,5 bar

② Plug



13 ELECTRONICS OPTIONS - only for REB and RES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 18.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 18.2

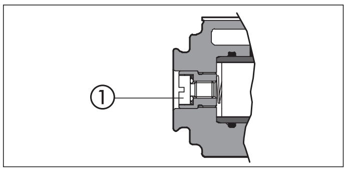
14 POSSIBLE COMBINED OPTIONS

for **R**: /PR

for **REB** and **RES**: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

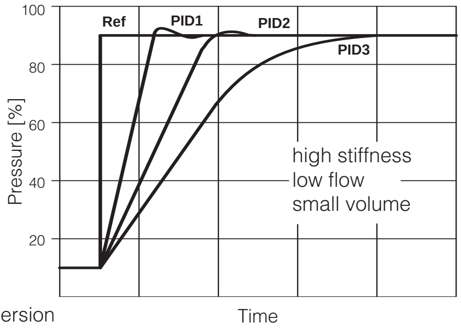


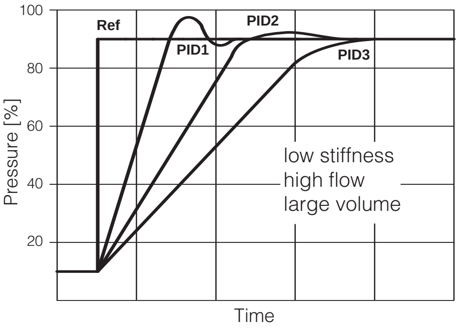
16 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

17 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for */Z*

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

18.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for */Z* option

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

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

19.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for P_INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 Communication connectors - for REB Ⓑ and RES Ⓑ - Ⓒ

Ⓑ **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin** (2)

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin** (2)

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

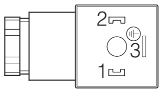
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin** (2)

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

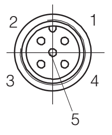
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

19.4 Solenoid connection - only for R

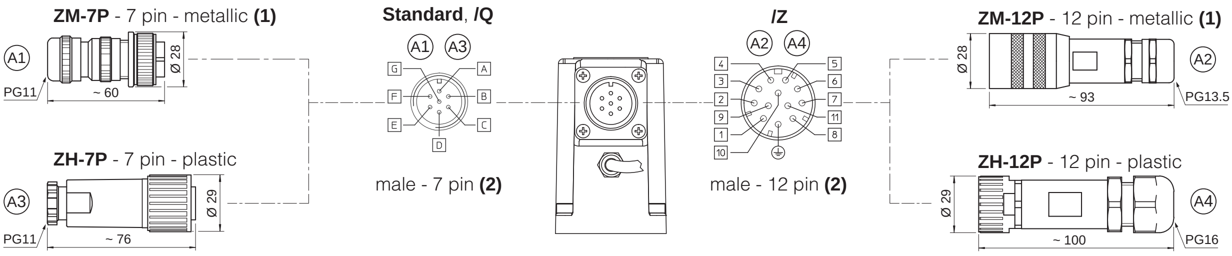
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

19.5 Pressure transducer connection - only for R

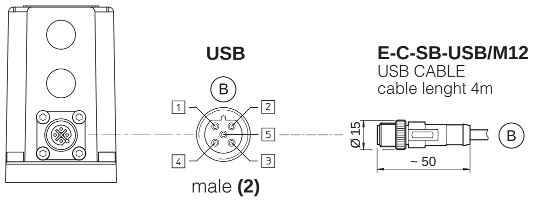
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

19.6 REB connections layout

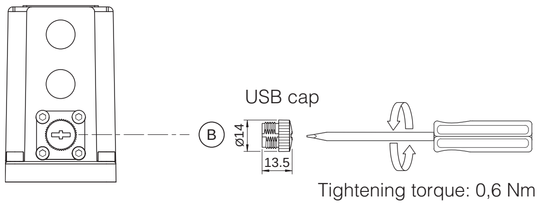
MAIN CONNECTORS



USB CONNECTOR



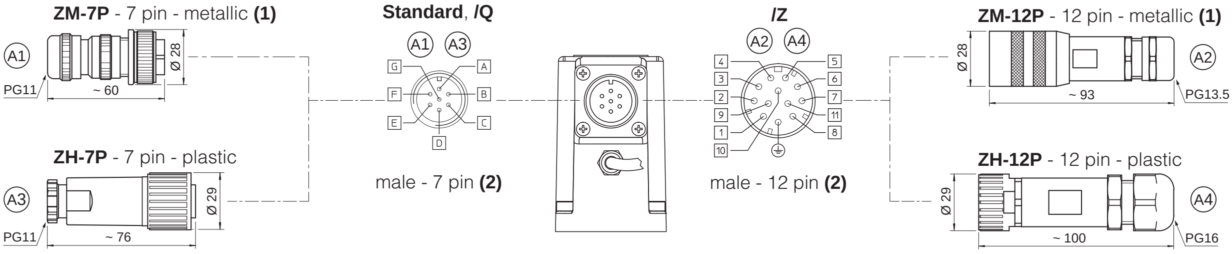
PLASTIC PROTECTION CAPS - supplied with the valves



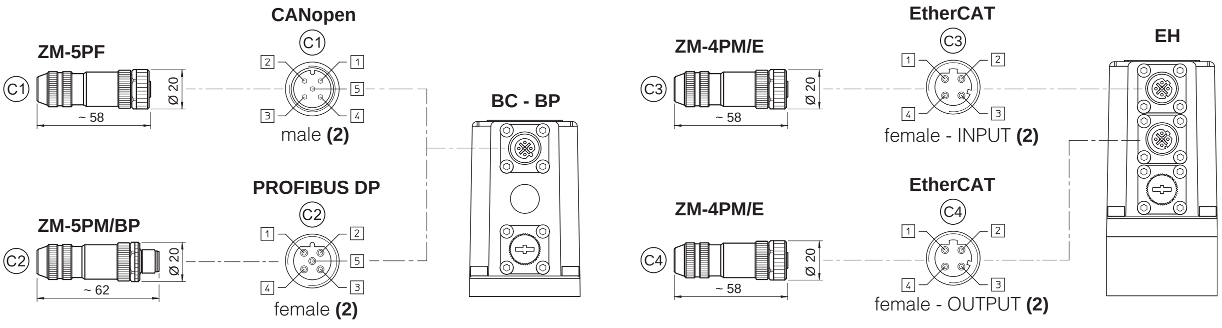
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19.7 RES connections layout

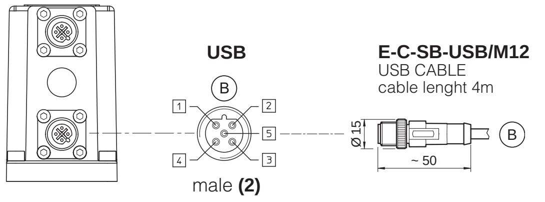
MAIN CONNECTORS



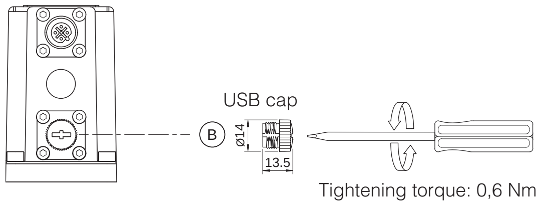
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

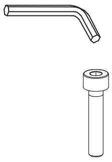
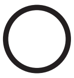
20.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

21 FASTENING BOLTS AND SEALS

	AGRCZO-*-10	**AGRCZO-*-20**
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

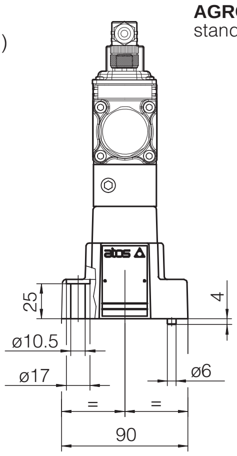
22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	**QB400**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF400**	Quickstart for RES valves commissioning
GS510	Fieldbus		

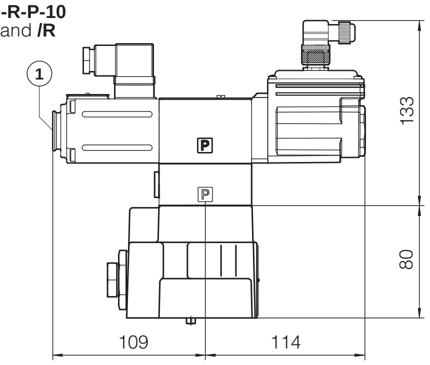
23 INSTALLATION DIMENSIONS FOR AGRCZO-10 [mm]

ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

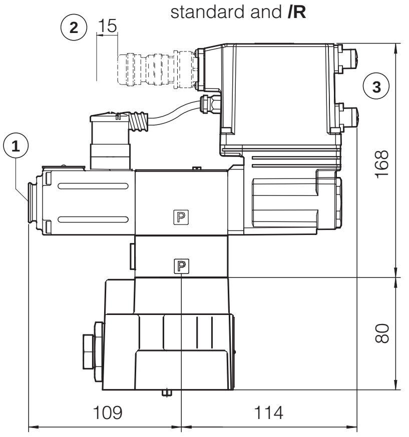
	Mass [kg]		
	R	**REB, RES**	**RES-EH**
AGRCZO-*-10	5,8	6,3	6,4
Option /P	+0,5		



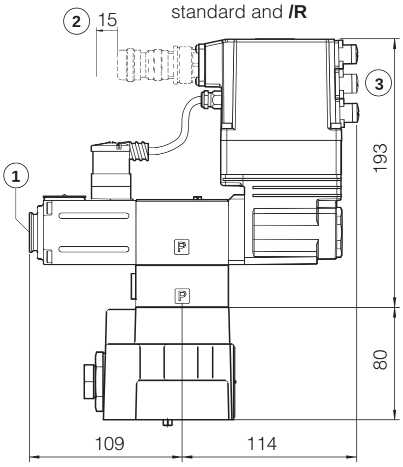
AGRCZO-R-P-10
standard and **/R**



AGRCZO-REB-P-NP-10
AGRCZO-RES-P-BC-10
AGRCZO-RES-P-BP-10
standard and **/R**



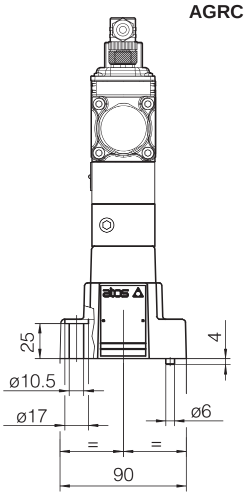
AGRCZO-RES-P-EH-10
standard and **/R**



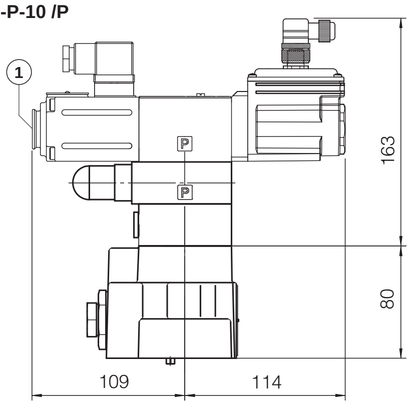
① = Air bleeding,
see section 15

② = Space to remove
the connectors

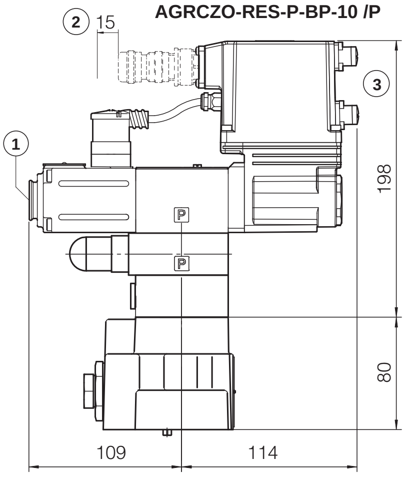
③ = The dimensions of all connectors
must be considered, see section 19.6 and 19.7



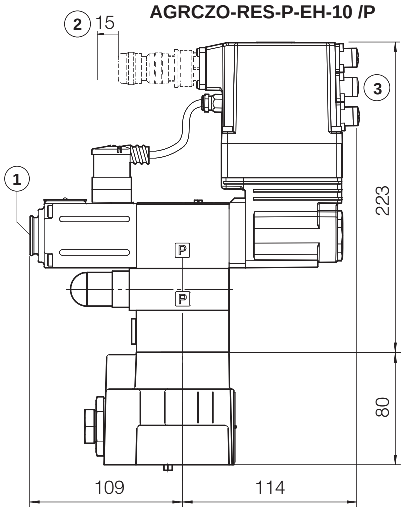
AGRCZO-R-P-10 /P



AGRCZO-REB-P-NP-10 /P
AGRCZO-RES-P-BC-10 /P
AGRCZO-RES-P-BP-10 /P



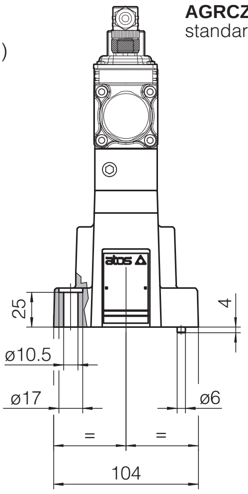
AGRCZO-RES-P-EH-10 /P



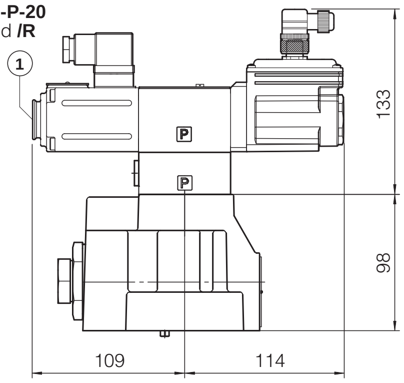
24 INSTALLATION DIMENSIONS FOR AGRCZO-20 [mm]

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

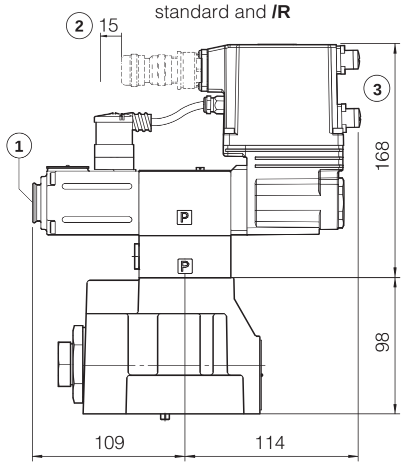
	Mass [kg]		
	R	**REB, RES**	**RES-EH**
AGRCZO-*-20	8,3	8,8	8,9
Option /P	+0,5		



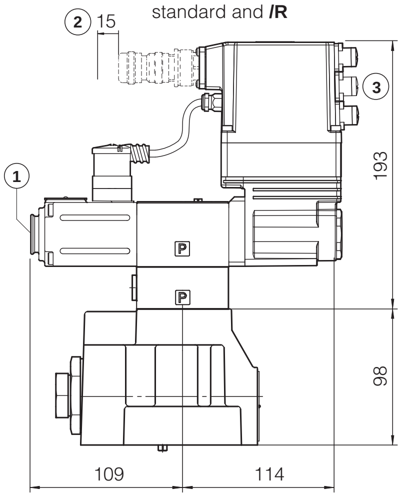
AGRCZO-R-P-20
standard and **/R**



AGRCZO-REB-P-NP-20
AGRCZO-RES-P-BC-20
AGRCZO-RES-P-BP-20
standard and **/R**



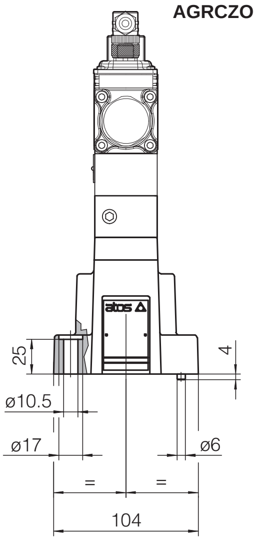
AGRCZO-RES-P-EH-20
standard and **/R**



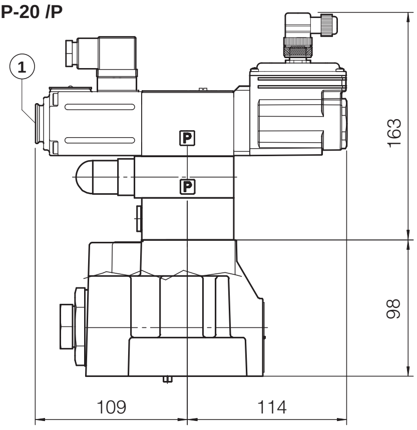
1 = Air bleeding,
see section 15

2 = Space to remove
the connectors

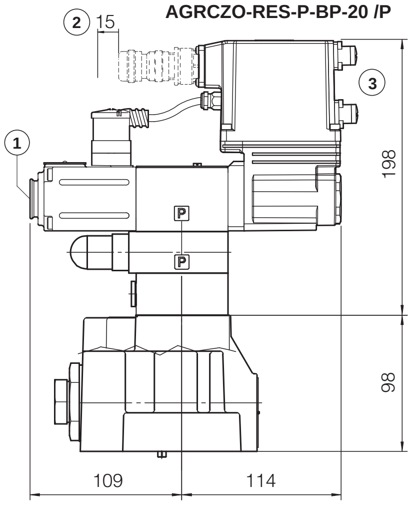
3 = The dimensions of all connectors
must be considered, see section 19.6 and 19.7



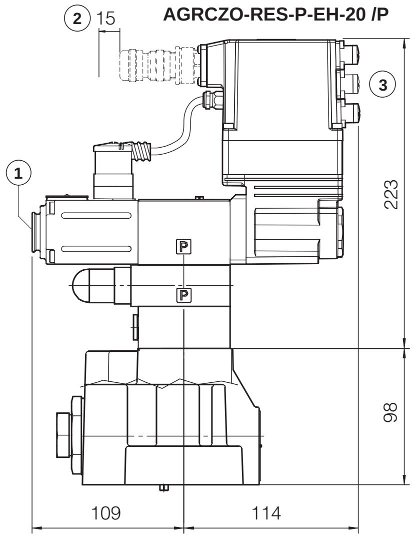
AGRCZO-R-P-20 /P



AGRCZO-REB-P-NP-20 /P
AGRCZO-RES-P-BC-20 /P
AGRCZO-RES-P-BP-20 /P

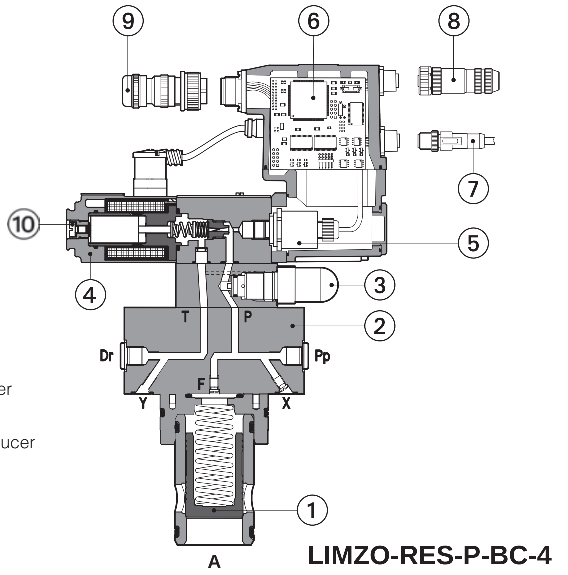


AGRCZO-RES-P-EH-20 /P



Digital proportional pressure cartridges high performance

piloted, with on-board pressure transducer - compensator, relief, reducing functions



① Poppet
② Cover
③ Mechanical pressure limiter
④ Proportional solenoid
⑤ On-board pressure transducer
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air blending

LIMZO-RES-P-BC-4

LICZO, LIMZO, LIRZO

2-way digital proportional cartridges with on-board pressure transducer, respectively performing: pressure compensator, relief and reducing closed loop functions.

R to be coupled with off-board drivers.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **16** ÷ **80** - ISO 7368
Max flow: up to **4500 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF COVERS

LIMZO - RES - P - BC - 4 / 315 / * / * / * *

Proportional
pressure cartridges, piloted
LICZO = pressure compensator
LIMZO = pressure relief
LIRZO = pressure reducing

R = for off-board driver, see section 5
REB = basic on-board digital driver **(1)**
RES = full on-board digital driver **(2)**

P = with integral pressure transducer

Fieldbus interfaces USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 7368:
1 = 16
2 = 25
3 = 32
4 = 40
5 = 50 (not for LIRZO)
6 = 63 (only for LIMZO)
8 = 80 (only for LIMZO)

Series number

Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

Dynamic response preset, see section 18 :
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

Hydraulic options (4):
P =with on-board mechanical pressure limiter (standard for size 1, 2 and 3)

Electronics options, only for **REB** and **RES (4)**:
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

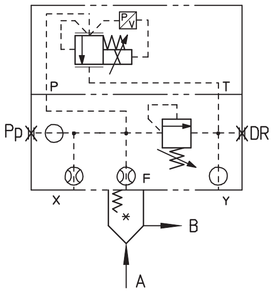
Max regulated pressure:
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **R** execution
(4) For possible combined options, see section 16

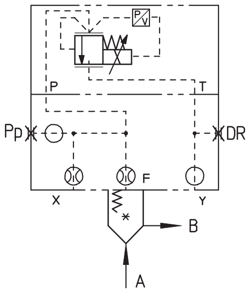
2 HYDRAULIC SYMBOLS

LICZO

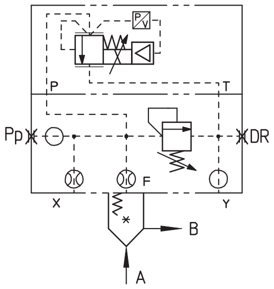
LICZO-R-1÷3
LICZO-R-4÷5 /P



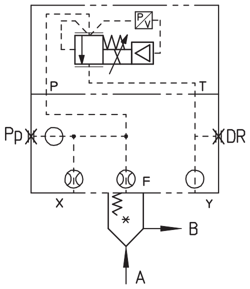
LICZO-R-4
LICZO-R-5



LICZO-REB(RES)-1÷3
LICZO-REB(RES)-4÷5 /P

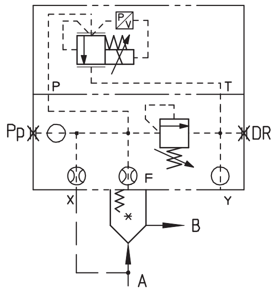


LICZO-REB(RES)-4÷5

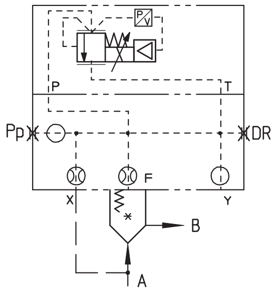


LIMZO

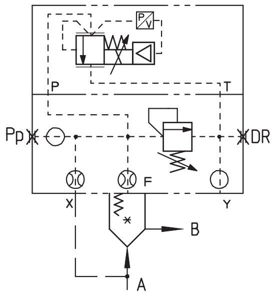
LIMZO-R-1÷3
LIMZO-R-4÷8 /P



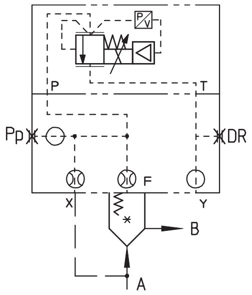
LIMZO-R-4÷8



LIMZO-REB(RES)-1÷3
LIMZO-REB(RES)-4÷8 /P

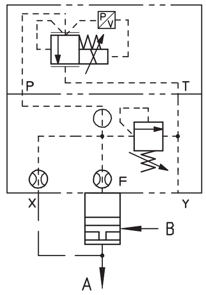


LIMZO-REB(RES)-4÷8

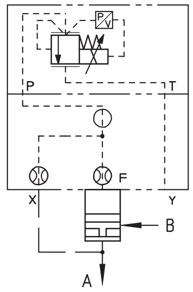


LIRZO

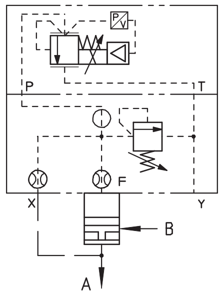
LIRZO-R-1÷3
LIRZO-R-4 /P



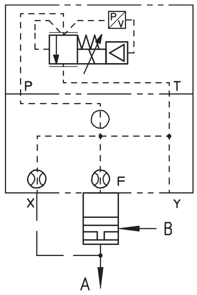
LIRZO-R-4



LIRZO-REB(RES)-1÷3
LIRZO-REB(RES)-4 /P



LIRZO-REB(RES)-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	*	/	*

Cartridge according to ISO 7368

Cartridge size ISO 7368:
16; **25**; **32**; **40**; **50**; **63**; **80**

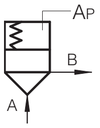
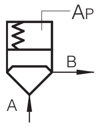
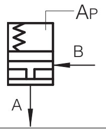
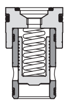
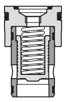
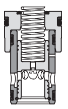
Type of poppet:
31 = for LIMZO and LICZO
36 = for LICZO
37 = for LIRZO

Series number

Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

4 TYPE OF POPPET

Type of poppet	31	36	37
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	**1:1**	**1:1**	**1:1**

5 **OFF-BOARD ELECTRONIC DRIVER** - only for **R**

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS

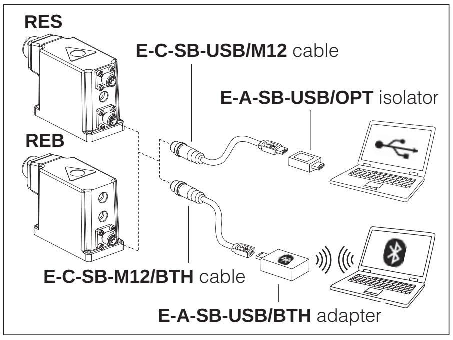
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

8 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**R:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **REB, RES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**R:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **REB, RES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	LICZO					LIMZO							LIRZO			
valve size	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow [l/min]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pres. at port A [bar]	9	8,5	8	13	15	7	7	7	10,5	12	12	12	7			
Min regulated pres. at port A for /350 [bar]	11	10	10	13	16	10	10	9	12	13	13	16	12			
Max regulated pres. at port A [bar]	100; 210; 315; 350					100; 210; 315; 350							100; 210; 315; 350			
Response time 0-100% step signal (depending on installation) **(1)** [ms]	80 ÷ 300					80 ÷ 350							80 ÷ 200			
Hysteresis [% of the regulated max flow]	≤ 0,5															
Linearity [% of the regulated max flow]	≤ 1,0															
Repeatability [% of the regulated max flow]	≤ 0,2															
Thermal drift	zero point displacement < 1% at ΔT = 40°C															

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 5

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 18 .

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**R** = 30 W **REB**, **RES** = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**R** = IP65; **REB**, **RES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 22			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

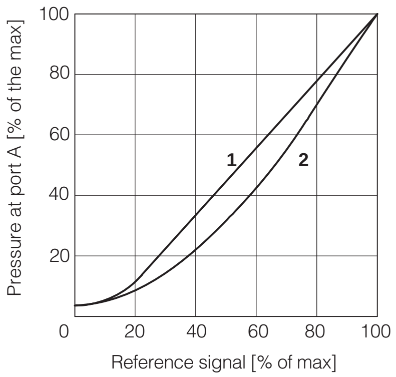
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **R**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

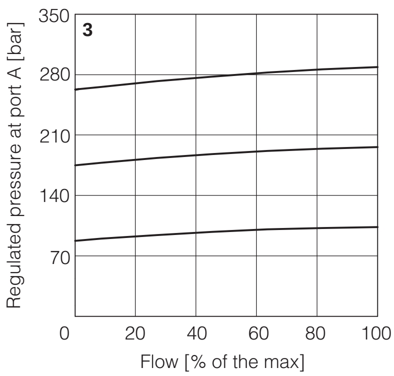
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

1 Regulation diagrams LIMZO
2 Regulation diagrams LICZO

3 Pressure/flow diagrams LICZO, LIMZO

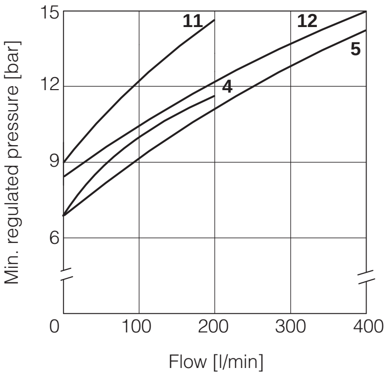


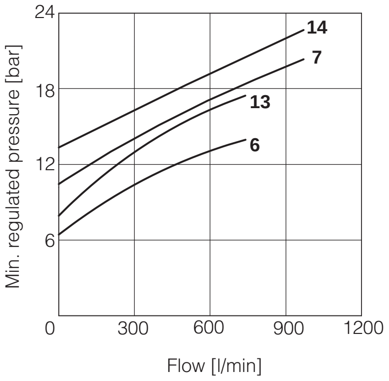


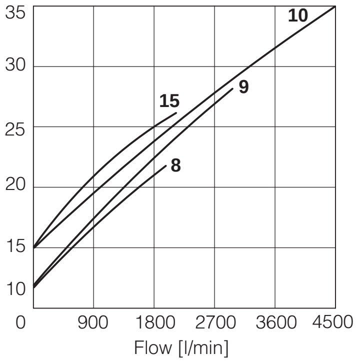
4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZO-*-1
5 = LIMZO-*-2
6 = LIMZO-*-3
7 = LIMZO-*-4
8 = LIMZO-*-5
9 = LIMZO-*-6
10 = LIMZO-*-8

11 = LICZO-*-1
12 = LICZO-*-2
13 = LICZO-*-3
14 = LICZO-*-4
15 = LICZO-*-5





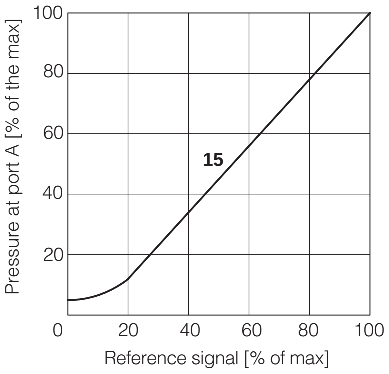


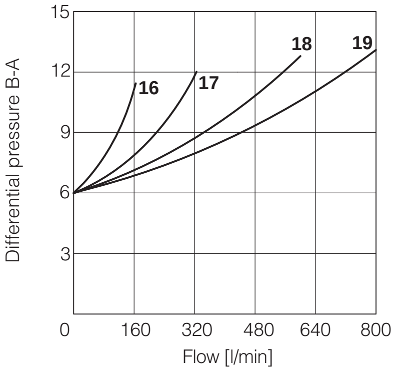
Regulation diagrams LIRZO

15 = LIRZO-A

16-19 Min. pressure/flow diagrams
with reference signal "null"

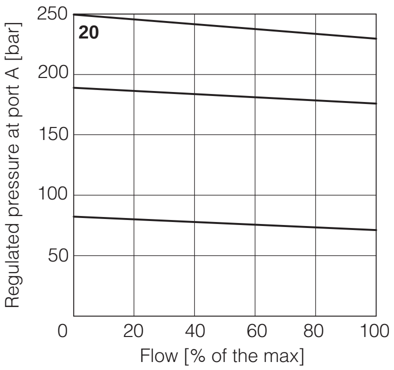
16 = LIRZO-*-1
17 = LIRZO-*-2
18 = LIRZO-*-3
19 = LIRZO-*-4





Pressure/flow diagrams

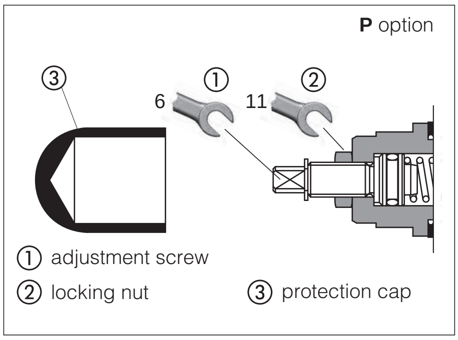
20 = LIRZO-A



14 HYDRAULIC OPTIONS

P = This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



15 ELECTRONIC OPTIONS - only for **REB** and **RES**

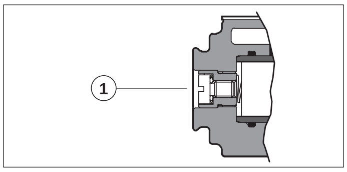
I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 20.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 20.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 20.2

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible; **Electronics options**: /IQ, /IZ



17 AIR BLEEDING

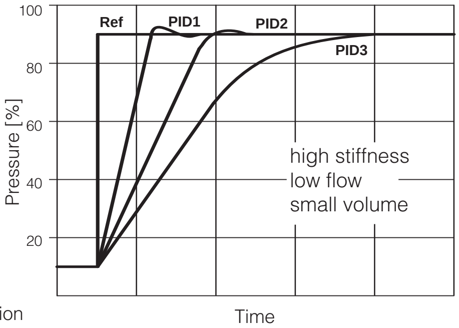
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

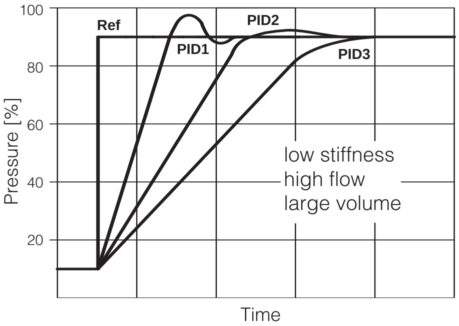
18 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop

(1) interchangeable with previous TERS version





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

19 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

20.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

20.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

20.6 Fault output signal (FAULT) - only for **/Z** option

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

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**P_INPUT+**		Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for P_INPUT+	Input - analog signal
F	**P_MONITOR** referred to: AGND	V0	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

21.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**P_INPUT+**	Pressure reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 Communication connectors - for REB (B) and RES (B) - (C)

(B)	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1)	**BC fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

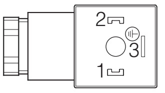
(C2)	**BP fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4)	**EH fieldbus execution, connector - M12 - 4 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

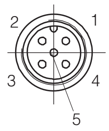
(1) Shield connection on connector's housing is recommended

(2) Only for **RES** execution

21.4 Solenoid connection - only for R

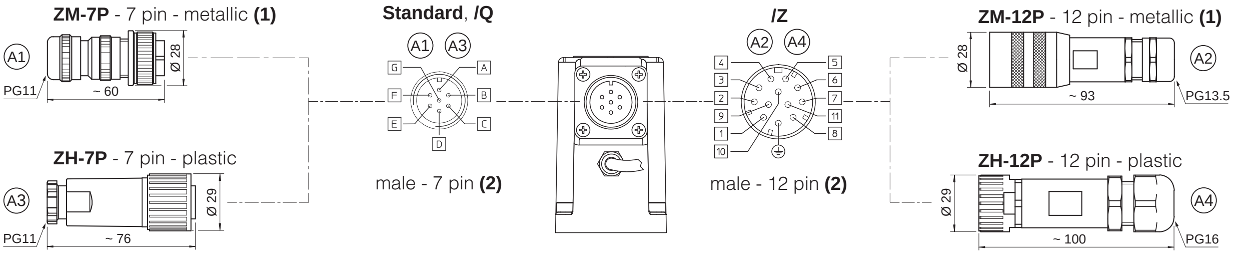
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

21.5 Pressure transducer connection - only for R

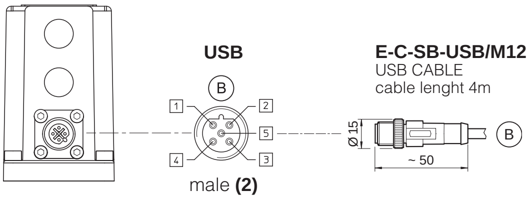
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	**V+**	Power supply	
2	**NC**	Not connected	
3	**TR**	Output signal 4 ÷ 20 mA	
4	**NC**	Not connected	
5	**NC**	Not connected	

21.6 REB connections layout

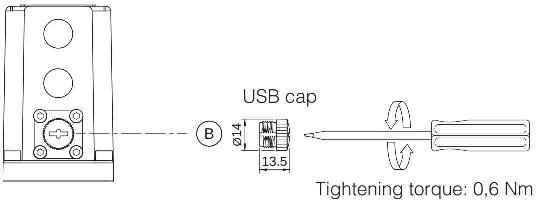
MAIN CONNECTORS



USB CONNECTOR



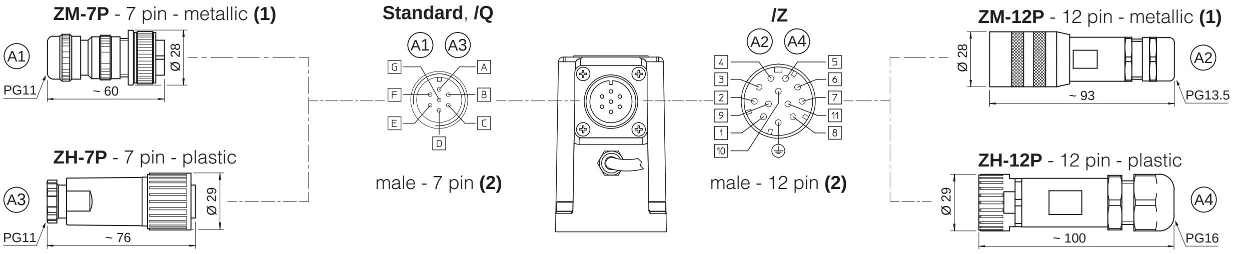
PLASTIC PROTECTION CAPS - supplied with the valves



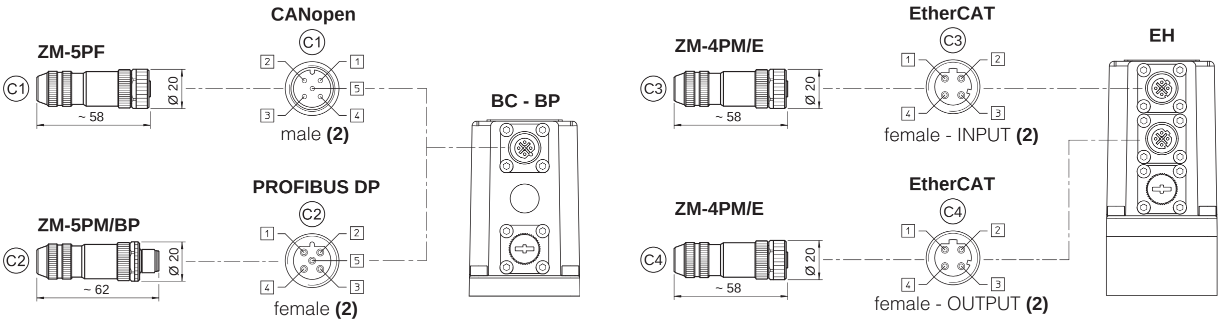
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

21.7 RES connections layout

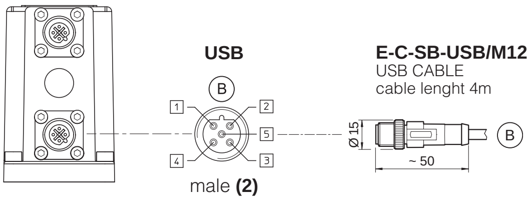
MAIN CONNECTORS



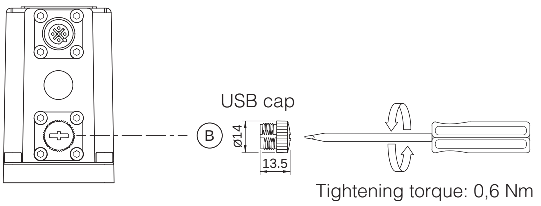
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

22 **CONNECTORS CHARACTERISTICS** - to be ordered separately

22.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

22.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

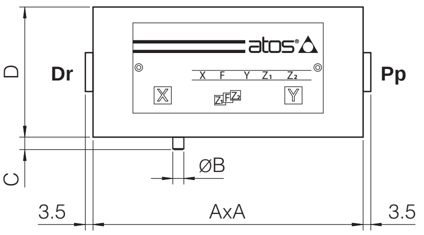
(2) Internally terminated

23 **FASTENING BOLTS AND SEALS**

Type	**Size**	**Fastening bolts**	**Seals**
LIMZO **LICZO** **LIRZO**	**1** = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO **LICZO**	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO	**6** = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

24 **COVERS DIMENSIONS [mm]**

Size	**AxA**	**ØB**	**C**	**D**	**Port Pp - Dr**
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4”
5 = 50	140x140	6	4	70	G 1/4”
6 = 63	180x180	6	4	80	G 3/8”
8 = 80	ø250	8	6	80	G 3/8”



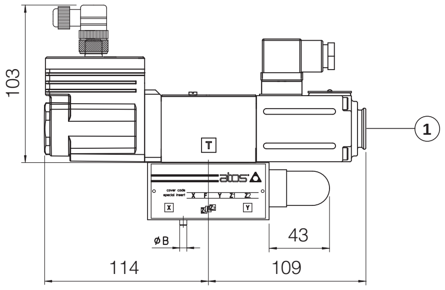
Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

25 COVERS INSTALLATION DIMENSIONS [mm]

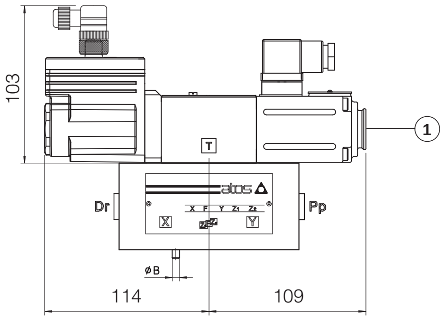
Version **R** for off-board driver

Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	3,8	-	0,2
2 = 25	4,3	-	0,5
3 = 32	5,6	-	0,9
4 = 40	11,0	12,0	1,7
5 = 50	14,5	15,5	2,9
6 = 63	24,0	25,0	6,7
8 = 80	32,6	33,6	13,1

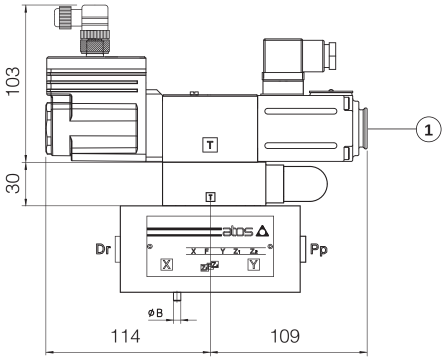
LICZO-R-1 LIMZO-R-1 LIRZO-R-1
LICZO-R-2 LIMZO-R-2 LIRZO-R-2
LICZO-R-3 LIMZO-R-3 LIRZO-R-3



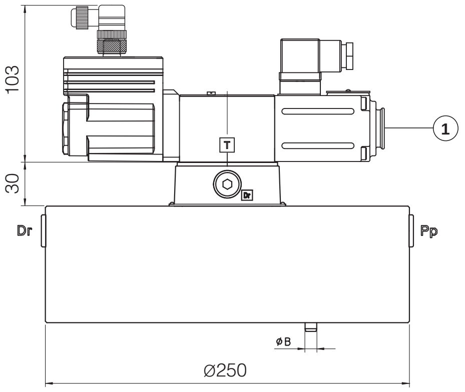
LICZO-R-4 LIMZO-R-4 LIRZO-R-4
LICZO-R-5 LIMZO-R-5
LIMZO-R-6



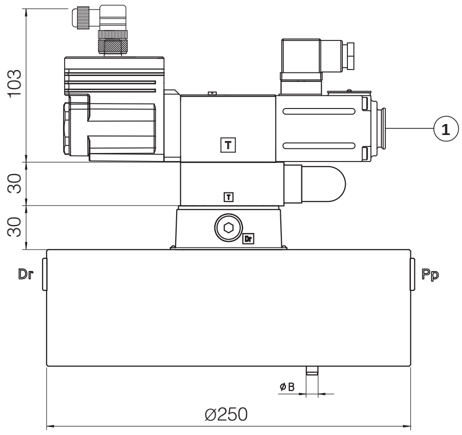
LICZO-R-4/P LIMZO-R-4/P LIRZO-R-4/P
LICZO-R-5/P LIMZO-R-5/P
LIMZO-R-6/P



LIMZO-R-8



LIMZO-R-8/P



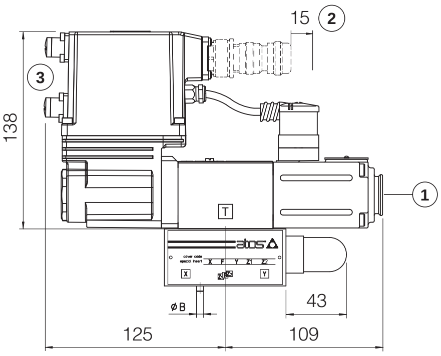
① = Air bleeding, see section 17

Note: for mounting surface and cavity dimensions, see tech. table P006

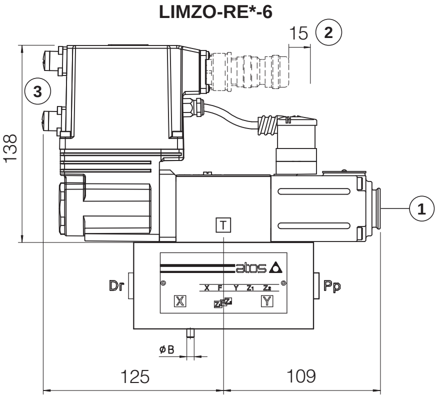
Versions **REB** and **RES** for on-board driver

Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,3	-	0,2
2 = 25	4,8	-	0,5
3 = 32	6,1	-	0,9
4 = 40	11,5	12,5	1,7
5 = 50	15,0	16,0	2,9
6 = 63	24,5	25,5	6,7
8 = 80	33,1	34,1	13,1

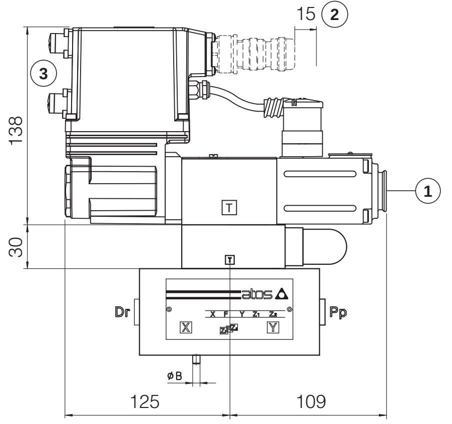
LICZO-RE*-1 LIMZO-RE*-1 LIRZO-RE*-1
LICZO-RE*-2 LIMZO-RE*-2 LIRZO-RE*-2
LICZO-RE*-3 LIMZO-RE*-3 LIRZO-RE*-3



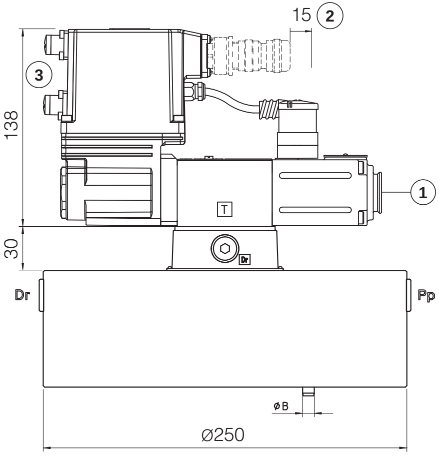
LICZO-RE*-4 LIMZO-RE*-4 LIRZO-RE*-4
LICZO-RE*-5 LIMZO-RE*-5
LIMZO-RE*-6



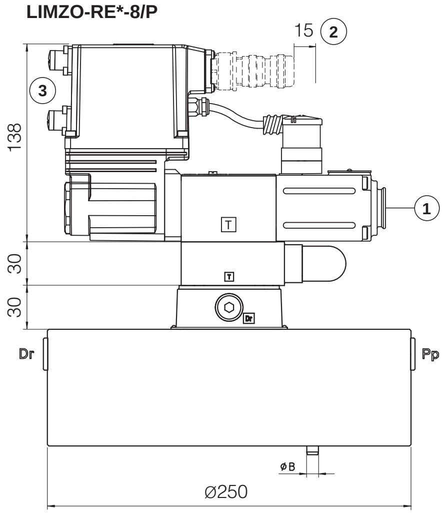
LICZO-RE*-4/P LIMZO-RE*-4/P LIRZO-RE*-4/P
LICZO-RE*-5/P LIMZO-RE*-5/P
LIMZO-RE*-6/P



LIMZO-RE*-8



LIMZO-RE*-8/P

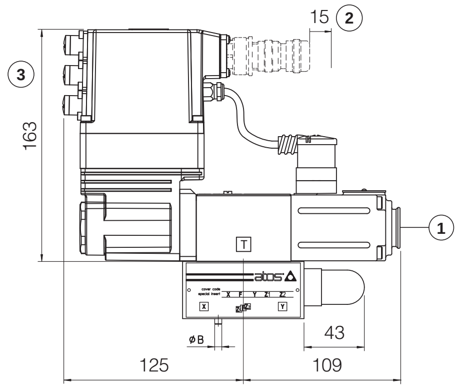


① = Air bleeding, see section 17
② = Space to remove the connectors
③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

Note: for mounting surface and cavity dimensions, see tech. table P006

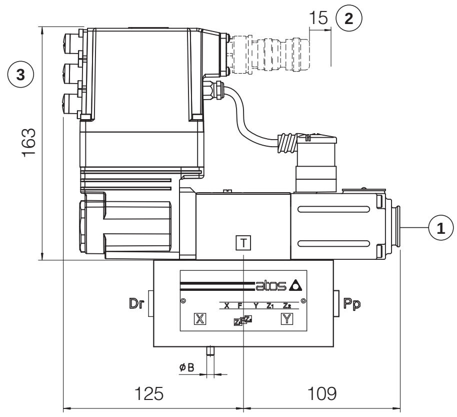
Version **RES-EH** for on-board driver

LICZO-RES-EH-1 LIMZO-RES-EH-1 LIRZO-RES-EH-1
LICZO-RES-EH-2 LIMZO-RES-EH-2 LIRZO-RES-EH-2
LICZO-RES-EH-3 LIMZO-RES-EH-3 LIRZO-RES-EH-3

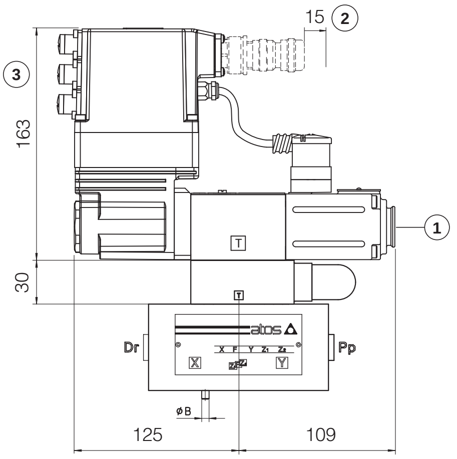


Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,4	-	0,2
2 = 25	4,9	-	0,5
3 = 32	6,2	-	0,9
4 = 40	11,6	12,6	1,7
5 = 50	15,1	16,1	2,9
6 = 63	24,6	25,6	6,7
8 = 80	33,2	34,2	13,1

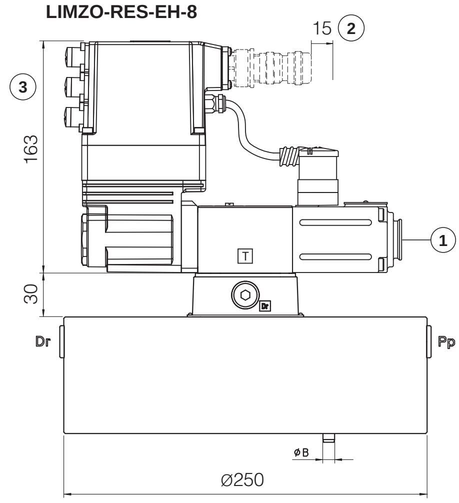
LICZO-RES-EH-4 LIMZO-RES-EH-4 LIRZO-RES-EH-4
LICZO-RES-EH-5 LIMZO-RES-EH-5
LIMZO-RES-EH-6



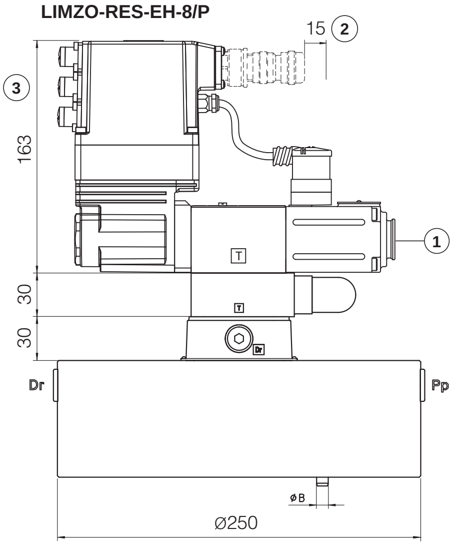
LICZO-RES-EH-4/P LIMZO-RES-EH-4/P LIRZO-RES-EH-4/P
LICZO-RES-EH-5/P LIMZO-RES-EH-5/P
LIMZO-RE*-6/P



LIMZO-RES-EH-8



LIMZO-RES-EH-8/P



① = Air bleeding, see section 17
② = Space to remove the connectors
③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

Note: for mounting surface and cavity dimensions, see tech. table P006

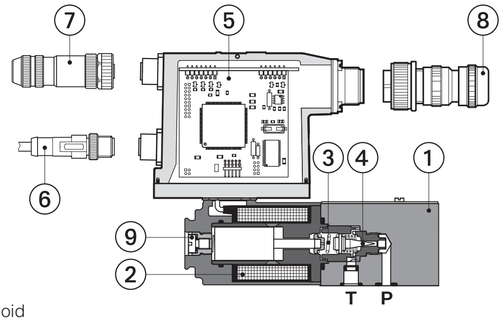
26 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS203	E-BM-RES digital driver	**QB420**	Quickstart for REB valves commissioning
GS500	Programming tools	**QF420**	Quickstart for RES valves commissioning
GS510	Fieldbus		

Digital proportional relief valves

direct, without transducer

CE



① Valve body
② Proportional solenoid
③ Spring
④ Poppet
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air bleeding

RZMO-AES-BC-010

RZMO-A , RZMO-AEB, RZMO-AES

Poppet type, direct, digital proportional relief valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **4 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO - **AEB** - **NP** - **010** / **210** / ***** / ***** ***** / *****

Proportional pressure relief valve, direct

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Series number

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

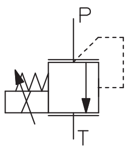
Max regulated pressure (5):
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350= 350 bar

Configuration:
010 = regulation on port P, discharge in T (direct operated version)

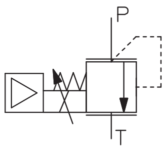
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ
(5) Special execution with max regulated pressure **500 bar** available on request

2 HYDRAULIC SYMBOLS

RZMO-A



RZMO-AEB RZMO-AES



3 **OFF-BOARD ELECTRONIC DRIVERS** - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 **GENERAL NOTES**

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 **VALVE SETTINGS AND PROGRAMMING TOOLS**

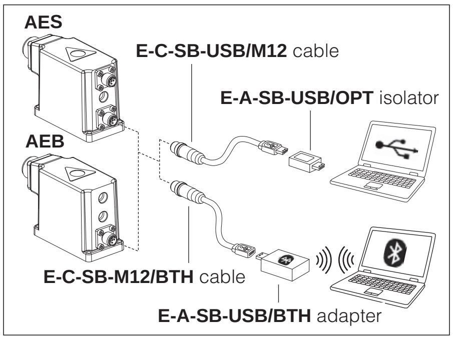
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 **FIELDBUS** - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 **GENERAL CHARACTERISTICS**

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 **HYDRAULIC CHARACTERISTICS** - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-010**
Max regulated pressure	[bar]	50; 100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Max flow	[l/min]	4
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 70
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

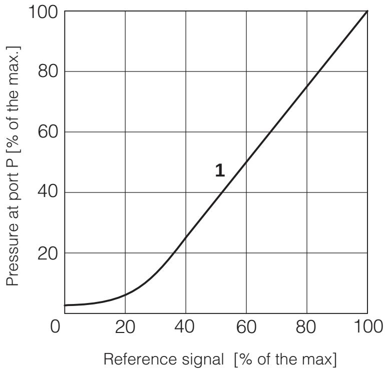
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

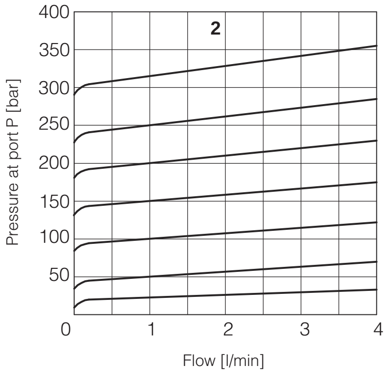
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

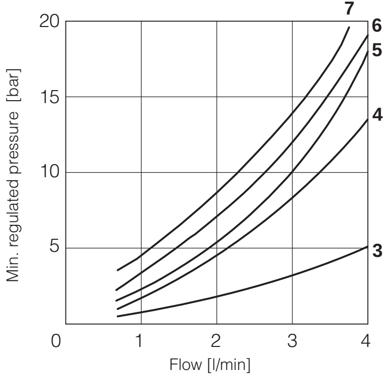
1 **Regulation diagrams**
with flow rate Q = 1 l/min



2 **Pressure/flow diagrams**
with reference signal set at Q = 1 l/min



3-6 **Min. pressure/flow diagrams**
with zero reference signal



3 = RZMO/50 **4 =** RZMO/100
5 = RZMO/210 **6 =** RZMO/315
7 = RZMO/350

Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

12 ELECTRONIC OPTIONS - only for AEB and AES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

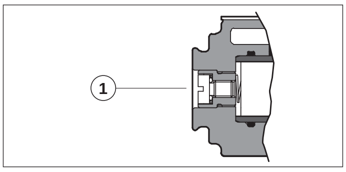
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

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

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **AEB** and **AES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) **/Z** option - for **AEB** and **AES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for **AEB** (B) and **AES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

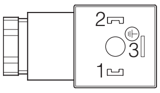
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for **A**

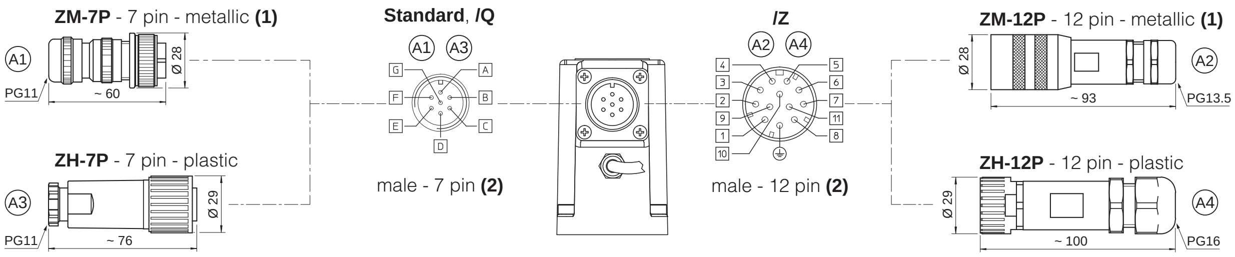
PIN	SIGNAL	TECHNICAL SPECIFICATION
1	**COIL**	Power supply
2	**COIL**	Power supply
3	**GND**	Ground

Connector code 666

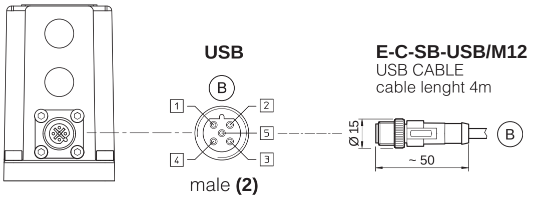


17.5 AEB connections layout

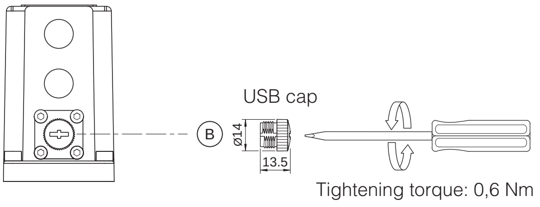
MAIN CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves

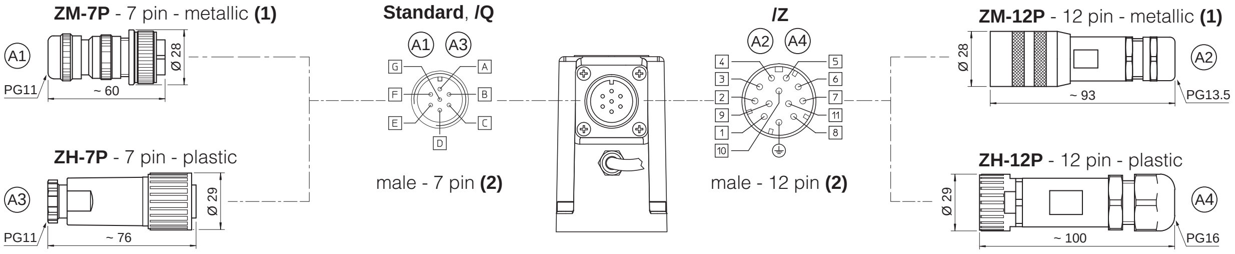


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

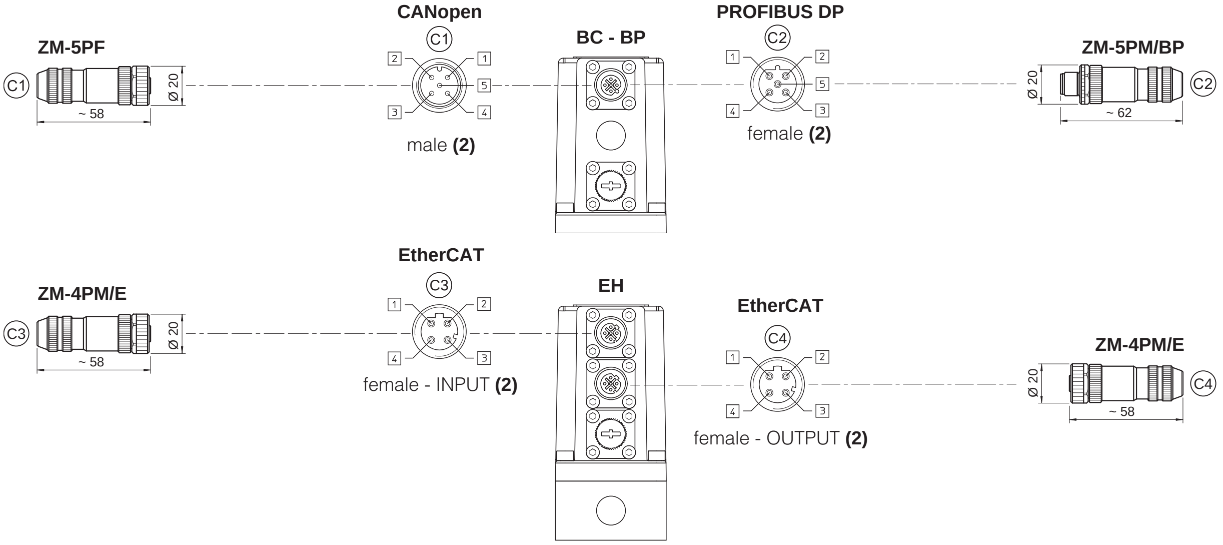
(2) Pin layout always referred to driver's view

17.6 AES connections layout

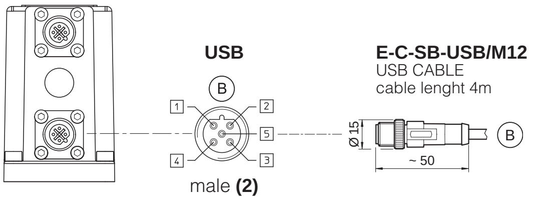
MAIN CONNECTORS



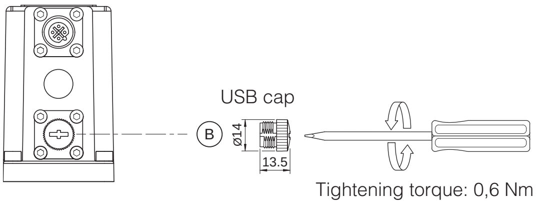
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

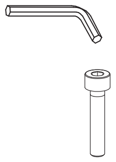
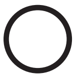
18.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

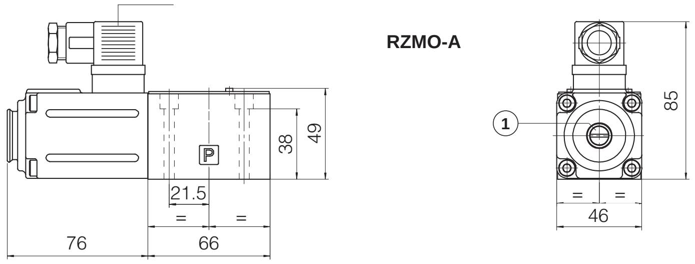
19 FASTENING BOLTS AND SEALS

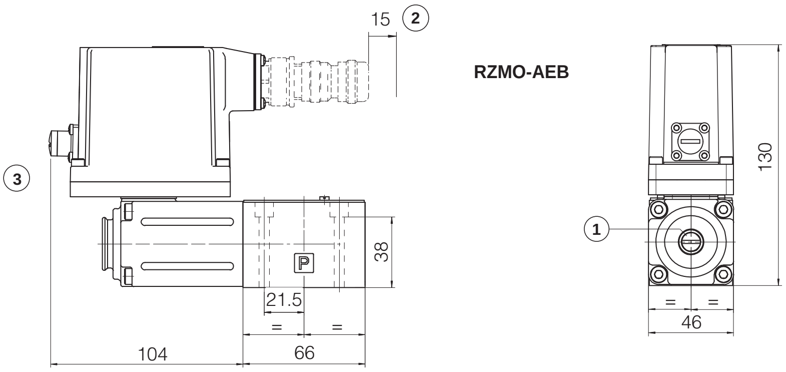
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm

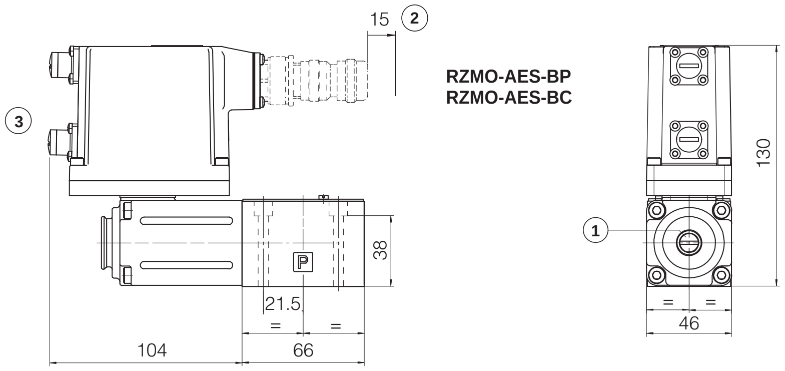
20 INSTALLATION DIMENSIONS [mm]

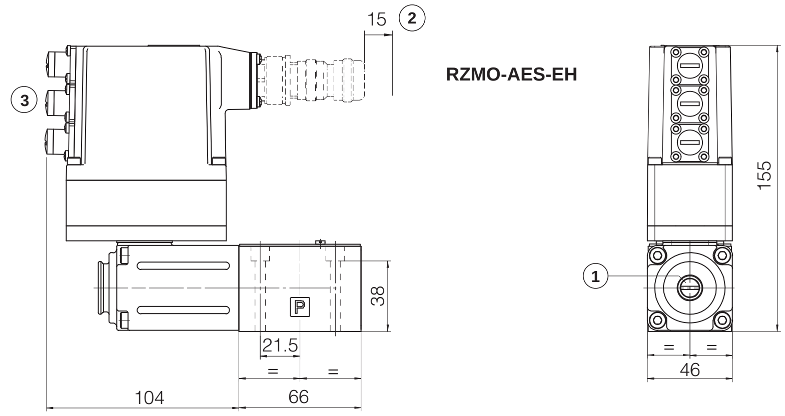
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
1,8	2,3	2,4


RZMO-A


RZMO-AEB


RZMO-AES-BP
RZMO-AES-BC


RZMO-AES-EH

① = Air bleeding, see section 15
② = Space to remove the connectors
③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

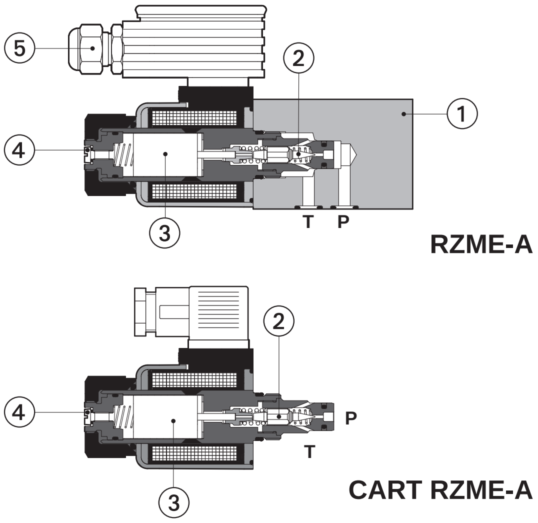
21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
G010	E-MI-AC analog driver	**P005**	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	**QB200**	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	**QF200**	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Proportional relief valves

direct, without transducer

CE



① Valve body
② Poppet
③ Proportional solenoid
④ Screw for air bleeding
⑤ E-MI-AS-IR digital driver (to be ordered separately)

RZME-A, CART RZME-A

Poppet type, direct, proportional pressure relief valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They are available in following executions:
RZME: subplate mounting, ISO size 06
CART RZME: M20 cartridge execution

The solenoids are certified according to North American standard **cURus**.

Size: **06** - ISO 4401 (RZME); **M20** (CART RZME)
Max flow: **4 l/min**
Max pressure: **350 bar**
For cavity CART RZME see section 16

1 MODEL CODE

RZME - **A** - **010** / **315** - ***** / ***** ***** / *****

Proportional
pressure relief valve, direct

RZME = subplate mounting
CART RZME = cartridge execution

A = for off-board driver, see section 3

Configuration:
010 = reduced pressure on port A, discharge in T

Max regulated pressure:
32 = 32 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Coil voltage, see section 10 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers **(1)**

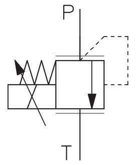
Series number

Seals material,
see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL

RZME-A
CART RZME-A



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F **(1)**		E-MI-AS-IR **(1)**		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

(1) For **CART RZME** the electronic driver may interfere with the manifold surface.
Please check the installation dimensions at section 16

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	150 years, see technical table P007		
Ambient temperature range	**Standard** = -20°C ÷ +70°C	**/PE** option = -20°C ÷ +70°C	**/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C	**/PE** option = -20°C ÷ +80°C	**/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

6 HYDRAULIC CHARACTERISTICS

Valve model	**RZME-A-010**
Max regulated pressure	50; 100; 210; 315; 350;
Min. regulated pressure [bar]	see min. pressure / flow diagrams at section 9
Max. pressure at port P [bar]	350
Max. pressure at port T [bar]	210
Max. flow [l/min]	4
Response time 0-100% step signal **(1)** [ms] (depending on installation)	≤ 70
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

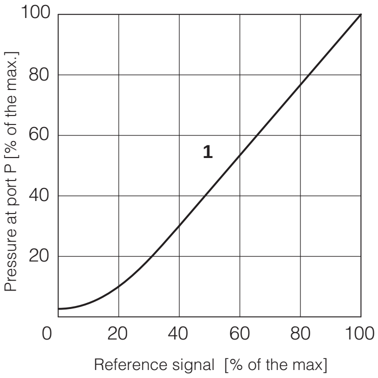
8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

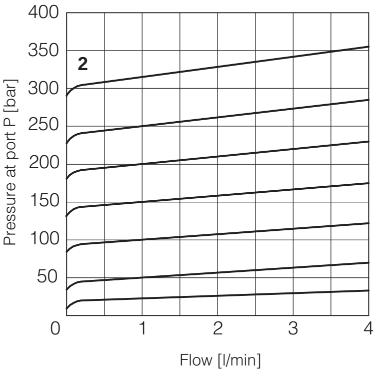
9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

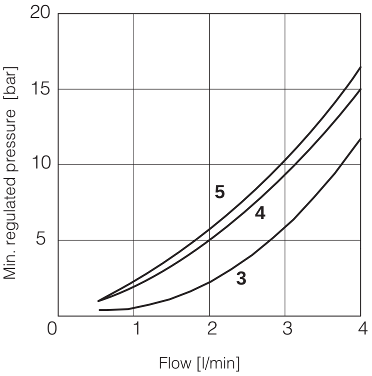


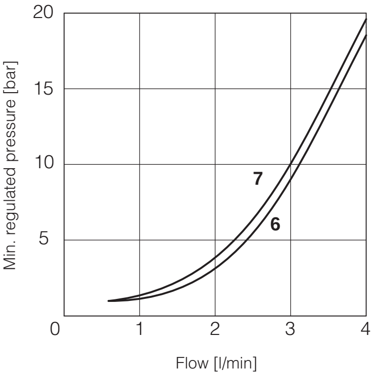
2 = Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-7 = Min. pressure/flow diagrams
with zero reference signal

3 = pressure range: 50
4 = pressure range: 100
5 = pressure range: 210
6 = pressure range: 315
7 = pressure range: 350





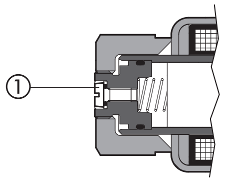
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

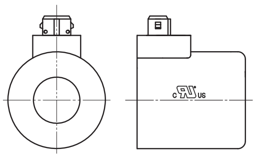
11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

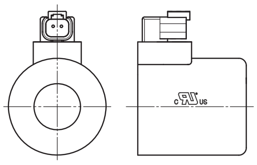


12 COILS WITH SPECIAL CONNECTORS

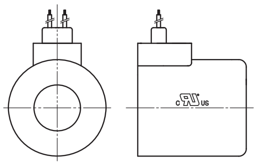
J option
Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



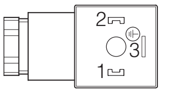
K option
Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67



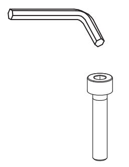
S option
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

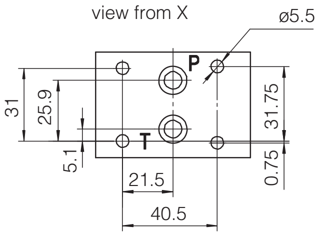
14 FASTENING BOLTS AND SEALS FOR RZME

	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	Seals: 2 OR 108 Diameter of ports P, T: Ø 5 mm

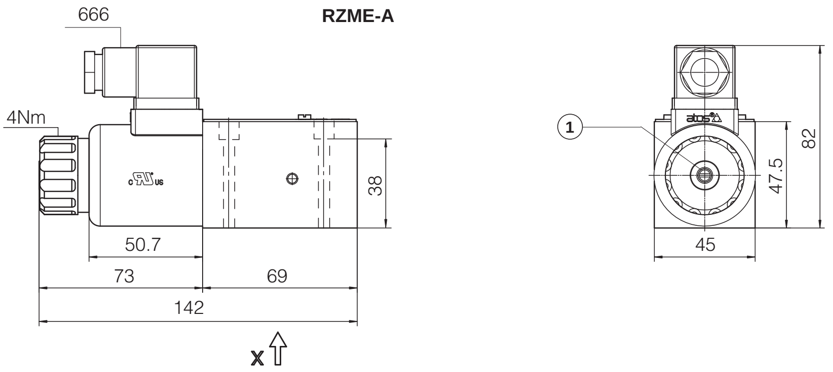
15 INSTALLATION DIMENSIONS FOR RZME [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

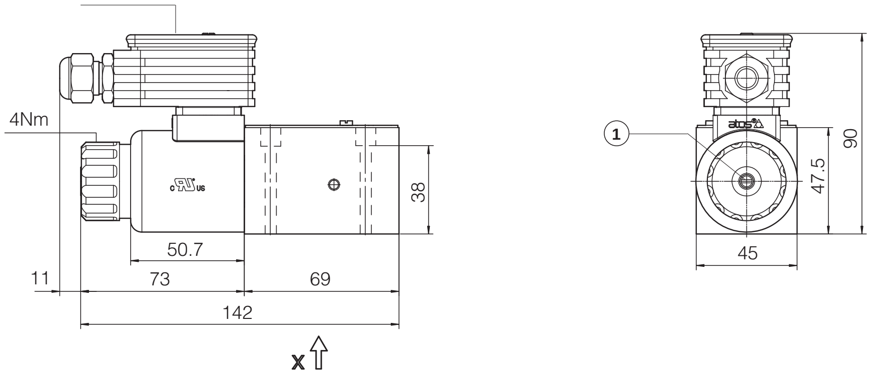
Mass [kg]	
RZME	1,5
RZME with E-MI-AS-IR	2,0

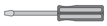


RZME-A



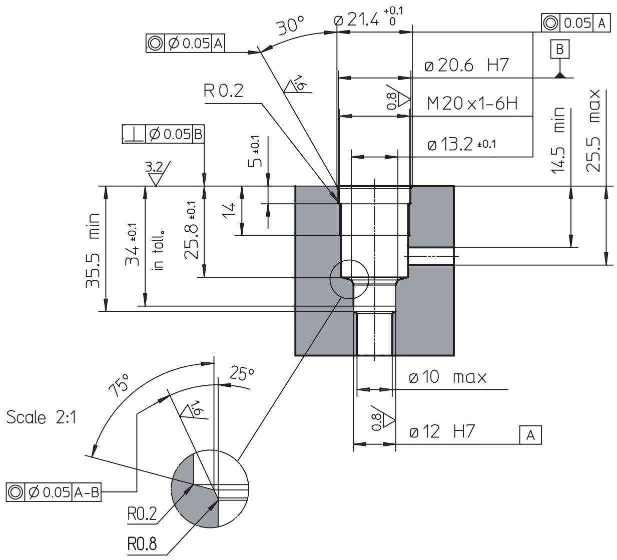
RZME-A
(with digital driver E-MI-AS-IR)



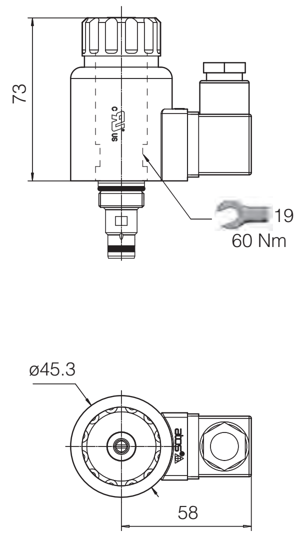
(1) = Air bleeding, see section 11 

16 INSTALLATION DIMENSIONS FOR CART RZME [mm]

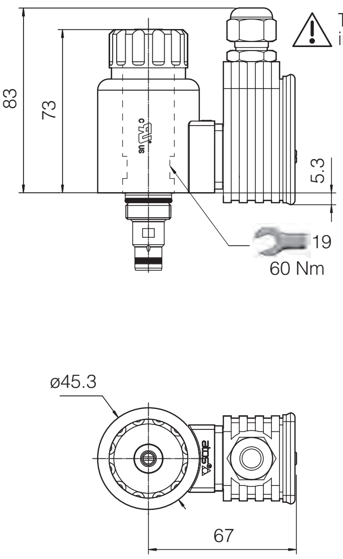
Cavity dimensions for **CART RZME-A**



CART RZME-A



CART RZME-A
(with E-MI-AS-IR digital driver)



⚠ To be checked for eventual interference with the manifold surface

Mass [kg]	
CART RZME	0,6
CART RZME with E-MI-AS-IR	1,1

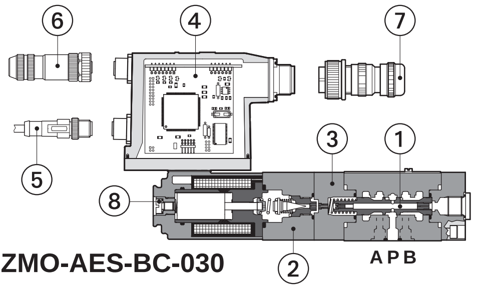
17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS050**	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

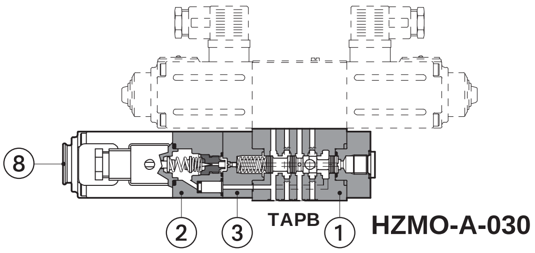
Digital proportional relief valves

piloted, without transducer, subplate or modular mounting

CE



RZMO-AES-BC-030



HZMO-A-030

① Main spool
② Proportional pilot relief valve
③ Pilot flow compensator
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector
⑧ Screw for air blending

RZMO-A , RZMO-AEB, RZMO-AES HZMO-A

Spool type piloted digital proportional reducing valves for pressure open loop controls, available in subplate or modular mounting.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **40 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZMO - **AEB** - **NP** - **030** / **210** / * / * * / *

Proportional pressure relief valve, piloted
RZMO = subplate
HZMO = modular

A = for off-board driver, see section 3

Only for **RMZO**:
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Configuration:
030 = regulation on port P, discharge in T (pilot operated version)

Max regulated pressure:
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

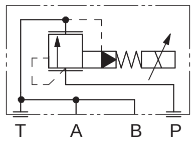
Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

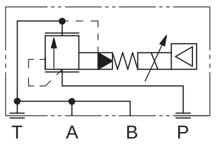
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

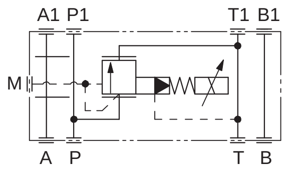
RZMO-A



RZMO-AEB RZMO-AES



HZMO-A



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

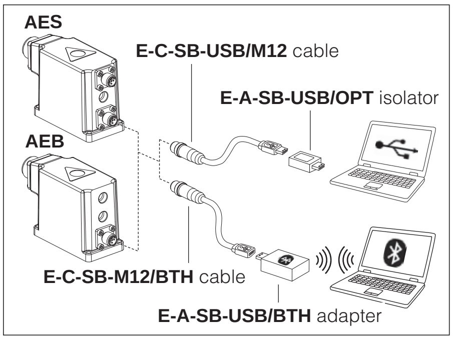
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZMO-*-030, HZMO-A-30**
Max regulated pressure	[bar]	50; 100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 11
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 60
Hysteresis		≤ 2 [% of max pressure]
Linearity		≤ 3 [% of max pressure]
Repeatability		≤ 2 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

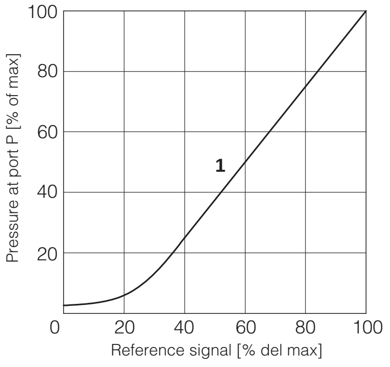
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

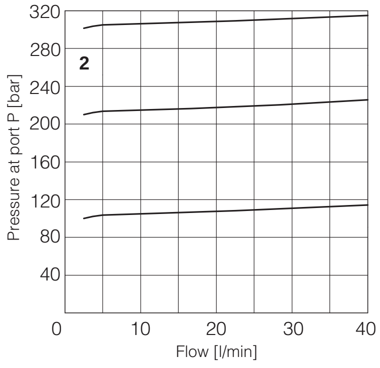
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

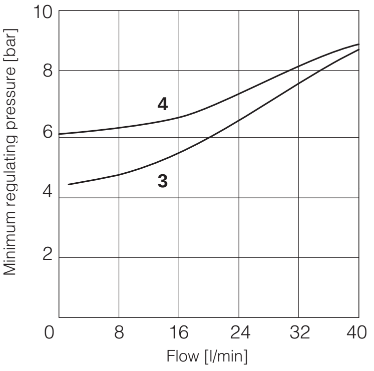
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = All the models (except /350)
4 = All the models (only /350)

Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

12 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

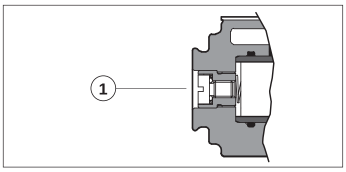
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

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

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**	▨	Analog ground	Gnd - analog signal
	▨	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

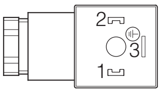
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

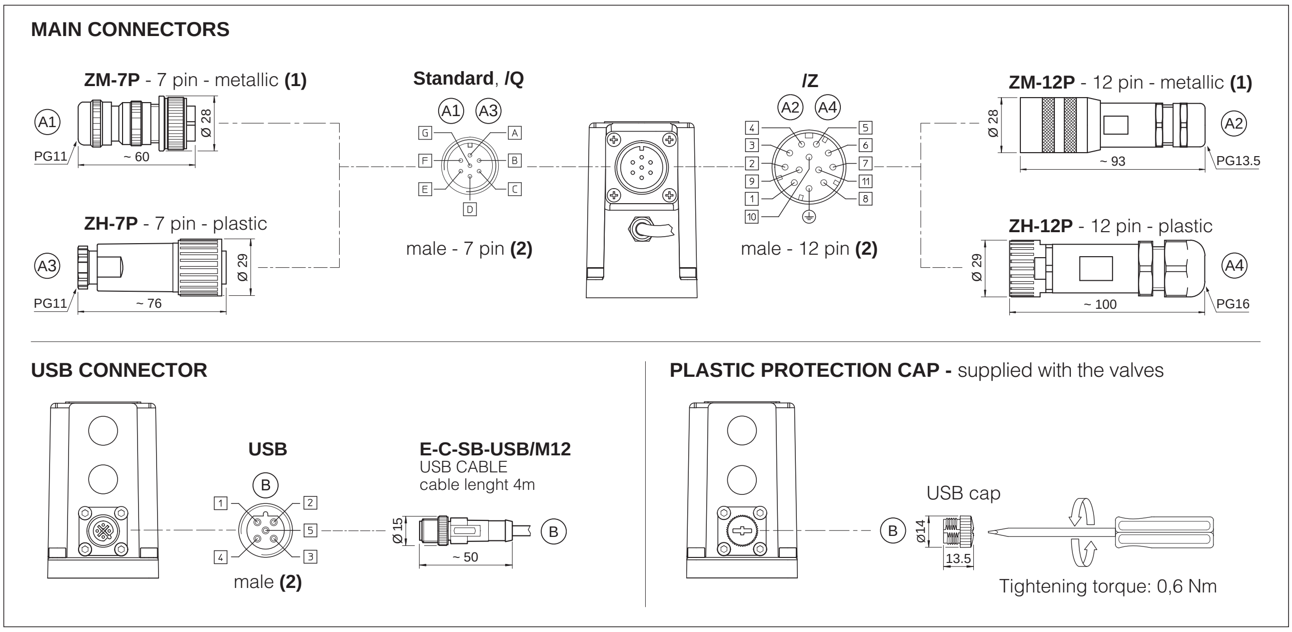
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

17.4 Solenoid connection - only for A

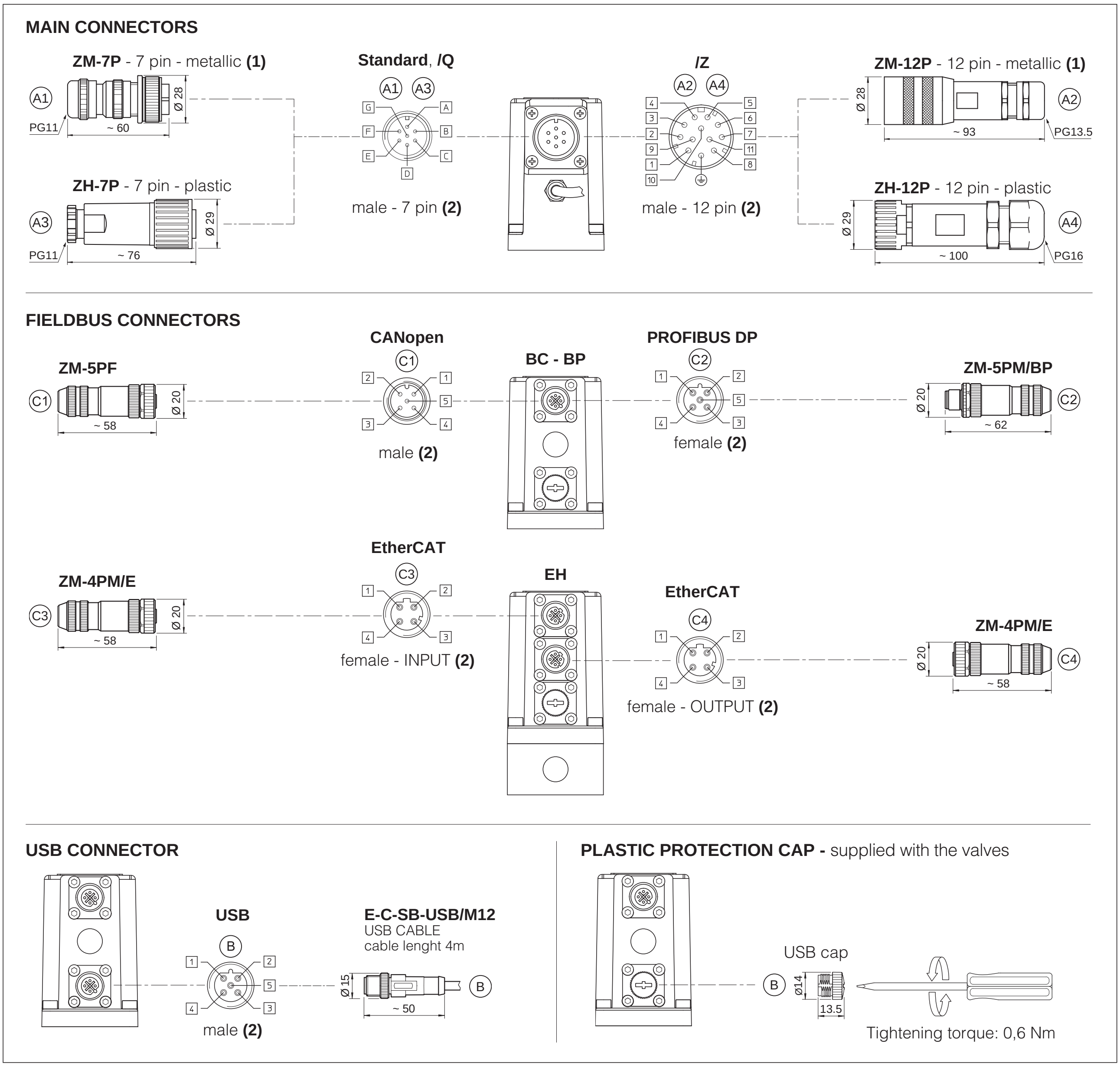
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver’s view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver’s view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

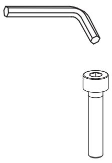
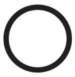
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

	RZMO	**HZMO**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** Not available
	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm Ports A, B connected to port T	**Seals:** 4 OR 108 Diameter of ports P, T, A, B: Ø 6,5 mm

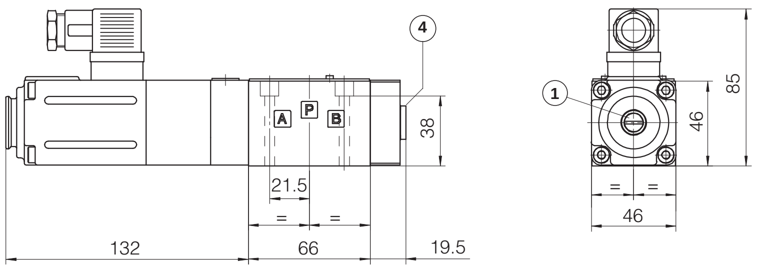
21 INSTALLATION DIMENSIONS [mm]

RZMO

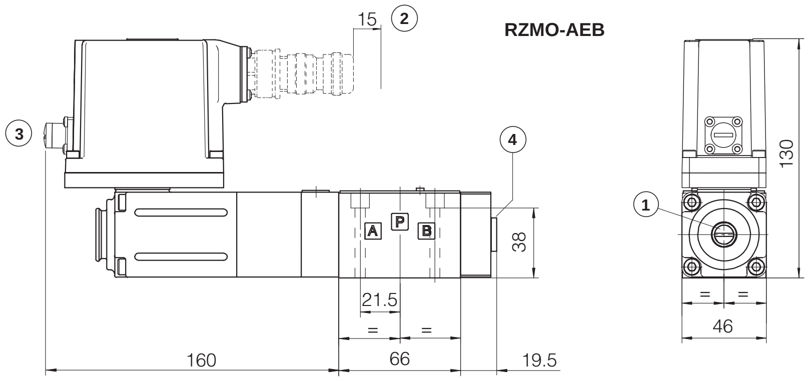
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
2,8	3,3	3,4

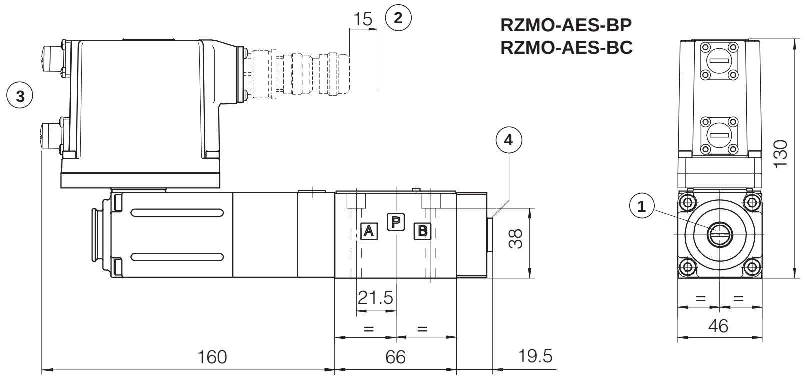
RZMO-A



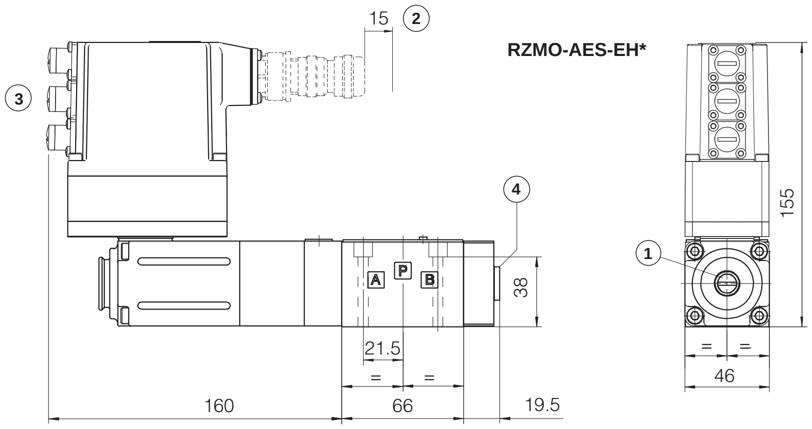
RZMO-AEB



RZMO-AES-BP
RZMO-AES-BC



RZMO-AES-EH*

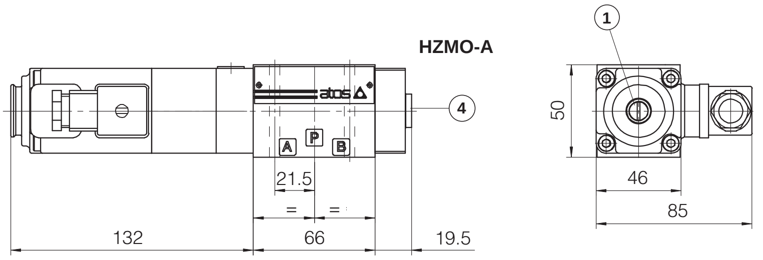


HZMO

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]
A
2,8

HZMO-A



① = Air bleeding, see section 15

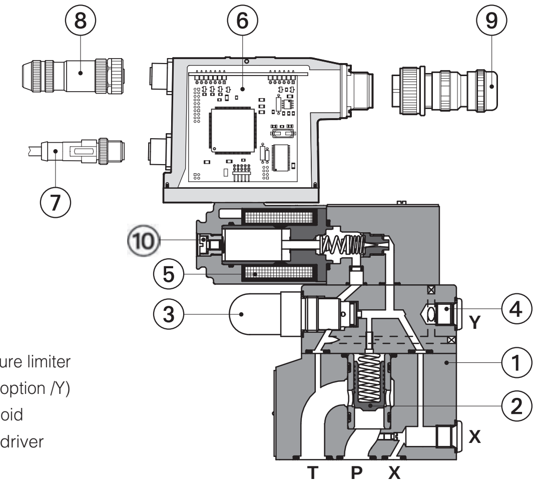
② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

④ = Pressure gauge port = G1/4"

Digital proportional relief valves

piloted, without transducer



① Main valve body
② Main poppet
③ Mechanical pressure limiter
④ Drain port G1/4" (option /Y)
⑤ Proportional solenoid
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air bleeding

AGMZO-AES-BC-10

AGMZO-A, AGMZO-AEB, AGMZO-AES

Poppet type, piloted, digital proportional relief valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10**, **20**, **32** - ISO 6264
Max flow: **200**, **400**, **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGMZO	-	**AES**	-	**BC**	-	**10**	/	**315**	/	*	/	*	*	/	*

Proportional pressure relief valve, piloted

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:

NP = Not present
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

Hydraulic options (4):
E = external pilot
Y = external drain (only pipe connection G ¼")

Electronics options, only for **AEB** and **AES (4)**:
I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers

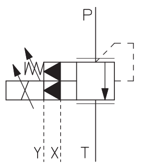
Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

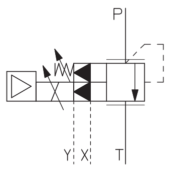
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

AGMZO-A



AGMZO-AEB AGMZO-AES



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

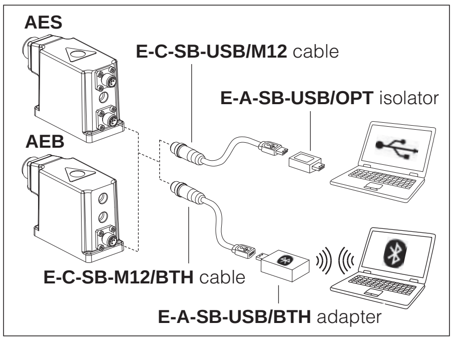
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**AGMZO-*-10**	**AGMZO-*-20**	**AGMZO-*-32**
Max regulated pressure [bar]	50; 100; 210; 315; 350		
Max pressure at port P [bar]	350		
Max pressure at port T [bar]	210		
Min regulated pressure [bar]	see min. pressure / flow diagrams at section 11		
Max flow [l/min]	200	400	600
Response time 0-100% step signal (depending on installation) **(1)** [ms]	≤ 120	≤ 135	≤ 150
Hysteresis	≤ 0,5 [% of max pressure]		
Linearity	≤ 1,0 [% of max pressure]		
Repeatability	≤ 0,2 [% of max pressure]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

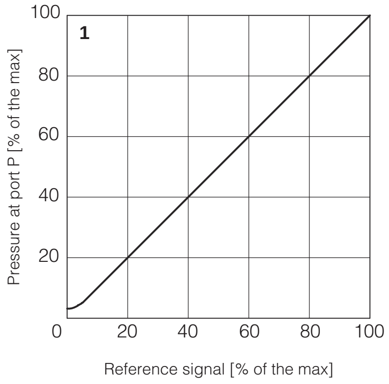
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

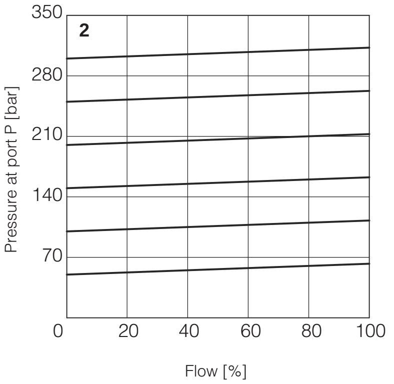
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

1 = Regulation diagrams
with flow rate Q = 50 l/min

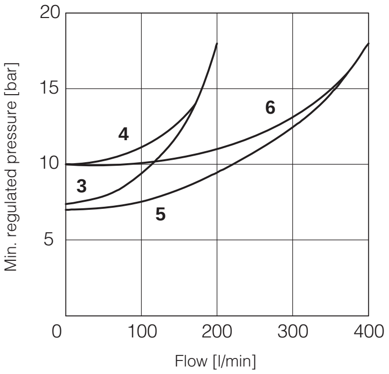


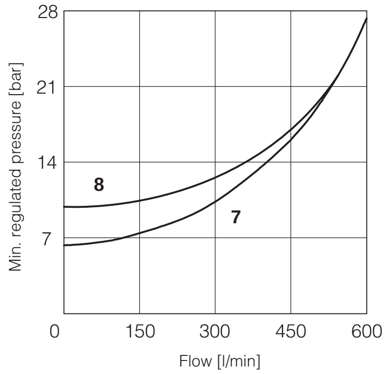
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-8 = Min. pressure/flow diagrams
with zero reference signal

3 = AGMZO-*-10/50, 100, 210, 315
4 = AGMZO-*-10/350
5 = AGMZO-*-20/50, 100, 210, 315
6 = AGMZO-*-20/350
7 = AGMZO-*-32/50, 100, 210, 315
8 = AGMZO-*-32/350

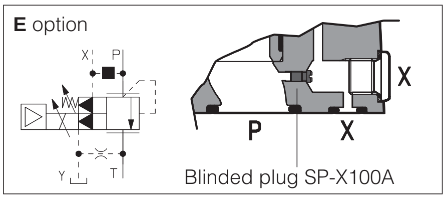


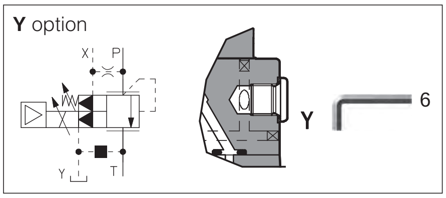


12 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G ¼" available on the pilot stage body.





13 ELECTRONICS OPTIONS - only for AEB and AES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 18.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 18.2

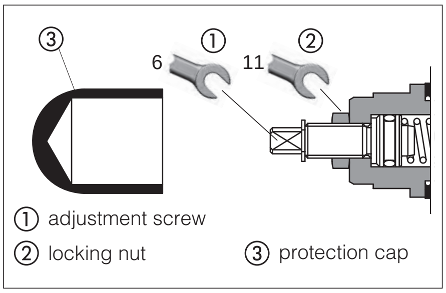
14 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible
Electronics options: /IQ, /IZ

15 MECHANICAL PRESSURE LIMITER

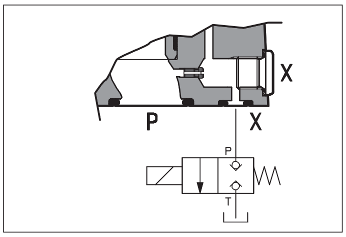
The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



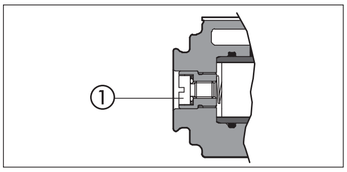
16 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.



17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

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

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**	▨	Analog ground	Gnd - analog signal
	▨	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

19.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 Communication connectors - for AEB Ⓑ and AES Ⓑ - Ⓒ

Ⓑ	**USB connector - M12 - 5 pin** always present	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1)	**BC fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

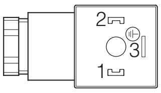
(C2)	**BP fieldbus execution, connector - M12 - 5 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4)	**EH fieldbus execution, connector - M12 - 4 pin (2)**	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION (1)**
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

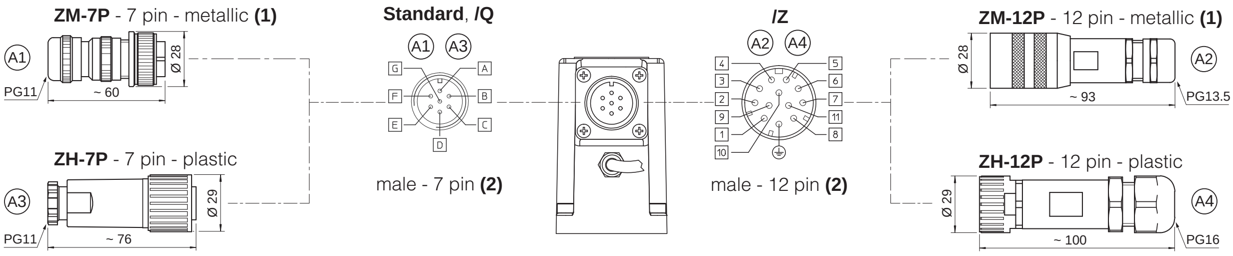
(2) Only for **AES** execution

19.4 Solenoid connection - only for A

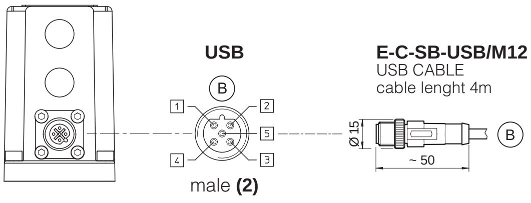
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

19.5 AEB connections layout

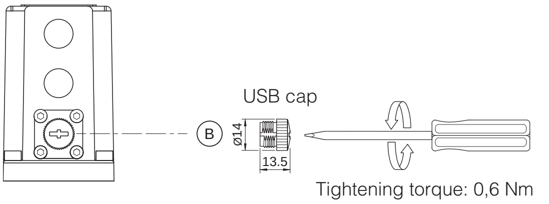
MAIN CONNECTORS



USB CONNECTOR



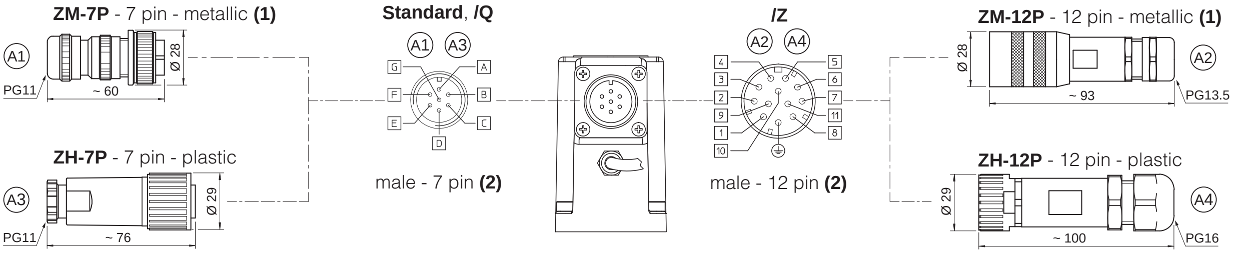
PLASTIC PROTECTION CAP - supplied with the valves



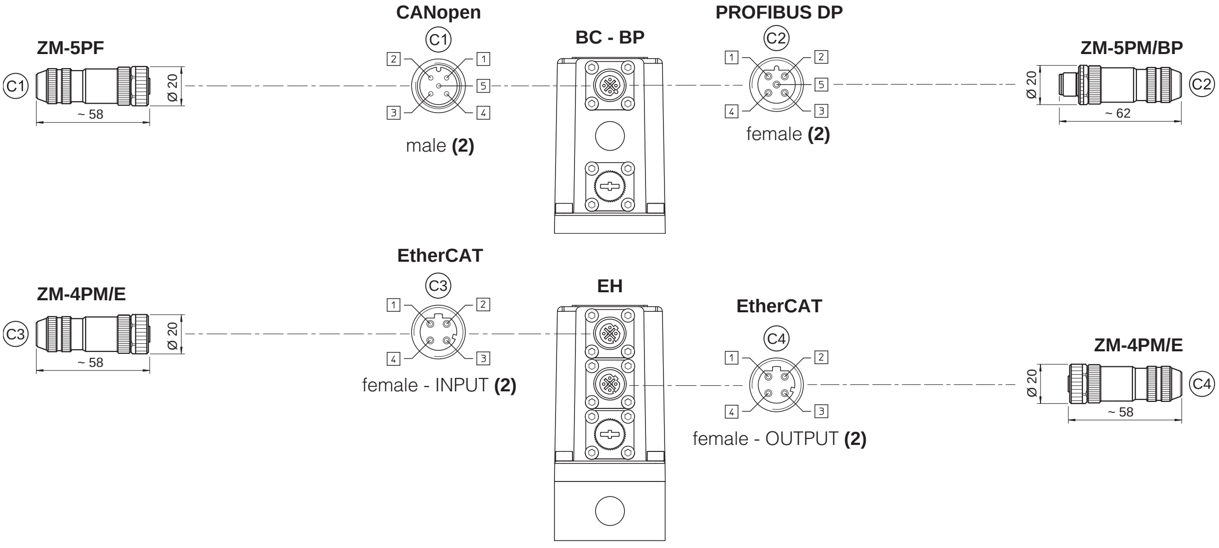
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19.6 AES connections layout

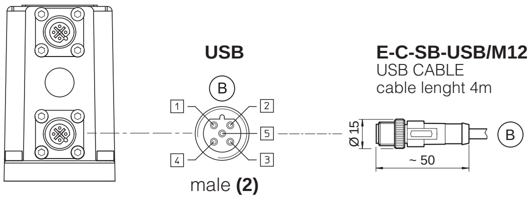
MAIN CONNECTORS



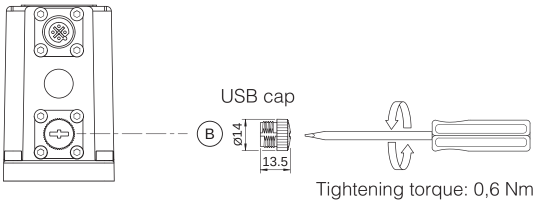
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

20 **CONNECTORS CHARACTERISTICS** - to be ordered separately

20.1 **Main connectors - 7 pin** - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 **Main connectors - 12 pin** - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

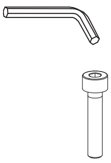
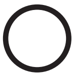
20.3 **Fieldbus communication connectors** - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

21 **FASTENING BOLTS AND SEALS**

	AGMZO-*-10	**AGMZO-*-20**	**AGMZO-*-32**
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

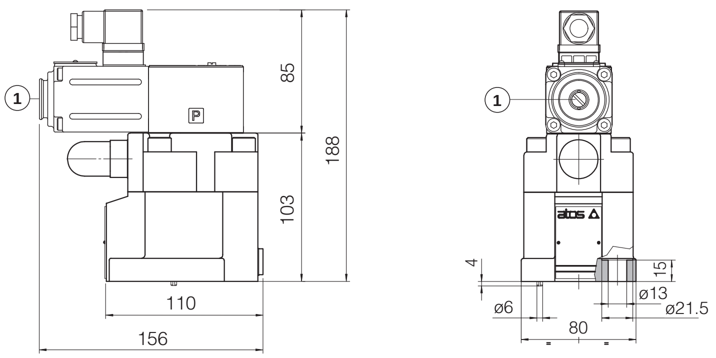
22 INSTALLATION DIMENSIONS [mm]

SIZE 10

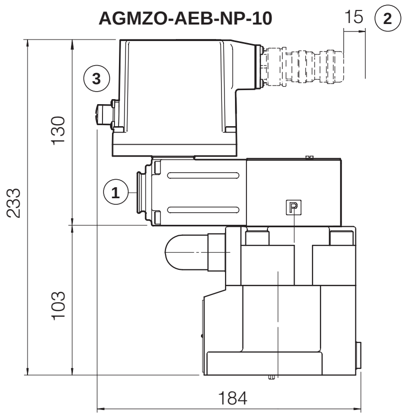
ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGMZO-*-10	5,4	5,9	6,0

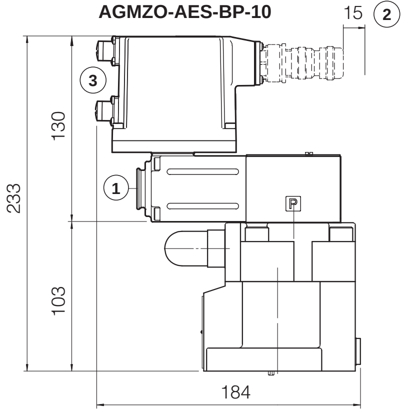
AGMZO-A-10



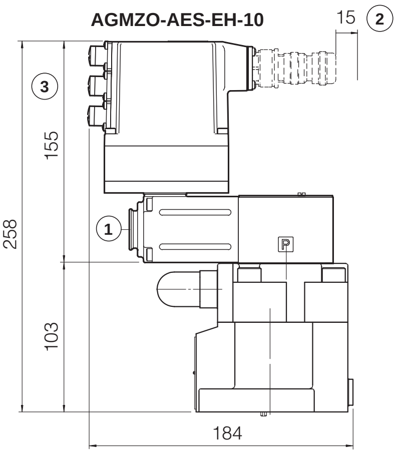
AGMZO-AEB-NP-10



AGMZO-AES-BC-10
AGMZO-AES-BP-10



AGMZO-AES-EH-10

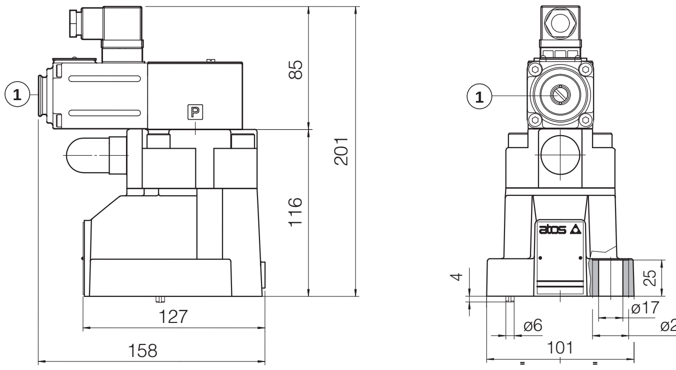


SIZE 20

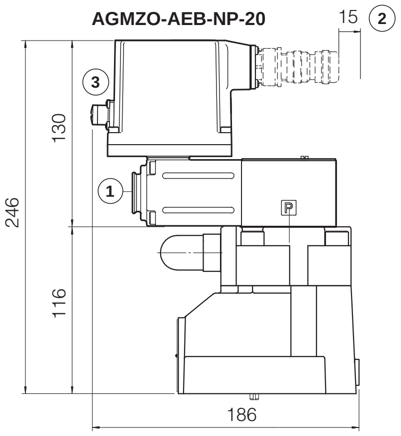
ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGMZO-*-20	6,6	7,1	7,2

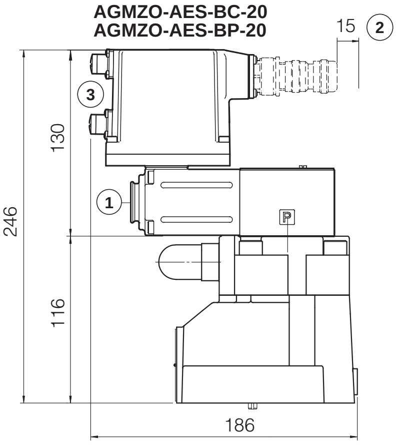
AGMZO-A-20



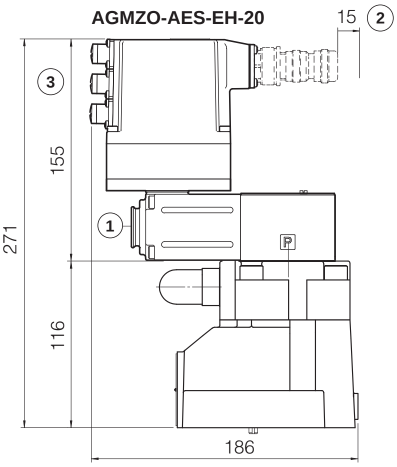
AGMZO-AEB-NP-20



AGMZO-AES-BC-20
AGMZO-AES-BP-20



AGMZO-AES-EH-20



① = Air bleeding, see section 17

② = Space to remove the connectors

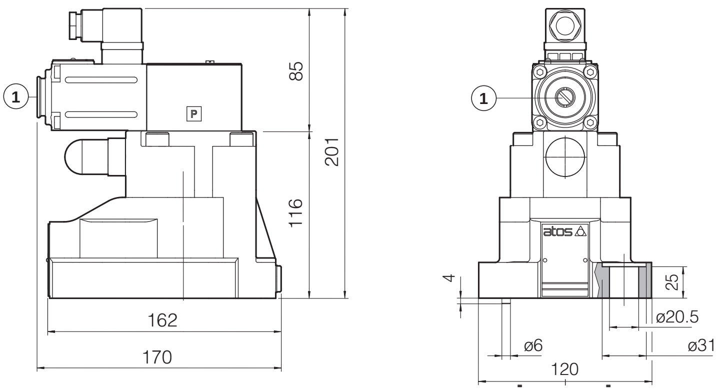
③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

SIZE 32

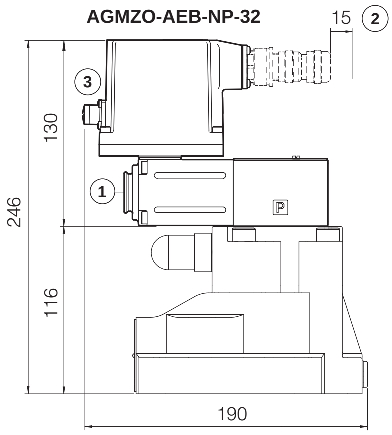
ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGMZO-*-32	8,0	8,5	8,6

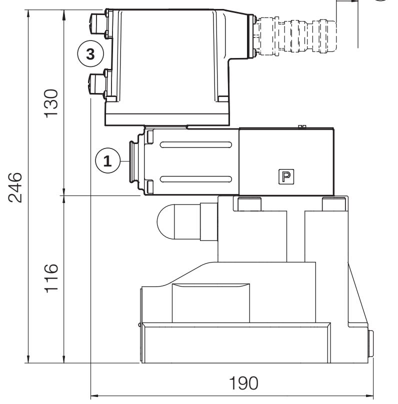
AGMZO-A-32



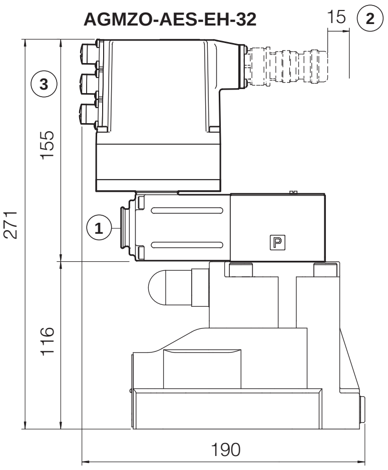
AGMZO-AEB-NP-32



AGMZO-AES-BC-32
AGMZO-AES-BP-32



AGMZO-AES-EH-32



① = Air bleeding, see section 17

② = Space to remove the connectors

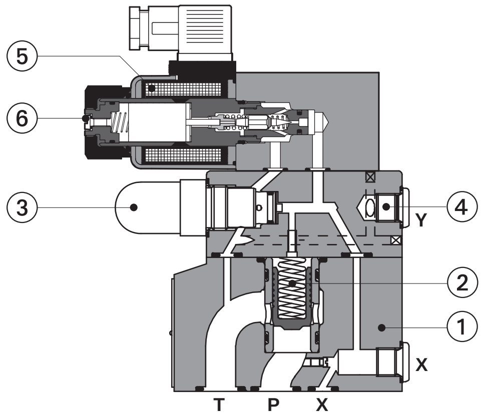
③ = The dimensions of all connectors must be considered, see section 19.5 and 19.6

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB200	Quickstart for AEB valves commissioning
QF200	Quickstart for AES valves commissioning

Proportional relief valves

piloted, without transducer



① Valve main body
② Main poppet
③ Mechanical pressure limiter
④ Drain port G 1/4" (option /Y)
⑤ Proportional solenoid
⑥ Screw for air bleeding

AGMZE-A-10

AGMZE-A

Poppet type, piloted, proportional pressure relief valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

The solenoids are certified according to North American standard **cURus**.

Size: **10**, **20**, **32** - ISO 6264
Max flow: **200**, **400**, **600 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGMZE - **A** - **10** / **315** / * - * / * * / *

Proportional pressure relief valve, piloted

A = for off-board driver, see section 3

Valve size ISO 6264: **10, 20, 32**

Max regulated pressure:
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Hydraulic options (1):
E = external pilot
Y = external drain (only pipe connection G 1/4")

Coil with special connectors, see section 16 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Coil voltage, see section 12 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers **(2)**

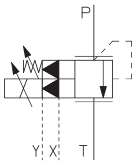
Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /EY
(2) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL

AGMZE-A



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	75 years, see technical table P007		
Ambient temperature range	**Standard** = -20°C ÷ +70°C	**/PE** option = -20°C ÷ +70°C	**/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C	**/PE** option = -20°C ÷ +80°C	**/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

6 HYDRAULIC CHARACTERISTICS

Valve model		**AGMZE-A-10**	**AGMZE-A-20**	**AGMZE-A-32**
Max regulated pressure	[bar]	50; 100; 210; 315; 350		
Max pressure at port P	[bar]	350		
Max pressure at port T	[bar]	210		
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 11		
Max flow	[l/min]	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 120	≤ 135	≤ 150
Hysteresis		≤ 0,5 [% of max pressure]		
Linearity		≤ 1,0 [% of max pressure]		
Repeatability		≤ 0,2 [% of max pressure]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

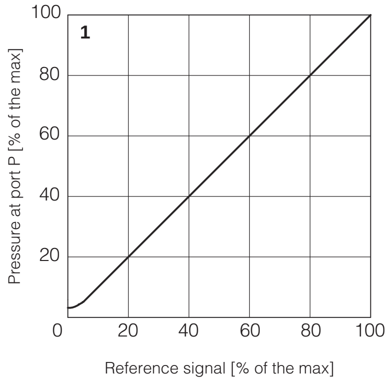
Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

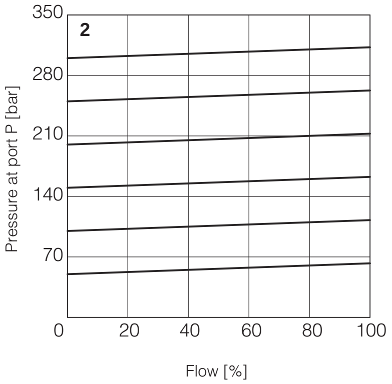
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level normal operation longer life	ISO4406 class 18/16/13 NAS1638 class 7 ISO4406 class 16/14/11 NAS1638 class 5		see also filter section at KTF catalog
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

1 = Regulation diagrams
with flow rate Q = 50 l/min

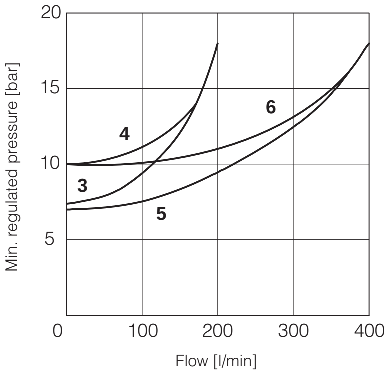


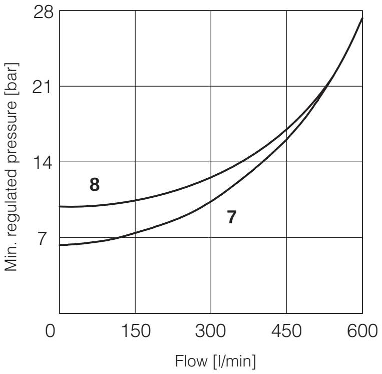
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



3-8 = Min. pressure/flow diagrams
with zero reference signal

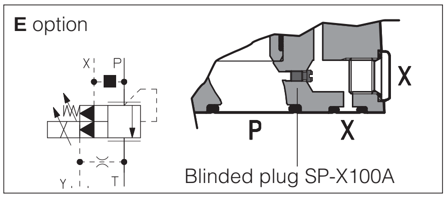
3 = AGMZE-A-10/50, 100, 210, 315
4 = AGMZE-A-10/350
5 = AGMZE-A-20/50, 100, 210, 315
6 = AGMZE-A-20/350
7 = AGMZE-A-32/50, 100, 210, 315
8 = AGMZE-A-32/350



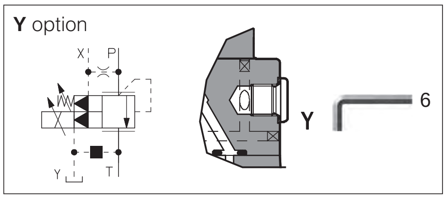


10 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").


E 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.


Y option

11 POSSIBLE COMBINED OPTIONS

/EY

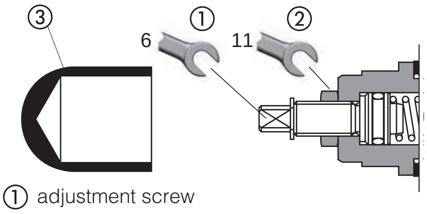
12 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

13 MECHANICAL PRESSURE LIMITER

The AGMZE are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

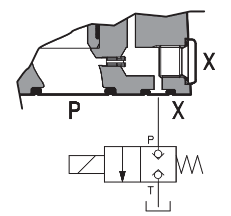
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



① adjustment screw
② locking nut
③ protection cap

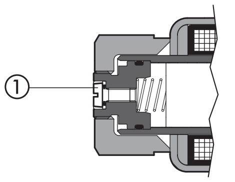
14 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).
This function can be used in emergency to unload the system pressure by-passing the proportional control.



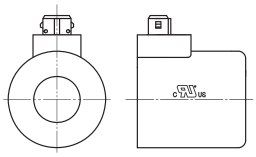
15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

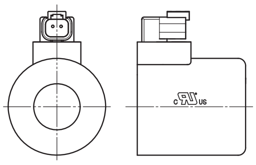


16 COILS WITH SPECIAL CONNECTORS

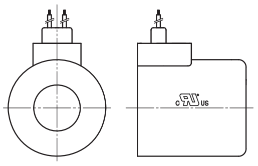
J option
Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



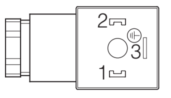
K option
Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67



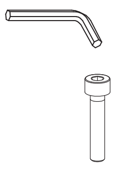
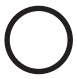
S option
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



17 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18 FASTENING BOLTS AND SEALS

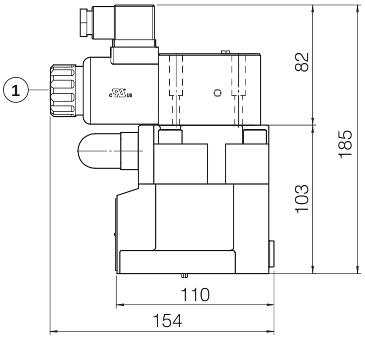
	AGMZE-A-10	AGMZE-A-20	AGMZE-A-32
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**Seals:** 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	**Seals:** 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

19 INSTALLATION DIMENSIONS [mm]

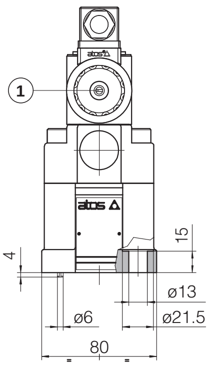
SIZE 10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

Mass [kg]	
AGMZE-A-10	5,4



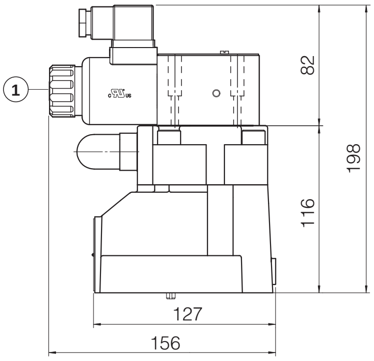
AGMZE-A-10



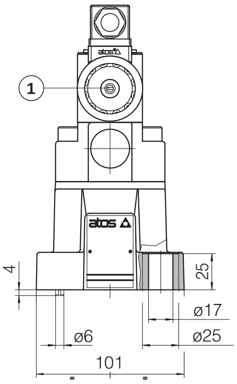
SIZE 20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

Mass [kg]	
AGMZE-A-20	6,6



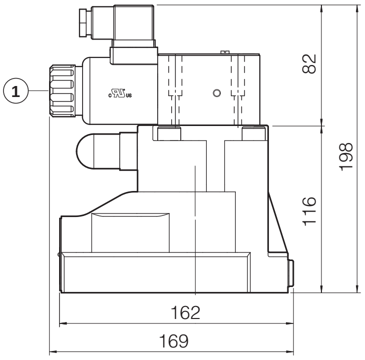
AGMZE-A-20



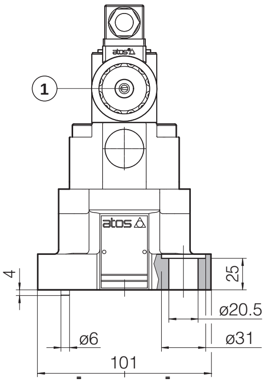
SIZE 32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes instead of standard M18)

Mass [kg]	
AGMZE-A-32	8



AGMZE-A-32



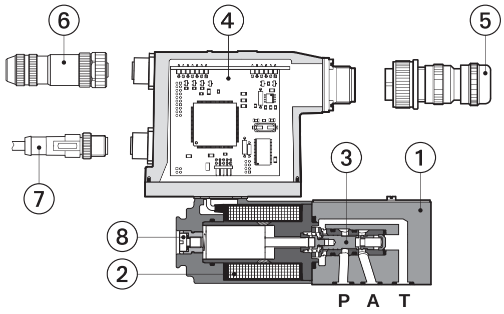
① = Air bleeding, see section 15

20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional reducing valves

direct, without transducer



RZGO-AES-BC-010

① Valve body
② Proportional solenoid
③ Spool
④ On-board digital driver
⑤ Main connector
⑥ Fieldbus connector
⑦ USB connector
⑧ Screw for air blending

RZGO-A , RZGO-AEB, RZGO-AES

Spool type, direct. digital proportional reducing valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401
Max flow: **12 l/min**
Max pressure: **350 bar**

1 MODEL CODE

RZGO	-	AEB	-	NP	-	010	/	210	/	*	/	*	*	/	*

Proportional pressure reducing valve, direct

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Configuration:
010 = regulation on port A, discharge in T (direct operated version)

Max regulated pressure:
32 = 32 bar **100** = 100 bar **210**= 210 bar

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

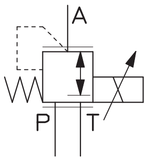
Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

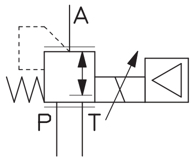
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

RZGO-A



RZGO-AEB RZGO-AES



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

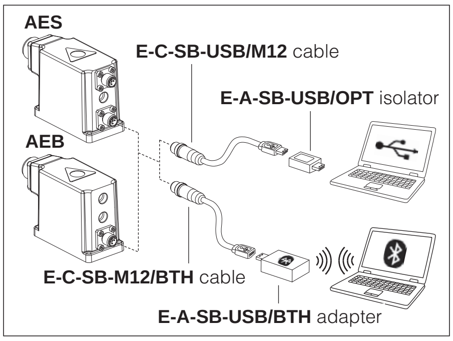
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO-*-010**
Max regulated pressure	[bar]	32; 100; 210
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure **(1)**	[bar]	0,8
Max flow	[l/min]	12
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 45
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,4 A 1,8 A for /32 - max pressure 32 bar	3 A 2,25 A for /32 - max pressure 32 bar	1 A 0,8 A for /32 - max pressure 32 bar	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

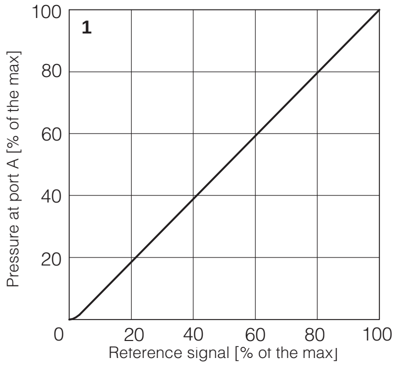
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

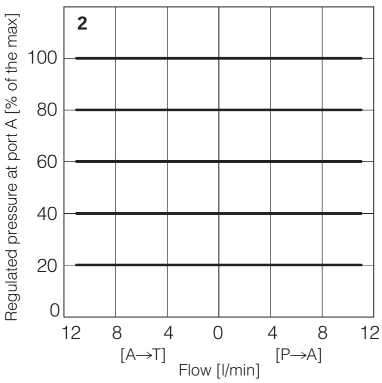
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

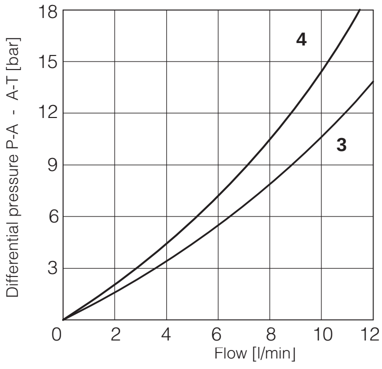
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

12 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

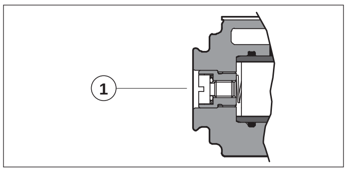
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

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

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**	▨	Analog ground	Gnd - analog signal
	▨	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

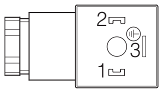
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

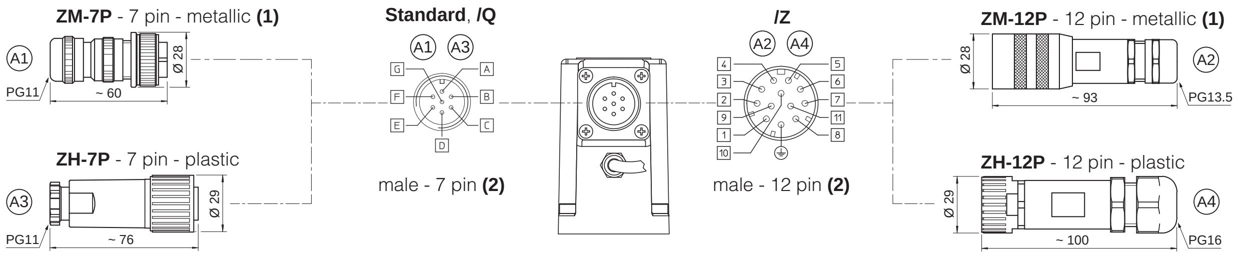
(2) Only for **AES** execution

17.4 Solenoid connection - only for A

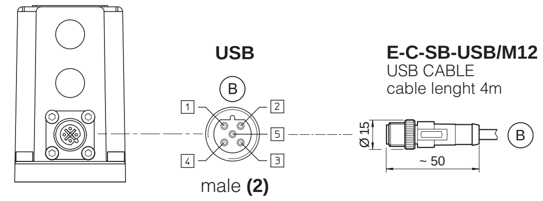
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout

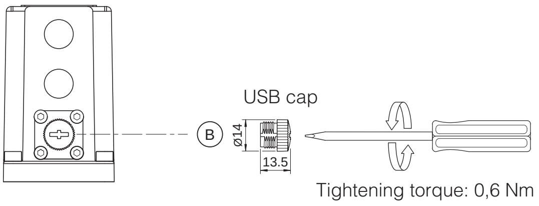
MAIN CONNECTORS



USB CONNECTOR



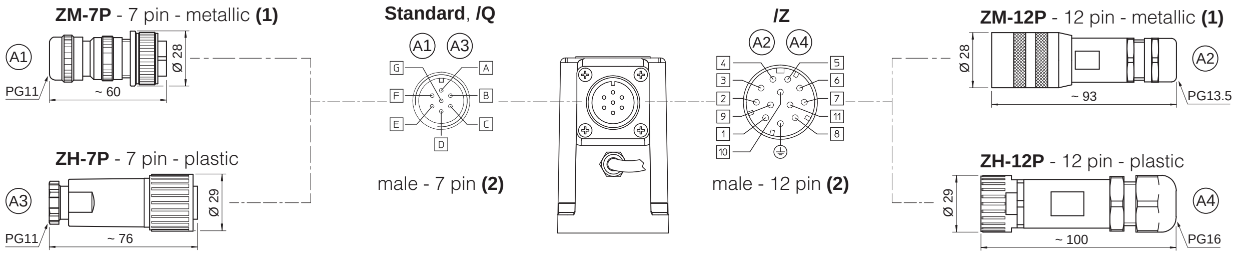
PLASTIC PROTECTION CAP - supplied with the valves



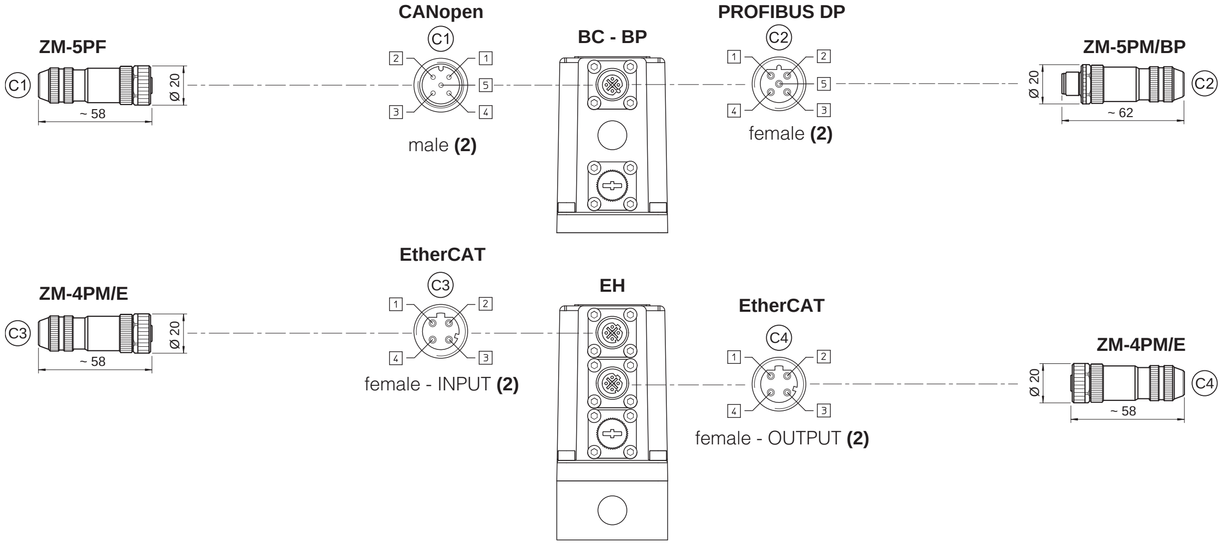
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout

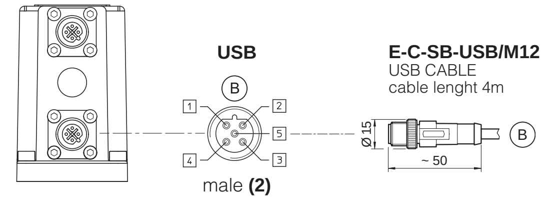
MAIN CONNECTORS



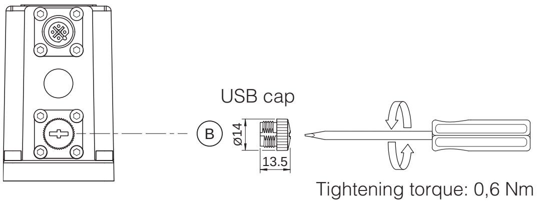
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

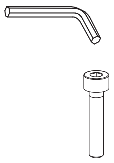
18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 FASTENING BOLTS AND SEALS

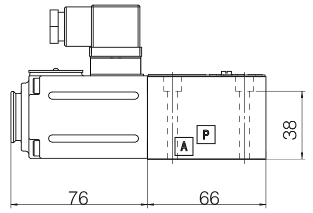
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	Seals: 4 OR 108 Diameter of ports P, A, T: Ø 5 mm Port B not used

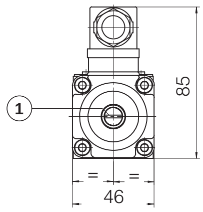
20 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

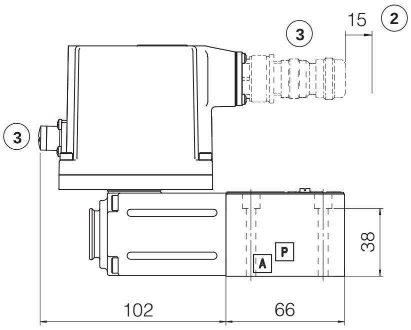
Mass [kg]		
A	**AEB, AES**	**AES-EH**
1,8	2,3	2,4

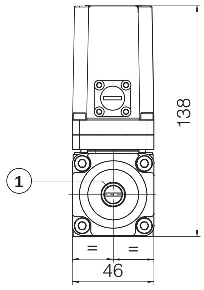
RZGO-A



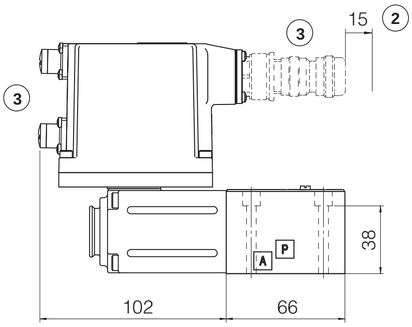


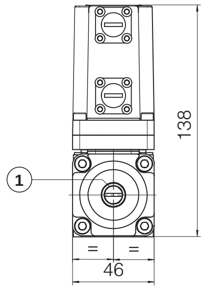
RZGO-AEB-NP



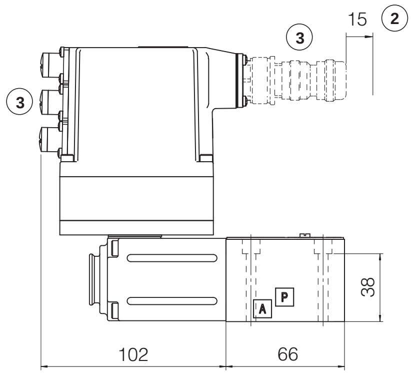


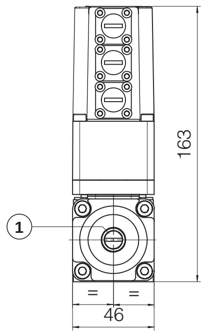
RZGO-AES-BP
RZGO-AES-BC





RZGO-AES-EH





① = Air bleeding, see section 15

② = Space to remove the connectors

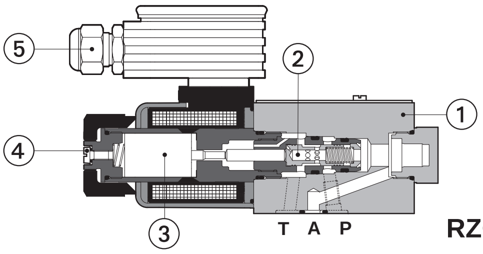
③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

21 RELATED DOCUMENTATION

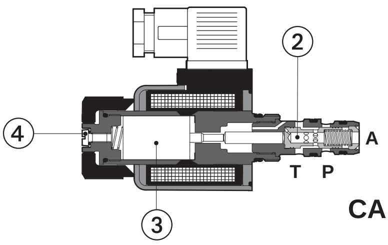
FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
G010	E-MI-AC analog driver	**P005**	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	**QB200**	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	**QF200**	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Proportional reducing valves

direct, without transducer



RZGE-A



CART RZGE-A

① Valve body
② Poppet
③ Proportional solenoid
④ Screw for air bleeding
⑤ E-MI-AS-IR digital driver (to be ordered separately)

RZGE-A, CART RZGE-A

Poppet type, direct, proportional pressure reducing valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They are available in following executions:
RZGE: subplate mounting, ISO size 06
CART RZGE: M20 cartridge execution

The solenoids are certified according to North American standard **cURus**.

Size: **06** - ISO 4401 (RZGE); **M20** (CART RZGE)
Max flow: **12 l/min**
Max pressure: **350 bar**
For cavity CART RZGE see section 16

1 MODEL CODE

RZGE - **A** - **010** / **210** - * / * * / *

Proportional
pressure reducing valve, direct
RZGE = subplate mounting
CART RZGE = cartridge execution

A = for off-board driver, see section 3

Configuration:
010 = reduced pressure on port A

Max regulated pressure:
32 = 32 bar
100 = 100 bar
210 = 210 bar

Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

Coil voltage, see section 10 :
- = standard coil for 24 VDC Atos drivers
6 = optional coil for 12 VDC Atos drivers
18 = optional coil for low current drivers **(1)**

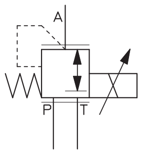
Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL

RZGE-A
CART RZGE-A



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F **(1)**		E-MI-AS-IR **(1)**		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

(1) For **CART RZGE** the electronic driver may interfere with the manifold surface.
Please check the installation dimensions at section 16

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	**RZGE-A-010**
Max regulated pressure	32; 100; 210
Min. regulated pressure [bar]	0,8 (or actual value at T port)
Max. pressure at port P [bar]	315
Max. pressure at port T [bar]	210
Max. flow [l/min]	12
Response time 0-100% step signal **(1)** [ms] (depending on installation)	≤ 70
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

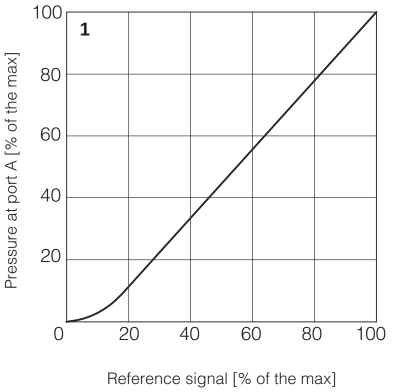
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

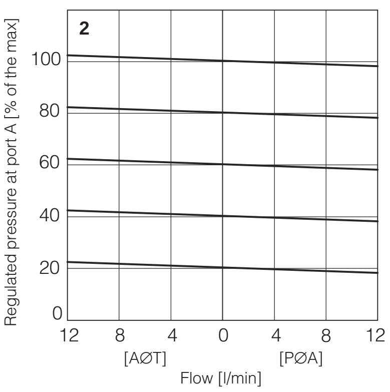
9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

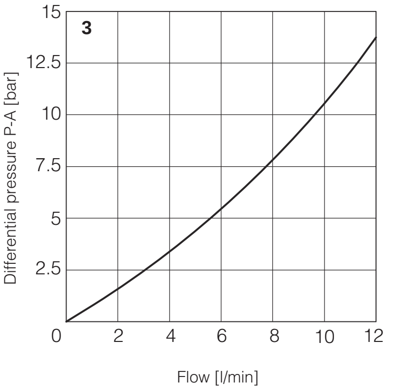
2 = Pressure/flow diagrams
with reference signal set at Q = 1 l/min

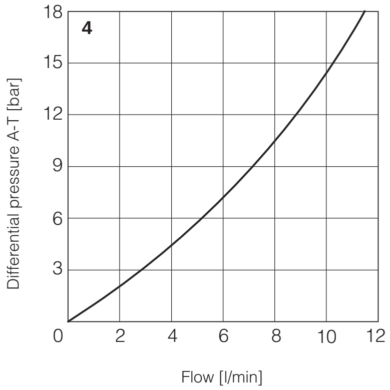




3-4 = Min. pressure/flow diagrams
with zero reference signal

3 = Pressure drops vs. flow P-A
4 = Pressure drops vs. flow A-T





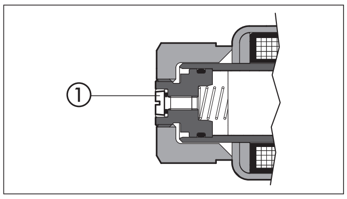
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

11 AIR BLEEDING

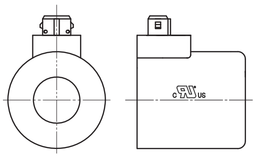
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



12 COILS WITH SPECIAL CONNECTORS

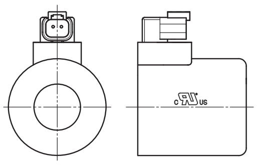
J option

Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



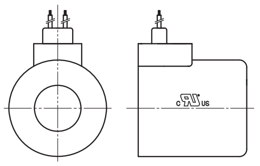
K option

Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67

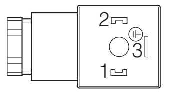


S option

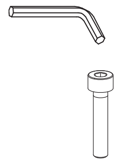
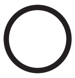
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

14 FASTENING BOLTS AND SEALS FOR RZGE

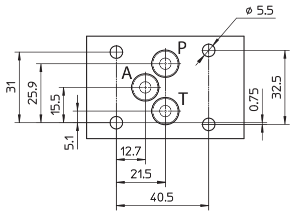
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 3 OR 108 Diameter of ports P, T, A: Ø 5 mm Port B not used

15 INSTALLATION DIMENSIONS FOR RZGE [mm]

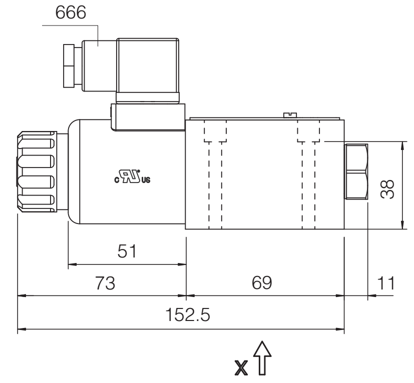
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without port B)

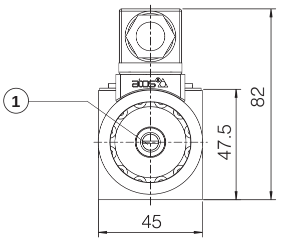
Mass [kg]	
RZGE	1,5
RZGE with E-MI-AS-IR	2,0

view from X

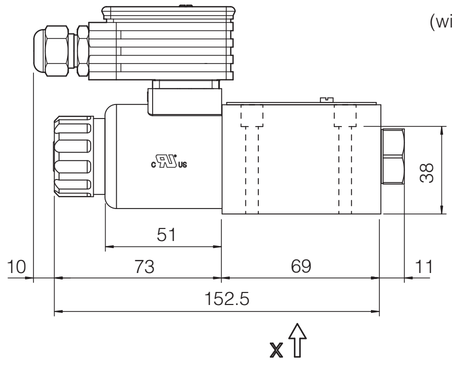


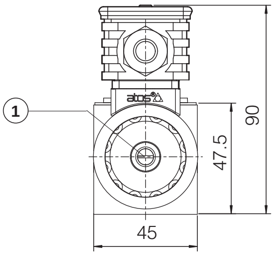
RZGE-A





RZGE-A
(with E-MI-AS-IRdigital driver)

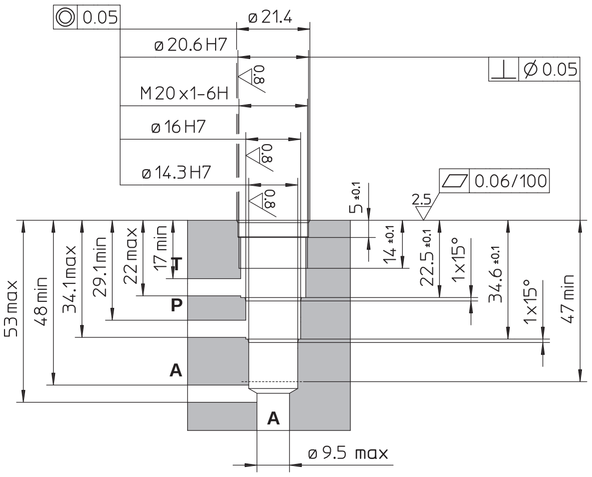




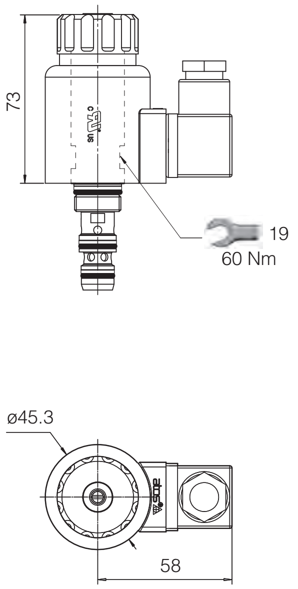
① = Air bleeding, see section 11

16 INSTALLATION DIMENSIONS FOR CART RZGE [mm]

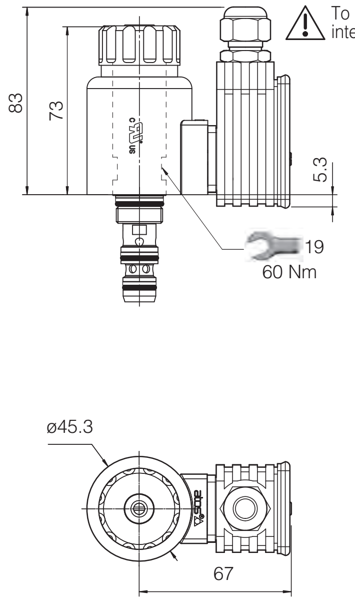
Cavity dimensions for **CART RZGE-A**



CART RZGE-A



CART RZGE-A
(with E-MI-AS-IR digital driver)



⚠ To be checked for eventual interference with the manifold surface

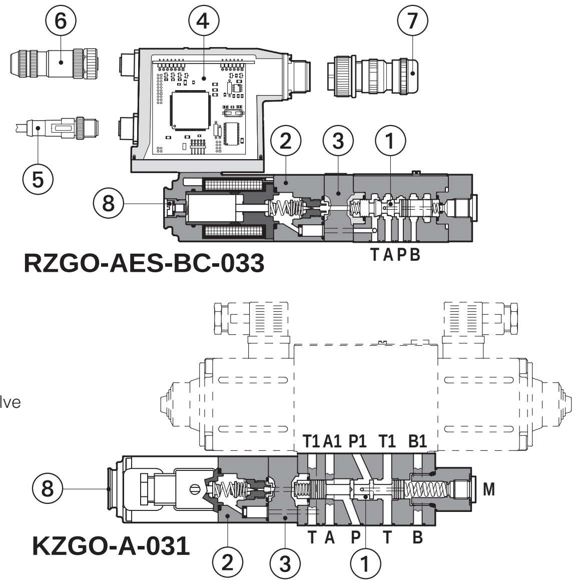
Mass [kg]	
CART RZGE	0,6
CART RZGE with E-MI-AS-IR	1,1

17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Digital proportional reducing valves

piloted, without transducer, subplate or modular mounting



① Main spool
② Proportional pilot relief valve
③ Pilot flow compensator
④ On-board digital driver
⑤ USB connector
⑥ Fieldbus connector
⑦ Main connector
⑧ Screw for air blending

RZGO-A , RZGO-AEB, RZGO-AES
HZGO-A , KZGO-A

Spool type, piloted, digital proportional reducing valves for pressure open loop controls, available in subplate size 06 or modular mounting size 06 and 10

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

RZGO, HZGO:	**KZGO**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **40 l/min**	Max flow: **100 l/min**
Max pressure: **350 bar**	Max pressure: **350 bar**

1 MODEL CODE

RZGO - **AEB** - **NP** - **033** / **210** / ***** / ***** ***** / *****

Proportional
pressure reducing valve, piloted
RZGO = subplate, size 06
HZGO = modular, size 06
KZGO = subplate, size 10

A = for off-board driver, see section 3

Only for **RZGO**:
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BP = PROFIBUS DP
BC = CANopen
EH = EtherCAT

Configuration:
031 = regulation on port P1, discharge in T (only for HZGO, KZGO)
033 = regulation on port A, discharge in T (only for RZGO)

Max regulated pressure:
50 = 50 bar (not for KZGO)
100 = 100 bar
210 = 210 bar
315 = 315 bar
350= 350 bar

Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

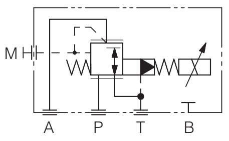
Series number

Seals material,
see section 10 :
- = NBR
PE = FKM
BT = HNBR

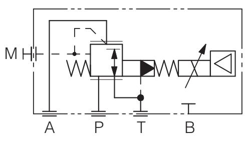
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS

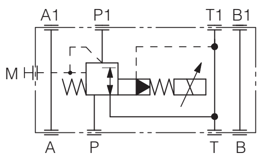
RZGO-A-033



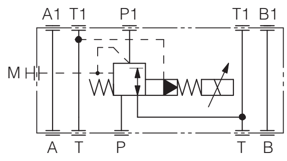
RZGO-AES-033



HZGO-A-031



KZGO-A-031



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

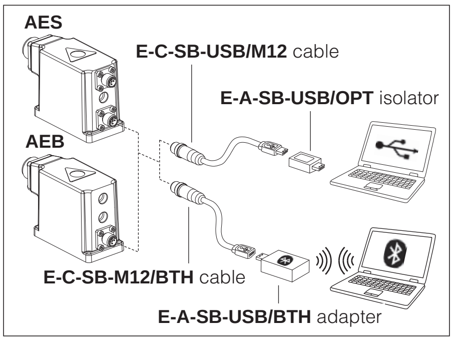
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**RZGO, HZGO**	**KZGO**
Max regulated pressure	[bar]	50; 100; 210; 315; 350	100; 210; 315; 350
Max pressure at port P	[bar]	350	
Max pressure at port T	[bar]	210	
Min regulated pressure **(1)**	[bar]	1,0; 3,0 (only for /350)	
Min flow	[l/min]	2,5	3
Max flow	[l/min]	40	100
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 50	≤ 80
Hysteresis		≤ 2 [% of max pressure]	
Linearity		≤ 3 [% of max pressure]	
Repeatability		≤ 2 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W	**AEB**, **AES** = 50 W		
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

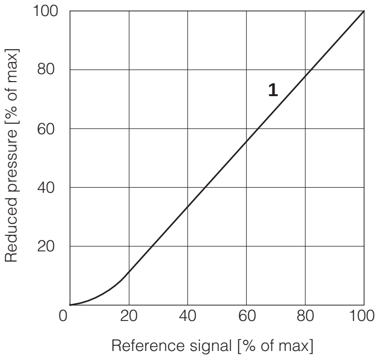
11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

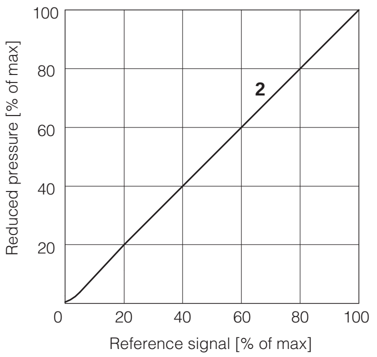
11.1 Regulation diagrams

with flow rate Q = 10 l/min

1 = RZGO, HZGO
2 = KZGO

Note: the presence of counter pressure at port T can affect the effective pressure regulation

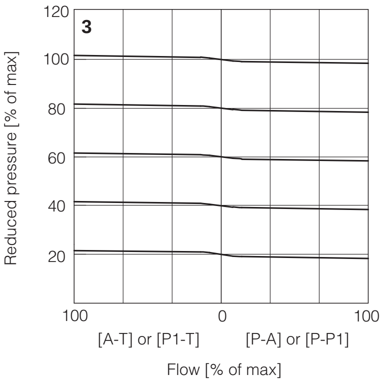




11.2 Pressure/flow diagrams

with reference pressure set with Q = 10 l/min

3 = RZGO, KZGO



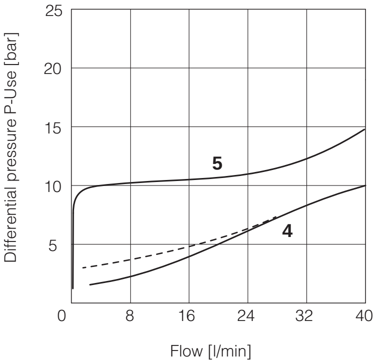
11.3 Pressure drop/flow diagram

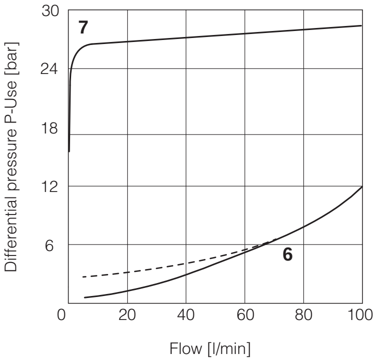
RZGO, HZGO

4 = A-T or P1-T (dotted line /350)
5 = P-P1 or P-A

KZGO

6 = P1-T (dotted line /350)
7 = P-P1





12 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

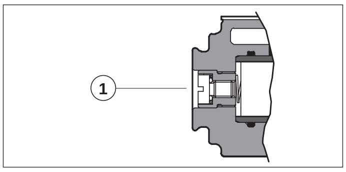
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for **/Z** option

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

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

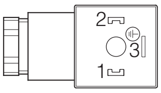
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

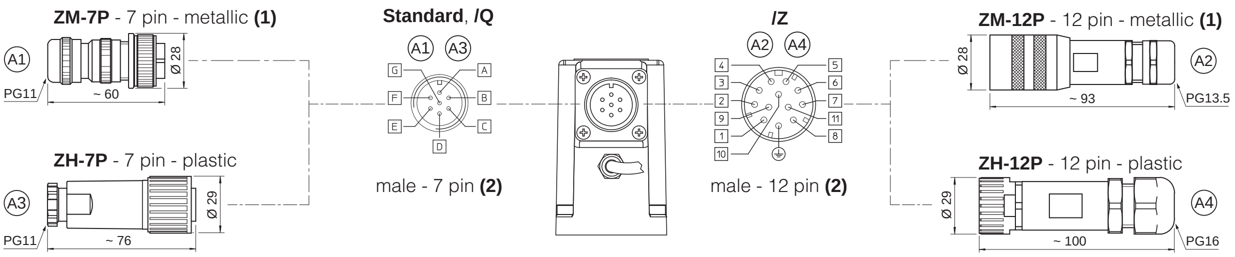
(2) Only for **AES** execution

17.4 Solenoid connection - only for A

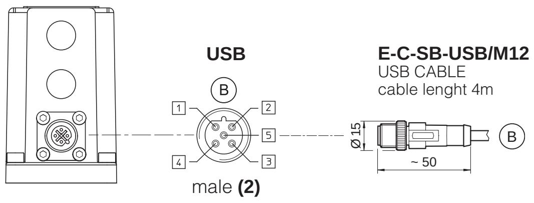
PIN	SIGNAL	TECHNICAL SPECIFICATION	**Connector code 666**
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout

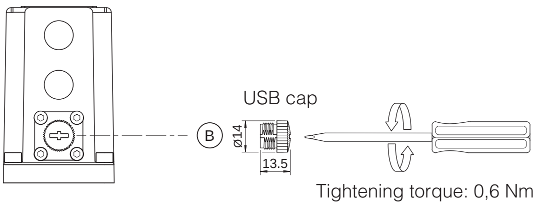
MAIN CONNECTORS



USB CONNECTOR



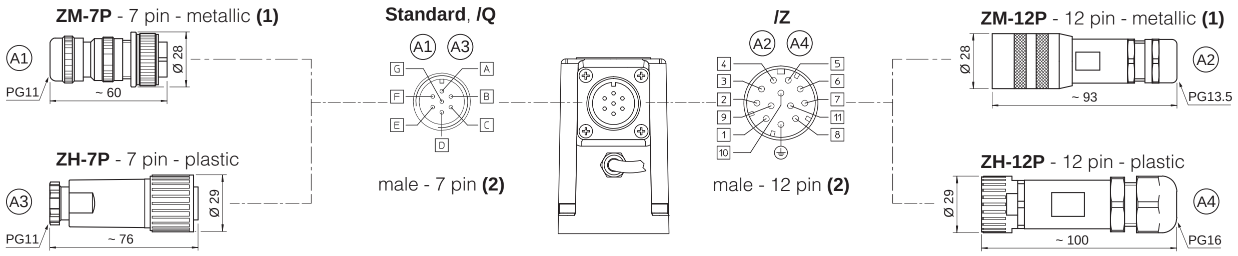
PLASTIC PROTECTION CAP - supplied with the valves



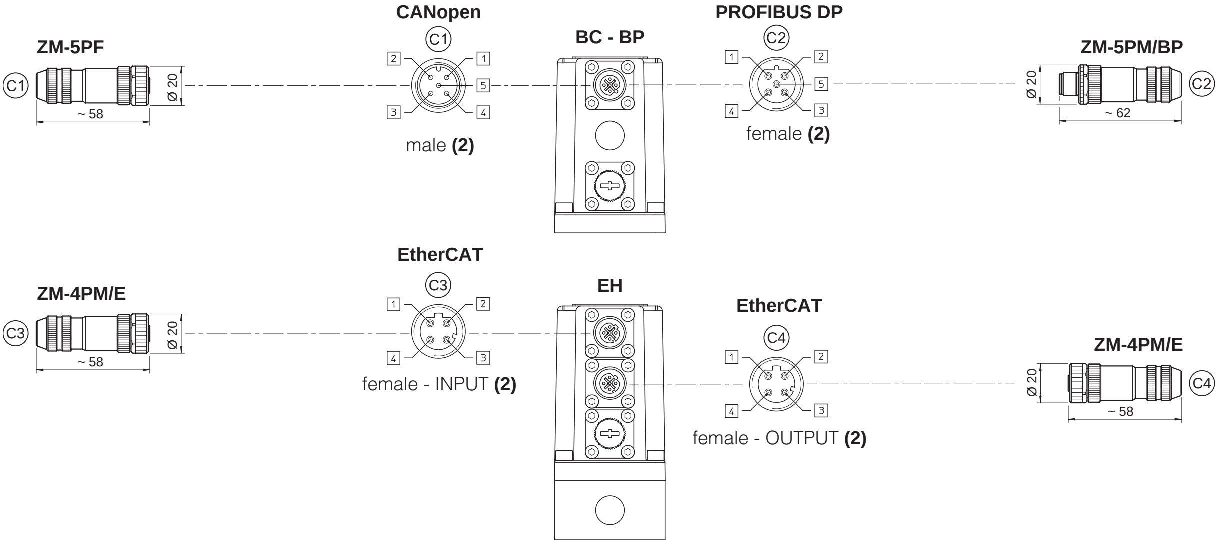
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout

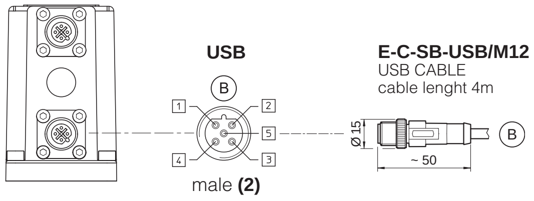
MAIN CONNECTORS



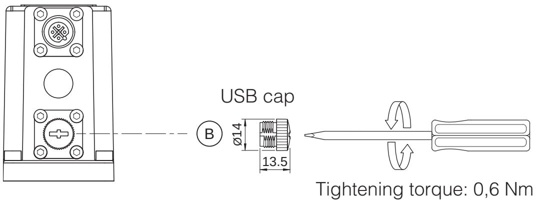
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A1 **ZM-7P**	A3 **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A2 **ZM-12P**	A4 **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	C1 **ZM-5PF**	C2 **ZM-5PM**	C1 **ZM-5PF/BP**	C2 **ZM-5PM/BP**	C1 C2 **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

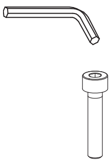
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

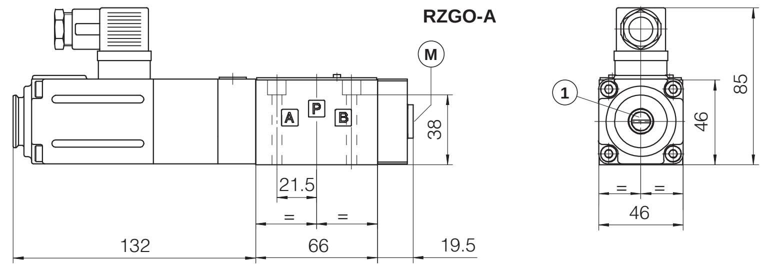
	RZGO	HZGO	KZGO
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** M5 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** M6 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm Port B not used	**Seals:** 4 OR 108 Diameter of ports P, A, B, T: Ø 6,5 mm	**Seals:** 5 OR 2050; 1 OR 108 Diameter of ports P, A, B, T: Ø 10,5 mm (max)

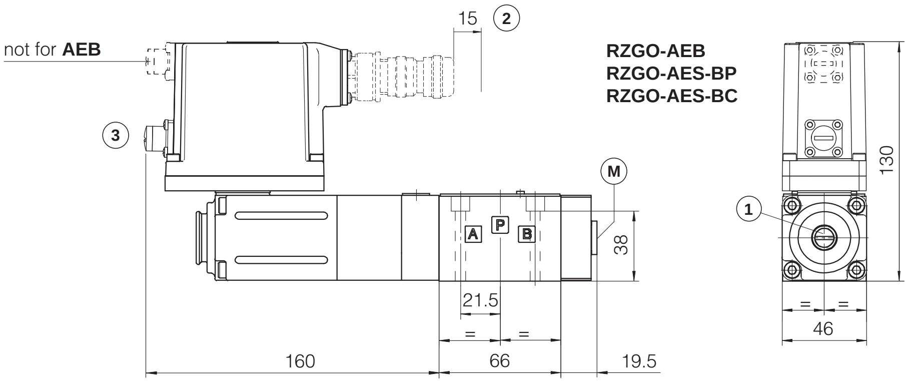
21 INSTALLATION DIMENSIONS [mm]

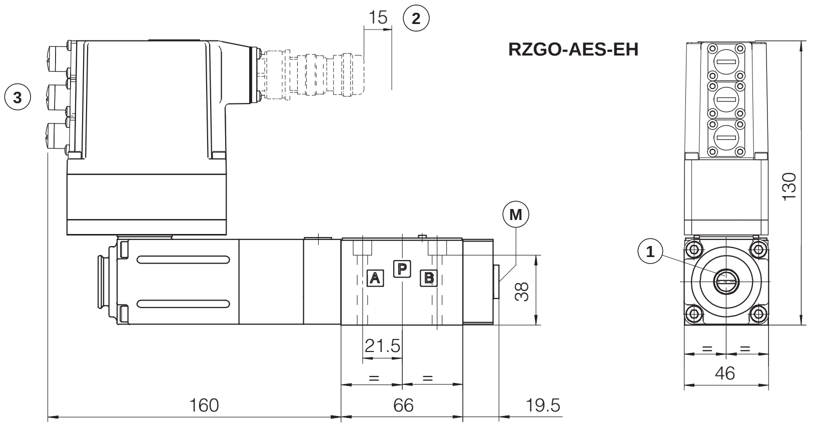
RZMO

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
2,8	3,3	3,4



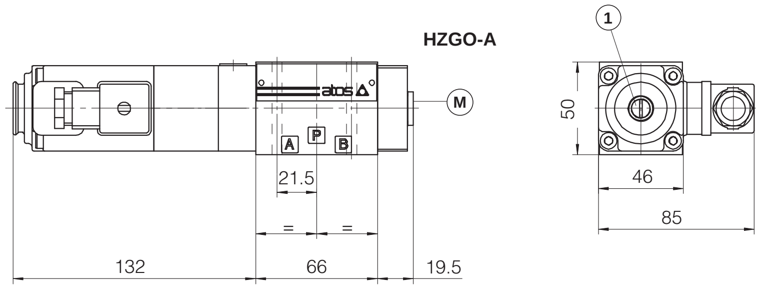




HZGO

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

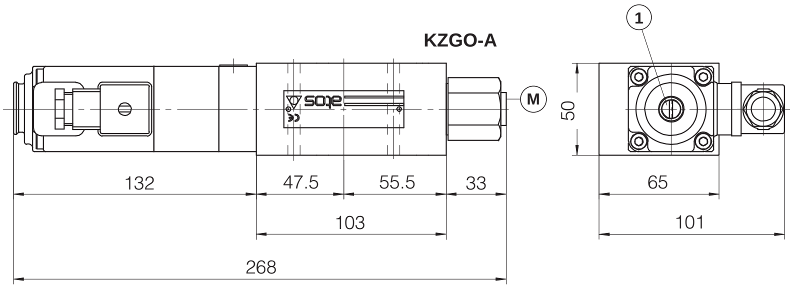
Mass [kg]
A
2,8



KZGO

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
(see table P005)

Mass [kg]
A
3,8



① = Air bleeding, see section 15

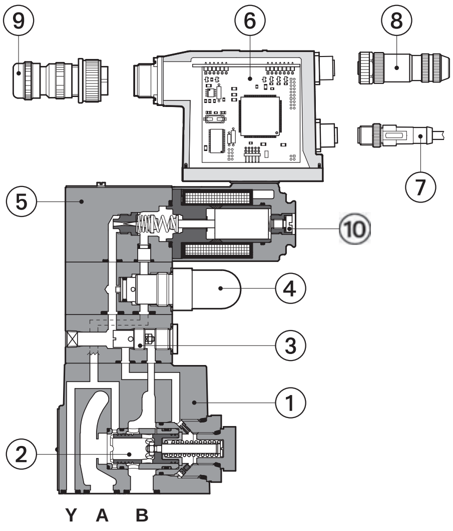
② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Ⓜ = Pressure gauge connection port = G$^1/_4$"

Digital proportional reducing valves

piloted, without transducer



① Valve body
② Main spool
③ Pilot flow compensator
④ On-board pressure limiter
⑤ Pilot relief valve
⑥ On-board digital driver
⑦ USB connector
⑧ Fieldbus connector
⑨ Main connector
⑩ Screw for air bleeding

AGRCZO-AES-BC-10

AGRCZO-A,
AGRCZO-AEB, AGRCZO-AES

Digital proportional reducing valves, piloted, for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**
Max pressure: **350 bar**

1 MODEL CODE

AGRCZO	-	AES	-	BC	-	10	/	315	/	*	/	*	*	/	*

Proportional pressure reducing valve, piloted

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Valve size ISO 5781: **10, 20**

Max regulated pressure:
50 = 50 bar **100** = 100 bar **210** = 210 bar **315** = 315 bar **350** = 350 bar

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Series number

Coil voltage, only for **A** - see section 14 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

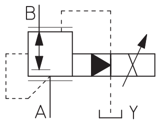
Hydraulic options (4):
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

Electronics options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

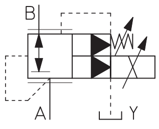
(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS

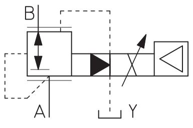
AGRCZO-A



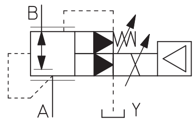
AGRCZO-A-*/P



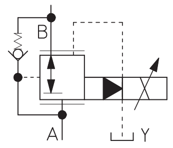
AGRCZO-AEB
AGRCZO-AES



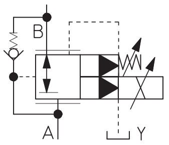
AGRCZO-AEB-*/P
AGRCZO-AES-*/P



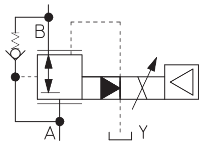
AGRCZO-A-*/R



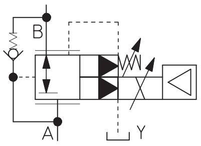
AGRCZO-A-*/PR



AGRCZO-AEB-*/R
AGRCZO-AES-*/R



AGRCZO-AEB-*/PR
AGRCZO-AES-*/PR



3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

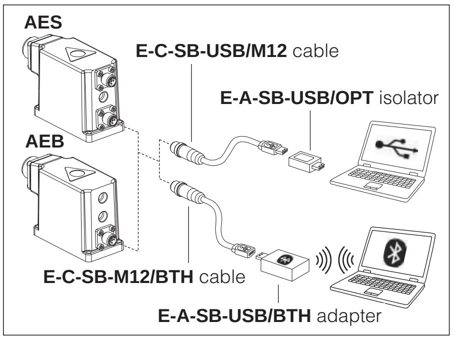
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**AGRCZO-*-10**	**AGRCZO-*-20**
Max regulated pressure [bar]	50; 100; 210; 315; 350	
Min regulated pressure **(1)** [bar]	1; 3 (only for /350)	
Max pressure at port A or B [bar]	350	
Max pressure at port Y [bar]	pilot drain always external, to be directly connected to tank at zero pressure	
Max flow [l/min]	160	300
Response time 0-100% step signal (depending on installation) **(2)** [ms]	≤ 45	≤ 50
Hysteresis	≤ 2,0 [% of max pressure]	
Linearity	≤ 3,0 [% of max pressure]	
Repeatability	≤ 2,0 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

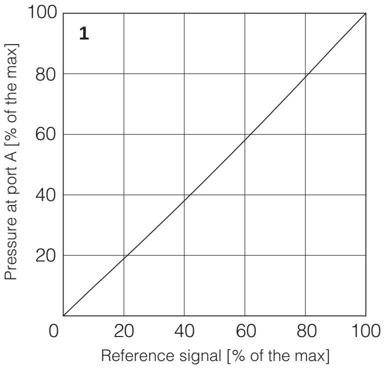
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

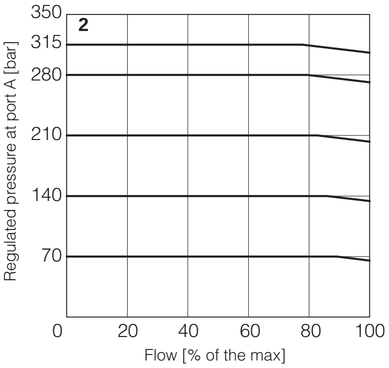
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

1 **Regulation diagrams**
with flow rate Q = 10 l/min

2 **Pressure/flow diagrams**
with reference pressure set with Q = 10 l/min

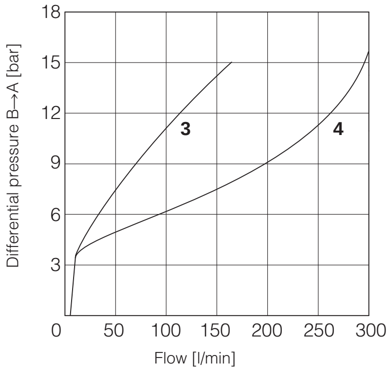


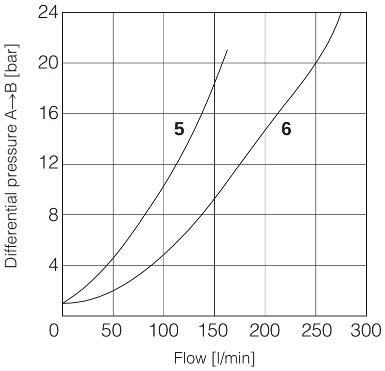


3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A
3 = AGRCZO-*-10
4 = AGRCZO-*-20

Differential pressure A→B (through check valve)
5 = AGRCZO-*-10/*/R
6 = AGRCZO-*-20/*/R

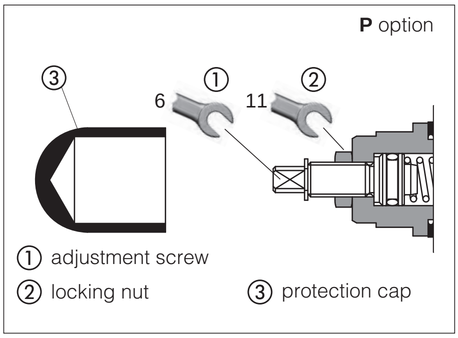




12 HYDRAULIC OPTIONS

P = This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

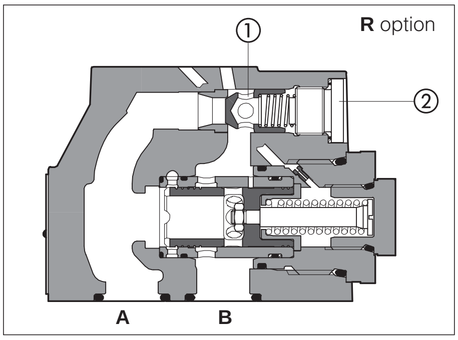
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



R = This option provides a integral check valve for free reverse flow A→B

① Check valve - cracking pressure = 0,5 bar

② Plug



13 ELECTRONICS OPTIONS - only for AEB and AES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

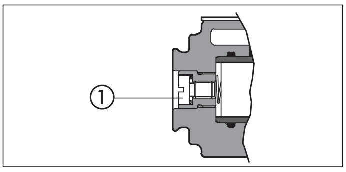
14 POSSIBLE COMBINED OPTIONS

for **A**: /PR

for **AEB** and **AES**: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 V_{DC} 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 V_{DC} or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{DC}.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 V_{DC} (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 V_{DC}.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 V_{DC} on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.
Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **AEB** and **AES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 V_{DC}	Input - power supply
B	**V0**		Power supply 0 V_{DC}	Gnd - power supply
C	**AGND**	▨	Analog ground	Gnd - analog signal
	▨	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are 0 ÷ 10 V_{DC} 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 V_{DC} maximum range Default is 0 ÷ 5 V_{DC} (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) **/Z** option - for **AEB** and **AES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 V_{DC} Rectified and filtered: V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})	Input - power supply
2	**V0**	Power supply 0 V_{DC}	Gnd - power supply
3	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are 0 ÷ 10 V_{DC} 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 V_{DC} maximum range, referred to VL0 Default is 0 ÷ 5 V_{DC} (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for **AEB** (B) and **AES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

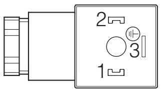
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

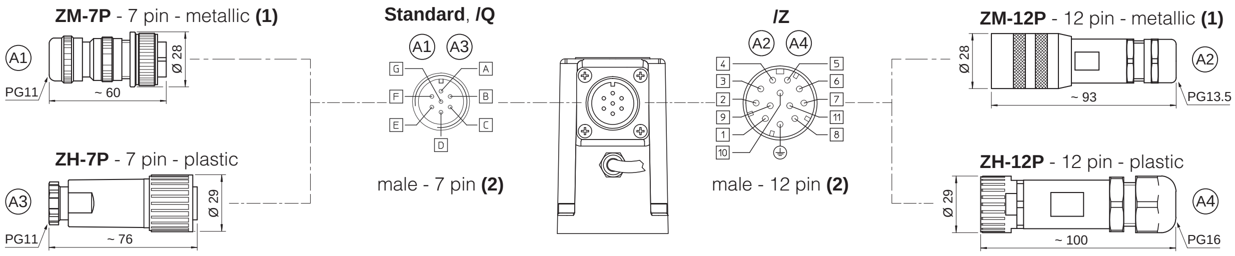
(2) Only for **AES** execution

17.4 Solenoid connection - only for **A**

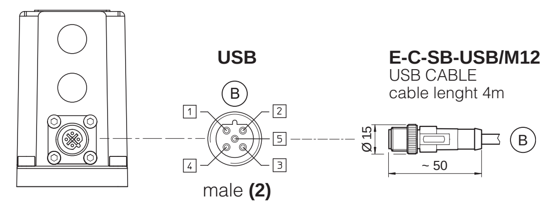
PIN	SIGNAL	TECHNICAL SPECIFICATION	**Connector code 666**
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout

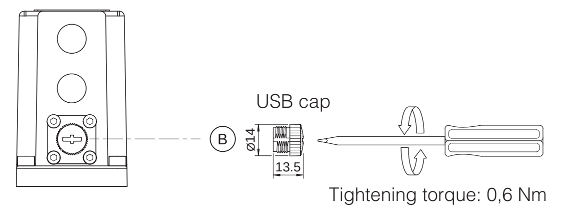
MAIN CONNECTORS



USB CONNECTOR



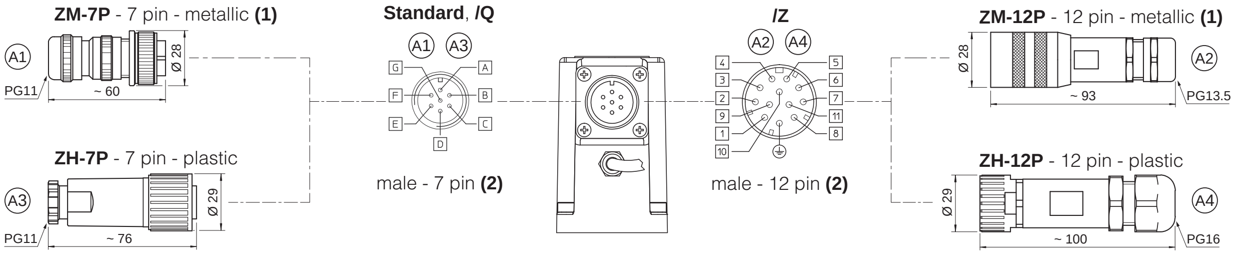
PLASTIC PROTECTION CAP - supplied with the valves



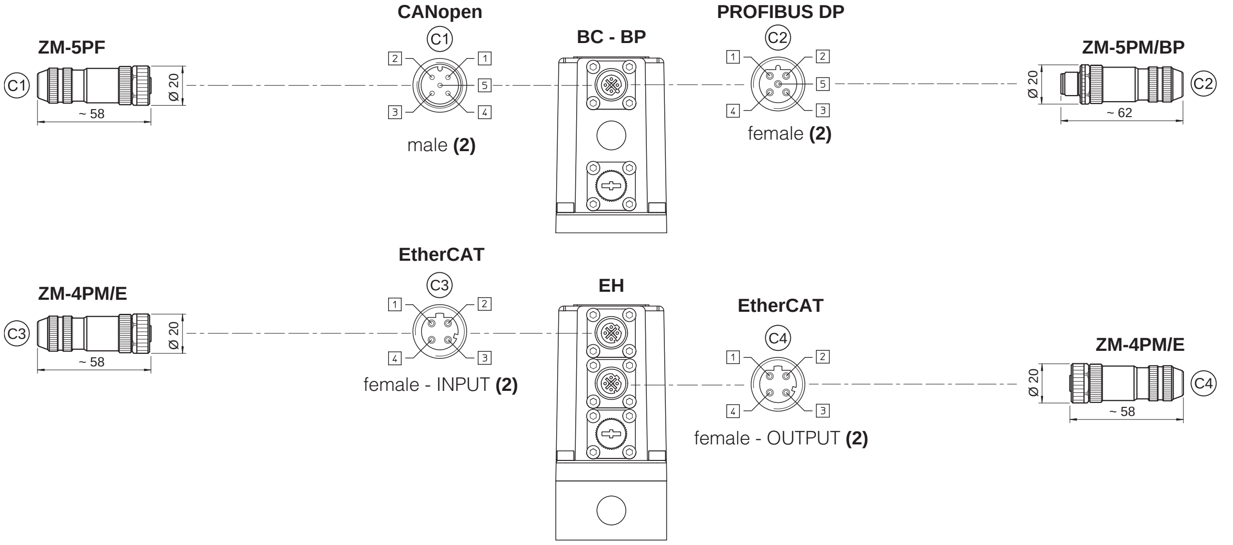
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout

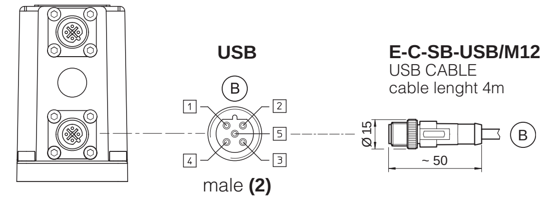
MAIN CONNECTORS



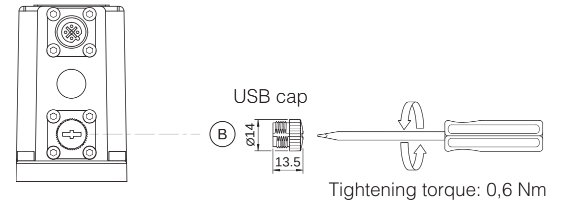
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A1 **ZM-7P**	A3 **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A2 **ZM-12P**	A4 **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	C1 **ZM-5PF**	C2 **ZM-5PM**	C1 **ZM-5PF/BP**	C2 **ZM-5PM/BP**	C1 C2 **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

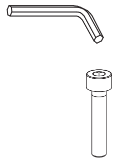
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

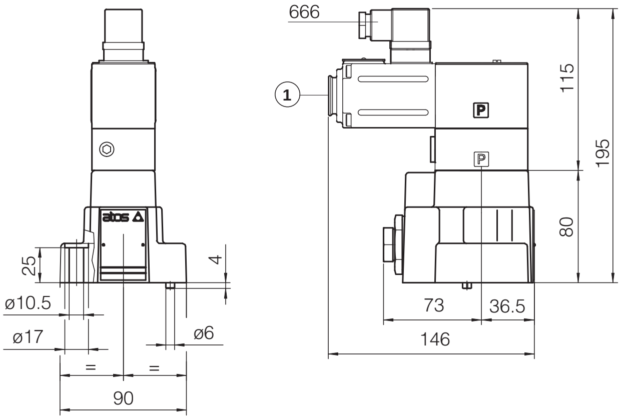
	AGRCZO-*-10	**AGRCZO-*-20**
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	Seals: 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

21 INSTALLATION DIMENSIONS FOR AGRCZO-10 [mm]

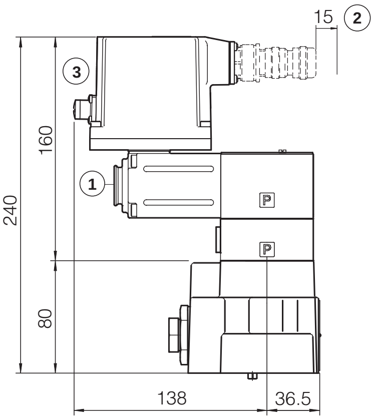
ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGRCZO-*-10	5,0	5,6	5,7
Option /P	+0,5		

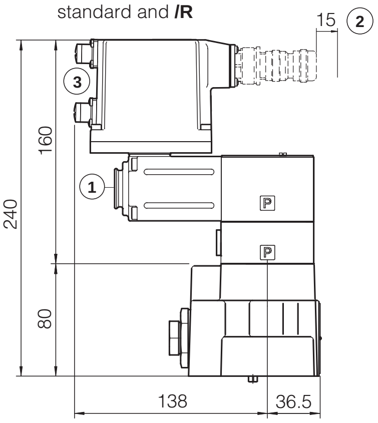
AGRCZO-A-10
standard and **/R**



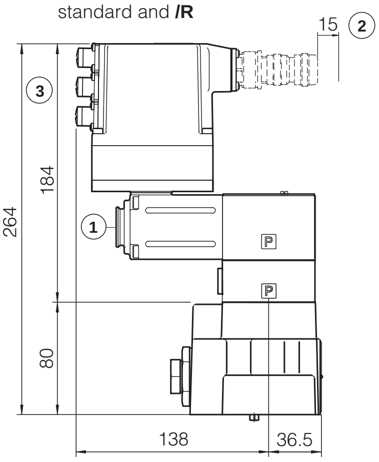
AGRCZO-AEB-NP-10
standard and **/R**



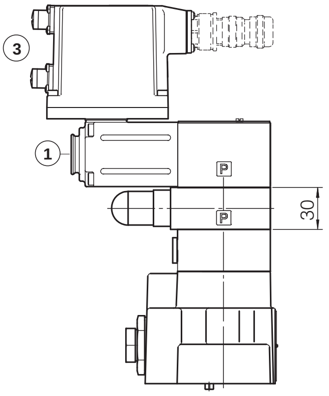
AGRCZO-AES-BC-10
AGRCZO-AES-BP-10
standard and **/R**



AGRCZO-AES-EH-10
standard and **/R**



Option /P



① = Air bleeding, see section 15

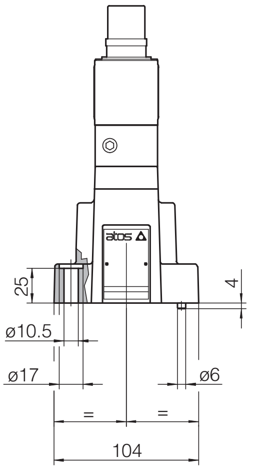
② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

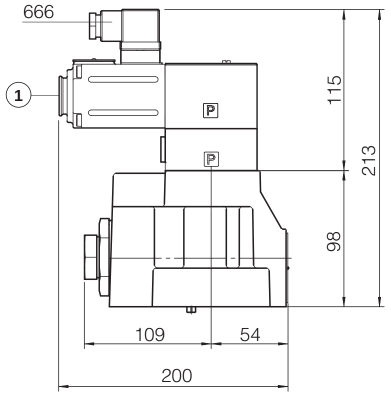
22 INSTALLATION DIMENSIONS FOR AGRCZO-20 [mm]

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

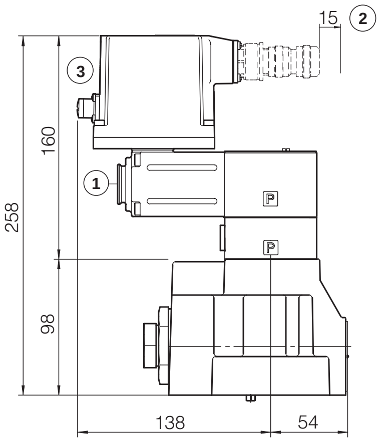
	Mass [kg]		
	A	**AEB, AES**	**AES-EH**
AGRCZO-*-20	7,5	8,1	8,2
Option /P	+0,5		



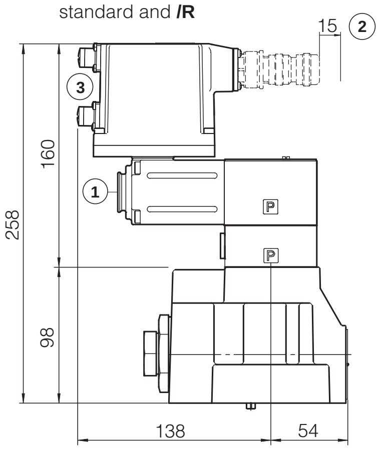
AGRCZO-A-20
standard and **/R**



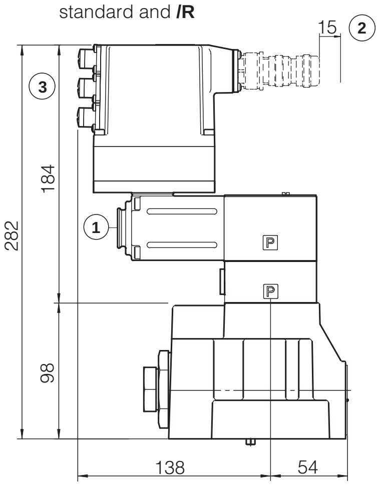
AGRCZO-AEB-NP-20
standard and **/R**



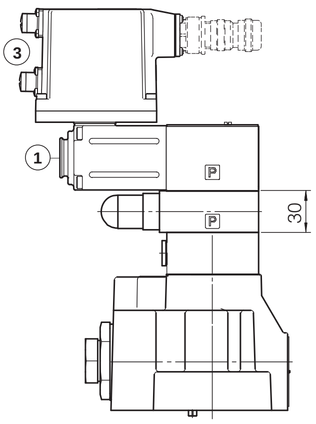
AGRCZO-AES-BC-20
AGRCZO-AES-BP-20
standard and **/R**



AGRCZO-AES-EH-20
standard and **/R**



Option /P



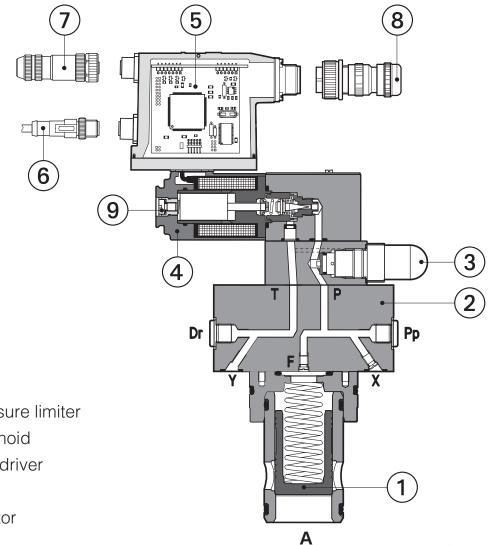
① = Air bleeding, see section 15

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Digital proportional pressure cartridges

piloted, without transducer - compensator, relief, reducing functions



① Poppet
② Cover
③ Mechanical pressure limiter
④ Proportional solenoid
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connector
⑧ Main connector
⑨ Screw for air blending

LIMZO-AES-BC-4

LICZO, LIMZO, LIRZO

2-way digital proportional cartridges respectively performing: pressure compensator, relief and reducing open loop functions.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **16** ÷ **80** - ISO 7368
Max flow: up to **4500 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF COVERS

LIMZO - **AES** - **BC** - **4** / **315** / * / * / * *

Proportional
pressure cartridges, piloted
LICZO = pressure compensator
LIMZO = pressure relief
LIRZO = pressure reducing

A = for off-board driver, see section 5
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 7368:
1 = 16
2 = 25
3 = 32
4 = 40
5 = 50 (not for LIRZO)
6 = 63 (only for LIMZO)
8 = 80 (only for LIMZO)

Max regulated pressure:
50 = 50 bar
100 = 100 bar
210 = 210 bar
315 = 315 bar
350 = 350 bar

Hydraulic options (4):
P =with integral mechanical pressure limiter (standard for size 1, 2 and 3)

Electronics options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 V)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

Coil voltage, only for **A** - see section 17 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Series
number

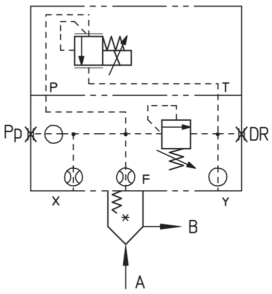
Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 16

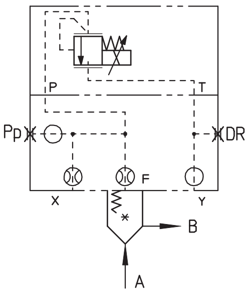
2 HYDRAULIC SYMBOLS

LICZO

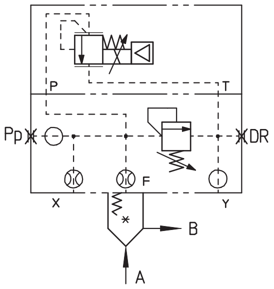
LICZO-A-1÷3
LICZO-A-4÷5 /P



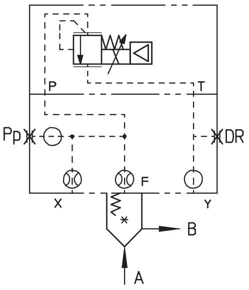
LICZO-A-4
LICZO-A-5



LICZO-AEB(AES)-1÷3
LICZO-AEB(AES)-4÷5 /P

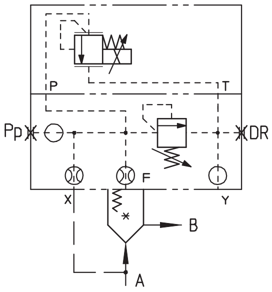


LICZO-AEB(AES)-4÷5

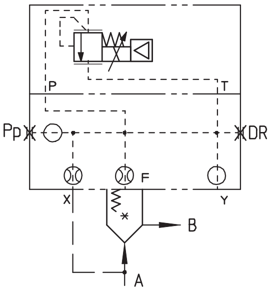


LIMZO

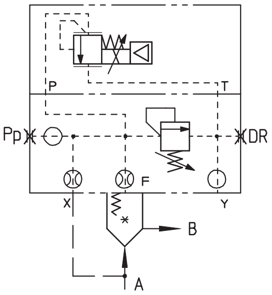
LIMZO-A-1÷3
LIMZO-A-4÷8 /P



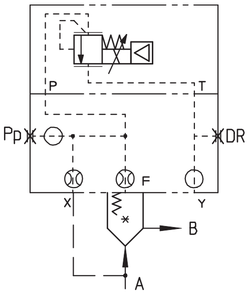
LIMZO-A-4÷8



LIMZO-AEB(AES)-1÷3
LIMZO-AEB(AES)-4÷8 /P

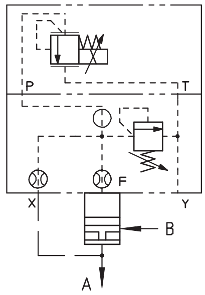


LIMZO-AEB(AES)-4÷8

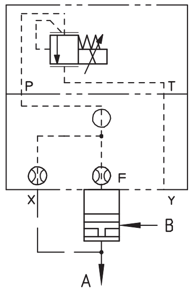


LIRZO

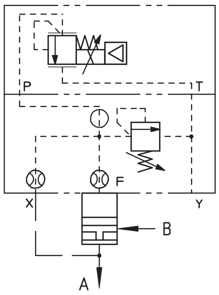
LIRZO-A-1÷3
LIRZO-A-4 /P



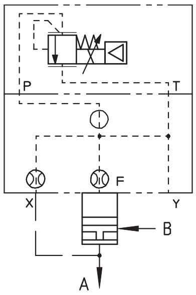
LIRZO-A-4



LIRZO-AEB(AES)-1÷3
LIRZO-AEB(AES)-4 /P



LIRZO-AEB(AES)-4



3 MODEL CODE OF CARTRIDGES

SC LI - **32** **31** **2** ***** / *****

Cartridge according to ISO 7368

Cartridge size ISO 7368:
16; **25**; **32**; **40**; **50**; **63**; **80**

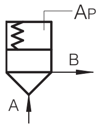
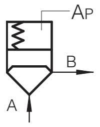
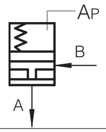
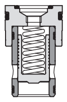
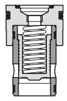
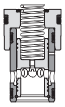
Type of poppet:
31 = for LIMZO and LICZO
36 = for LICZO
37 = for LIRZO

Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

Series number

Seals material, see section 12 :
- = NBR
PE = FKM
BT = HNBR

4 TYPE OF POPPET

Type of poppet	**31**	**36**	**37**
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	**1:1**	**1:1**	**1:1**

5 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS

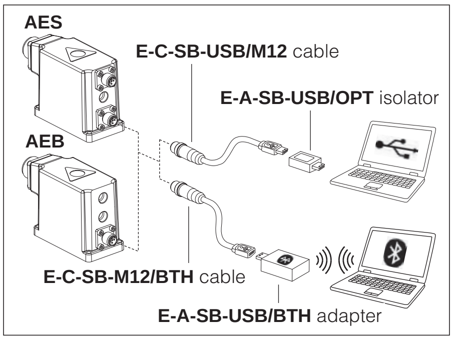
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**LICZO**					**LIMZO**							**LIRZO**			
valve size	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow [l/min]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pres. at port A [bar]	9	8,5	8	13	15	7	7	7	10,5	12	12	**(2)**	7			
Min regulated pres. at port A for /350 [bar]	11	10	10	13	16	10	10	9	12	13	13	16	12			
Max regulated pres. at port A [bar]	50; 100; 210; 315; 350					50; 100; 210; 315; 350							50; 100; 210; 315; 350			
Response time 0-100% step signal (depending on installation) **(1)** [ms]	100 ÷ 400					100 ÷ 450							100 ÷ 350			
Hysteresis [% of the regulated max flow]	≤ 2					≤ 1,5							≤ 2			
Linearity [% of the regulated max flow]	≤ 3					≤ 3							≤ 3			
Repeatability [% of the regulated max flow]	≤ 2					≤ 2							≤ 2			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 5

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.
(2) Consult our techincal office.

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 21			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

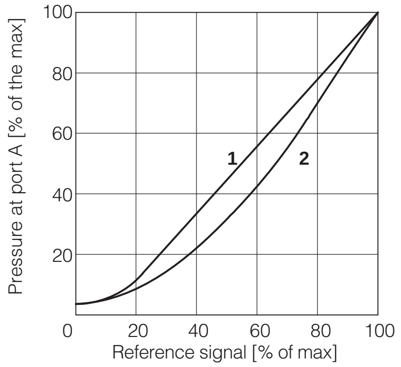
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

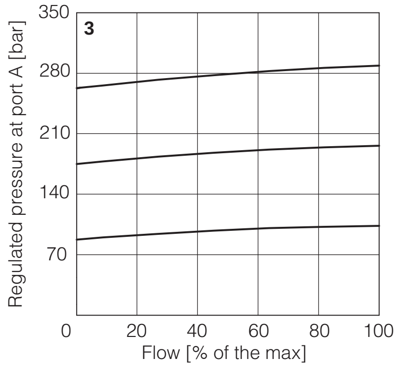
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

1 **Regulation diagrams LIMZO**
2 **Regulation diagrams LICZO**

3 **Pressure/flow diagrams LICZO, LIMZO**

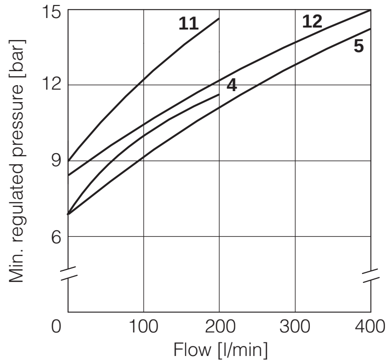


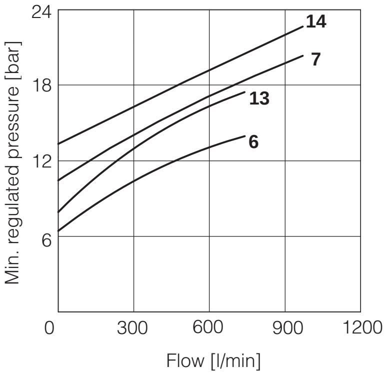


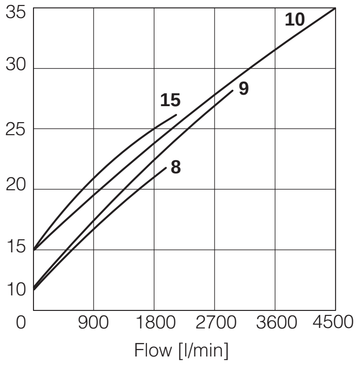
4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZO-*-1
5 = LIMZO-*-2
6 = LIMZO-*-3
7 = LIMZO-*-4
8 = LIMZO-*-5
9 = LIMZO-*-6
10 = LIMZO-*-8

11 = LICZO-*-1
12 = LICZO-*-2
13 = LICZO-*-3
14 = LICZO-*-4
15 = LICZO-*-5







Regulation diagrams LIRZO

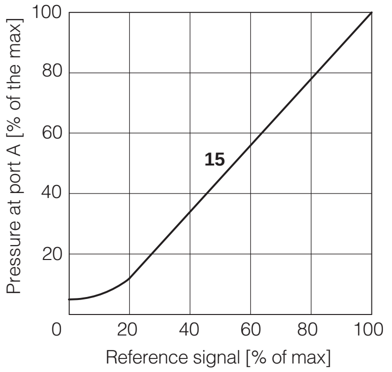
15 = LIRZO-A

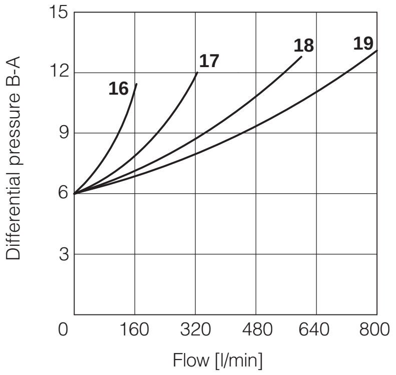
16-19 Min. pressure/flow diagrams
with reference signal “null”

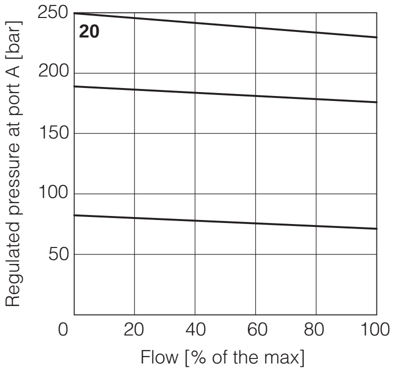
16 = LIRZO-*-1
17 = LIRZO-*-2
18 = LIRZO-*-3
19 = LIRZO-*-4

Pressure/flow diagrams

20 = LIRZO-A





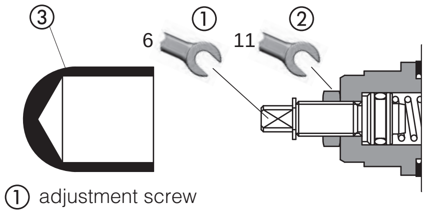


14 HYDRAULIC OPTIONS

P = This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve’s driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working

P option



① adjustment screw
② locking nut
③ protection cap

15 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 19.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 19.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 19.2

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ

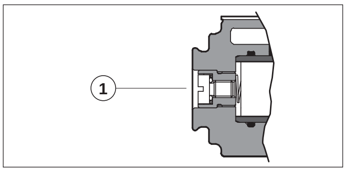
17 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

18 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

19.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT) - only for **/Z** option

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

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **AEB** and **AES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**	▨	Analog ground	Gnd - analog signal
	▨	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

20.2 Main connector signals - 12 pin (A2) **/Z** option - for **AEB** and **AES**

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 Communication connectors - for **AEB** (B) and **AES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

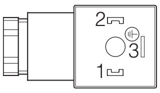
(1) Shield connection on connector's housing is recommended

(2) Only for **AES** execution

20.4 Solenoid connection - only for **A**

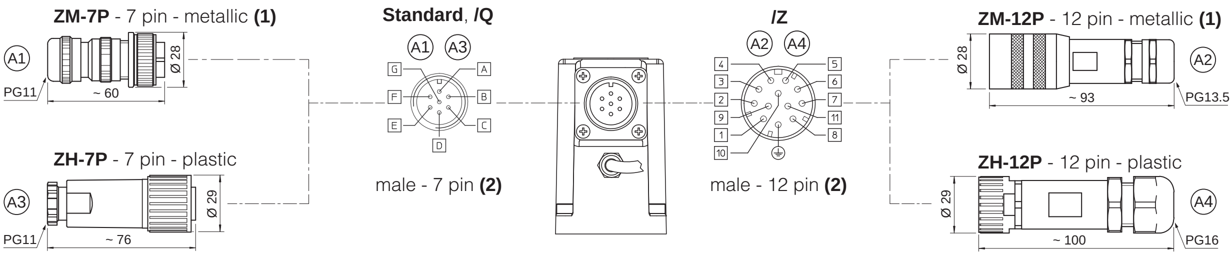
PIN	SIGNAL	TECHNICAL SPECIFICATION
1	**COIL**	Power supply
2	**COIL**	Power supply
3	**GND**	Ground

Connector code 666

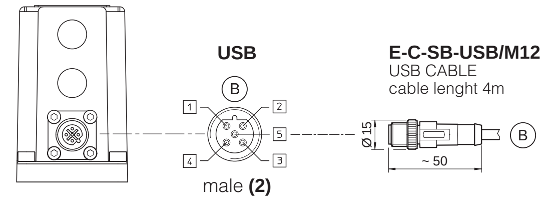


20.5 AEB connections layout

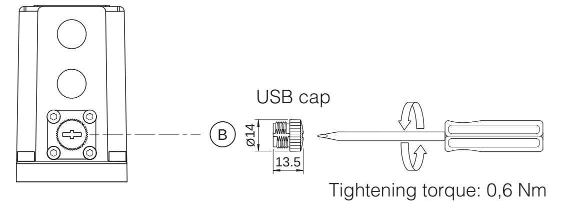
MAIN CONNECTORS



USB CONNECTOR



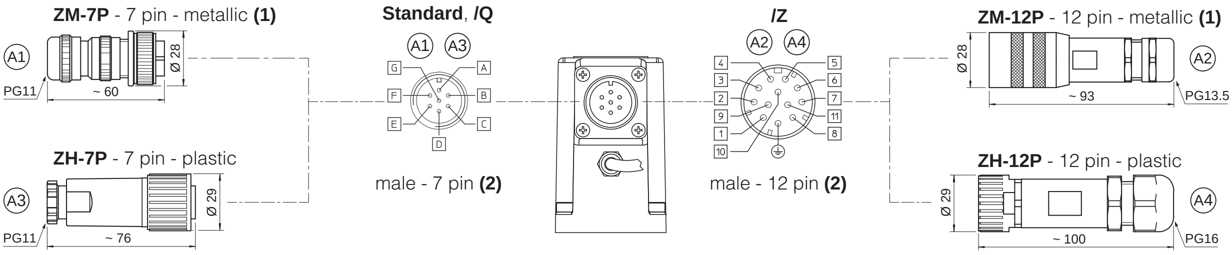
PLASTIC PROTECTION CAP - supplied with the valves



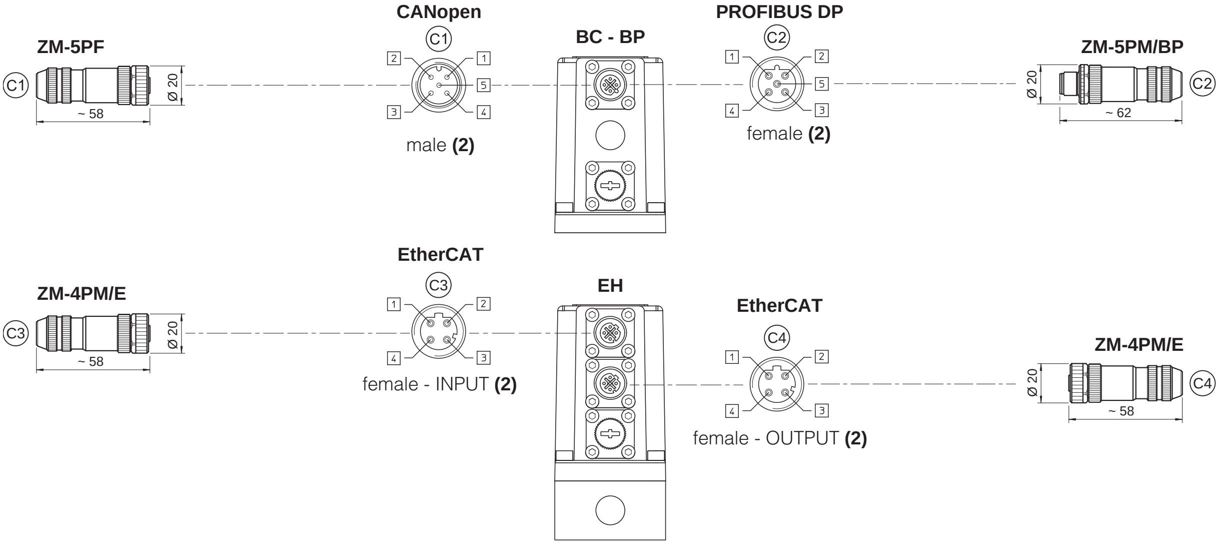
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

20.6 AES connections layout

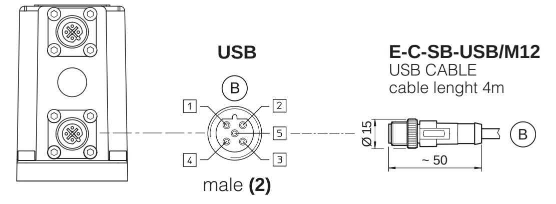
MAIN CONNECTORS



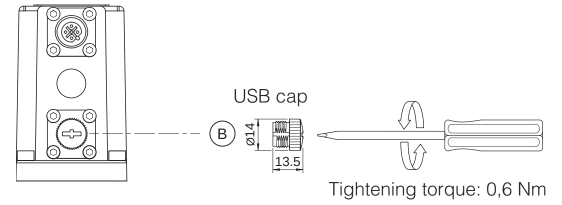
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

21.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

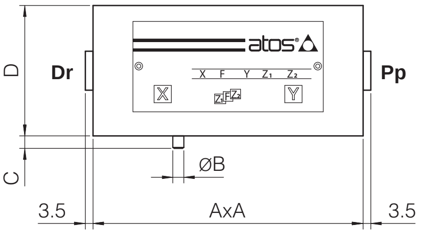
(2) Internally terminated

22 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZO **LICZO** **LIRZO**	**1** = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO **LICZO**	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO	**6** = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

23 COVERS DIMENSIONS [mm]

Size	AxA	ØB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4”
5 = 50	140x140	6	4	70	G 1/4”
6 = 63	180x180	6	4	80	G 3/8”
8 = 80	ø250	8	6	80	G 3/8”



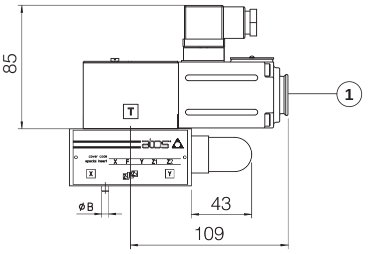
Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

24 COVERS INSTALLATION DIMENSIONS [mm]

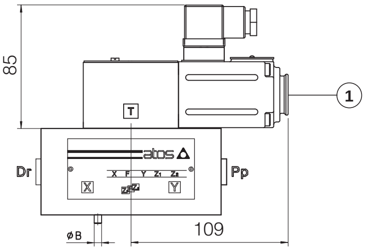
Version **A** for off-board driver

Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	3,3	-	0,2
2 = 25	4,0	-	0,5
3 = 32	5,3	-	0,9
4 = 40	10,7	11,7	1,7
5 = 50	14,2	15,2	2,9
6 = 63	23,7	24,7	6,7
8 = 80	32,3	33,3	13,1

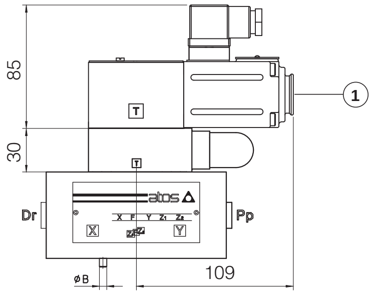
LICZO-A-1 LIMZO-A-1 LIRZO-A-1
LICZO-A-2 LIMZO-A-2 LIRZO-A-2
LICZO-A-3 LIMZO-A-3 LIRZO-A-3



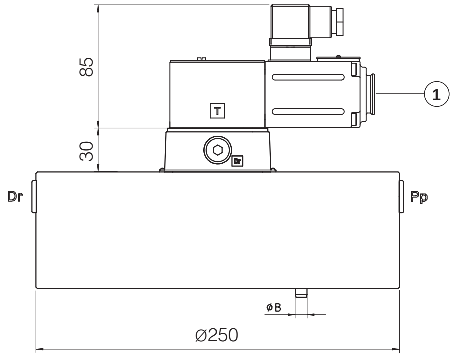
LICZO-A-4 LIMZO-A-4 LIRZO-A-4
LICZO-A-5 LIMZO-A-5
LIMZO-A-6



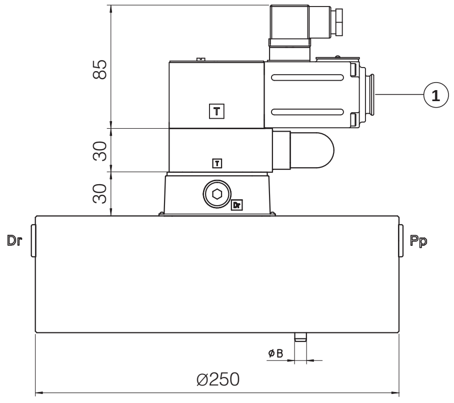
LICZO-A-4/P LIMZO-A-4/P LIRZO-A-4/P
LICZO-A-5/P LIMZO-A-5/P
LIMZO-A-6/P



LIMZO-A-8



LIMZO-A-8/P



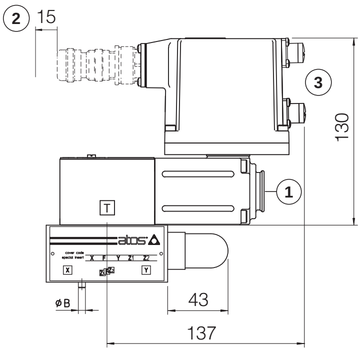
① = Air bleeding, see section 18

Note: for mounting surface and cavity dimensions, see tech. table P006

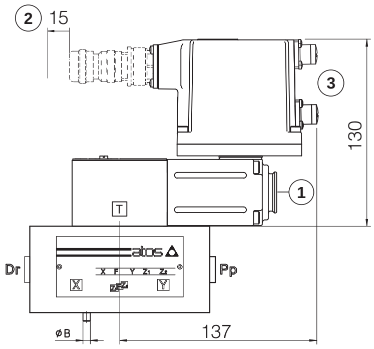
Versions **AEB** and **AES** for on-board driver

Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,0	-	0,2
2 = 25	4,5	-	0,5
3 = 32	5,8	-	0,9
4 = 40	11,2	12,2	1,7
5 = 50	14,7	15,7	2,9
6 = 63	24,2	25,2	6,7
8 = 80	32,8	33,8	13,1

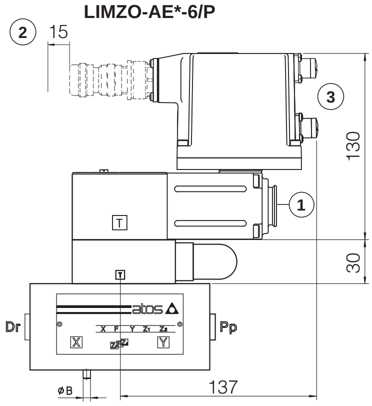
LICZO-AE*-1 LIMZO-AE*-1 LIRZO-AE*-1
LICZO-AE*-2 LIMZO-AE*-2 LIRZO-AE*-2
LICZO-AE*-3 LIMZO-AE*-3 LIRZO-AE*-3



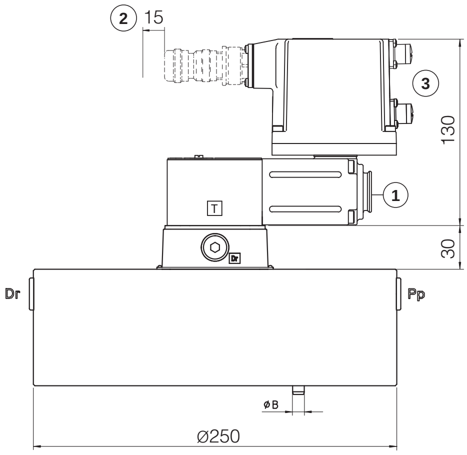
LICZO-AE*-4 LIMZO-AE*-4 LIRZO-AE*-4
LICZO-AE*-5 LIMZO-AE*-5
LIMZO-AE*-6



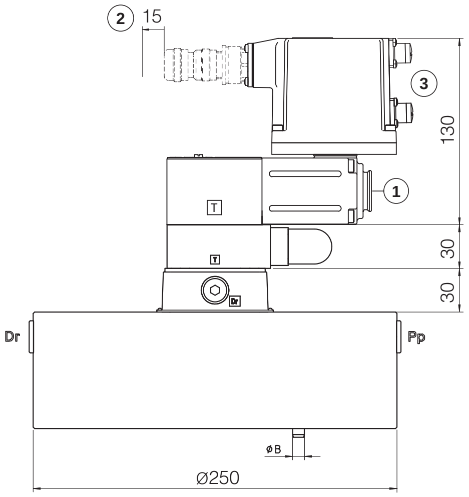
LICZO-AE*-4/P LIMZO-AE*-4/P LIRZO-AE*-4/P
LICZO-AE*-5/P LIMZO-AE*-5/P
LIMZO-AE*-6/P



LIMZO-AE*-8



LIMZO-AE*-8/P

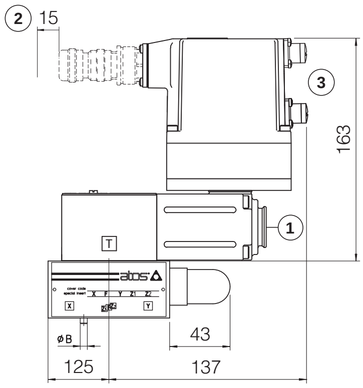


① = Air bleeding, see section 18
② = Space to remove the connectors
③ = The dimensions of all connectors must be considered, see section 20.5 and 20.6

Note: for mounting surface and cavity dimensions, see tech. table P006

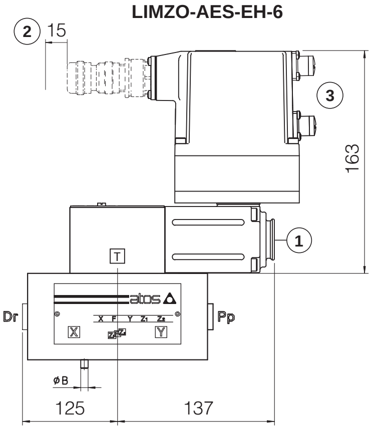
Version **AES-EH** for on-board driver

LICZO-AES-EH-1 LIMZO-AES-EH-1 LIRZO-AES-EH-1
LICZO-AES-EH-2 LIMZO-AES-EH-2 LIRZO-AES-EH-2
LICZO-AES-EH-3 LIMZO-AES-EH-3 LIRZO-AES-EH-3

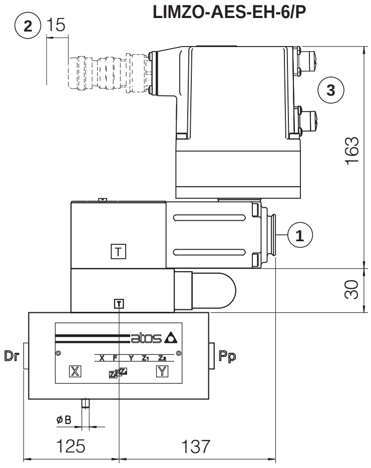


Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,1	-	0,2
2 = 25	4,6	-	0,5
3 = 32	5,9	-	0,9
4 = 40	11,3	12,3	1,7
5 = 50	14,8	15,8	2,9
6 = 63	24,3	25,3	6,7
8 = 80	32,9	33,9	13,1

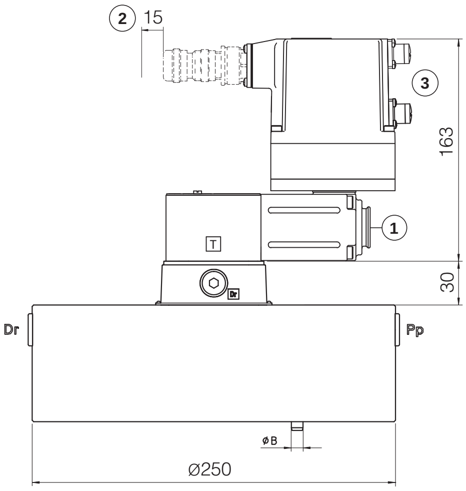
LICZO-AES-EH-4 LIMZO-AES-EH-4 LIRZO-AES-EH-4
LICZO-AES-EH-5 LIMZO-AES-EH-5
LIMZO-AES-EH-6



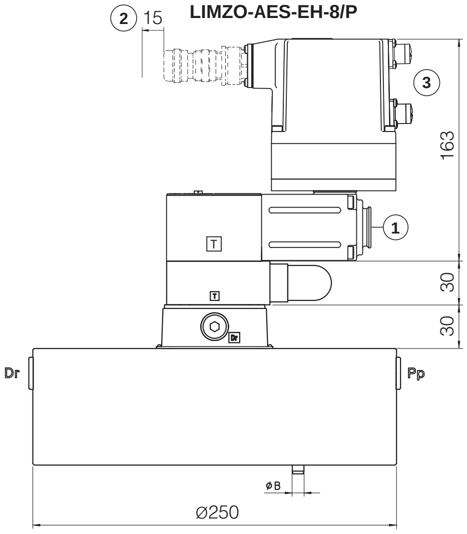
LICZO-AES-EH-4/P LIMZO-AES-EH-4/P LIRZO-AES-EH-4/P
LICZO-AES-EH-5/P LIMZO-AES-EH-5/P
LIMZO-AES-EH-6/P



LIMZO-AES-EH-8



LIMZO-AES-EH-8/P



① = Air bleeding, see section 18

③ = The dimensions of all connectors must be considered, see section 20.5 and 20.6

② = Space to remove the connectors

Note: for mounting surface and cavity dimensions, see tech. table P006

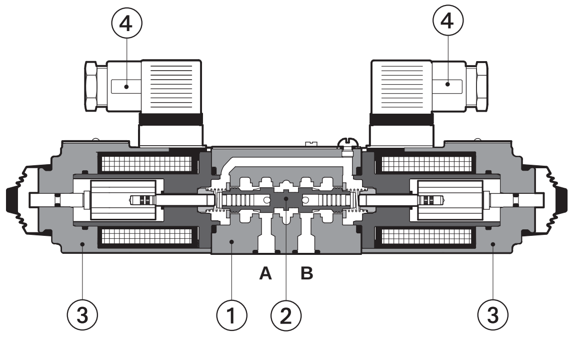
25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS500**	Programming tools
FS900	Operating and maintenance information for proportional valves	**GS510**	Fieldbus
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P006**	Mounting surfaces and cavities for cartridge valves
G030	E-BM-AS digital driver	**QB200**	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	**QF200**	Quickstart for AES valves commissioning

Digital proportional reducing valves

3-way, direct, without transducer

CE



DHRZO-A-012/25

① Valve body
② Spool
③ Proportional solenoid
④ Connector

DHRZO-A, DHRZO-AEB, DHRZO-AES

3 way, direct, digital proportional reducing valves for pressure open loop controls.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

They provide the pressure reduction on ports A, or B, or A and B, depending on the valve model.

The direct execution performs low internal leakages, fast response and low hysteresis.

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **25 bar**

1 MODEL CODE

DHRZO	**-**	**A**	**-**	*****	**-**	**010**	**/**	**25**	**/**	*****	**/**	*****	*****	**/**	*****

Proportional pressure reducing valve, direct

A = off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present **BC** = CANopen
BP = PROFIBUS DP **EH** = EtherCAT

Configuration:
010 = reduced pressure on port A
012 = reduced pressure on port A and B

Max regulated pressure:
25 = 25 bar

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

Series number

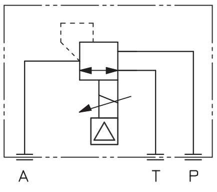
Coil voltage, only for **A** - see section 15 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Hydraulic options:
For configuration 010:
B = reduced pressure on port B, solenoid at side of port A
For configuration 012:
B = solenoid with on-board digital driver at side of port A

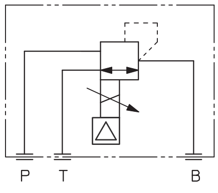
Electronic options, only for **AEB** and **AES (4)**:
I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector

(1) Only for **NP** **(2)** Only for **BC**, **BP**, **EH** **(3)** Omit for **A** execution **(4)** Possible combined options: see section 14

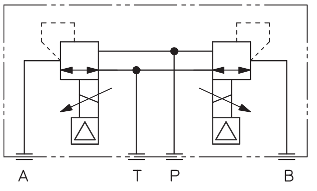
2 HYDRAULIC SYMBOLS (representation according to ISO 1219-1)



DHRZO-*-010/25*



DHRZO-*-010/25/B*



DHRZO-*-012/25*

Hydraulic symbols are represented with on-board digital driver

3 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

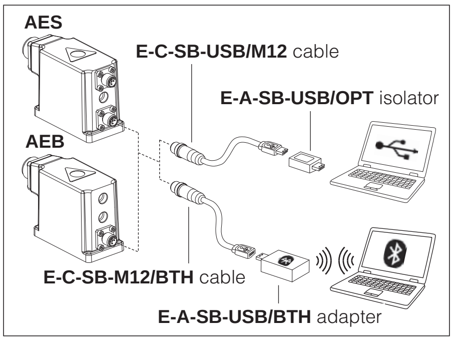
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		**DHRZO**
Max regulated pressure	[bar]	25
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure **(1)**	[bar]	3
Max flow	[l/min]	24
Response time 0-100% step signal (depending on installation) **(2)**	[ms]	≤ 45
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure
(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	**A** = 30 W **AEB**, **AES** = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,4 A 1,8 A for /32 - max pressure 32 bar	3 A 2,25 A for /32 - max pressure 32 bar	1 A 0,8 A for /32 - max pressure 32 bar	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

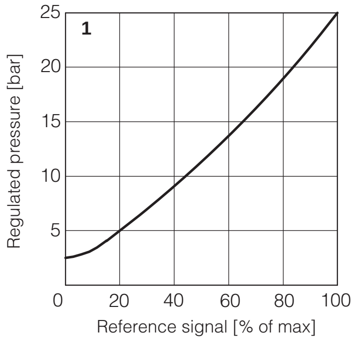
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level – normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at KTF catalog
Max fluid contamination level – longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

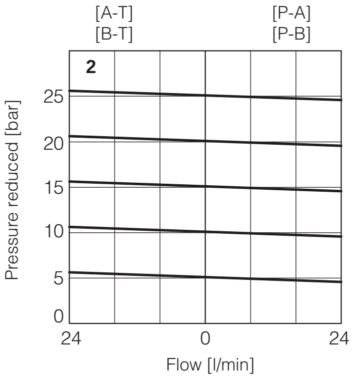
11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = **Regulation diagrams**
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

2 = **Pressure/flow diagrams**
reference signal set at Q = 1 l/min





12 HYDRAULIC OPTIONS

For configuration **010**:
B = reduced pressure on port B, solenoid at side of port A

For configuration **012**:
B = solenoid with on-board digital driver at side of port A (only for AEB and AES version)

13 ELECTRONIC OPTIONS - only for AEB and AES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

14 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ

15 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

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

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**	▨	Analog ground	Gnd - analog signal
	▨	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC	Input - power supply
2	**V0**	Power supply 0 VDC	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**	Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**	Do not connect	
8	**NC**	Do not connect	
9	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

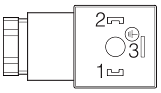
(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

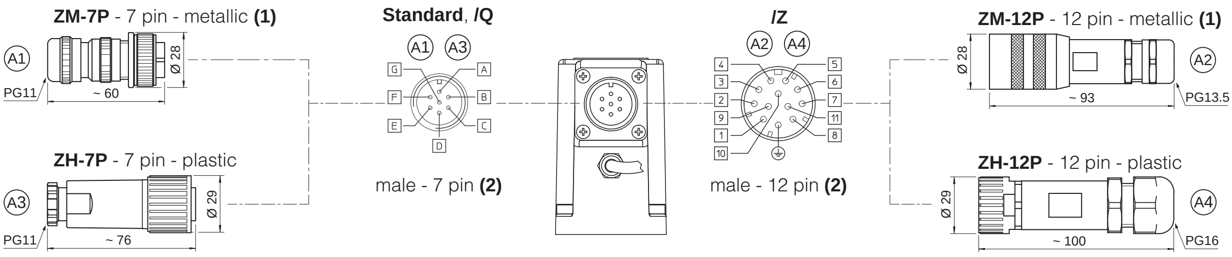
(2) Only for **AES** execution

17.4 Solenoid connection - only for A

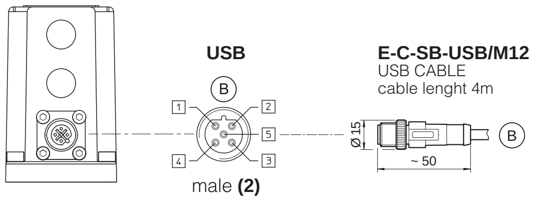
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	 2 3 1
2	**COIL**	Power supply	
3	**GND**	Ground	

17.5 AEB connections layout

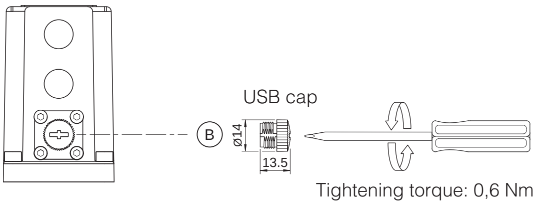
MAIN CONNECTORS



USB CONNECTOR



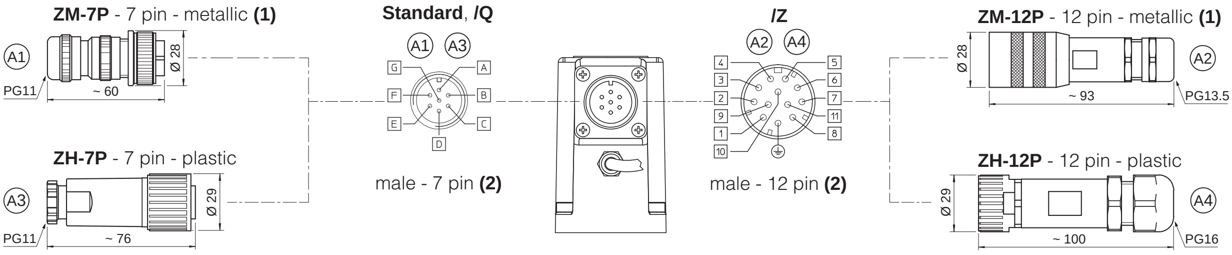
PLASTIC PROTECTION CAP - supplied with the valves



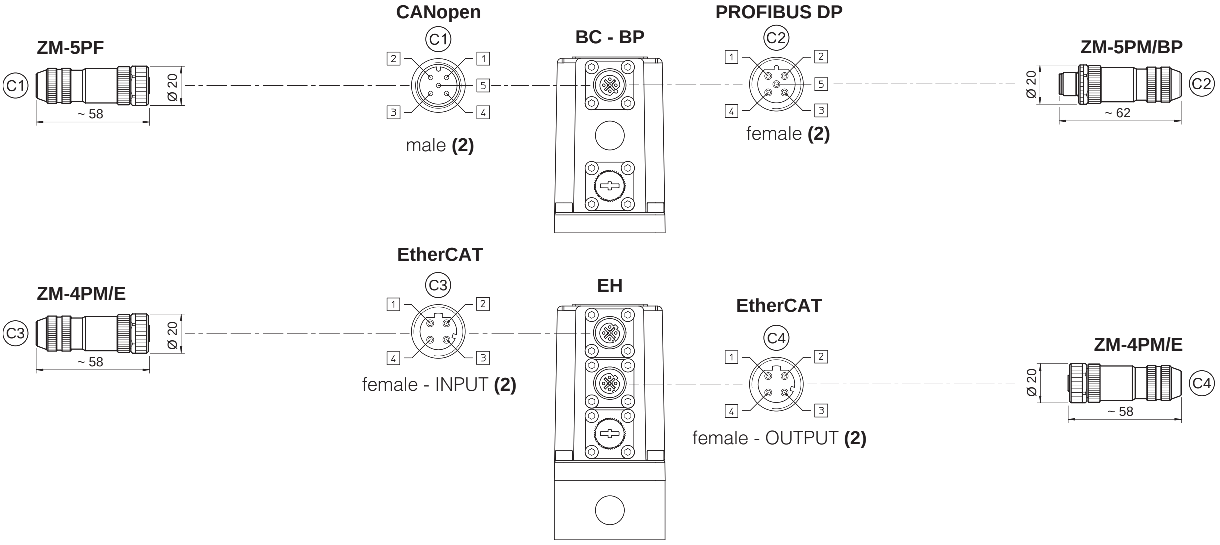
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 AES connections layout

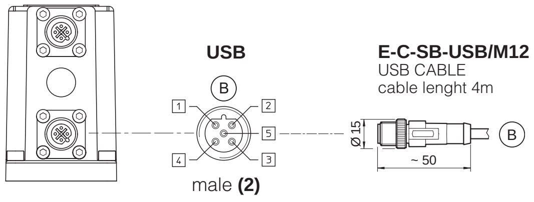
MAIN CONNECTORS



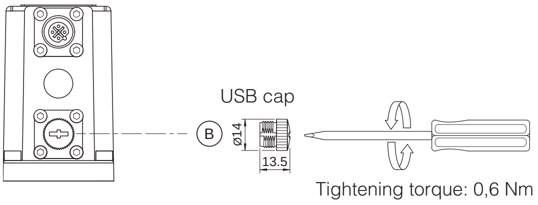
FIELDBUS CONNECTORS



USB CONNECTOR



PLASTIC PROTECTION CAP - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

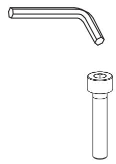
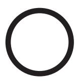
18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 FASTENING BOLTS AND SEALS

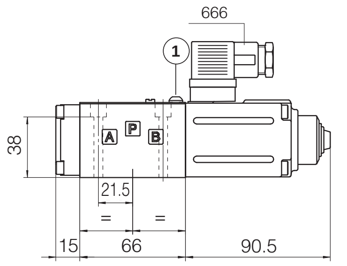
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm

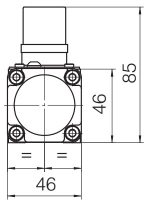
20 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)

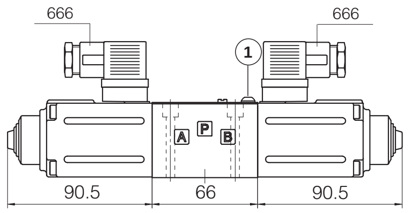
Mass [kg]		
A	**AEB, AES**	**AES-EH**
1,8	2,3	2,4

DHRZO-A-010

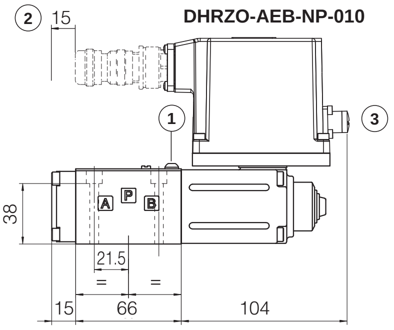


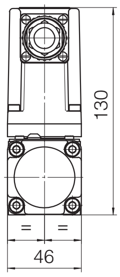


DHRZO-A-012

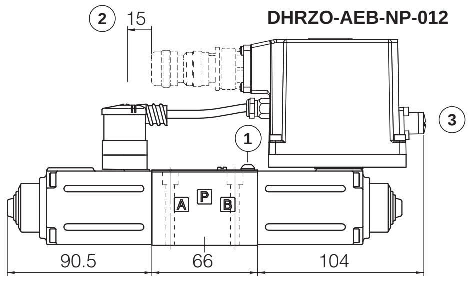


DHRZO-AEB-NP-010

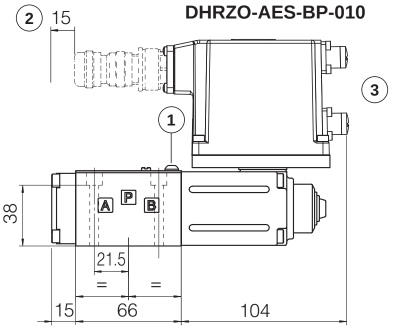


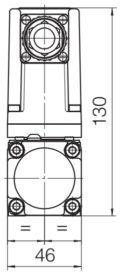


DHRZO-AEB-NP-012

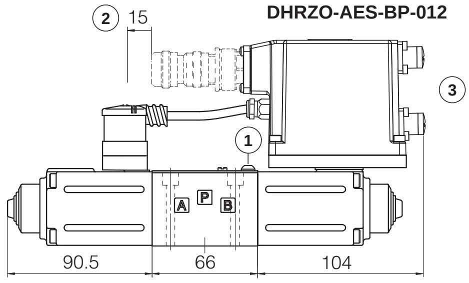


DHRZO-AES-BC-010
DHRZO-AES-BP-010

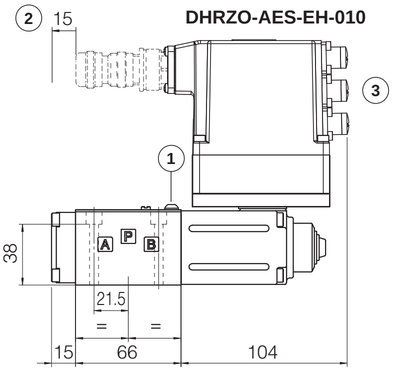


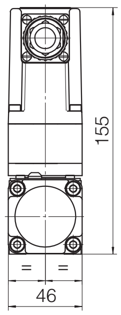


DHRZO-AES-BC-012
DHRZO-AES-BP-012

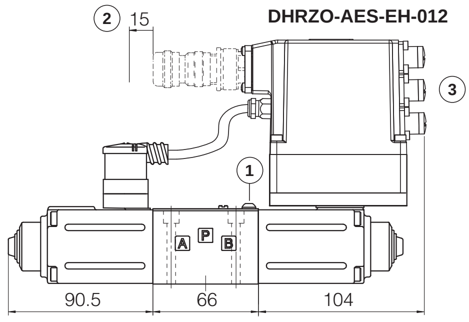


DHRZO-AES-EH-010





DHRZO-AES-EH-012



① = Air bleeding 3

② = Space to remove the connectors

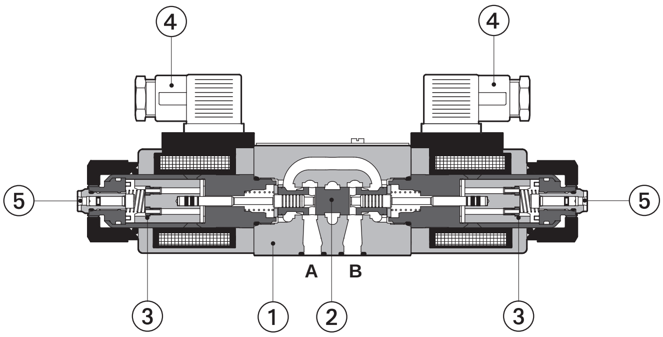
③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
G010	E-MI-AC analog driver
G020	E-MI-AS-IR digital driver
G030	E-BM-AS digital driver
GS050	E-BM-AES digital driver
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB200	Quickstart for AEB valves commissioning
QF200	Quickstart for AES valves commissioning

Proportional reducing valves

3-way, direct, without transducer



DHRZE- A-012/25

① Valve body
② Spool
③ Proportional solenoid
④ Electric connector (supplied with the valve)
⑤ Bleeding screw

DHRZE-A

3 way, direct, pressure reducing valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They provide the pressure reduction on ports A, or B or A and B, depending on the valve model.

The direct execution performs low internal leakages, fast response and low hysteresis.

The solenoids are certified according to North American standard **cURus.**

Typical applications:
- Pressure reduction in low flow systems
- Pilot stage of pilot operated valves

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **315 bar**
Max regulated pressure: **25 bar**

1 MODEL CODE

DHRZE - **A** - **010** / **25** / ***** - ***** / ***** ***** / *****

Proportional pressure reducing valve, direct

A = off-board driver, see section 3

Configuration:
010 = reduced pressure on port A (port B for option /B)
012 = reduced pressure on port A and B

Regulated pressure:
25 = reduced pressure range 3÷25 bar

Hydraulic option:
B = reduced pressure on port B, solenoid side of port A (only for valve configuration 010)

Coil with special connectors, see section 12 :
- = omit for standard DIN connector
J = AMP Junior Timer connector
K = Deutsch connector
S = Lead Wire connection

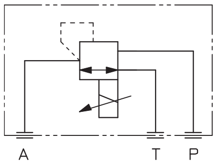
Coil voltage, see section 10 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for 24VDC low current drivers **(1)**

Series number

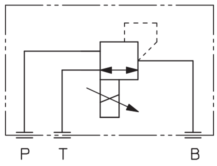
Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

(1) Select valve's coil voltage **/18** in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

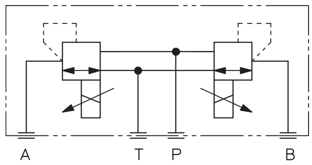
2 HYDRAULIC SYMBOL (representation according to ISO 1219-1)



DHRZE-A-010/25



DHRZE-A-010/25/B



DHRZE-A-012/25

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	**DHRZE**
Max regulated pressure (Q=1 l/min) [bar]	25
Min. regulated pressure (Q=1 l/min) **(1)** [bar]	3
Max. pressure at port P [bar]	315
Max. pressure at port T [bar]	210
Max. flow [l/min]	24
Response time 0-100% step signal **(2)** (depending on installation) [ms]	≤ 45
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3,0
Repeatability [% of the max pressure]	≤ 2,0

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	**cURus** North American Standard		

8 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

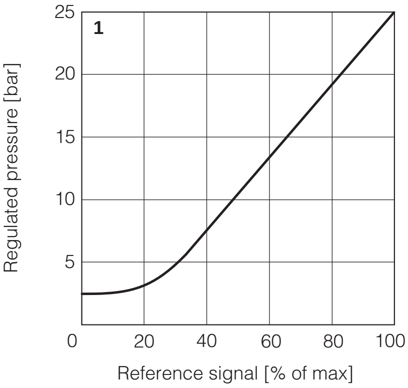
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm^2/s - max allowed range 15 ÷ 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	

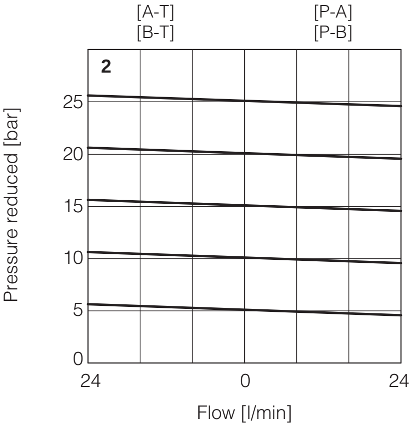
9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

2 = Pressure/flow diagrams
reference signal set at Q = 1 l/min





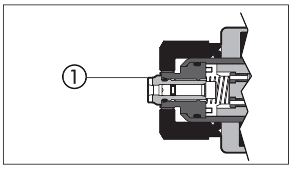
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

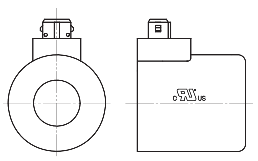
11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.

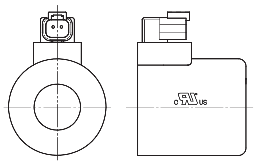


12 COILS WITH SPECIAL CONNECTORS

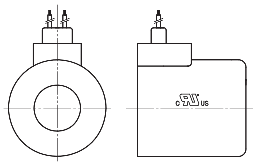
J option
Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



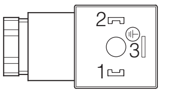
K option
Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67



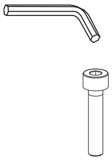
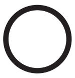
S option
Coil type COZES
Lead Wire connection
Cable lenght = 180 mm



13 SOLENOID CONNECTION

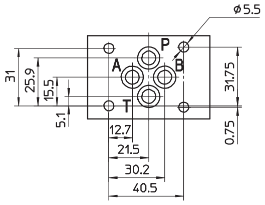
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

14 FASTENING BOLTS AND SEALS FOR DHRZE

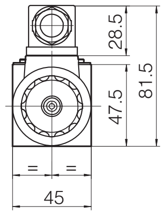
	**Fastening bolts:** 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm
	**Seals:** 4 OR 108 Diameter of ports P, T, A: Ø 7,5 mm

15 INSTALLATION DIMENSIONS FOR DHRZE [mm]

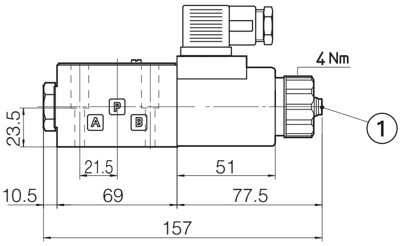
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)



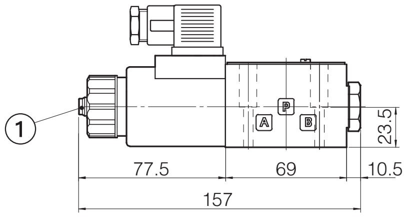
Mass [kg]	
DHRZE-A-010	1,9
DHRZE-A-012	2,6



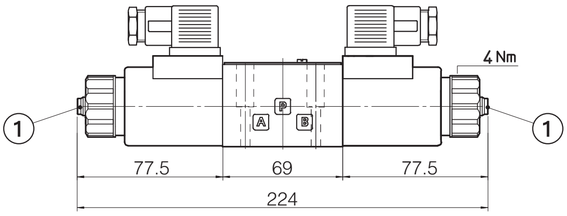
DHRZE-A-010



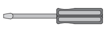
DHRZE-A-010/B



DHRZE-A-012



① = Air bleeding, see section 11



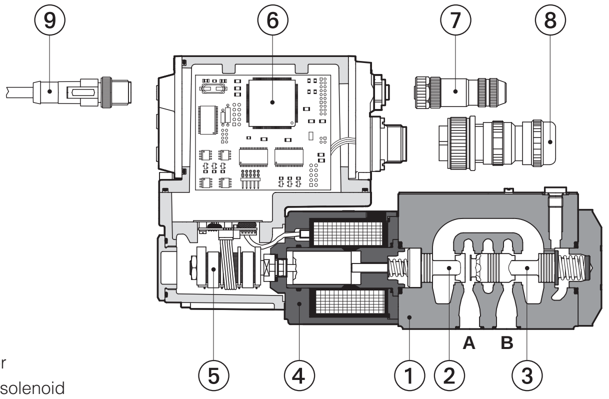
16 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**GS050**	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
G010	E-MI-AC analog driver	**K800**	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	**P005**	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

Digital proportional flow valves

direct, pressure compensated, with on-board driver and LVDT transducer

CE



① Valve body
② Throttle
③ Compensator
④ Proportional solenoid
⑤ LVDT transducer
⑥ On-board digital driver
⑦ Communication connector
⑧ Main connector
⑨ USB connector

QVKZOR-TES-SN-BP

QVHZO-TEB, QVHZO-TES
QVKZOR-TEB, QVKZOR-TES

Proportional flow control valves, direct, pressure compensated, equipped with LVDT position transducer for best accuracy in flow regulations.

TEB basic execution with analog reference signal and USB port for software functional parameters setting.

TES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

QVHZO:	**QVKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZOR	-	TES	-	SN	-	NP	-	10	/	65	/	*		*	/	*

Proportional flow control valves, direct, pressure compensated

QVHZO = size 06
QVKZOR = size 10

TEB = basic on-board digital driver **(1)**
TES = full on-board digital driver

Alternated P/Q controls:
SN = none

Fieldbus interfaces, USB port always present:

NP = Not present	
BC = CANopen	**EW** = POWERLINK
BP = PROFIBUS DP	**EI** = EtherNet/IP
EH = EtherCAT	**EP** = PROFINET RT/IRT

Valve size ISO 4401:
06 = size 06 **10** = size 06

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

Series number

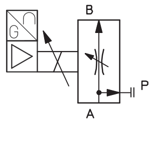
Electronic options (2):
I = current reference input and monitor 4÷20 mA (omit for std voltagea and monitor 0÷10 VDC)
F = fault signal
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector **(3)**

Max regulated flow:

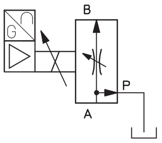
QVHZO:		**QVKZOR**:
3 = 3,5 l/min	**36** = 35 l/min	**65** = 65 l/min
12 = 12 l/min	**45** = 45 l/min	**90** = 90 l/min
18 = 18 l/min		

(1) Only in version **SN-NP** **(2)** Possible combined options: /FI, /IQ, /IZ **(3)** Double power supply only for **TES**

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)
For application examples of 2 and 3 way connections, see section 11

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

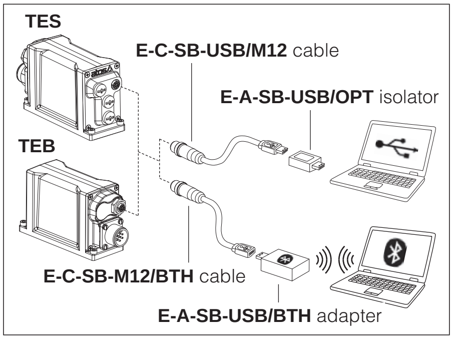
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**QVHZO**					**QVKZOR**	
Max regulated flow [l/min]	3,5	12	18	35	45	65	90
Min regulated flow [cm^3/min]	15	20	30	50	60	85	100
Regulating Δp [bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A [l/min]	50				60	70	100
Max pressure [bar]	210					210	
Response time 0÷100% step signal [ms]	25					35	
Hysteresis [% of the regulated max flow]	0,5					0,5	
Linearity [% of the regulated max flow]	0,5					0,5	
Repeatability [% of the regulated max flow]	0,1					0,1	
Thermal drift	zero point displacement < 1% at ΔT = 40°C						

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	**QVHZO** = 2,6 A **QVKZOR** = 3 A			
Coil resistance R at 20°C	**QVHZO** = 3 ÷ 3,3 Ω **QVKZOR** = 3,8 ÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 17			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

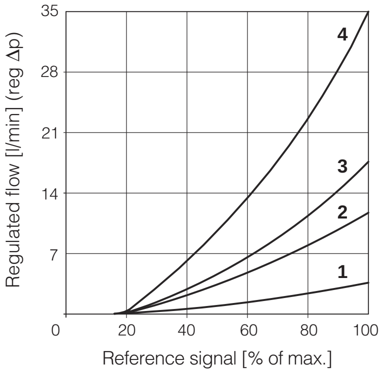
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

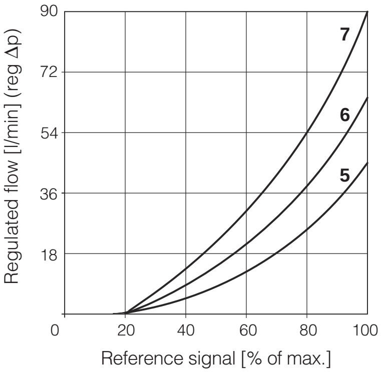
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

10.1 Regulation diagrams

1 = QVHZO-*-06**/3**
2 = QVHZO-*-06**/12**
3 = QVHZO-*-06**/18**
4 = QVHZO-*-06**/36**
5 = QVHZO-*-06**/45**
6 = QVKZOR-*-10**/65**
7 = QVKZOR-*-10**/90**



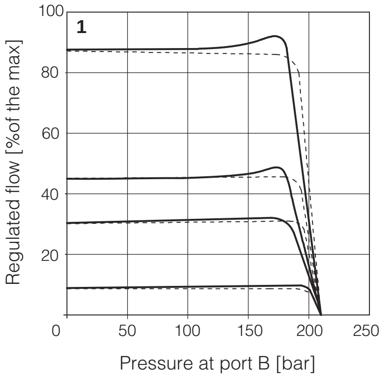


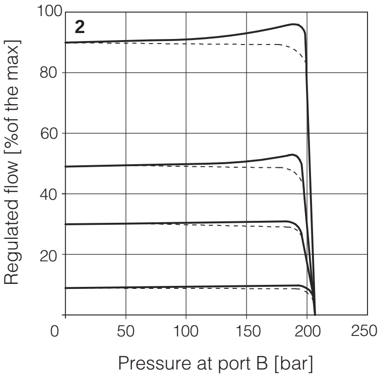
10.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZO
2 = QVKZOR

Dotted line for 3-way versions

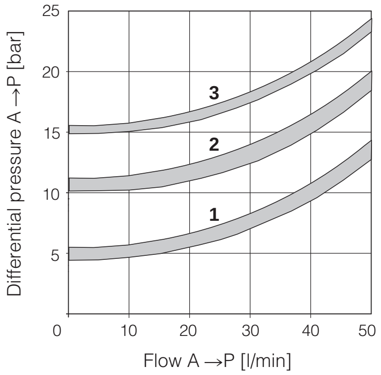


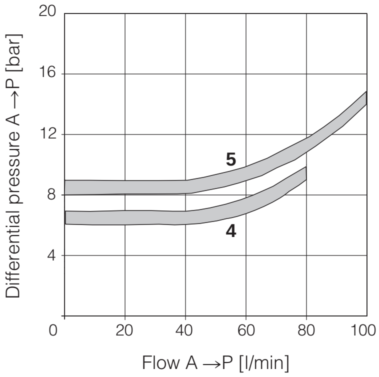


10.3 Flow A →P/Δp diagrams

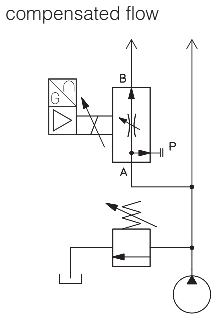
3-way configuration

1 = QVHZO-*-06**/3**
QVHZO-*-06**/12**
2 = QVHZO-*-06**/18**
QVHZO-*-06**/36**
3 = QVHZO-*-06**/45**
4 = QVKZOR-*-10**/65**
5 = QVKZOR-*-10**/90**

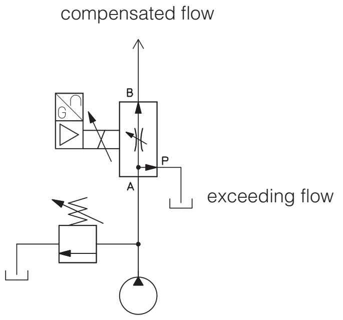




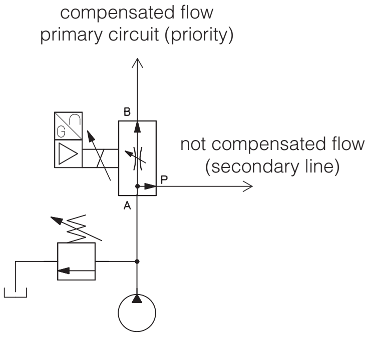
11 APPLICATIONS AND CONNECTIONS



2 way connection



3 way connection



priority connection

2 way connection
The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator.
The metered flow in the controlled line is kept constant, independently to the load variations
If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection
The 3 way connection is normally used when the valve directly controls the pump flow (main line)
The metered flow in the controlled line is kept constant, independently to the load variations
The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way)

Priority connection
The priority connection guarantees the pressure compensated flow supply to the primary circuit.
The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

12 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 14.7 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 14.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 14.6)
Power supply for driver's logics and communication - only for **TES** (see 14.2)

13 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

14 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

14.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 14.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

14.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

14.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

14.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

14.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

14.6 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 14.5).

14.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

15 ELECTRONIC CONNECTIONS AND LEDS

15.1 Main connector signals - 7 pin - standard, /F and /Q options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**			Power supply 24 VDC	Input - power supply
B	**V0**			Power supply 0 VDC	Gnd - power supply
C	**AGND**		**AGND**	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
D	**Q_INPUT+**			Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**			Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR** referred to: AGND	V0		Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
			FAULT	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	**EARTH**			Internally connected to the driver housing	

15.2 Main connector signal - 12 pin - /Z option (A2)

PIN	TEB-SN /Z	TES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
	V+		Power supply 24 VDC	Input - power supply
1	**V0**		Power supply 0 VDC	Gnd - power supply
2 3	**ENABLE** referred to: V0	VL0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
4	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for Q_INPUT+	Input - analog signal
6	**Q_MONITOR** referred to: AGND	VL0	Flow monitor output signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
7	**AGND**		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
8	**R_ENABLE**		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	**NC**		Do not connect	
		VL+	Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**NC**		Do not connect	
		VL0	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11 PE	**FAULT** referred to: V0	VL0	Fault (0 VDC) or normal working (24 VDC)	Output - on/off signal
	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

15.3 Communications connectors (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) (C2) **BC fieldbus execution, connector - M12 - 5 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**not used**	(C1) - (C2) pass-through connection (2)
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C1) (C2) **BP fieldbus execution, connector - M12 - 5 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**

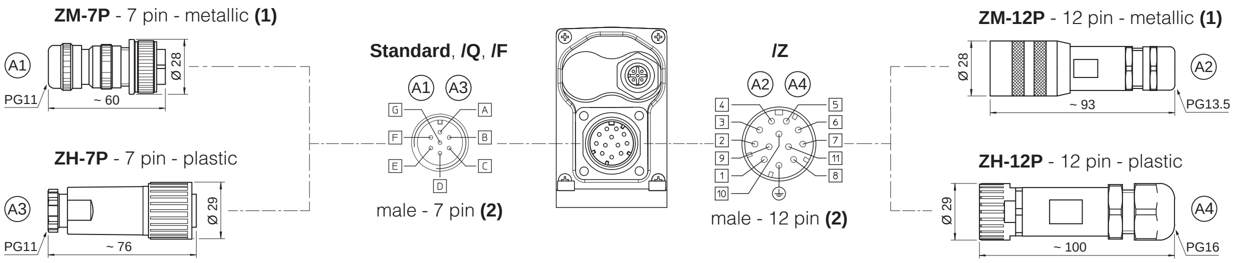
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
	SHIELD	

(1) shield connection on connector's housing is recommended

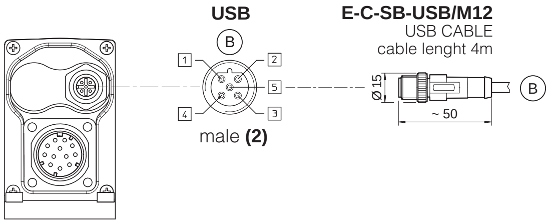
(2) Pin 2 can be fed with external +5V supply of CAN interface

15.4 TEB connections layout

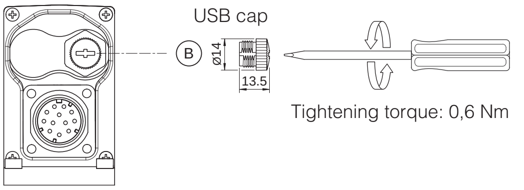
MAIN CONNECTORS



USB CONNECTOR



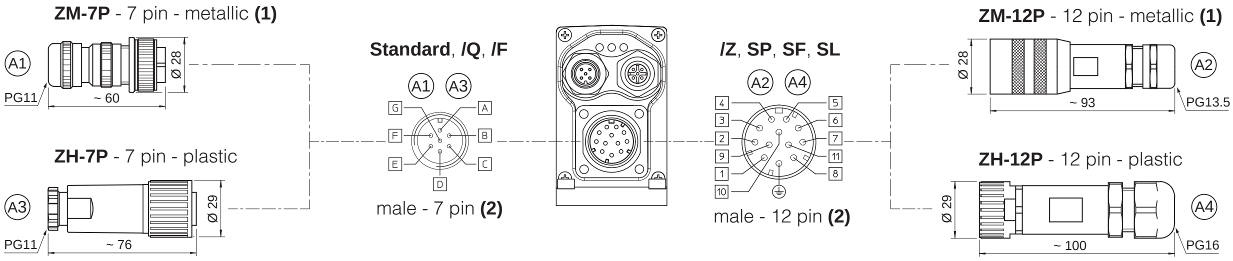
PLASTIC PROTECTION CAP - supplied with the valves



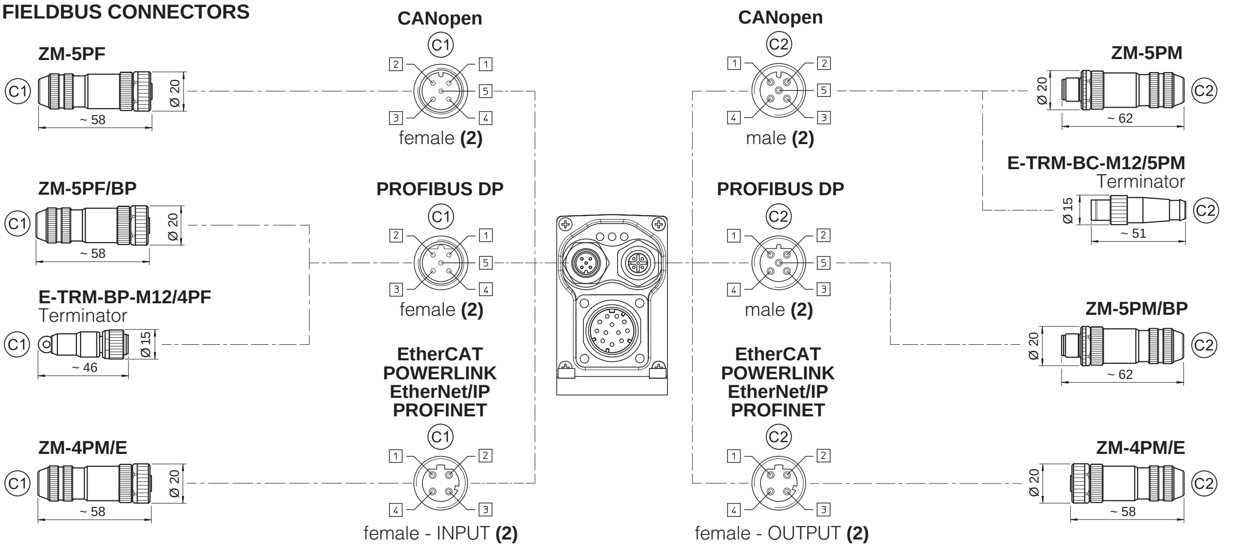
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

15.5 TES connections layout

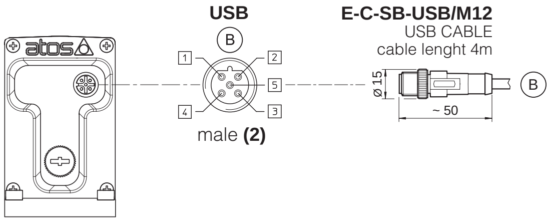
MAIN CONNECTORS



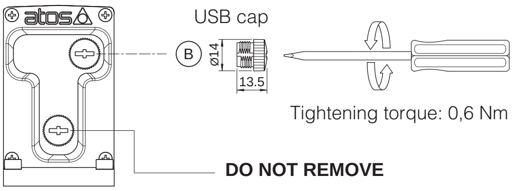
FIELDBUS CONNECTORS



USB CONNECTOR



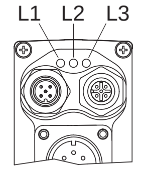
PLASTIC PROTECTION CAPS - supplied with the valves



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

15.6 Diagnostic LEDs - only for **TES**

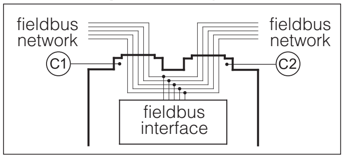
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	**NP** **Not Present**	**BC** **CANopen**	**BP** **PROFIBUS DP**	**EH** **EtherCAT**	**EW** **POWERLINK**	**EI** **EtherNet/IP**	**EP** **PROFINET**	
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

16 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

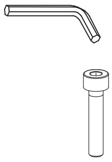
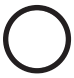
17.3 Fieldbus communication connectors

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

18 FASTENING BOLTS AND SEALS

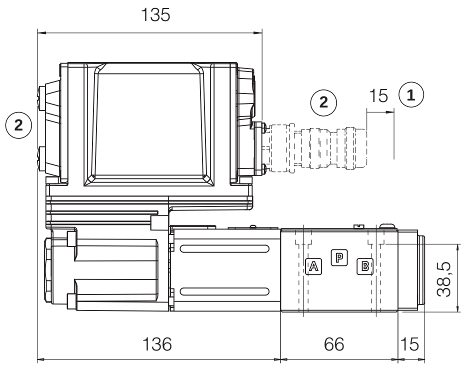
	QVHZO	**QVKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

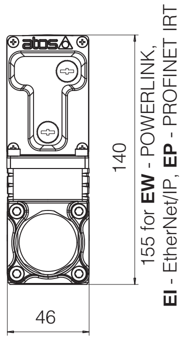
19 INSTALLATION DIMENSIONS [mm]

QVHZO-TEB, QVHZO-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZO-*	2,3

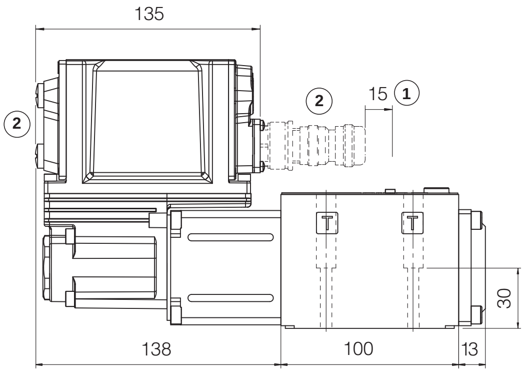


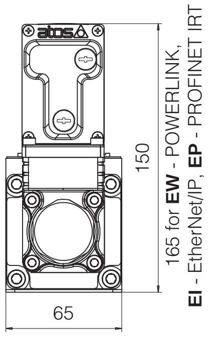

140
155 for **EW** - POWERLINK,
EI - EtherNet/IP, **EP** - PROFINET IRT
46

QVKZOR-TEB, QVKZOR-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZOR-*	4,3




150
165 for **EW** - POWERLINK,
EI - EtherNet/IP, **EP** - PROFINET IRT
65

Mass: 4,3 kg

① = Space to remove the connectors

② = The dimensions of all connectors must be considered, see section 15.4 and 15.5

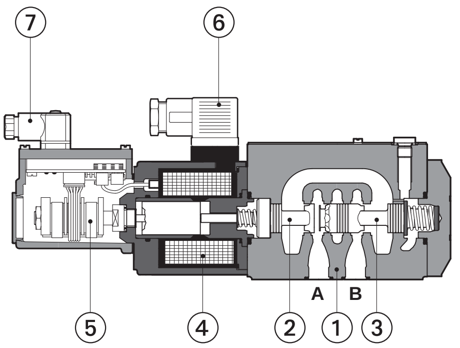
20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	**K800**	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools	**QB300**	Quickstart for TEB valves commissioning
GS510	Fieldbus	**QF300**	Quickstart for TES valves commissioning

Proportional flow valves

direct, pressure compensated, with LVDT transducer

CE



- ① Valve body
- ② Throttle
- ③ Compensator
- ④ Proportional solenoid
- ⑤ LVDT transducer
- ⑥ Solenoid connector
- ⑦ Transducer connector

QVKZOR-T-10/*

QVHZO-T, QVKZOR-T

Proportional flow control valves, direct, pressure compensated, equipped with LVDT position transducer for best accuracy in flow regulations.

The valves operate in association with digital off-board divers, see section 2.

The mechanical pressure compensator keeps a constant Δp across the proportional throttle, thus the regulated flow is independent to the load conditions.

The valves can be connected in 2-way or in 3-way, in this last the exceeding flow, not regulated from A to B ports, returns to tank trough the P port (3rd way).

QVHZO:	**QVKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZOR	-	T	-	10	/	65	/	*	/	*

Proportional flow control valves, direct, pressure compensated

QVHZO = size 06
QVKZOR = size 10

T = with LVDT transducer

Valve size ISO 4401:

06 = size 06
10 = size 10

Max regulated flow:

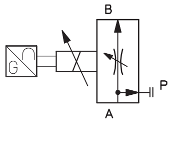
QVHZO:		**QVKZOR**:
3 = 3,5 l/min	**36** = 35 l/min	**65** = 65 l/min
12 = 12 l/min	**45** = 45 l/min	**90** = 90 l/min
18 = 18 l/min		

Series number

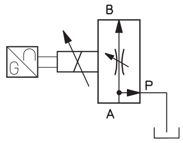
Seals material,
see section 7 :

- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)

For application examples of 2 and 3 way connections, see section 9

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	**QVHZO**					**QVKZOR**	
Max regulated flow [l/min]	3,5	12	18	35	45	65	90
Min regulated flow [cm^3/min]	15	20	30	50	60	85	100
Regulating Δp [bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A [l/min]	50				60	70	100
Max pressure [bar]	210					210	
Response time 0÷100% step signal [ms]	25					35	
Hysteresis [% of the regulated max flow]	0,5					0,5	
Linearity [% of the regulated max flow]	0,5					0,5	
Repeatability [% of the regulated max flow]	0,1					0,1	
Thermal drift	zero point displacement < 1% at ΔT = 40°C						

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	**QVHZO** = 2,6 A **QVKZOR** = 3 A
Coil resistance R at 20°C	**QVHZO** = 3 ÷ 3,3 Ω **QVKZOR** = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

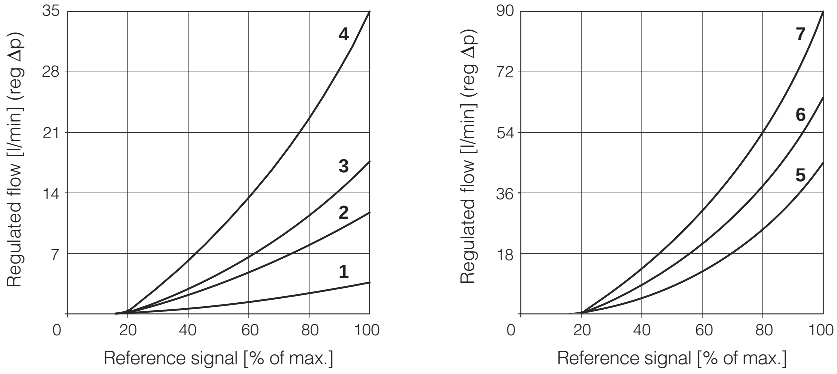
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20÷100 mm^2/s - max allowed range 15 ÷ 380 mm^2/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13	NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11	NAS1638 class 5	

Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

8.1 Regulation diagrams

1 = QVHZO-T-06**/3**
2 = QVHZO-T-06**/12**
3 = QVHZO-T-06**/18**
4 = QVHZO-T-06**/36**
5 = QVHZO-T-06**/45**
6 = QVKZOR-T-10**/65**
7 = QVKZOR-T-10**/90**

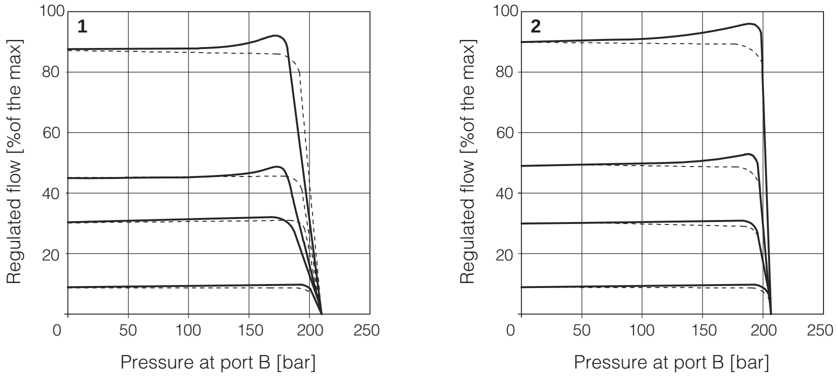


8.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZO
2 = QVKZOR

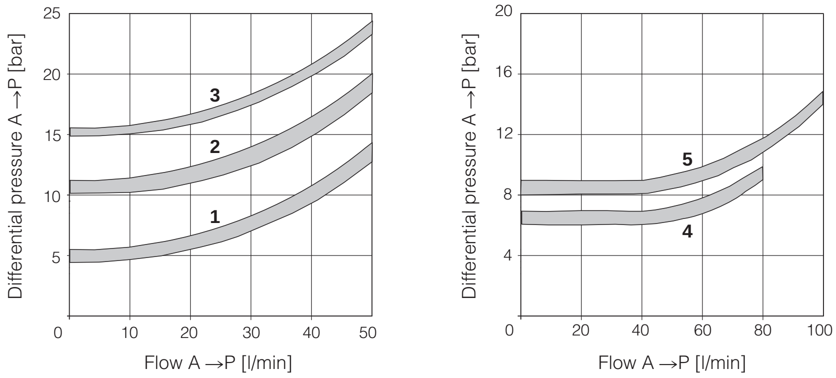
Dotted line for 3-way versions



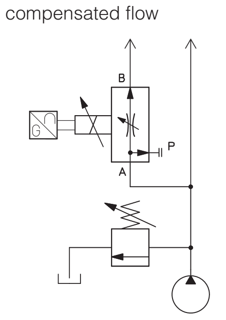
8.3 Flow A →P/Δp diagrams

3-way configuration

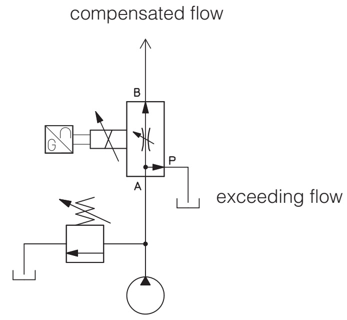
1 = QVHZO-T-06**/3**
QVHZO-T-06**/12**
2 = QVHZO-T-06**/18**
QVHZO-T-06**/36**
3 = QVHZO-T-06**/45**
4 = QVKZOR-T-10**/65**
5 = QVKZOR-T-10**/90**



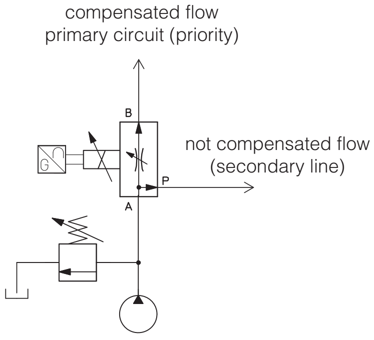
9 APPLICATIONS AND CONNECTIONS



2 way connection



3 way connection



priority connection

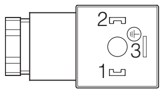
2 way connection
The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator.
The metered flow in the controlled line is kept constant, independently to the load variations
If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection
The 3 way connection is normally used when the valve directly controls the pump flow (main line)
The metered flow in the controlled line is kept constant, independently to the load variations
The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way)

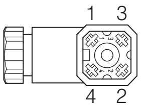
Priority connection
The priority connection guarantees the pressure compensated flow supply to the primary circuit.
The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

10 ELECTRICAL CONNECTION

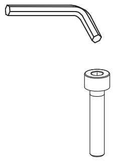
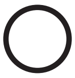
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	**TR**	Output signal	
2	**VT-**	Power supply -15VDC	
3	**VT+**	Power supply +15VDC	
4	**GND**	Ground	

11 FASTENING BOLTS AND SEALS

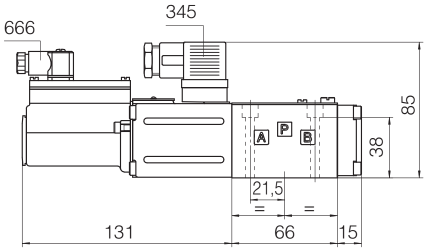
	QVHZO	QVKZOR
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

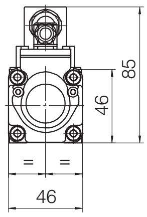
12 INSTALLATION DIMENSIONS [mm]

QVHZO-T

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZO-T	2,3

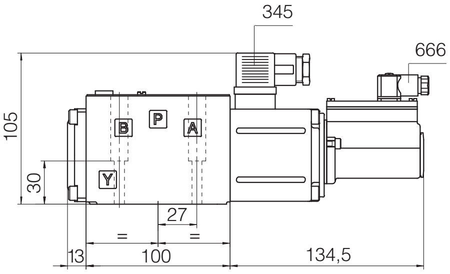


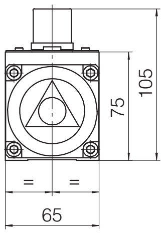


QVKZOR-T

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZOR-T	3,9





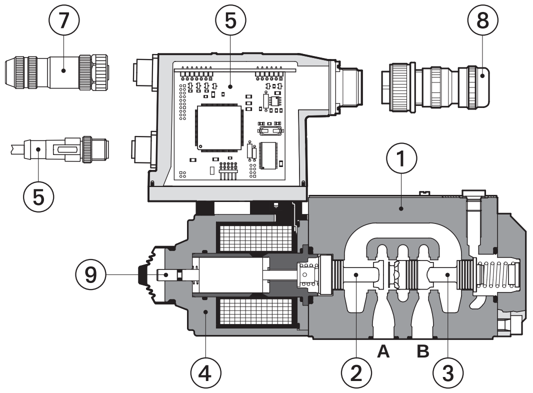
13 RELATED DOCUMENTATION

FS900	Operating and maintenance information for proportional valves	**GS500**	Programming tools
GS230	E-BM-TEB digital driver	**GS510**	Fieldbus
GS235	E-BM-TID digital driver	**K800**	Electric and electronic connectors
GS240	E-BM-TES digital driver	**P005**	Mounting surfaces for electrohydraulic valves

Digital proportional flow valves

direct, pressure compensated, without transducer

CE



1. Valve body
2. Throttle
3. Compensator
4. Proportional solenoid
5. On-board digital driver
6. USB connector
7. Communication connector
8. Main connector
9. Standard manual override protected by rubber cap

QVKZOR-AES-BC

QVHZO-A, QVHZO-AEB, QVHZO-AES
QVKZOR-A, QVKZOR-AEB, QVKZOR-AES

Proportional flow control valves, direct, pressure compensated without position transducer for open loop flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

QVHZO:	**QVKZOR**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZOR - **AES** - **BC** - **10** / **65** / ***** / ***** / ***** / *****

Pressure compensated flow control valves, direct
QVHZO = size 06
QVKZOR = size 10

A = for off-board driver, see section 3
AEB = basic on-board digital driver **(1)**
AES = full on-board digital driver **(2)**

Fieldbus interfaces, USB port always present **(3)**:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

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

Max regulated flow:
QVHZO:
3 = 3,5 l/min
12 = 12 l/min
18 = 18 l/min
36 = 35 l/min
45 = 45 l/min
QVKZOR:
65 = 65 l/min
90 = 90 l/min

Hydraulic options (4):
D = quick venting of port B

Hand lever options, only for **QVHZO-A** - see section 13 :
MO = horizontal hand lever
MV = vertical hand lever

Electronics options, only for **AEB** and **AES (4)**:
C = current feedback for pressure transducer 4÷20 mA (omit for std voltage 0÷10 VDC) - only for **W**
I = current reference input 4÷20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals -12 pin connector
W = power limitation function - 12 pin connector

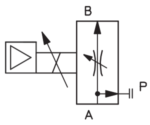
Coil voltage, only for **A** - see section 16 :
- = standard coil for 24VDC Atos drivers
6 = optional coil for 12VDC Atos drivers
18 = optional coil for low current drivers

Series number

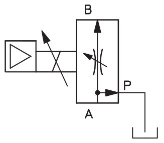
Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR

(1) Only for **NP**
(2) Only for **BC**, **BP**, **EH**
(3) Omit for **A** execution
(4) For possible combined options, see section 15

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines
The port T must be always not connected (blocked)
For application examples of 2 and 3 way connections, see section 12

Note: hydraulic symbols are rapresented with on-board digital driver

3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

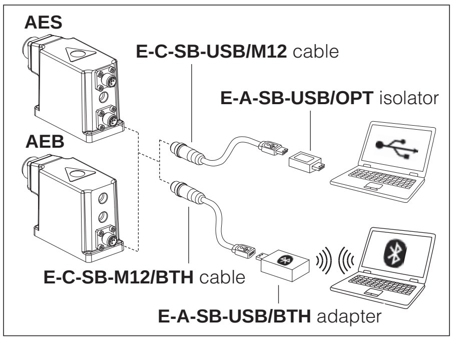
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

6 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C **AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C **AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	QVHZO					QVKZOR	
Max regulated flow [l/min]	3,5	12	18	35	45	65	90
Min regulated flow [cm³/min]	15	20	30	50	60	85	100
Regulating Δp [bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A [l/min]	40			50	55	70	100
Max pressure [bar]	210						
Response time 0-100% step signal [ms]	≤ 30					≤ 45	
Hysteresis	≤ 5 [% of the regulated max flow]						
Linearity	≤ 3 [% of the regulated max flow]						
Repeatability	≤ 1 [% of the regulated max flow]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	QVHZO			QVKZOR		
	A = 30 W	**AEB**, **AES** = 50 W		**A** = 35 W	**AEB**, **AES** = 50 W	
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1,2 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω					
Monitor output	Output range: voltage ±5 VDC @ max 5 mA					
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ					
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)					
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	**A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 19					

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

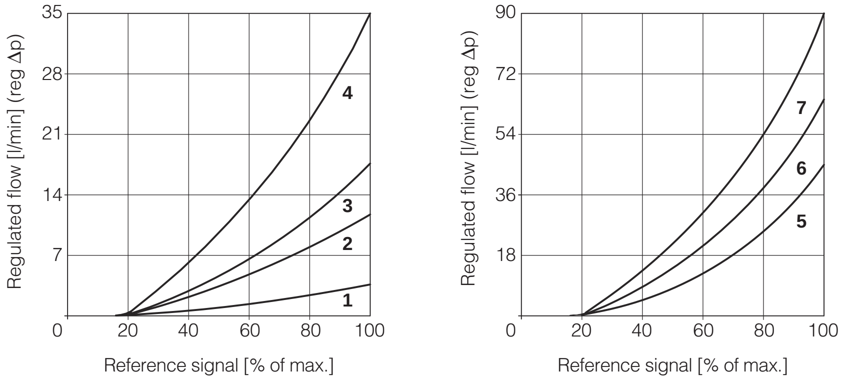
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C	
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s	
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	

Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

11.1 Regulation diagrams

1 = QVHZO-*-06**/3**
2 = QVHZO-*-06**/12**
3 = QVHZO-*-06**/18**
4 = QVHZO-*-06**/36**
5 = QVHZO-*-06**/45**
6 = QVKZOR-*-10**/65**
7 = QVKZOR-*-10**/90**

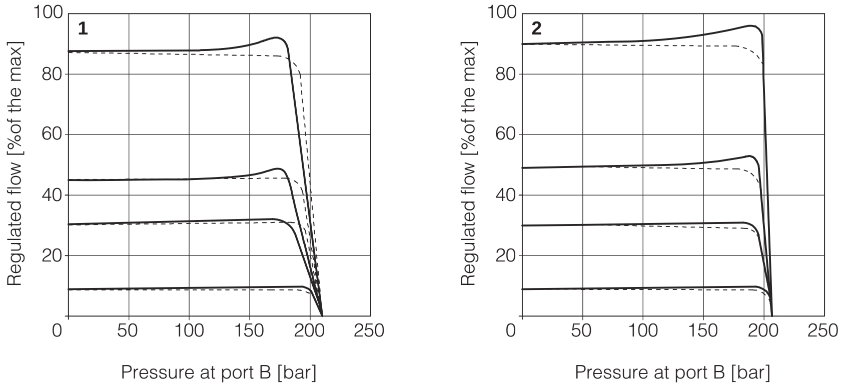


11.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZO
2 = QVKZOR

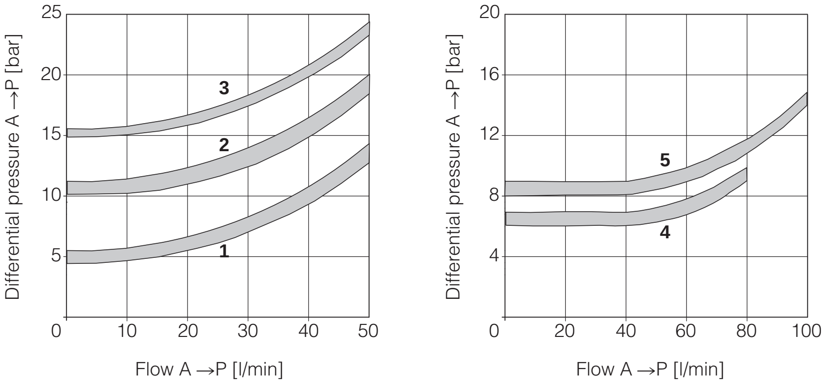
Dotted line for 3-way versions



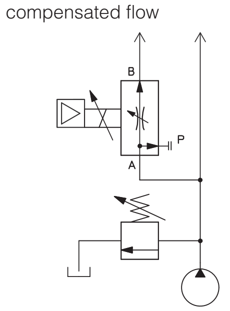
11.3 Flow A →P/Δp diagrams

3-way configuration

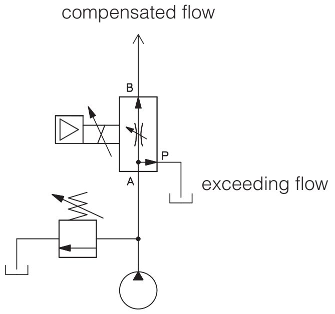
1 = QVHZO-*-06**/3**
QVHZO-*-06**/12**
2 = QVHZO-*-06**/18**
QVHZO-*-06**/36**
3 = QVHZO-*-06**/45**
4 = QVKZOR-*-10**/65**
5 = QVKZOR-*-10**/90**



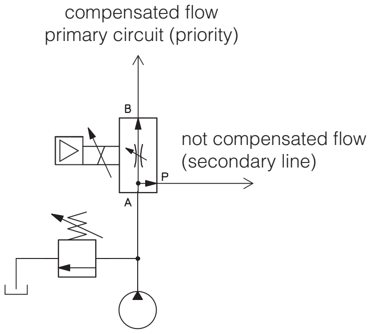
12 APPLICATIONS AND CONNECTIONS



2 way connection



3 way connection



priority connection

2 way connection
The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator.
The metered flow in the controlled line is kept constant, independently to the load variations.
If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection
The 3 way connection is normally used when the valve directly controls the pump flow (main line).
The metered flow in the controlled line is kept constant, independently to the load variations.
The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way).

Priority connection
The priority connection guarantees the pressure compensated flow supply to the primary circuit.
The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

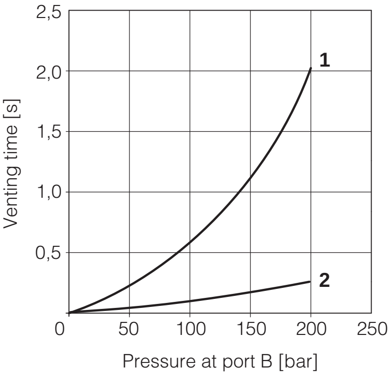
13 HYDRAULIC OPTIONS

D = This option provides a quick venting of the use port B when the valve is closed or de-energized.
The valve must be connected in 3 way, with P port connected to tank.
When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.

In the diagram aside are represented the venting times of **QVHZO** and **QVKZOR** with option /D respect to standard versions:

1 = standard version

2 = option /Q

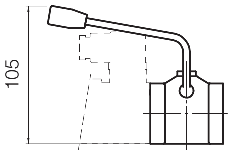


Hand lever option - only for **QVHZO-A**

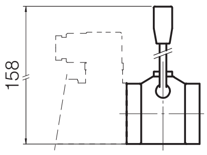
It allows to operate the valve in absence of electrical power supply.
For detailed description of QVHZO-A with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

MV = Vertical hand lever



MO option

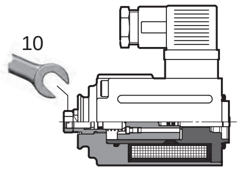


MV option

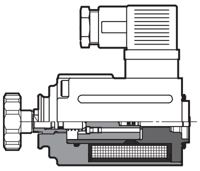
The following supplementary options allow to operate **QVHZO-A** and **QVKZOR-A** in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table **TK150**

N = Manual micrometric adjustment

NV = As option /N plus handwheel and graduated scale



N option



NV option

14 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

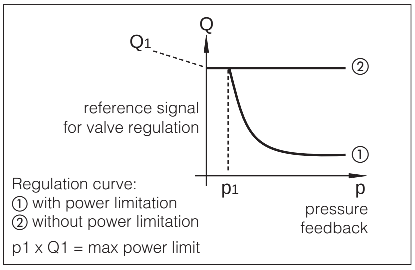
C = Only in combination with option **/W**
This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.

It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR.
When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve.
The higher is the pressure feedback the lower is the valve's regulated flow:

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

Hydraulic Power Limitation - only for option **/W**



Regulation curve:
① with power limitation
② without power limitation

p1 x Q1 = max power limit

15 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ, /IW, /CW, /CWI

16 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z and /W options

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

17.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 18.4).
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) **Standard** and **/Q** option - for **AEB** and **AES**

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDC) or disable (0 VDC) the driver, referred to V0	Input - on/off signal
D	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
E	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
F	**MONITOR** referred to: AGND	 V0	Monitor output signal: ±5 VDC maximum range Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
G	**EARTH**		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) **/Z** and **/W** options - for **AEB** and **AES**

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**		Power supply 24 VDC	Input - power supply
2	**V0**		Power supply 0 VDC	Gnd - power supply
3	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	**INPUT+**		Reference input signal: ±10 VDC / ±20 mA maximum range Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
5	**INPUT-**		Negative reference input signal for INPUT+	Input - analog signal
6	**MONITOR**		Monitor output signal: ±5 VDC maximum range, referred to VL0 Default is 0 ÷ 5 VDC (1V = 1A)	Output - analog signal **Software selectable**
7	**NC**		Do not connect	
8	**NC**		Do not connect	
		MONITOR2	2nd monitor output signal: ±5 VDC maximum range, referred to VL0. Default is 0 ÷ 5 VDC	Output - analog signal
9	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
10	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
11	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
PE	**EARTH**		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for **AEB** (B) and **AES** (B) - (C)

(B) **USB connector - M12 - 5 pin** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(C1) **BC fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**NC**	do not connect
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(C2) **BP fieldbus execution, connector - M12 - 5 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V**	Termination supply signal
2	**LINE-A**	Bus line (high)
3	**DGND**	Data line and termination signal zero
4	**LINE-B**	Bus line (low)
5	**SHIELD**	

(C3) (C4) **EH fieldbus execution, connector - M12 - 4 pin (2)**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

(1) Shield connection on connector's housing is recommended

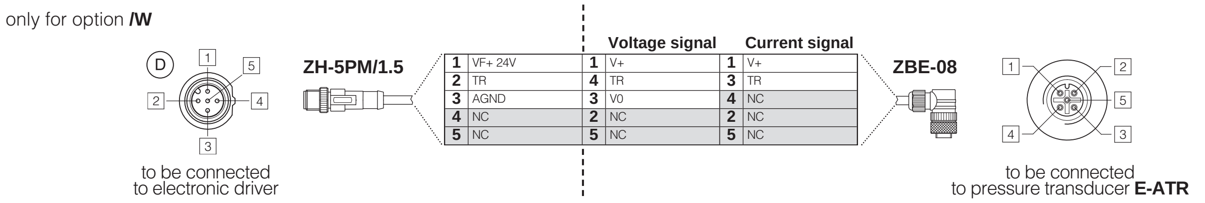
(2) Only for **AES** execution

18.4 Remote pressure transducer connector - M12 - 5 pin - only for **/W** option - for **AEB** and **AES** Ⓓ

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	**VF +24V**	Power supply +24VDC	Connect	Connect
2	**TR**	Signal transducer maximum range ±10 VDC / ±20 mA, software selectable Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/
4	**NC**	Not Connect	/	/
5	**NC**	Not Connect	/	/

Remote pressure transducer connection - example

only for option **/W**



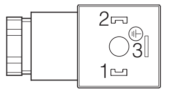
		Voltage signal		Current signal	
1	VF+ 24V	**1**	V+	**1**	V+
2	TR	**4**	TR	**3**	TR
3	AGND	**3**	V0	**4**	NC
4	NC	**2**	NC	**2**	NC
5	NC	**5**	NC	**5**	NC

to be connected to electronic driver

to be connected to pressure transducer **E-ATR**

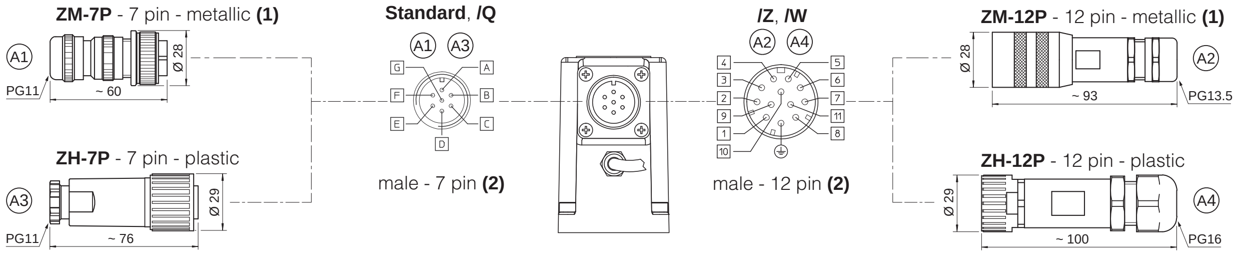
Note: connectors front view

18.5 Solenoid connection - only for **A**

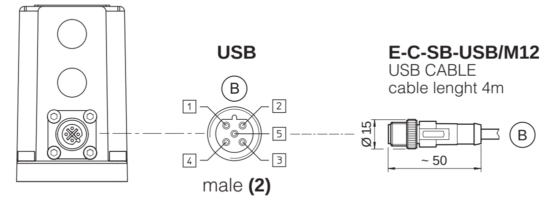
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	**COIL**	Power supply	
2	**COIL**	Power supply	
3	**GND**	Ground	

18.6 AEB connections layout

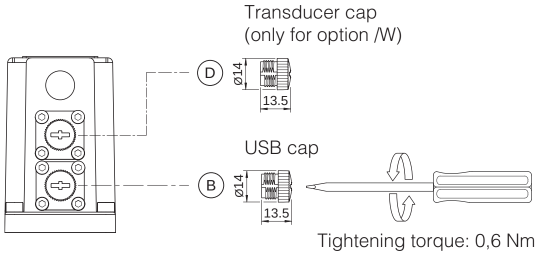
MAIN CONNECTORS



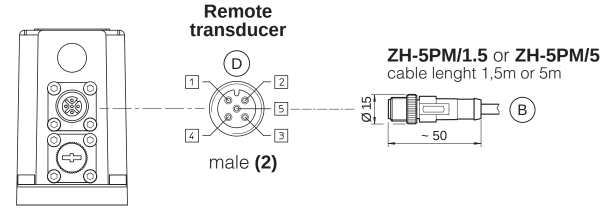
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option **/W**

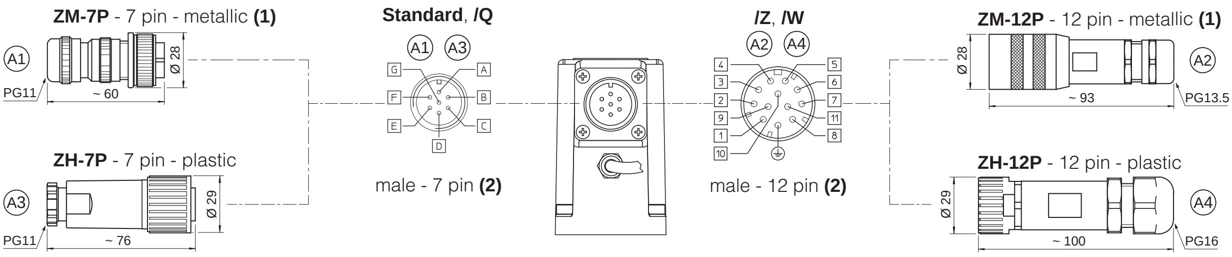


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

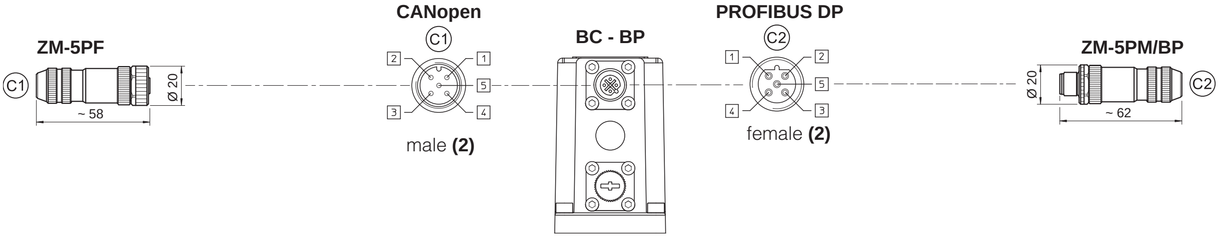
(2) Pin layout always referred to driver's view

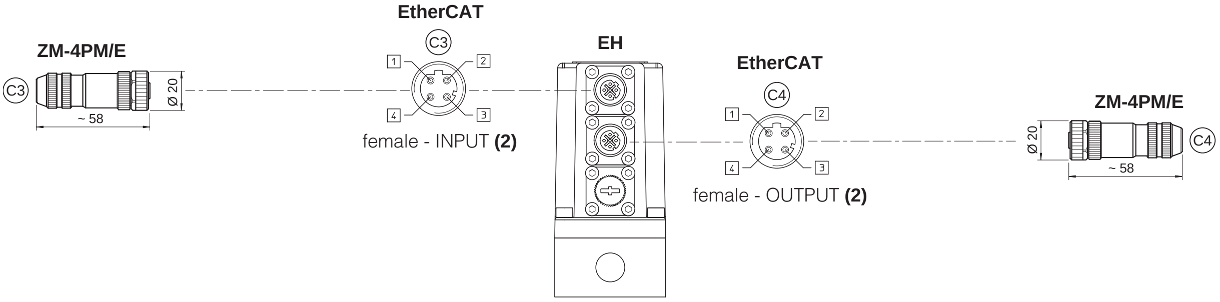
18.7 AES connections layout

MAIN CONNECTORS

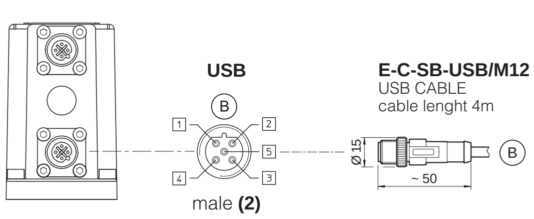


FIELDBUS CONNECTORS

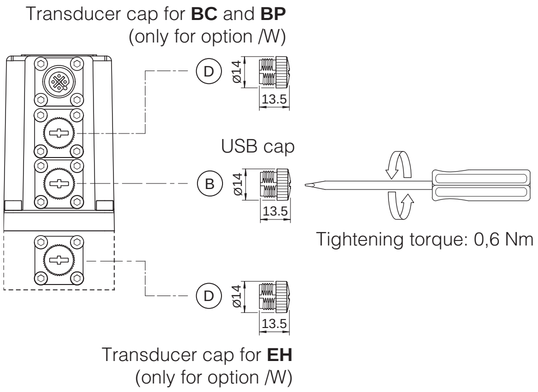




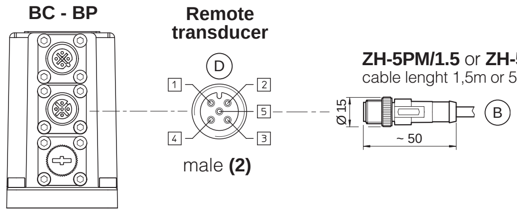
USB CONNECTOR

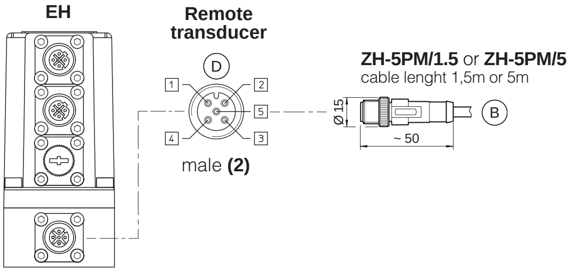


PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W





(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm^2 max 20 m (logic and power supply) or LiYCY 7 x 1 mm^2 max 40 m (logic and power supply)
Conductor size	up to 1 mm^2 - available for 7 wires	up to 1 mm^2 - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	**POWER SUPPLY**	**POWER SUPPLY**
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm^2 max 20 m (logic and power supply)	LiYCY 10 x 0,14mm^2 max 40 m (logic) LiYY 3 x 1mm^2 max 40 m (power supply)
Conductor size	0,5 mm^2 to 1,5 mm^2 - available for 12 wires	0,14 mm^2 to 0,5 mm^2 - available for 9 wires 0,5 mm^2 to 1,5 mm^2 - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	**BC CANopen** (1)		**BP PROFIBUS DP** (1)		**EH EtherCAT** (2)
CODE	(C1) **ZM-5PF**	(C2) **ZM-5PM**	(C1) **ZM-5PF/BP**	(C2) **ZM-5PM/BP**	(C1) (C2) **ZM-4PM/E**
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

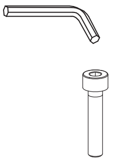
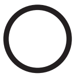
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19.4 Pressure transducer connectors - only for **/W** option

CONNECTOR TYPE	**TRANSDUCER**	
CODE	(D1) **ZH-5PM/1.5**	(D1) **ZH-5PM/5**
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm^2	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

20 FASTENING BOLTS AND SEALS

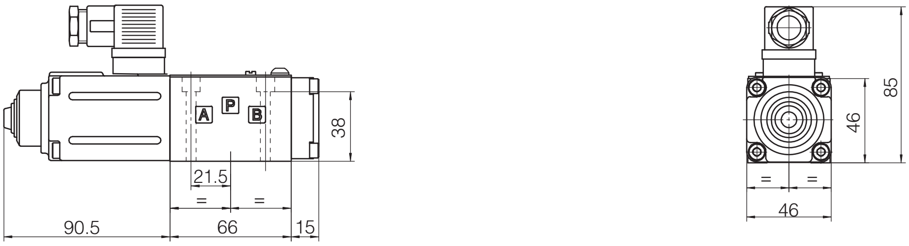
	QVHZO	**QVKZOR**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm	**Seals:** 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm

21 INSTALLATION DIMENSIONS FOR QVHZO [mm]

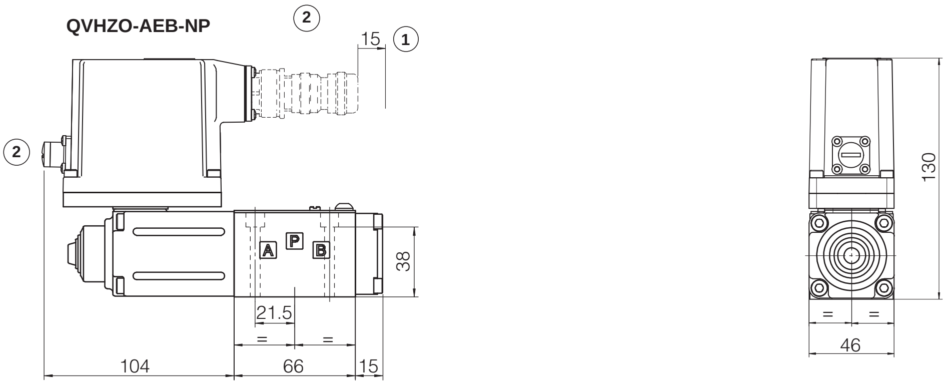
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
2,3	2,8	2,9

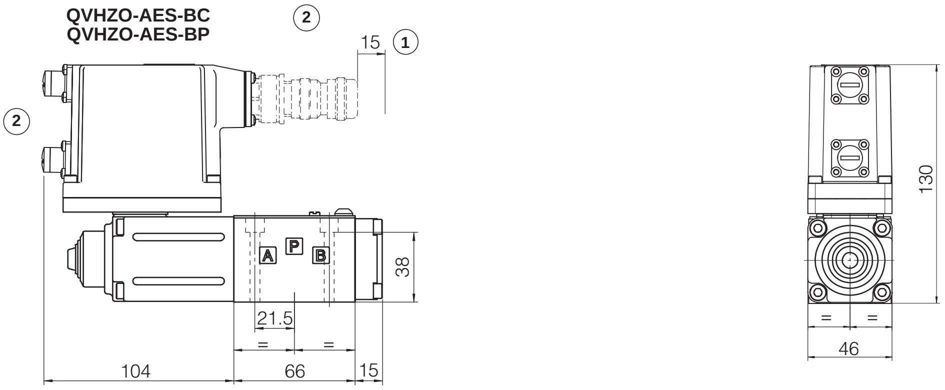
QVHZO-A



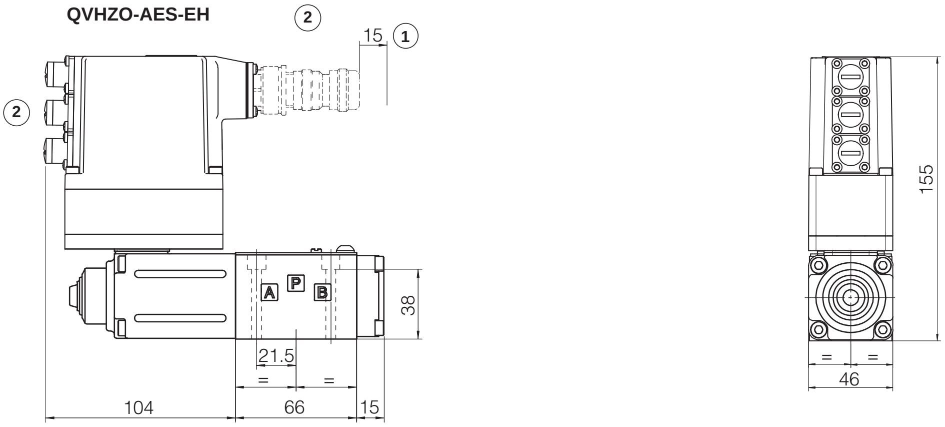
QVHZO-AEB-NP



QVHZO-AES-BC
QVHZO-AES-BP



QVHZO-AES-EH



① = Space to remove the connectors

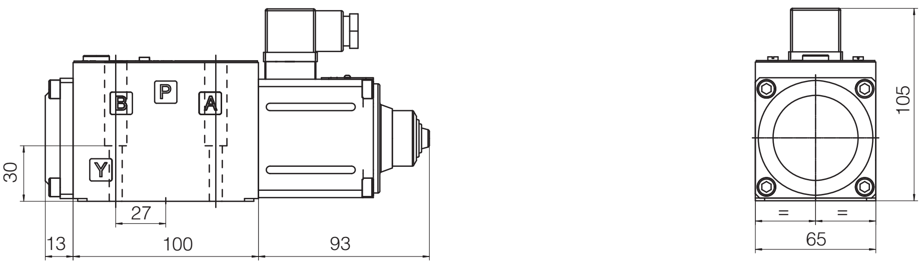
② = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 INSTALLATION DIMENSIONS FOR QVHZOR [mm]

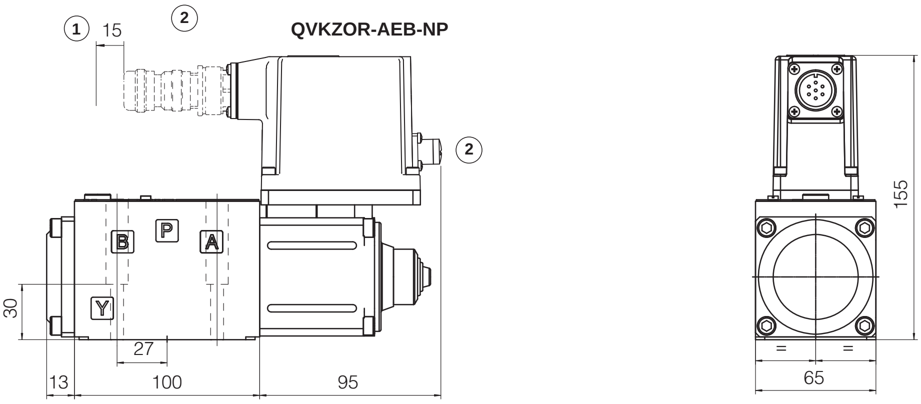
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]		
A	**AEB, AES**	**AES-EH**
3,8	4,3	4,4

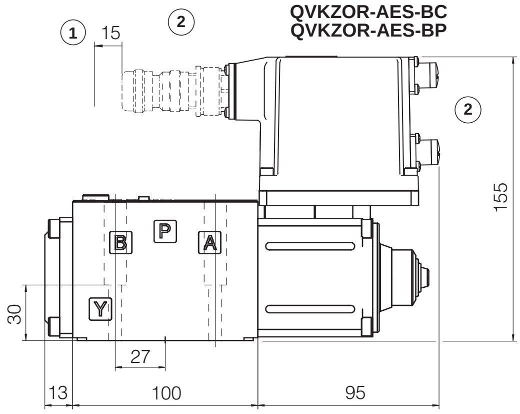
QVKZOR-A



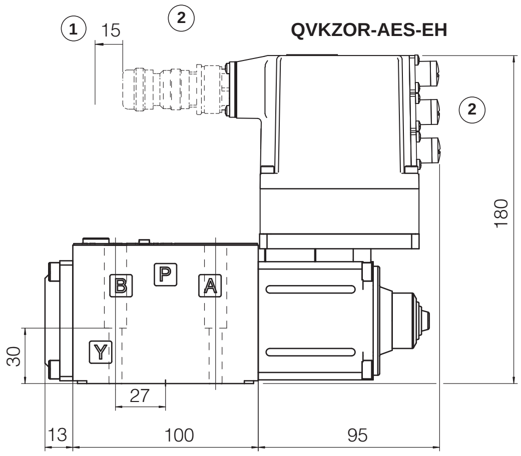
QVKZOR-AEB-NP



QVKZOR-AES-BC
QVKZOR-AES-BP



QVKZOR-AES-EH



① = Space to remove the connectors

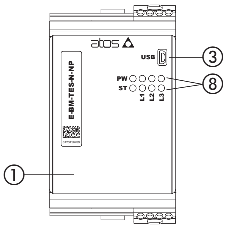
② = The dimensions of all connectors must be considered, see section 18.6 and 18.7

23 RELATED DOCUMENTATION

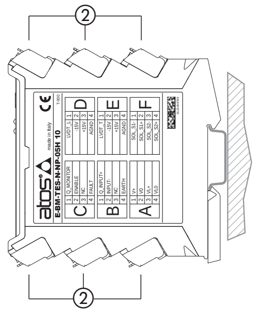
FS001	Basics for digital electrohydraulics	**GS510**	Fieldbus
FS900	Operating and maintenance information for proportional valves	**K800**	Electric and electronic connectors
G010	E-MI-AC analog driver	**P005**	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	**QB200**	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	**QF200**	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

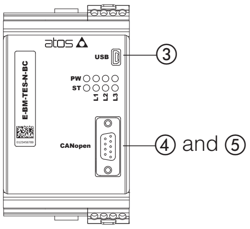
Digital E-BM-TES/LES drivers

DIN-rail format, for proportional valves with one or two LVDT transducers

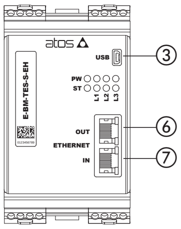


E-BM-TES-N- **NP** Not Present

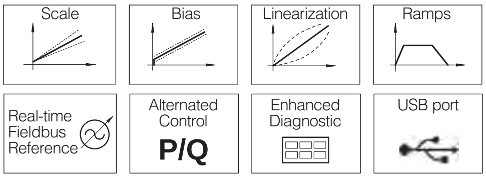




E-BM-TES-N- **BC** CANopen
BP PROFIBUS DP



E-BM-TES-S- **EH** EtherCAT
EW POWERLINK
EI EtherNet/IP
EP PROFINET RT/IRT



E-SW
programming software

Connectors ② included

E-BM-TES/LES

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.
TES execution controls direct operated directional/flow valves with one LVDT transducer.
LES execution controls pilot operated directional valves with two LVDT transducers.
Option S adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation (see section 4).
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- up to 9 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 6.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM - **TES** - **N** - **NP** - **01H** * / * * / *

Off-board electronic driver in DIN rail format

TES = digital full driver, for valves with one LVDT transducer
LES = digital full driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none
S = closed loop pressure/force (see tech table **FS500**)

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

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TES**)

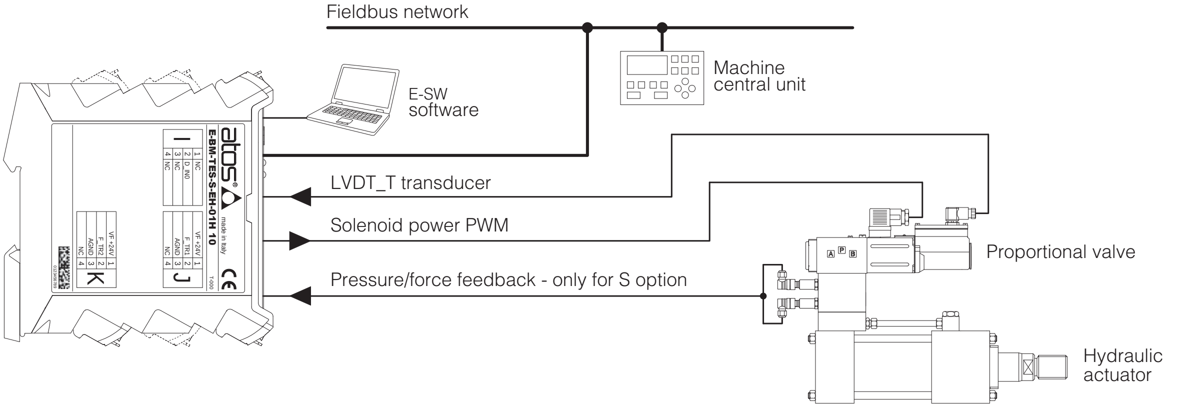
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TES-N**)

Options, see section 6 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for remote transducers (only for option **S**) and LVDT transducers (only for option **A**)
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 V_{DC})

Series number

Set code (see section 7)

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

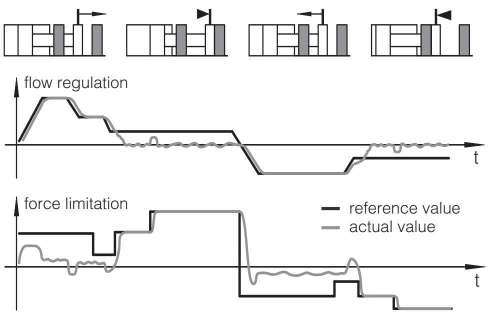
Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	**DHZO-T, DKZOR-T** F165, F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175, F178	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Tech table	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	**LIQZA-L** FX350, FX370
Driver model	**E-BM-TES**				**E-BM-LES**	

▨ Option S not available

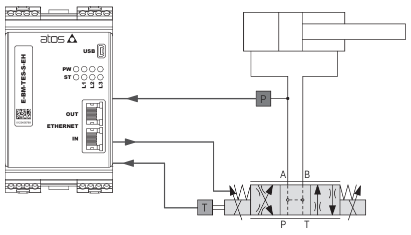
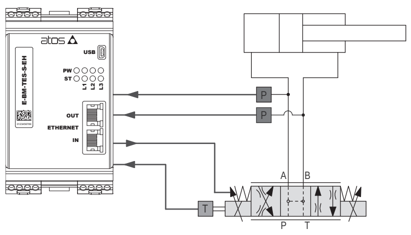
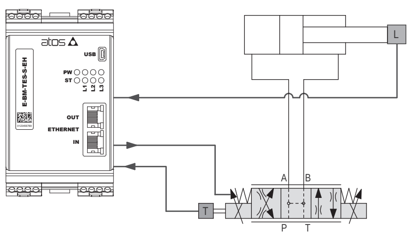
4 ALTERNATED P/Q CONTROL - only for S option

S option on digital drivers adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation.
The alternated P/Q control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time.
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.
Flow regulation is active when the actual system pressure/force is lower than the relevant input reference signal - the valve works normally to regulate the flow by controlling in closed-loop the spool/poppet position through the integral LVDT transducer.
Pressure/force control is activated when the actual system pressure/force, measured by remote transducers, grows up to the relevant input reference signal - the driver reduces the valve's flow regulation in order to keep steady the system pressure/force.
If the pressure/force tends to decrease under its input reference signal, the flow control returns active.
The dynamic response of pressure/force control can be adapted to different system's characteristics, by setting the internal PID parameters using Atos PC software.
Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.

Flow Priority



Alternated control configurations - software selectable

SP	SF	SL
		
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load

T valve's spool transducer
P pressure transducer
L load cell

SP – flow/pressure control
Adds pressure control to standard flow control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.

SF – flow/force control
Adds force control to standard flow control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

SL – flow/force control
Adds force control to standard flow control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

5 MAIN CHARACTERISTICS

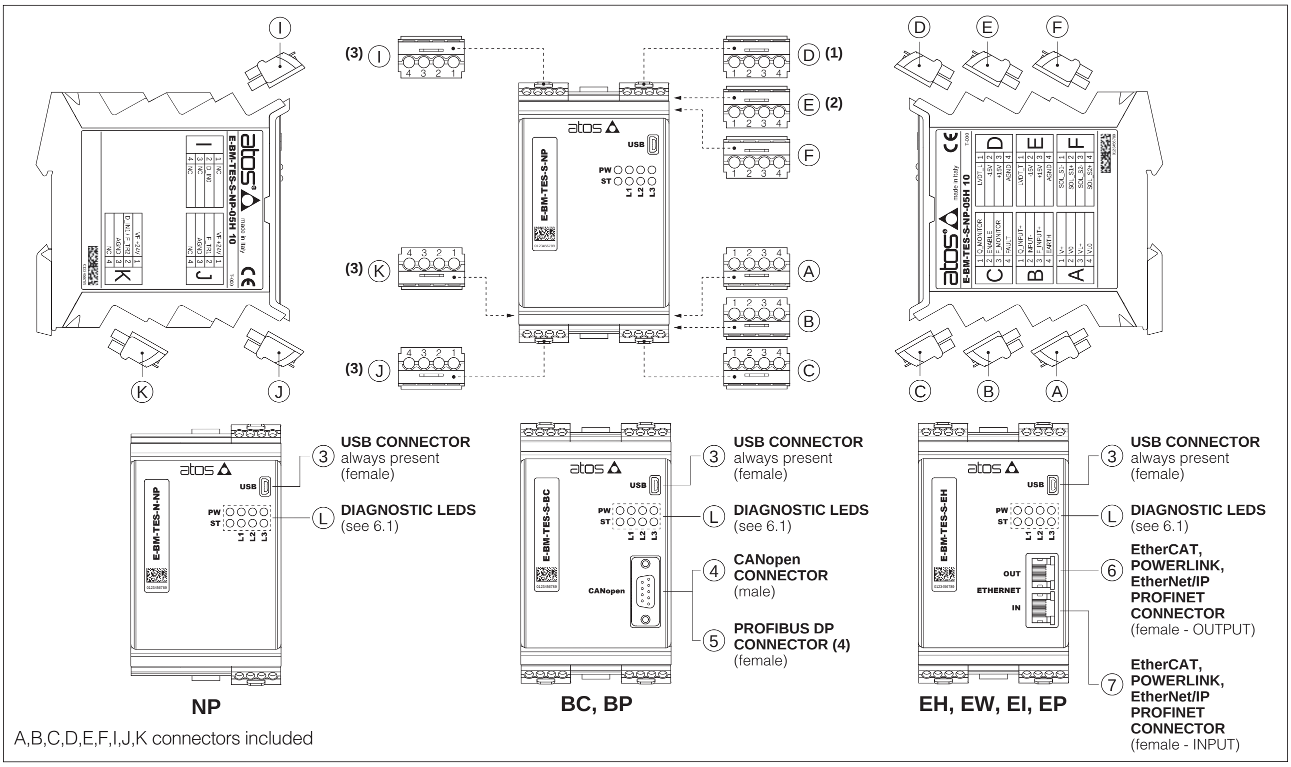
Power supplies (see 8.1, 8.2)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			

Current supplied to solenoids	IMAX = 3.0 A for standard driver
	IMAX = 2.5 A for ex-proof driver (**/A option**)			

Analog input signals (see 8.3, 8.4)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs (see 8.5, 8.6)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 8.7) Digital inputs (see 8.11)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 8.8)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Pressure/Force transducers power supply (only for S option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 400 g			
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 max 50 m for logic - 1,5 mm^2 max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size (see 12)	2,5 mm^2			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

6 CONNECTIONS AND LEDS



NP **BC, BP** **EH, EW, EI, EP**

A,B,C,D,E,F,I,J,K connectors included

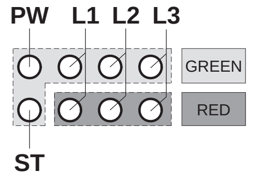
(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S

(4) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector:
DG909MF1 - the connector will be oriented upwards
DG909MF3 - the connector will be oriented downwards

6.1 Diagnostic LEDs Ⓛ

Eight leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS			NETWORK STATUS			
L3	SOLENOID STATUS			LINK/ACT			
PW	OFF = Power supply OFF		ON = Power supply ON				
ST	OFF = Fault present		ON = No fault				



6.2 Connectors - 4 pin

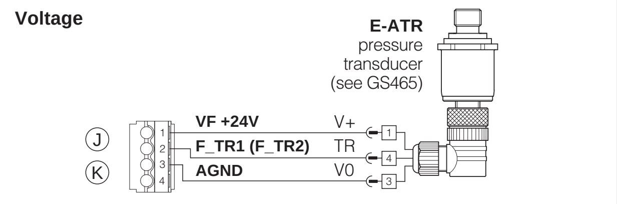
CONNECTOR	PIN	ALTERNATED P/Q CONTROL		TECHNICAL SPECIFICATIONS	NOTES
		N none	**S** pressure/force		
A	A1	**V+**		Power supply 24 VDC (see 8.1)	Input - power supply
	A2	**V0**		Power supply 0 VDC (see 8.1)	Gnd - power supply
	A3	**VL+**		Power supply 24 VDC for driver's logic and communication (see 8.2)	Input - power supply
	A4	**VL0**		Power supply 0 VDC for driver's logic and communication (see 8.2)	Gnd - power supply
B	B1	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.3)	Input - analog signal **Software selectable**
	B2	**INPUT-**		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	B3	**NC**		Do not connect	
			F_INPUT+	Pressure/Force reference input signal ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.4)	Input - analog signal **Software selectable**
	B4	**EARTH**		Connect to system ground	
C	C1	**Q_MONITOR**		Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND. Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.5)	Output - analog signal **Software selectable**
	C2	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the controller, referred to VL0 (see 8.7)	Input - on/off signal
	C3	**NC**		Do not connect	
			F_MONITOR	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 8.6)	Output - analog signal **Software selectable**
	C4	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 8.8)	Output - on/off signal
D (1)	D1	**LVDT_L**		Main stage valve position transducer signal (see 8.9)	Input - analog signal
	D2	**-15V**		Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**		Main stage valve position transducer power supply +15V	Output power supply
	D4	**AGND**		Common gnd for transducer power and monitor outputs	Common gnd
E (2)	E1	**LVDT_T**		Direct valve or pilot valve position transducer signal (see 8.9)	Input - analog signal
	E2	**-15V**		Direct valve or pilot valve position transducer power supply -15V	Output power supply
	E3	**+15V**		Direct valve or pilot valve position transducer power supply +15V	Output power supply
	E4	**AGND**		Common gnd for transducer power and monitor outputs	Common gnd
F	F1	**SOL_S1-**		Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**		Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**		Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**		Positive current to solenoid S2	Output - power PWM
I	I1		**NC**	Do not connect	
	I2		**D_IN0**	NP execution: multiple pressure/force PID selection, referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0 (see 8.11)	Input - on/off signal
	I3		**NC**	Do not connect	
	I4		**NC**	Do not connect	
J	J1		**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2		**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /C option (see 8.10)	Input - analog signal **Software selectable**
	J3		**AGND**	Common gnd for transducer power and signals	Common gnd
	J4		**NC**	Do not connect	
K	K1		**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2		**F_TR2**	2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /C option (see 8.10)	Input - analog signal **Software selectable**
			D_IN1	NP execution: multiple pressure/force PID selection (only for SP and SL), referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0 (see 8.11)	Input - on/off signal
	K3		**AGND**	Common gnd for transducer power and signals	Common gnd
	K4		**NC**	Do not connect	

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*

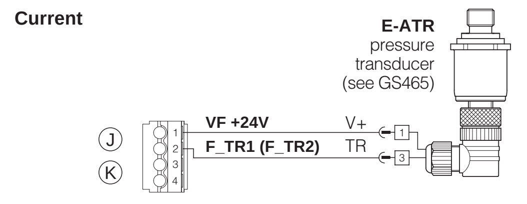
(2) E connector is available only for TES-* versions 01H / 05H and LES-*

6.3 Pressure/force transducers connection - example - only for **S** option

Voltage



Current



6.4 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) shield connection on connector’s housing is recommended

7 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

8 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine’s safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

8.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

8.2 Power supply for driver’s logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for driver’s logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver’s logic and communication power supply: 500 mA fast fuse.

8.3 Flow reference input signals (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve’s spool position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

8.4 Pressure or force reference input signal (F_INPUT+) - only for **S** option

Functionality of pressure or force input reference signal (pin B3), is used as reference for the driver pressure/force closed loop, see section 4 .
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

8.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ± 20 mA.

8.6 Pressure or force monitor output signal (F_MONITOR) - only for **S** option

The driver generates an analog output signal (C3) proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 V_{DC} 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 V_{DC} or ± 20 mA

8.7 Enable input signal (ENABLE)

To enable the driver, supply 24 V_{DC} on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as digital input by software selection.

8.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

8.9 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 V_{DC} supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 V_{DC} for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

8.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - only for **S** option

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are ±10 V_{DC} 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 V_{DC} or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

8.11 Multiple PID selection or digital input signals (D_IN0 and D_IN1) - only for **S** option

Two on-off input signals are available on the connectors I and K.
For NP executions pin I2 and/or pin K2 are used to select one of the four pressure (force) PID parameters setting, stored into the driver. Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 V_{DC} or a 0 V_{DC} on pin I2 and/or pin K2, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.
For fieldbus executions pin I2 and/or K2 can be used as generic purpose on-off input signals.

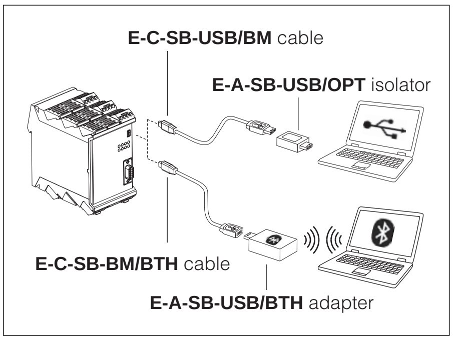
	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
I2	0	24 V_{DC}	0	24 V_{DC}
K2	0	0	24 V_{DC}	24 V_{DC}

8.12 Possible combined options: /AC, /AI, /ACI, /CI - combined options **/CI** is available only for E-BM-TES/LES-S.

9 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

USB or Bluetooth connection



The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at **USB**

Adapters, Cables and Terminators, can be ordered separately

10 MAIN SOFTWARE PARAMETER SETTINGS

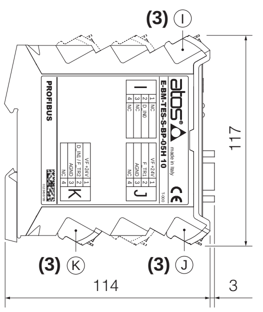
For basic information about main setting parameters by E-SW programming software, see tech table **FS900**

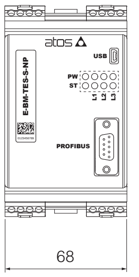
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

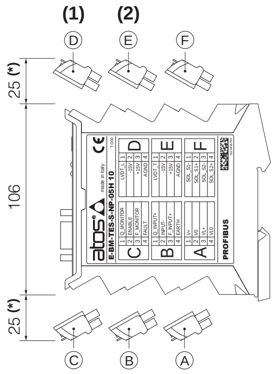
E-MAN-BM-LES - user manual for **E-BM-TES-N** and **E-BM-LES-N** digital drivers
E-MAN-BM-LES-S - user manual for **E-BM-TES-S** and **E-BM-LES-S** digital drivers

11 OVERALL DIMENSIONS [mm]

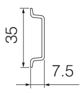
overall dimension with
assembled connectors







DIN rail
dimensions



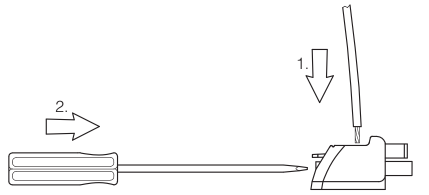
A,B,C,D,E,F,I,J,K connectors included

(*) Space to remove the connectors

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S

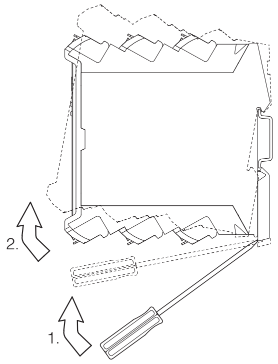
12 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver

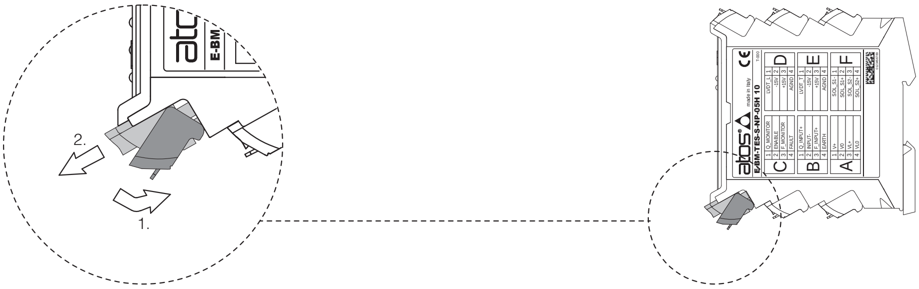


Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

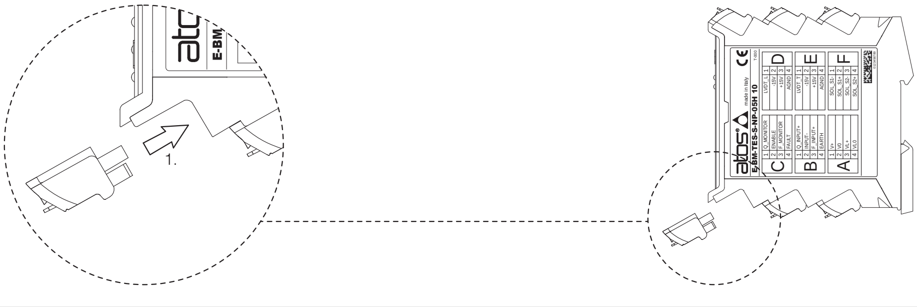
To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



To extract the connectors:
1. push lever
2. pull connector



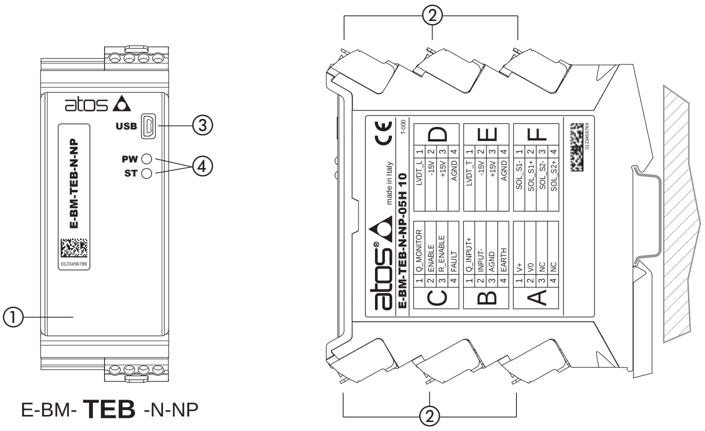
To insert the connectors:
1. push the connector in its slot



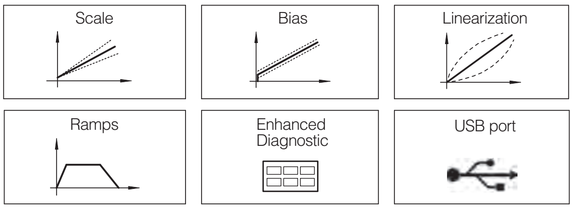
Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F,I,J,K)

Digital E-BM-TEB/LEB drivers

DIN-rail format, for proportional valves with one or two LVDT transducers


②
③
④
①
USB
PW
ST
E-BM-TEB-N-NP
E-BM-TEB-N-NP-05H 10
made in Italy
C
D
B
E
A
F
1 Q_MONITOR 2 ENABLE 3 R_ENABLE 4 FAULT
LVDT_L 1 -15V 2 +15V 3 AGND 4
1 Q_INPUT+ 2 INPUT- 3 AGND 4 EARTH
LVDT_T 1 -15V 2 +15V 3 AGND 4
1 V+ 2 V0 3 NC 4 NC
SOL_S1- 1 SOL_S1+ 2 SOL_S2- 3 SOL_S2+ 4

E-BM- **TEB** -N-NP



E-SW
programming software

Connectors ② included

E-BM-TEB/LEB

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.
TEB execution controls direct operated directional/flow valves with one LVDT transducer.
LEB execution controls pilot operated directional valves with two LVDT transducers.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 6 fast plug-in connectors ②
- Mini USB port ③ always present
- 2 leds for diagnostics ④ (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM - **TEB** - **N** - **NP** - **01H** ***** / ***** ***** / *****

E-BM: Off-board electronic driver in DIN rail format

TEB = digital basic driver, for valves with one LVDT transducer
LEB = digital basic driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none

Fieldbus interface, USB port always present:
NP = Not Present

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TEB**)

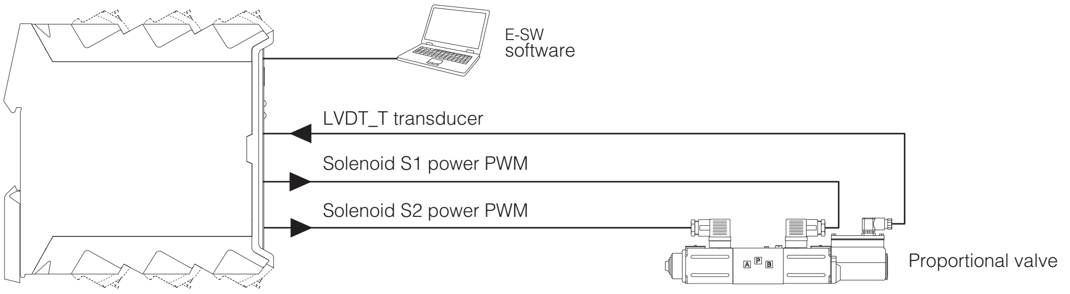
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TEB**)

Options, see section 5 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers only in combination with option **A**
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 V_{DC})

Series number

Set code (see section 6)

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

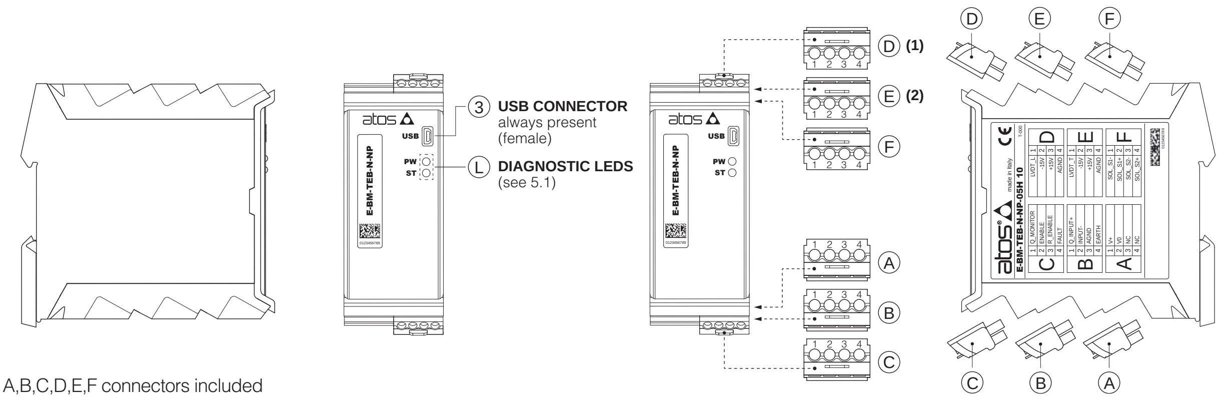
Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	**DHZO-T, DKZOR-T** F165, F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175, F178	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Tech table	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	**LIQZA-L** FX350, FX370
Driver model	**E-BM-TEB**				**E-BM-LEB**	

4 MAIN CHARACTERISTICS

Power supply (see 7.1)	Nominal : +24 V_{DC} Rectified and filtered : V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})
Max power consumption	50 W
Current supplied to solenoids	I_{MAX} = 3.0 A for standard driver I_{MAX} = 2.5 A for ex-proof driver (**/A option**)
Analog input signal (see 7.2)	Voltage: range ±10 V_{DC} (24 V_{MAX} tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Monitor output (see 7.3)	Output range: voltage ±10 V_{DC} @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input (see 7.4)	Range: 0 ÷ 5 V_{DC} (OFF state), 9 ÷ 24 V_{DC} (ON state), 5 ÷ 9 V_{DC} (not accepted); Input impedance: Ri > 10 kΩ
Repeat enable output (see 7.5) Fault output (see 7.6)	Output range: 0 ÷ 24 V_{DC} (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)
Mass	Approx. 400 g
Additional characteristics	2 leds for diagnostic; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 max 50 m for logic - 1,5 mm^2 max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 11)	2,5 mm^2

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

5 CONNECTIONS AND LEDS

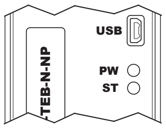


A,B,C,D,E,F connectors included

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

5.1 Diagnostic LEDs Ⓛ

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION		
PW	OFF = Power supply OFF	ON = Power supply ON	
ST	OFF = Fault present	ON = No fault	

5.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 7.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 7.1)	Gnd - power supply
	A3	**NC**	Do not connect	
	A4	**NC**	Do not connect	
B	B1	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.2)	Input - analog signal **Software selectable**
	B2	**INPUT-**	Negative reference input signal for Q_INPUT+	Input - analog signal
	B3	**AGND**	Common gnd for monitor output	Common gnd
	B4	**EARTH**	Connect to system ground	
C	C1	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.3)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 7.4)	Input - on/off signal
	C3	**R_ENABLE**	Repeat enable, output repeater signal of enable input, referred to V0 (see 7.5)	Output - on/off signal
	C4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 7.6)	Output - on/off signal
D (1)	D1	**LVDT_L**	Main stage valve position transducer signal (see 7.7)	Input - analog signal
	D2	**-15V**	Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**	Main stage valve position transducer power supply +15V	Output power supply
	D4	**AGND**	Common gnd for transducer power	Common gnd
E (2)	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 7.7)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power	Common gnd
F	F1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	F3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	F4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

6 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

7 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

7.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

7.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position.
Reference input signal is factory preset according to selected valve code, defaults are ±10 V_{DC} 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 V_{DC} or ± 20 mA.

7.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 V_{DC} 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 V_{DC} or ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 V_{DC} on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

7.5 Repeat enable output signal (R_ENABLE)

Repeat enable (pin C3) is used as output repeater signal of enable input signal (see 7.4).

7.6 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.
Fault status is not affected by the status of the Enable input signal.

7.7 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 V_{DC} supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 V_{DC} for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

7.8 Possible combined options: /AC, /AI, /ACI

8 VALVE SETTINGS AND PROGRAMMING TOOLS

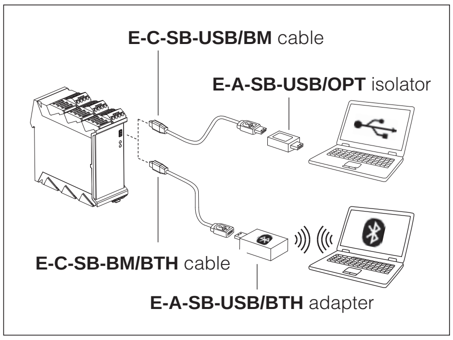
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at **USB Adapters, Cables and Terminators, can be ordered separately**

9 MAIN SOFTWARE PARAMETER SETTINGS

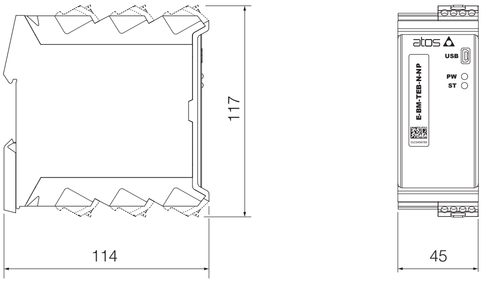
For basic information about main setting parameters by E-SW programming software, see tech table **FS900**

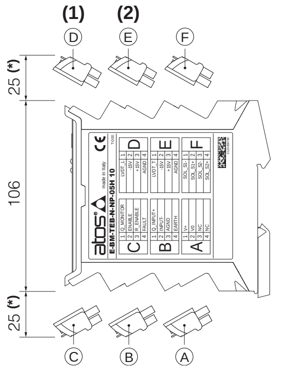
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-LEB - user manual for **E-BM-TEB** and **E-BM-LEB** digital drivers

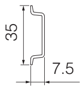
10 OVERALL DIMENSIONS [mm]

overall dimension with
assembled connectors





DIN rail
dimensions



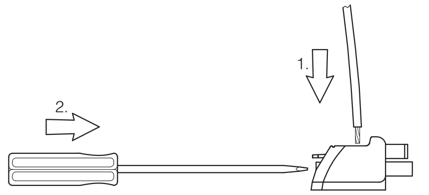
A,B,C,D,E,F connectors included

(*) Space to remove the connectors

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

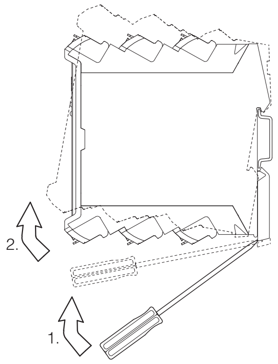
11 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver

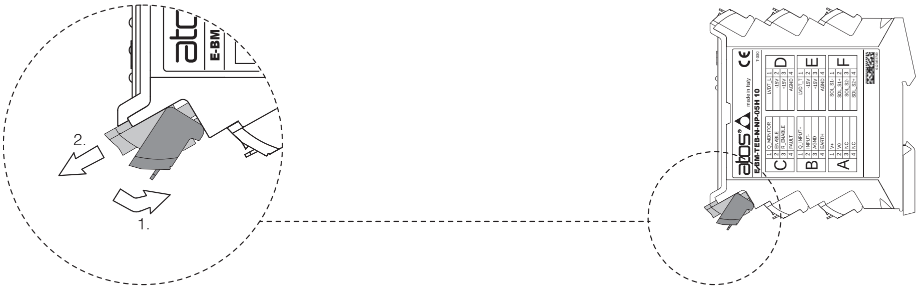


Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

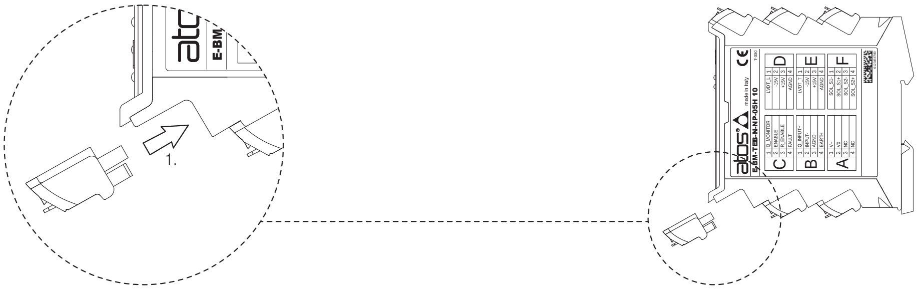
To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



To extract the connectors:
1. push lever
2. pull connector



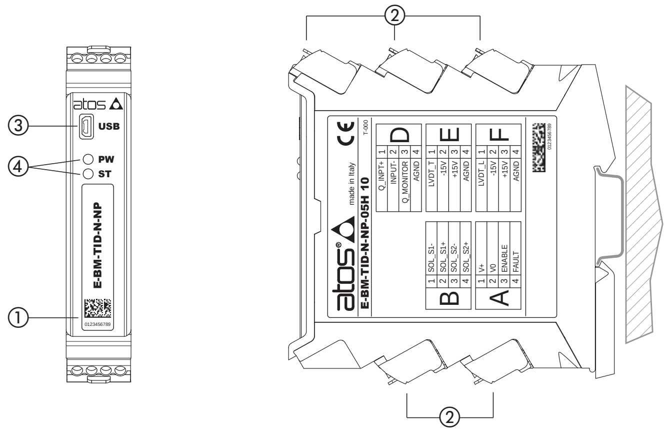
To insert the connectors:
1. push the connector in its slot

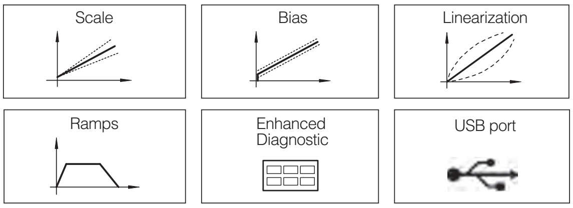


Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F)

Digital E-BM-TID/LID drivers

DIN-rail format, for proportional valves with one or two LVDT transducers





E-SW
programming software

Connectors ② included

E-BM-TID/LID

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.

TID execution controls direct operated directional/flow valves with one LVDT transducer.

LID execution controls pilot operated directional valves with two LVDT transducers.

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 5 fast plug-in connectors ②
- Mini USB port ③ always present
- 2 leds for diagnostics ④ (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM - **TID** - **N** - **NP** - **01H** ***** / ***** ***** / *****

Off-board electronic driver in DIN rail format

TID = digital basic driver, for valves with one LVDT transducer
LID = digital basic driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none

Fieldbus interface, USB port always present:
NP = Not Present

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TID**)

- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TID**)

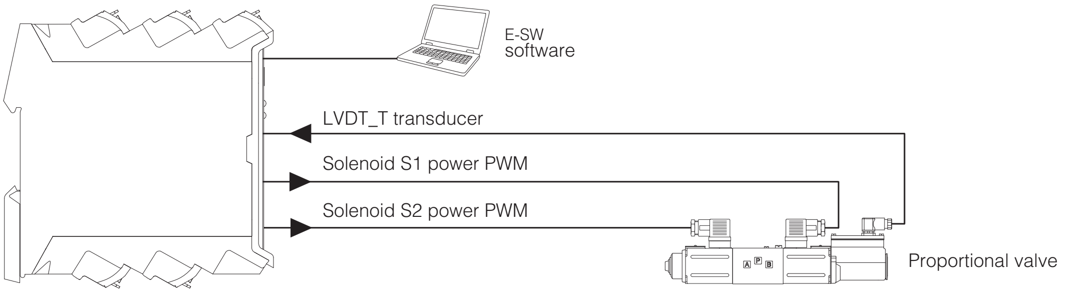
Options, see section 5 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers only in combination with option A
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 VDC) **(1)**

Series number

Set code (see section 6)

(1) No software selectable

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	**DHZO-T, DKZOR-T** F165, F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175, F178	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Tech table	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	**LIQZA-L** FX350, FX370
Driver model	**E-BM-TID**				**E-BM-LID**	

4 MAIN CHARACTERISTICS

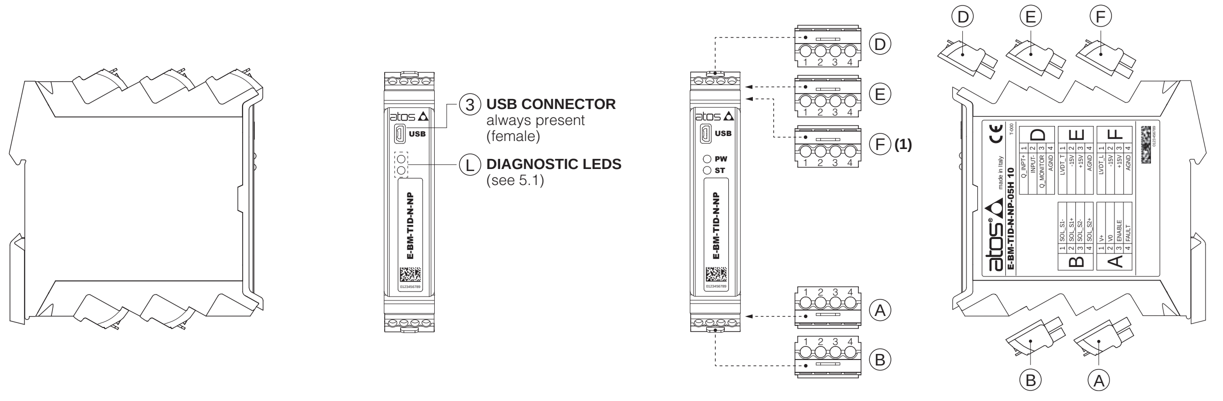
Power supply (see 7.1)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	50 W

Current supplied to solenoids	IMAX = 3.0 A for standard driver
	IMAX = 2.5 A for ex-proof driver (**/A option**)

Analog input signal (see 7.2)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Monitor output (see 7.3)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input (see 7.4)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ
Fault output (see 7.5)	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)
Mass	Approx. 300 g
Additional characteristics	2 leds for diagnostic; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 max 50 m for logic - 1,5 mm^2 max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 11)	2,5 mm^2

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

5 CONNECTIONS AND LEDS

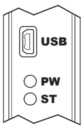

atos
USB
③ USB CONNECTOR
always present
(female)
Ⓛ DIAGNOSTIC LEDS
(see 5.1)
E-BM-TID-N-NP
0123456789
PW
ST
Ⓓ
Ⓔ
Ⓕ (1)
Ⓐ
Ⓑ
1 2 3 4
E-BM-TID-N-NP-05H 10
made in Italy
T-000
D 1 Q_INPT+ 2 INPUT- 3 Q_MONITOR 4 AGND
E 1 LVDT_T 2 -15V 3 +15V 4 AGND
F 1 LVDT_L 2 -15V 3 +15V 4 AGND
B 1 SOL_S1- 2 SOL_S1+ 3 SOL_S2- 4 SOL_S2+
A 1 V+ 2 V0 3 ENABLE 4 FAULT

A,B,D,E,F connectors included

(1) F connector is available only for LID

5.1 Diagnostic LEDs Ⓛ

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION		
PW	OFF = Power supply OFF	ON = Power supply ON	
ST	OFF = Fault present	ON = No fault	

5.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 7.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 7.1)	Gnd - power supply
	A3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 7.4)	Input - on/off signal
	A4	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 7.5)	Output - on/off signal
B	B1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	B2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	B3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	B4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
D	D1	**Q_INPUT+**	Flow reference input signal: ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.2)	Input - analog signal
	D2	**INPUT-**	Negative reference input signal for Q_INPUT+	Input - analog signal
	D3	**Q_MONITOR**	Flow monitor output signal: ±10 VDC for standard and 4 ÷ 20 mA for /I option, referred to AGND (see 7.3)	Output - analog signal
	D4	**AGND**	Common gnd for monitor output	Common gnd
E	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 7.6)	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	**AGND**	Common gnd for transducer power	Common gnd
F (1)	F1	**LVDT_L**	Main stage valve position transducer signal (see 7.6)	Input - analog signal
	F2	**-15V**	Main stage valve position transducer power supply -15V	Output power supply
	F3	**+15V**	Main stage valve position transducer power supply +15V	Output power supply
	F4	**AGND**	Common gnd for transducer power	Common gnd

(1) F connector is available only for LID

6 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

7 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

7.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

7.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin D1) for the valve's spool position.
Standard (voltage reference input)
Default is ±10 VDC and can be reconfigured via software, within a maximum range of ±10 VDC.
Option /I (current reference input)
Default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

7.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin D3) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).
Standard (voltage monitor output)
Default is ±10 VDC and can be reconfigured via software, within a maximum range of ±10 VDC.
Option /I (current monitor output)
Default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin A3: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

7.5 Fault output signal (FAULT)

Fault output signal (pin A4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.

7.6 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin F1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 VDC supply output available at pin F2, F3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

7.7 Possible combined options: /AC, /AI, /ACI

8 VALVE SETTINGS AND PROGRAMMING TOOLS

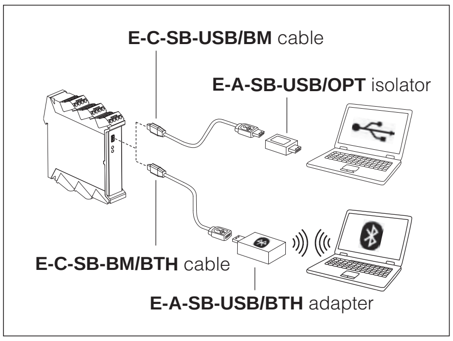
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



⚠ **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at **USB**

Adapters, Cables and Terminators, can be ordered separately

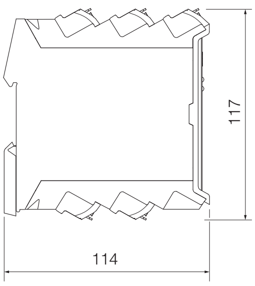
9 MAIN SOFTWARE PARAMETER SETTINGS

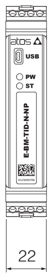
For basic information about main setting parameters by E-SW programming software, see tech table **FS900**
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

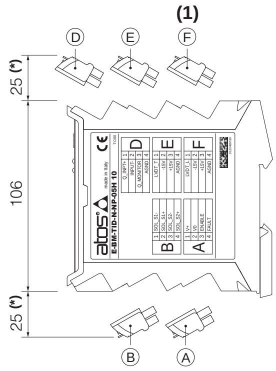
E-MAN-BM-LID - user manual for **E-BM-TID** and **E-BM-LID** digital drivers

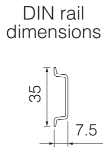
10 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors









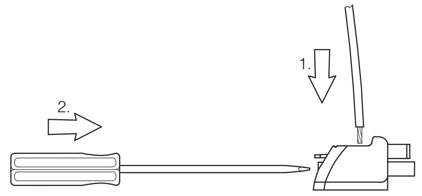
A,B,D,E,F connectors included

(*) Space to remove the connectors

(1) F connector is available only for LID

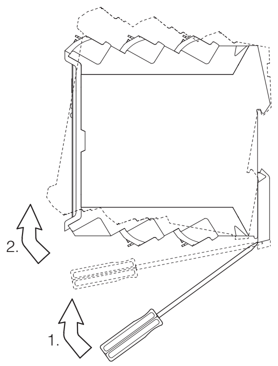
11 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver

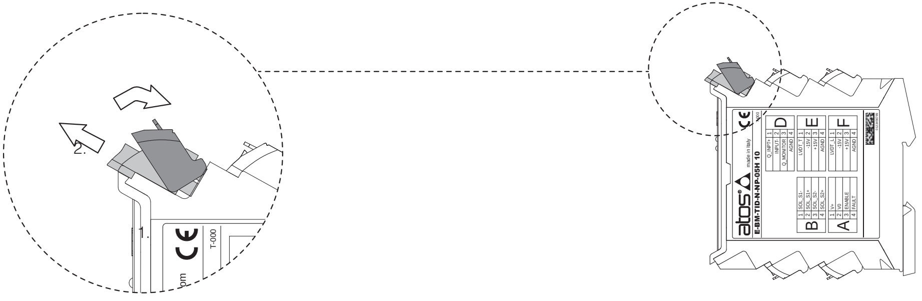


Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

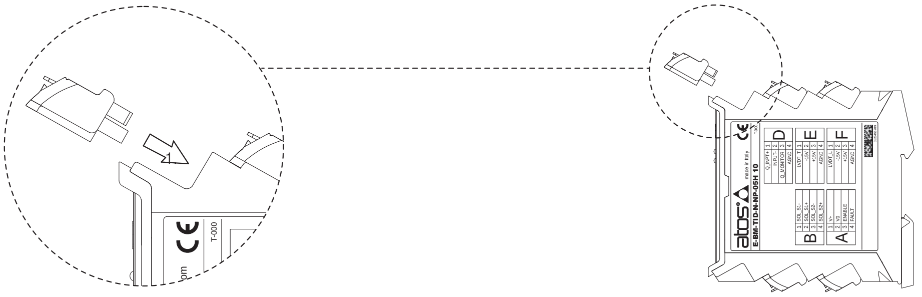
To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



To extract the connectors:
1. push lever
2. pull connector



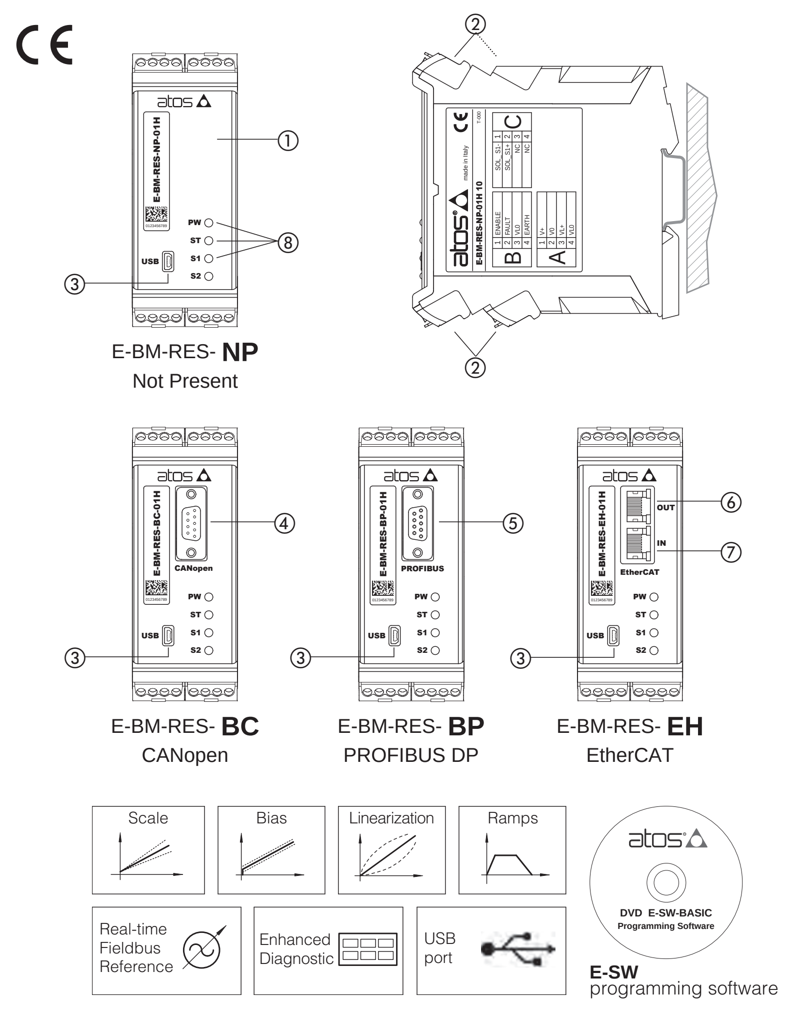
To insert the connectors:
1. push the connector in its slot



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,D,E,F)

Digital electronic E-BM-RES drivers

DIN-rail format, for proportional valves with integral pressure transducer



Connectors ② included

E-BM-RES

Digital drivers ① control, in closed loop, the regulated pressure of direct and pilot operated proportional valves according to the electronic reference input signal.
E-BM-RES operate direct and pilot operated relief/reducing control valves ZO-R with integral pressure transducer.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors ⑥ output and ⑦ input
- 3 leds for diagnostics ⑧ (see 4.1)
- Pressure transducer input signal 4 ÷ 20 mA
- ±5 V_{DC} output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- 4 factory pre-set dynamic response setting to match different hydraulic conditions (see 8.5)
- Linearization function for hydraulic regulation
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

1 MODEL CODE

E-BM - **RES** - **NP** - **01H** / ***** / ***** ***** / *****

E-BM: Off-board electronic driver in DIN rail format

RES = digital full driver, for valves with pressure transducer

Fieldbus interface - USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

01H = for single solenoid proportional valves

Option:
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input 0 ÷10 V_{DC})

Dynamic response preset - see 8.5 **:**
- = PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

Series number

Set code (see section 5)

2 VALVES RANGE

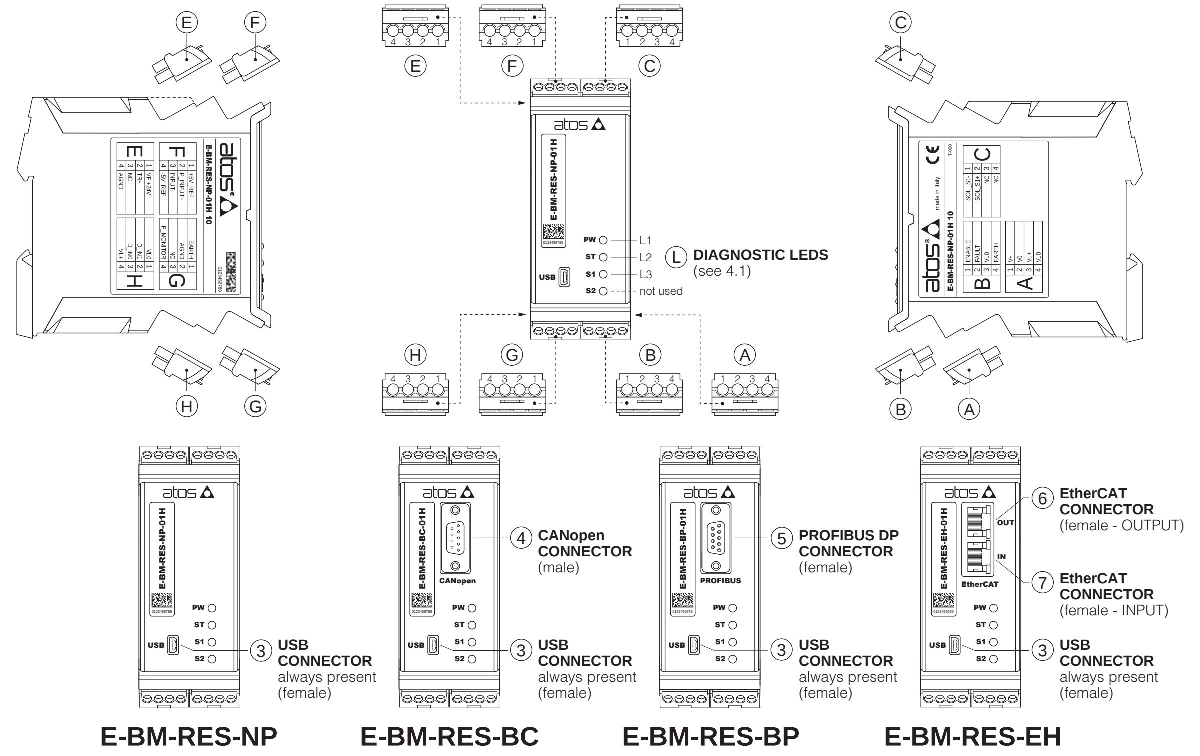
Valves model	Relief			Reducing			Compensator
	RZMO	**AGMZO**	**LIMZO**	**RZGO**	**AGRCZO**	**LIRZO**	**LICZO**
Tech table	FS010 FS067	FS040	FS305	FS020 FS075	FS055	FS305	FS305

3 MAIN CHARACTERISTICS

Power supply (see 6.1, 6.4)	Nominal : +24 V_{DC} Rectified and filtered : V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})			
Max power consumption	50 W			
Current supplied to solenoids	I_{MAX} = 2.7 A with +24 V_{DC} power supply to drive standard proportional valves (3,2 Ω solenoid)			
Analog input signals (see 6.2)	Voltage: maximum range ±10 V_{DC} Input impedance: Ri > 50 kΩ Current: maximum range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output (see 6.3)	Voltage: maximum range 0 ÷ 10 V_{DC} @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input (see 6.5)	Range : 0 ÷ 9 V_{DC} (OFF state), 15 ÷ 24 V_{DC} (ON state), 9 ÷ 15 V_{DC} (not accepted); Input impedance: Ri > 87 kΩ			
Output supply (see 6.8)	±5 V_{DC} @ max 10 mA : output supply for external potentiometer			
Fault output (see 6.6)	Output range : 0 ÷ 24 V_{DC} (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24V_{DC} @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure, alarms history storage function			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 330 g			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 max 50 m for logic - 1,5 mm^2 max 50 m for power supply and solenoids			
Max conductor size (see 10)	2,5 mm^2			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

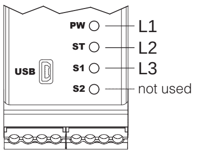
4 CONNECTIONS AND LEDS



A,B,C,E,F,G,H connectors included

4.1 Diagnostic LEDs Ⓛ

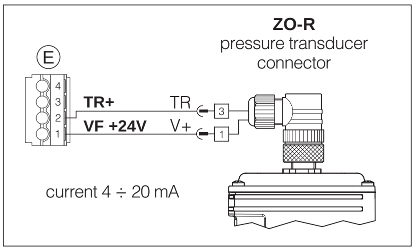
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION	
L1	GREEN	PW	OFF	Power supply OFF	
			ON	Power supply ON	
L2	GREEN	ST	OFF	Fault present	
			ON	No fault	
L3	YELLOW	S1	OFF	PWM command OFF	
			ON	PWM command ON	

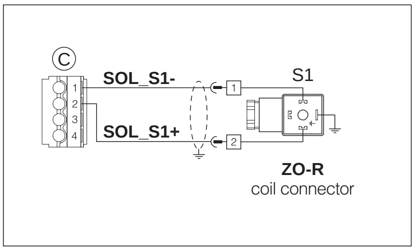
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 6.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 6.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for driver's logic and communication (see 6.4)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for driver's logic and communication (see 6.4)	Gnd - power supply
B	B1	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0 (see 6.5)	Input - on/off signal
	B2	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 6.6)	Output - on/off signal
	B3	**VL0**	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	**EARTH**	Connect to system ground	
C	C1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	C2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	C3	**NC**	Do not connect	
	C4	**NC**	Do not connect	
E	E1	**VF +24V**	Power supply +24 VDC	Output - power supply
	E2	**TR+**	Positive pressure transducer input signal: ±20 mA maximum range (see 6.7) Default is 4 ÷ 20 mA	Input - analog signal **Software selectable**
	E3	**NC**	Do not connect	
	E4	**AGND**	Common GND for transducer power, signals and external potentiometer	
F	F1	**+5V_REF**	External potentiometer power supply +5 VDC @ 10mA (see 6.8)	Output - power supply
	F2	**P_INPUT+**	Positive pressure reference input signal: ±10 VDC / ±20 mA maximum range (see 6.2) Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	F3	**INPUT-**	Negative pressure reference input signal for P_INPUT+	Input - analog signal
	F4	**-5V_REF**	External potentiometer power supply -5 VDC @ 10mA (see 6.8)	Output - power supply
G	G1	**EARTH**	Connect to system ground	
	G2	**AGND**	Analog ground for P_MONITOR and external potentiometer	Gnd - analog signal
	G3	**NC**	Do not connect	
	G4	**P_MONITOR**	Pressure monitor output signal: 0 ÷ 10 VDC / 0 ÷ 20 mA maximum range (see 6.3) Default are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
H	H1	**VL0**	Power supply 0 VDC for digital input (see 6.4)	Gnd - power supply
	H2	**D_IN1**	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H3	**D_IN0**	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H4	**VL+**	Power supply 24 VDC for digital input (see 6.4)	Output - power supply

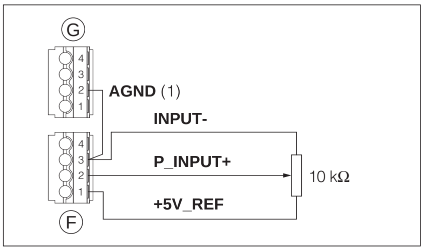
Pressure transducer connection



Coil connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used

4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH fieldbus execution, connector - RJ45 - 8 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) shield connection on connector's housing is recommended

5 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve **ZO-R** to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve **ZO-R**. For further information about set code, please contact Atos technical office.

6 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software. Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

6.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers. In case of double power supply see 6.4.
A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

6.2 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).
Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

6.3 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

6.4 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.
A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

6.5 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

6.6 Fault output signal (FAULT)

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

6.7 Pressure transducer integrated to the valve, input signal (TR+)

Analog pressure transducer integrated to the valve, has to be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, default is 4 ÷ 20 mA.
Input signal can be reconfigured via software, within a maximum range of ± 20 mA.

6.8 Output supply for external potentiometer (±5V_REF) - not available for **EH** version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 VDC supply output available at pin F1 and F4.
Note: using an external potentiometer, the reference input signal must be set via software at 0 ÷ 5 VDC (default 0 ÷10 VDC, see 6.2)

6.9 PID selection (D_IN0 and D_IN1)

Two on-off input signals are available on the pin H2 and H3 to select one of the four pressure PID parameters setting, stored into the driver.
Supply a 24 VDC or a 0 VDC on pin H2 and/or pin H3, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.
Refer to dynamic response for function description (see 8.5).

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
H2	0	24 VDC	0	24 VDC
H3	0	0	24 VDC	24 VDC

7 PROGRAMMING TOOLS - see tech table **GS500**

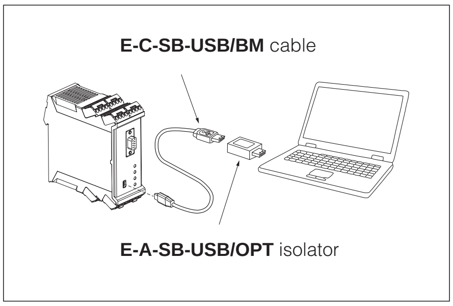
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB connection



Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at **USB**

Adapters, Cables and Terminators, can be ordered separately

8 MAIN SOFTWARE PARAMETER SETTINGS

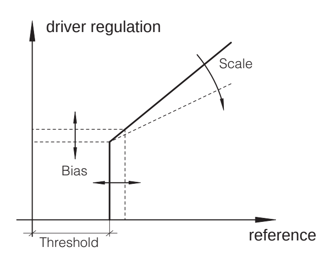
The following is a brief description of the main settings and features of digital drivers.
For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-RES - user manual for **E-BM-RES**

8.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max pressure valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the pressure proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

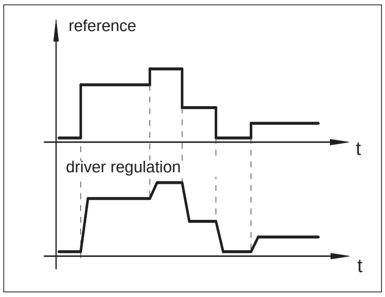
8.1, 8.2 - Scale, Bias & Threshold



8.2 Bias and Threshold

Pressure proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the pressure valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).
The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current to the specific pressure proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If fieldbus reference signal is active (see 6.2), threshold should be set to zero.
Refer to the programming manuals for a detailed description of other software selectable Bias functions.

8.3 - Ramps



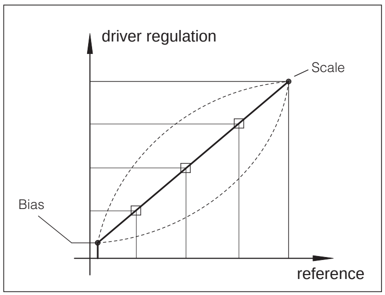
8.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the pressure proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

8.4 - Linearization



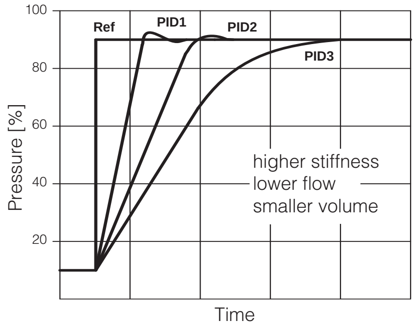
8.4 Linearization - E-SW level 2 functionality

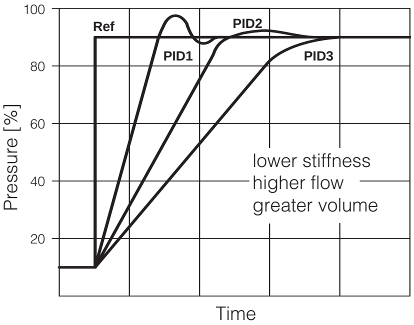
Linearization function allows to set the relation between the reference input signal and the controlled valve's pressure regulation. Linearization is useful for applications where it is required to linearize the valve's pressure regulation in a defined working condition.

8.5 Dynamic response – 4 pressure PIDs

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected in real time through digital inputs (see 6.9). Only for BC, BP, EH execution, the PID can be also selected in real time through PLC via fieldbus.

PID	**Dynamic response** example diagrams at side
1	Fast (default) interchangeable with TERS version
2	Standard
3	Smooth
4	Open Loop





Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

In case of pressure instability, select PID4 to operate the valve in open loop.

If the instability still persists, check eventual anomalies in the hydraulic circuit as the presence of air.

If the instability disappears, select an alternative configuration within PID selection 1, 2 or 3 which better matches the application requirements.

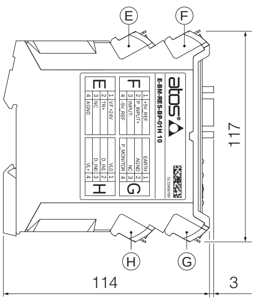
If no one of the above selection fulfills the application, tune P - I - D parameters at E-SW software level 2 to obtain the desired dynamic response.

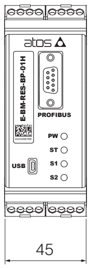
8.6 Pressure transducer failure

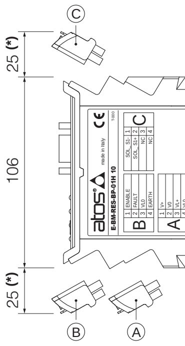
This function is available only for pressure transducer input configured in current as 4 ÷ 20 mA.
In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

9 OVERALL DIMENSIONS [mm]

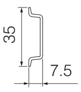
overall dimension with
assembled connectors







DIN rail
dimensions

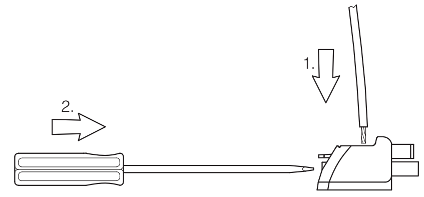


A, B, C, E, F, G, H connectors included

(*) Space to remove the connectors

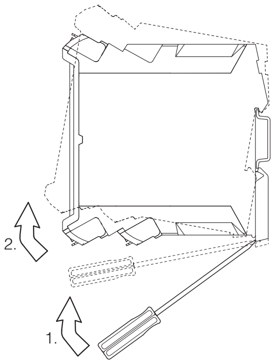
10 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver

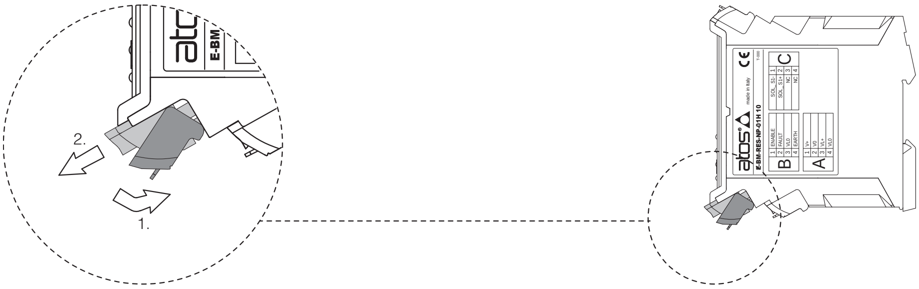


Note: max conductor size: 2,5 mm^2
tightening torque: 0,4 ÷ 0,6 Nm

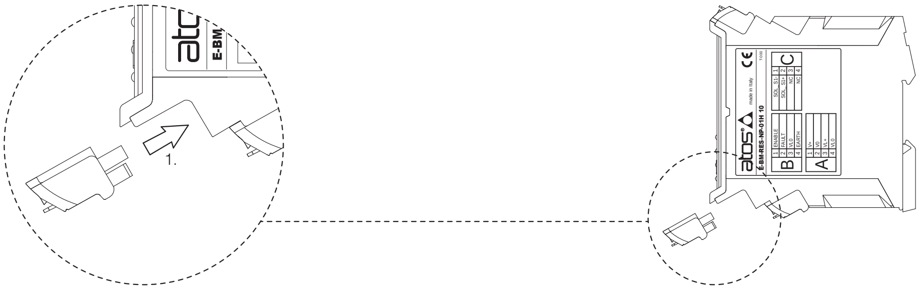
To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



To extract the connectors:
1. push lever
2. pull connector



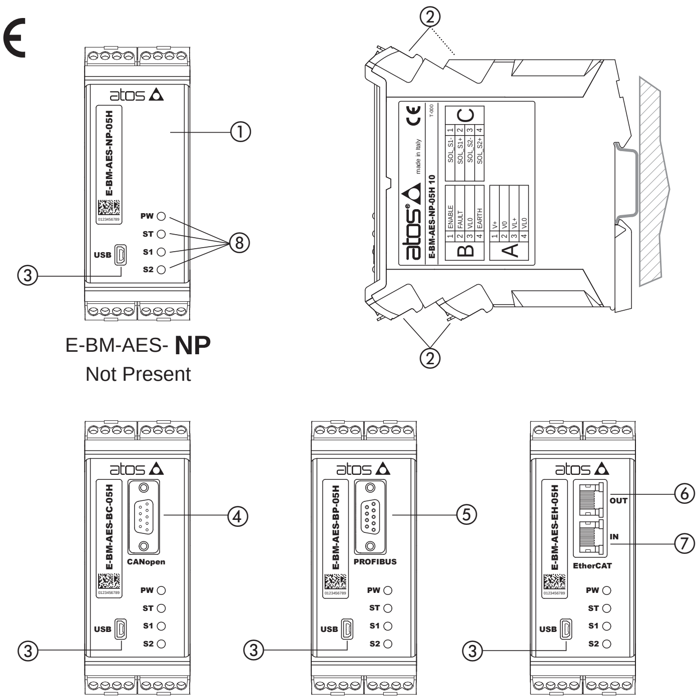
To insert the connectors:
1. push the connector in its slot



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot
(eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

Digital electronic E-BM-AES drivers

DIN-rail format, for proportional valves without transducer

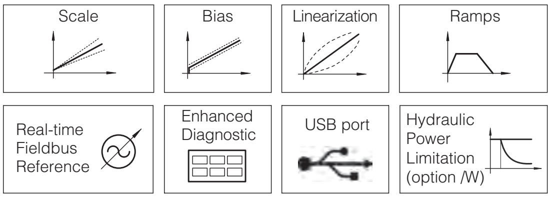


E-BM-AES- **NP**
Not Present

E-BM-AES- **BC**
CANopen

E-BM-AES- **BP**
PROFIBUS DP

E-BM-AES- **EH**
EtherCAT


Scale
Bias
Linearization
Ramps
Real-time Fieldbus Reference
Enhanced Diagnostic
USB port
Hydraulic Power Limitation (option /W)

E-SW
programming software

Connectors ② included

E-BM-AES

Digital drivers ① control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.
E-BM-AES operate direct and pilot operated proportional valves ZO-A without transducer.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors ⑥ output and ⑦ input
- 4 leds for diagnostics ⑧ (see 4.1)
- ±5 V_{DC} output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- Linearization function for hydraulic regulation
- /W option max power limitation function
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

1 MODEL CODE

E-BM - **AES** - **NP** - **01H** / ***** ***** / *****

E-BM = Off-board electronic driver in DIN rail format

AES = digital full driver,
for valves without transducer

Fieldbus interface - USB port always present**:**
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves

Options:
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for remote transducer, only in combination with option **W**
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input ±10 V_{DC})
W = power limitation function

* = Series number

* = Set code **(1)**

(1) set code identifies the corrispondence between the driver and the relevant valve

2 VALVES RANGE

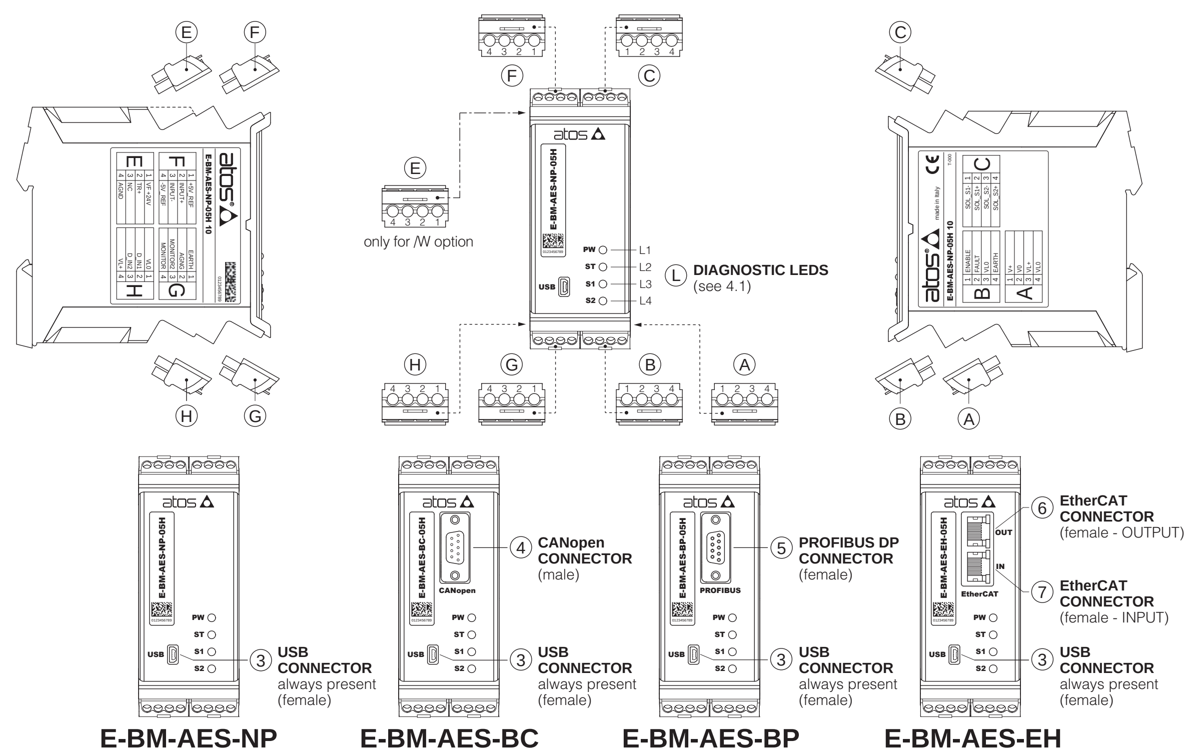
Valves	Pressure									Directional			Cartridge	Flow
Industrial	**RZMO** **HMZO**	**RZME**	**RZGO** **HZGO, KZGO**	**RZGE** **CART RZGE**	**AGMZO**	**AGMZE**	**AGRCZO**	**DHRZO**	**DHRZE**	**DHZO** **DKZOR**	**DHZE** **DKZE**	**DPZO**	**LI*ZO**	**QVHZO** **QVKZOR**
Tech table	FS007, FS065	F005	FS015, FS070	F012	FS035	F030	FS050	FS025	F022	FS160	F150	FS170	FS300	FS410
Ex-proof	**RZMA** **HZMA**	-	**RZGA** **HZGA, KZGA**	-	**AGMZA**	-	**AGRCZA**	**DHRZA**	-	**DHZA** **DKZA**	-	**DPZA**	**LI*ZA**	**QVHZA,** **QVKZA**
Tech table	FX010		FX040		FX010		FX040	FX070		FX100		FX200	FX300	FX400

3 MAIN CHARACTERISTICS

Power supply (see 5.1, 5.2)	Nominal : +24 V_{DC} Rectified and filtered : V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})			
Max power consumption	50 W			
Current supplied to solenoids	I_{MAX} = 2.7 A with +24 V_{DC} power supply to drive standard proportional valves (3,2 Ω solenoid) I_{MAX} = 2.5 A with +24 V_{DC} power supply to drive ex-proof proportional valves (3,2 Ω solenoid) for **/A option**			
Analog input signals (see 5.3)	Voltage: maximum range ±10 V_{DC} Input impedance: Ri > 50 kΩ Current: maximum range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output (see 5.4)	Voltage: maximum range ±5 V_{DC} @ max 5 mA			
Enable input (see 5.5)	Range : 0 ÷ 9 V_{DC} (OFF state), 15 ÷ 24 V_{DC} (ON state), 9 ÷ 15 V_{DC} (not accepted); Input impedance: Ri > 87 kΩ			
Output supply (see 5.8)	±5 V_{DC} @ max 10 mA : output supply for external potentiometer			
Fault output (see 5.6)	Output range : 0 ÷ 24 V_{DC} (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only for /W option)	+24V_{DC} @ max 100 mA (E-ATR-8 see tech table **GS465**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 330 g			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 max 50 m for logic - 1,5 mm^2 max 50 m for power supply and solenoids			
Max conductor size (see 9)	2,5 mm^2			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

4 CONNECTIONS AND LEDS



only for /W option

Ⓛ **DIAGNOSTIC LEDS** (see 4.1)

④ **CANopen CONNECTOR** (male)

⑤ **PROFIBUS DP CONNECTOR** (female)

⑥ **EtherCAT CONNECTOR** (female - OUTPUT)

⑦ **EtherCAT CONNECTOR** (female - INPUT)

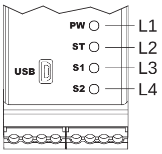
③ **USB CONNECTOR** always present (female)

E-BM-AES-NP **E-BM-AES-BC** **E-BM-AES-BP** **E-BM-AES-EH**

A,B,C,F,G,H connectors included; E connector is available only for /W option

4.1 Diagnostic LEDs Ⓛ

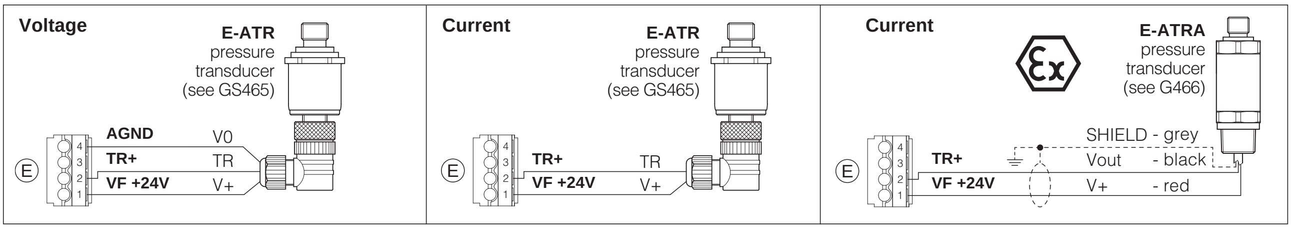
Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION	
L1	GREEN	PW	OFF	Power supply OFF	
			ON	Power supply ON	
L2	GREEN	ST	OFF	Fault present	
			ON	No fault	
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF	
			ON	PWM command ON	

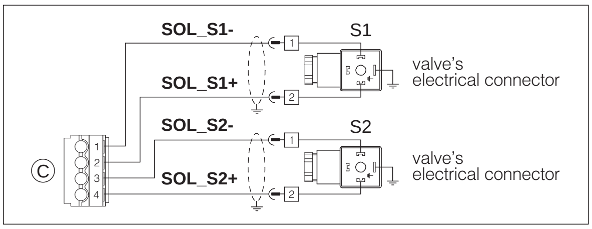
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 VDC (see 5.1)	Input - power supply
	A2	**V0**	Power supply 0 VDC (see 5.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 VDC for driver's logic and communication (see 5.2)	Input - power supply
	A4	**VL0**	Power supply 0 VDC for driver's logic and communication (see 5.2)	Gnd - power supply
B	B1	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0 (see 5.5)	Input - on/off signal
	B2	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0 (see 5.6)	Output - on/off signal
	B3	**VL0**	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	**EARTH**	Connect to system ground	
C	C1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	C2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	C3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	C4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
E available only for **/W** option	E1	**VF +24V**	Power supply +24 VDC	Output - power supply
	E2	**TR+**	Positive pressure transducer input signal: ±10 VDC / ±20 mA maximum range (see 5.7) Default are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Input - analog signal **Software selectable**
	E3	**NC**	Do not connect	
	E4	**AGND**	Common GND for transducer power, signals and external potentiometer	
F	F1	**+5V_REF**	External potentiometer power supply +5 VDC @ 10mA (see 5.8)	Output - power supply
	F2	**INPUT+**	Positive reference input signal: ±10 VDC / ±20 mA maximum range (see 5.3) Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	F3	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	F4	**-5V_REF**	External potentiometer power supply -5 VDC @ 10mA (see 5.8)	Output - power supply
G	G1	**EARTH**	Connect to system ground	
	G2	**AGND**	Analog ground for MONITOR and external potentiometer	Gnd - analog signal
	G3	**MONITOR2**	Only for /W option, 2nd monitor output signal: ±5 VDC maximum range (see 5.4) Default is 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	G4	**MONITOR**	Monitor output signal: ±5 VDC maximum range (see 5.4) Default is ±5 VDC (1V = 1A)	Output - analog signal **Software selectable**
H	H1	**VL0**	Power supply 0 VDC for digital input (see 5.2)	Gnd - power supply
	H2	**D_IN1**	Digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	H3	**D_IN0**	Digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	H4	**VL+**	Power supply 24 VDC for digital input (see 5.2)	Output - power supply

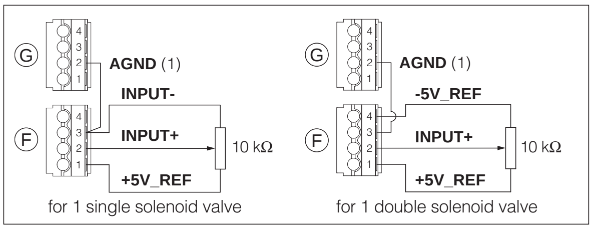
Pressure transducer connections - only for **/W** option



Coils connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used (only /W option)

4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ **USB connector - Mini USB type B** always present

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution, connector - DB9 - 9 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution, connector - DB9 - 9 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**SHIELD**	
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥ ⑦ **EH fieldbus execution, connector - RJ45 - 8 pin**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

(1) shield connection on connector's housing is recommended

5 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.
Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

5.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
In case of double power supply see 5.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

5.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

5.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 V_{DC} 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 V_{DC} or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{DC}.

5.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 V_{DC} (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 V_{DC}.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 V_{DC}; default setting is 0 ÷ 5 V_{DC}.

5.5 Enable input signal (ENABLE)

To enable the driver, supply 24 V_{DC} on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

5.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.
Fault status is not affected by the Enable input signal.

5.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 V_{DC} 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 V_{DC} or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

5.8 Output supply for external potentiometer (±5V_REF) - not available for EH version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 V_{DC} supply output available at pin F1 and F4.
Note: using an external potentiometer, the reference input signal must be set via software at ±5 V_{DC} (default ±10 V_{DC}, see 5.3)

5.9 Possible combined options: /AI, /AW, /IW, /AIW, /ACW, /CIW, /ACIW, /CW

6 VALVE SETTINGS AND PROGRAMMING TOOLS

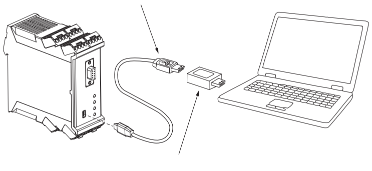
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

⚠ **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

USB connection



Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at **USB**

Adapters, Cables and Terminators, can be ordered separately

7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers.
For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-AES - user manual for **E-BM-AES**

7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.
Two different Scale regulations are available for double solenoid valves: ScaleA for positive reference signal and ScaleB for negative reference signal.

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).
The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current to the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If fieldbus reference signal is active (see 5.3), threshold should be set to zero.
Two different Bias regulations are available for double solenoid valves: positive reference signals activate BiasA and negative reference signals activate BiasB.
Refer to the programming manuals for a detailed description of other software selectable Bias functions.

7.3 Offset

Proportional valves may be provided with zero overlapping in the hydraulic regulation corresponding to zero reference input signal (valve's central spool position).
The Offset function allows to calibrate the Offset current, required to obtain valve's spool central position, to the specific hydraulic system setup (e.g. valve applied to cylinder with differential areas).

7.4 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

7.5 Linearization - E-SW level 2 functionality

Linearization function allows to set the relation between the reference input signal and the controlled valve's regulation.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition.

7.6 Variable Dither

The dither is the frequency modulation of the current supplied to the solenoid. To reduce the hysteresis should be selected a lower value of frequency, despite a lower regulation stability, because a small vibration in the valve regulating parts considerably reduces static friction effects.
To improve the regulation stability, should be selected a high value of frequency, despite a higher hysteresis. This solution in some application can lead to vibration and noise. Normally, the right setting is a compromise and depends on system setup.
E-BM-AES drivers allow to realize a variable dither frequency that linearly depends on the demanded current: variable dither frequency allows an higher degree to optimize the valve hysteresis.

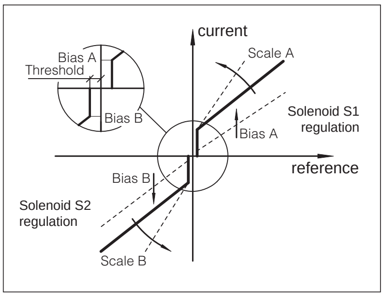
7.7 Hydraulic Power Limitation - only for **/W** option

Digital E-BM-AES drivers with /W option electronically perform hydraulic power limitation on:
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech table **A170**)

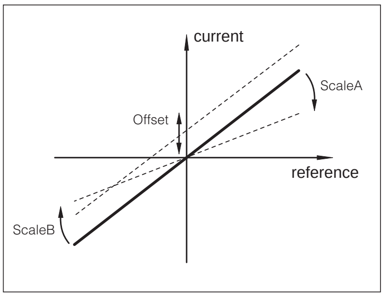
The driver receives the flow reference signal by the analog external input INPUT+ (see 5.3) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR (see 5.7).
When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

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

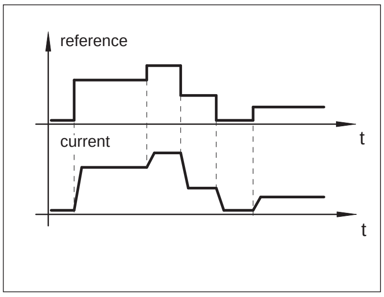
7.1, 7.2 - Scale, Bias & Threshold



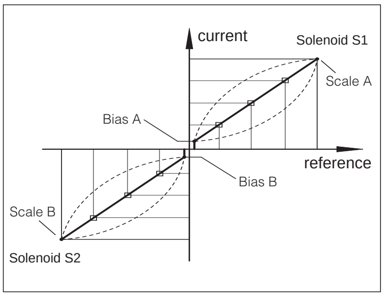
7.3 - Offset



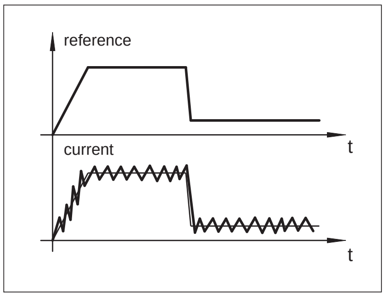
7.4 - Ramps



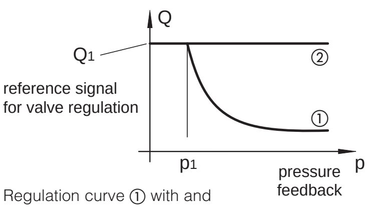
7.5 - Linearization



7.6 - Variable Dither



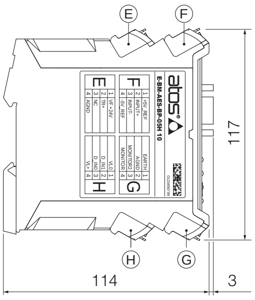
7.7 - Hydraulic Power Limitation

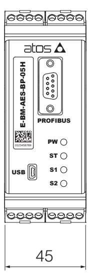


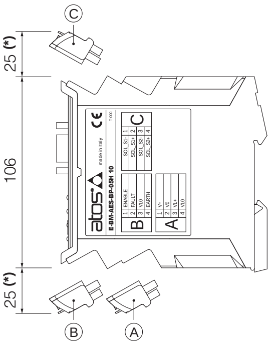
Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

8 OVERALL DIMENSIONS [mm]

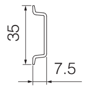
overall dimension with assembled connectors







DIN rail dimensions

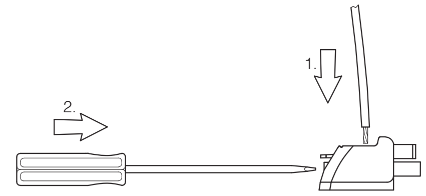


A,B,C,F,G,H connectors included; E connector is available only for /W option

(*) Space to remove the connectors

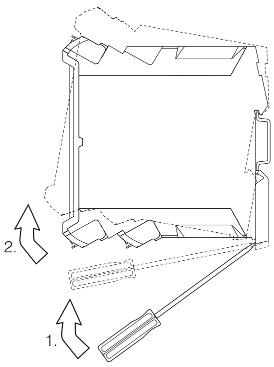
9 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver

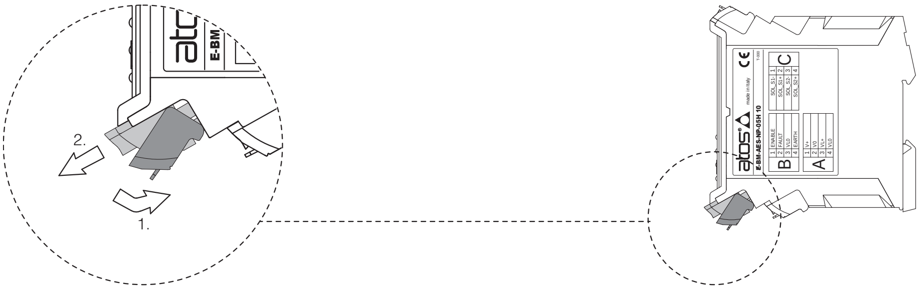


Note: max conductor size: 2,5 mm^2
tightening torque: 0,4 ÷ 0,6 Nm

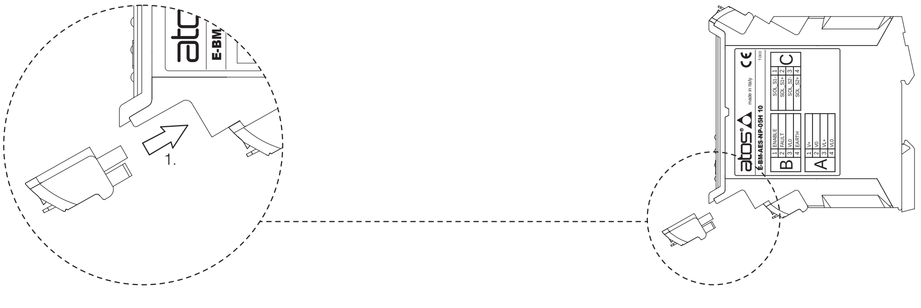
To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



To extract the connectors:
1. push lever
2. pull connector



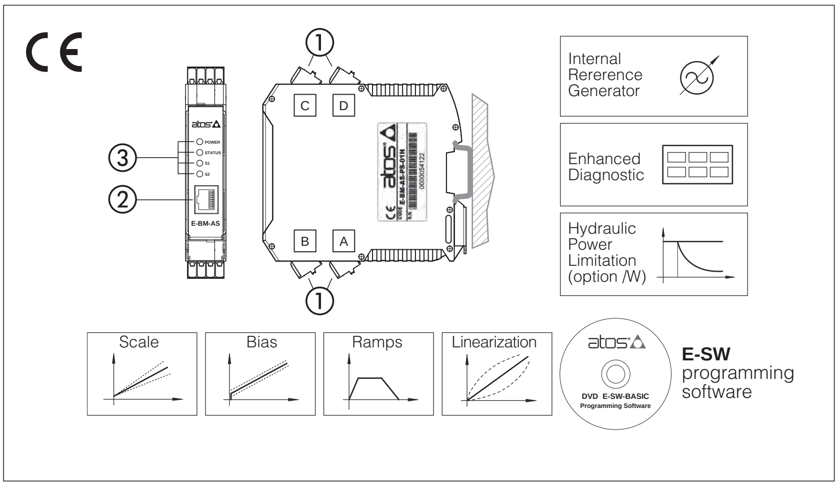
To insert the connectors:
1. push the connector in its slot



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

Digital electronic E-BM-AS drivers

DIN-rail format, for proportional valves without transducer


CE
①
③
②
POWER
STATUS
S1
S2
E-BM-AS
C
D
B
A
Internal Rererence Generator
Enhanced Diagnostic
Hydraulic Power Limitation (option /W)
Scale
Bias
Ramps
Linearization
DVD E-SW-BASIC Programming Software
E-SW programming software

1 MODEL CODE

E-BM - **AS** - **PS** - **01H** / ***** *****

Off-board electronic driver in DIN rail format

AS = digital basic driver, for valves without transducer

PS = Serial communication interface

01H = for single solenoid proportional valves
05H = for double solenoid or two single solenoid proportional valves

Series number

Options:

- **-** = standard 24 VDC power supply
- **12** = 12 VDC power supply
- **A** = max current limitation for ex-proof valves
- **C** = current feedback 4 ÷ 20 mA for remote transducer, only for **IW**
- **I** = current reference input 4 ÷ 20 mA (omit for standard voltage reference input ±10 VDC)
- **P** = electrical supply for external potentiometers to generate reference signal, not available with **I** option (see 4.4)
- **W** = power limitation function, only for **05H** (see 7.7)

E-BM-AS

Digital drivers control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.
The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the hydraulic regulation.
E-BM-AS can drive up to two single or one double solenoid proportional valves.

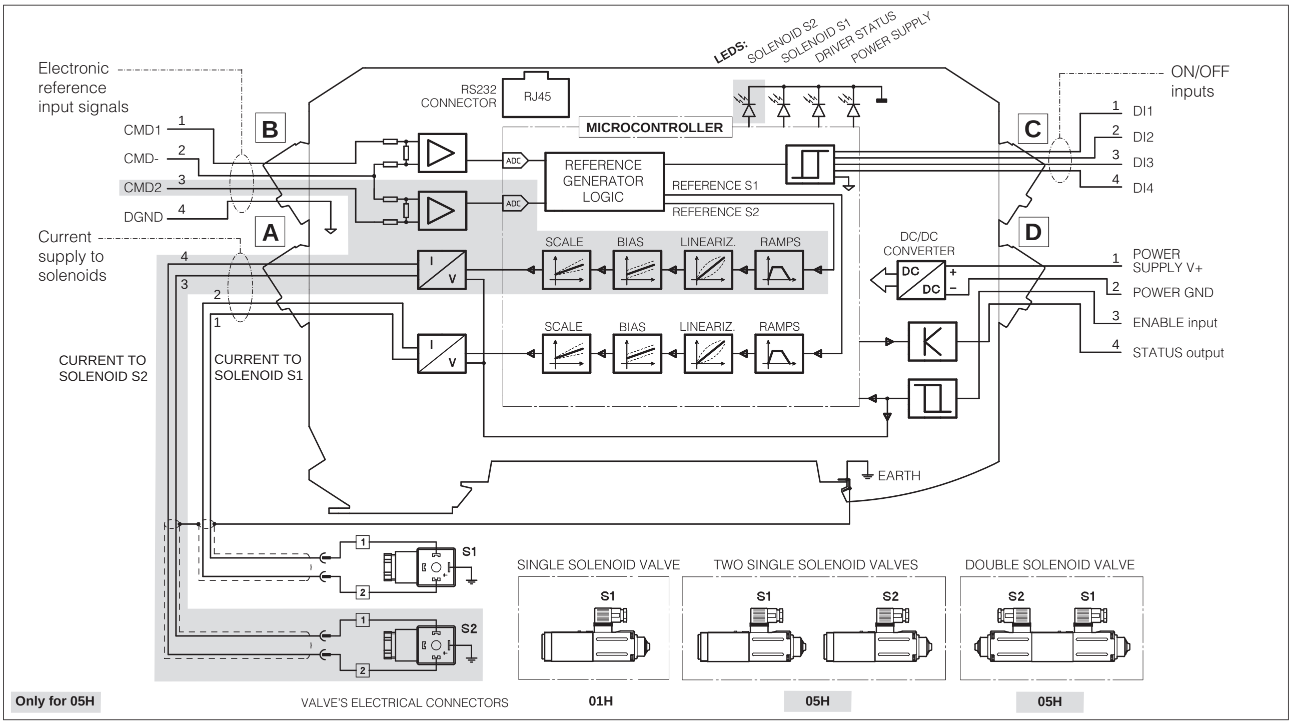
Electrical Features:

- 4 fast plug-in connectors ①
- RJ45 connector ② for RS232 Serial communication to program the driver with the Atos PC software
- 4 leds for diagnostics ③ (see section 10)
- ±5 VDC output supply for external reference potentiometers (/P option)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function
- Complete diagnostics of driver status

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	**Standard** Nominal: +24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP) **option /12** Nominal: +12 VDC Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)
Max power consumption	50 W 01H single solenoid valve and 05H double solenoid valve 100 W 05H two single solenoid valves
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply for standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply for proportional valves with /6 option (2,1 Ω solenoid) IMAX = 2.5 A with +24 VDC power supply for ex-proof proportional valves (3,2 Ω solenoid) for **/A option**
Analog input signal (see 4.2)	Voltage: range ±10 VDC Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Enable and optical insulated ON/OFF inputs (see 4.5, 4.7)	Range : 0 ÷ 24 VDC (OFF state: 0 ÷ 5 VDC ; ON state: 9 ÷ 24 VDC) Input impedance: Ri > 10 kΩ
Output supply (see 4.4)	±5 VDC @ max 10 mA : output supply for external potentiometers (only for **/P option**)
Status output (see 4.6)	Output range : 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 1,4 A
Alarms	Solenoid not connected, short circuit and cable break with current reference signal
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (-20 ÷ +40 °C for 05H version if drive two single solenoid proportional valves; storage -25 ÷ +85 °C)
Mass	130 g
Additional characteristics	Short circuit protection of current output to solenoids; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	RS232 serial connection (not insulated), Atos protocol with ASCII coding (see section 9)
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 for length up to 40 m [1,5 mm^2 for power supply and solenoids]
Max conductor size (see section 12)	2,5 mm^2

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
5 A time lag fuse for 05H two single solenoid valves

Option /12

This driver execution is designed to receive a 12 VDC power supply and it is commonly used in mobile application.
A safety fuse is required in series to each driver power supply:

⚠ A safety fuse is required in series to each power supply: 4 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
6,3 A time lag fuse for 05H two single solenoid valves

4.2 Reference Input Signals (pin B1 and B3, both referred to pin B2)

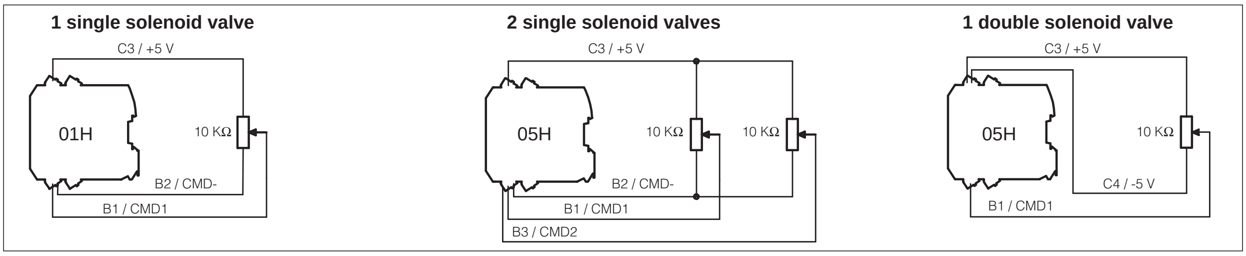
The driver proportionally transforms the external reference input signal into the current supplied to the solenoid.
The driver is designed to receive one (01H) or two (05H) analog reference inputs (CMD1 on pin B1, CMD2 on pin B3); both signals are referred to a common electric ground (CMD- on pin B2). CMD1 has to be used in case of 05H version that drives one double solenoid valve. CMD2 has to be used in case of 05H version that drives two single solenoid valves or transducer input for /W option (see 4.3).
The input range is software selectable among voltage (0 ÷ ±10 VDC) or current (4 ÷ 20 mA with cable break detection or 0 ÷ ±20 mA).
Defaults for standard: 0 ÷ 10 VDC for two position valves; 0 ÷ ±10 VDC for three position valves (see valve's tech. table).
Default for /I option: 4 ÷ 20 mA (see valve's tech. table)
Other ranges can be set by software. Internal reference generation is software selectable (see 7.6).
Note: software selection of analog input range (voltage or current) is applied to both signals CMD1 and CMD2.

4.3 Pressure Input Signal (pin B3 referred to pin B2) only for, /W option)

When hydraulic power limitation is active (see 7.7), input signal CMD2 must be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 VDC.

4.4 Output supply Signal for external reference potentiometers (/P option)

The reference analog signals can be generated by one (01H) or two (05H) external potentiometers directly connected to the driver, using the ±5 VDC supply output available at pin C3 and C4. Reference input signal can be set up via software to ±5 VDC, in order to match potentiometer output signal.



4.5 Enable Input Signal (pin D3 referred to pin D2)

Enable input signal allows to enable/disable the current supply to the solenoids, without removing the electrical power supply to the driver; it is used to maintain active the serial connection and the other driver functions when the valve must be disabled for safety reasons.
To enable the driver, supply a 24VDC on pin D3 referred to pin D2.

4.6 Status Output Signal (pin D4 referred to pin D2)

Status output signal indicates fault conditions of the driver (short circuits, solenoids not connected, cable broken for 4 ÷ 20mA input) and is not affected by Enable input signal status: fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
When hydraulic power limitation function is active (see 7.7), status output signal can be software configured to indicate power limitation status: not active (0 VDC) or active (24 VDC).

4.7 ON/OFF Input Signals (pin C1...C4 referred to DGND pin B4)

Analog Drivers Compatibility - **default** for series 12 or higher

The four ON/OFF digital input signals (DI) can be used to activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers (see section 5). If digital inputs are not connected, the driver behavior corresponds to an E-BM-AS series 11 or lower

or

Internal Reference Generation - software selectable

When the driver is configured in internal reference generation mode (see 7.6), the 4 ON/OFF input signals (DI) are used to select the active reference signal, among the available stored values. If the 4 ON/OFF input signals (DI) are not active, the driver can be commanded by external analog reference. The polarity of the digital inputs can be customized: active status = 24 VDC is the default setting.

Note: for /P option DI3 and DI4 are not available

4.8 Possible combined options:

/12W, **/12PW**, **/12CIW**, **/AW**, **/ACIW**, **/APW**, **/CIW**, **/PW** only for 05H
/12I, **/12P**, **/AI**, **/AP** for 01H and 05H

5 ANALOG DRIVERS COMPATIBILITY - only for E-BM-AS series 12 or higher

E-BM-AS digital inputs (DI1..DI4) activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers:

REFERENCE COMPATIBILITY

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI1:	0 VDC to DI1:
DI1	24 VDC	E-BM-AS 01H E-BM-AS 05H	E-BM-AC 01F E-BM-AC 05F E-BM-AC 011F E-ME-AC 01F E-ME-AC 05F	01H Voltage 0 ÷ 5 VDC / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100% 05H Voltage ± 5 VDC / ± 100% Current 4 ÷ 20 mA / 0 ÷ 100%	See section 4.2
DI2	0 VDC				
DI3	0 VDC				
DI4	0 VDC				

Note: set 0 VDC to DI1 and power-off/on the driver to restore latest settings

REFERENCE INVERSION

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI2:	0 VDC to DI2:
DI1	24 VDC	E-BM-AS 05H	E-BM-AC 05F	Voltage 0 ÷ 5 VDC / 0 ÷ -100% Current 4 ÷ 20 mA / 0 ÷ -100%	Voltage 0 ÷ 5 VDC / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100%
DI2	24 VDC				
DI3	0 VDC				
DI4	0 VDC				

Note: to enable reference inversion, set 24 VDC to DI1 before driver power-on

RAMP SWITCH OFF

Digital Inputs Signals		Digital driver	Analog driver	24 VDC to DI3:	0 VDC to DI3:
DI1	24 VDC	E-BM-AS 01H E-BM-AS 05H	E-ME-AC 01F E-ME-AC 05F	Ramp excluded	Ramp activated
DI2	0 VDC				
DI3	24 VDC				
DI4	0 VDC				

Notes: to enable ramp switch off, set 24 VDC to DI1 before driver power-on; DI3 not available for /P option

011F CONFIGURATION

Digital inputs dignals		Digital driver	Analog driver	24 VDC to DI4:	0 VDC to DI4:
DI1	(*)	E-BM-AS 05H	E-BM-AC 011F	Driver configuration 011F (*) = don’t care	Driver configuration 05H (*) = don’t care
DI2	(*)				
DI3	(*)				
DI4	24 VDC				

Notes: set 0 VDC to DI4 and power-off/on the driver to restore latest settings; DI4 not available for /P option

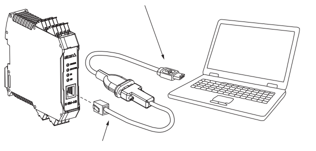
6 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver’s options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

Connection


E-A-PS-USB/DB9 USB to serial adapter
E-C-PS-DB9/RJ45 serial cable

⚠ **WARNING: drivers RS232 port is not isolated!**

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at **USB Adapters, Cables and Terminators, can be ordered separately**

7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-AS - user manual for **E-BM-AS**

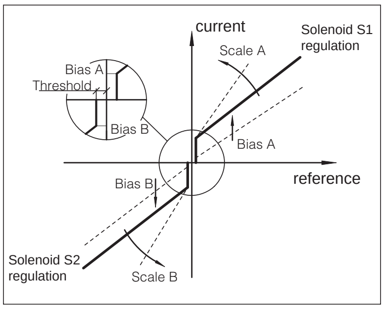
7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.
For double solenoid valves two different Scale regulations are available:
ScaleA for positive reference signal and ScaleB for negative reference signal

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).
The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If internal reference generation is active (see 7.6), threshold should be set to 0.
For double solenoid valves two different Bias regulations are available: positive reference signal activates BiasA for solenoid S1 and negative reference signal activates BiasB for solenoid S2

7.1, 7.2 - Scale, Bias & Threshold



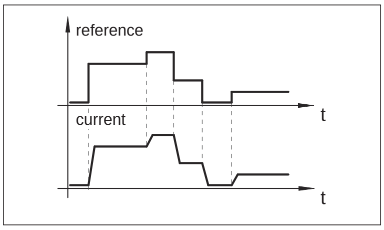
7.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:

- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

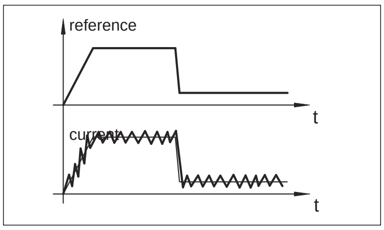
7.3 - Ramps



7.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.
Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).
Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup.
Default dither is a valid setting for a wide range of hydraulic applications

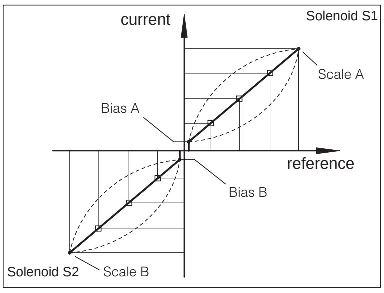
7.4 - Dither



7.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

7.5 - Linearization



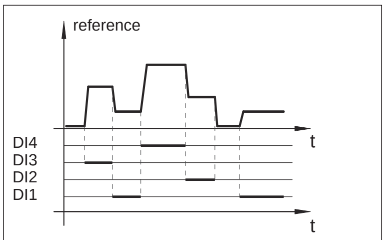
7.6 Internal Reference Generation

Internal generation of reference values is software selectable.
In this mode the 4 digital inputs of the driver (DI1..DI4) allow to activate the desired internal reference signal, among the different driver's stored values: external control unit can thus manage complex machine profile by simple switching the reference signal, by 4 digital inputs (see 4.7).
The digital inputs are software configurable into 2 different reference selection mode:

- *Standard mode*
  each digital input corresponds to a different value; up to 4 different internal values are available (2+2 with E-BM-AS-PS-05H driving two single solenoid valves)
- *Binary mode*
  each digital input combination corresponds to a different value; up to 15 different internal values are available (3+3 with E-BM-AS-PS-05H when driving two single solenoid valves)

A dedicated ramp time value can be set by software for each available stored reference value.
Note: with all input signals (DI) set to zero, the driver can be commanded by external analog reference also if internal reference generation is selected (for more information please refer to the programming manual E-MAN-BM-AS).

7.6 - Internal Reference Generation



Single internal generator selection (standard mode)

DI1	DI2	DI3	DI4	Reference
OFF	OFF	OFF	OFF	External
ON	OFF	OFF	OFF	Generation 1
(*)	ON	OFF	OFF	Generation 2
(*)	(*)	ON	OFF	Generation 3
(*)	(*)	(*)	ON	Generation 4

Double internal generator selection (standard mode)

DI1	DI2	S1	DI3	DI4	S2
OFF	OFF	External	OFF	OFF	External
ON	OFF	Generation 1	ON	OFF	Generation 1
(*)	ON	Generation 2	(*)	ON	Generation 2

(*) don't care

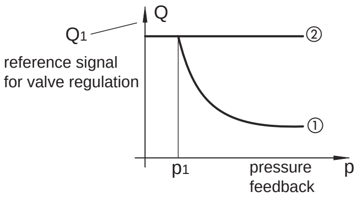
7.7 **Hydraulic Power Limitation** (**/W option**, only for drivers E-BM-AS-PS-05H)

E-BM-AS drivers with /W option electronically perform hydraulic power limitation on:
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech. table A170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) or by the internal generator (see 7.6) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2.
When the actual requested hydraulic power **p**x**Q** (CMD2xCMD1) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}} \text{; Flow Reference [CMD1]} \right)$$

7.7 - Hydraulic Power Limitation



Regulation curve ① with and
② without power limitation.
p1 x Q1 = max power limit

8 CONNECTIONS

The 4 fast plug-in connectors (A,B,C,D), included in the supply, provide simple wirings, easy driver's replacement and the possibility to test the signals directly on the connectors.

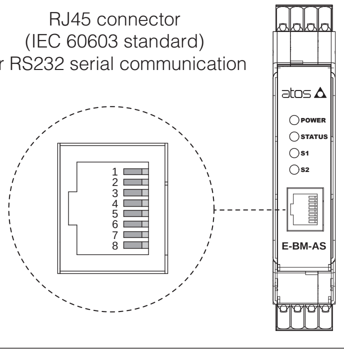
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES	
A	A1	SOL S1	Current to solenoid S1		Output - power PWM	
	A2					
	A3	SOL S2	Current to solenoid S2 (only for 05H version)			
	A4					
B	B1	CMD1	Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)		Input - analog signal	
	B2	CMD-	Standard	**/P option** (see 4.4)		
			Zero signal, ground for reference signals	Reference for ±5 VDC output (AGND)		
	B3	CMD2 **(1)**	Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)			
	B4	DGND	Optical insulated ground for on/off inputs (DI1 ÷ DI4)			
C			Standard	**/P option** (see 4.4)	Standard	Option /P
	C1	DI1	Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Input - on/off signal	
	C2	DI2				
	C3	DI3		+5 VDC @ 10 mA output supply to pin B2 (AGND)	Input - on/off	Output - reference analog
	C4	DI4		-5 VDC @ 10 mA output supply to pin B2 (AGND)		
D	D1	V+	Power supply 24 VDC (see 4.1)		Input - power supply	
	D2	V0	Power supply 0 VDC			
	D3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (see 4.5)		Input - on/off signal	
	D4	STATUS	Fault (default) or software selected output (see 4.6)		Output - on/off signal	

(1) Only for 05H version, when used to drive two single solenoid valves or transducer input for /W option
WARNING: if CMD2 is not used has to be connect to CMD- (ground)

9 RJ45 CONNECTOR

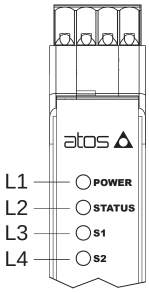
RJ45 CONNECTOR		
PIN	SIGNAL	DESCRIPTION
1	/	Not connected
2	/	Not connected
3	/	Not connected
4	GND	Signal zero data line
5	RX	Driver receiving data line
6	TX	Driver transmitting data line
7	/	Not connected
8	/	Not connected

RJ45 connector
(IEC 60603 standard)
for RS232 serial communication

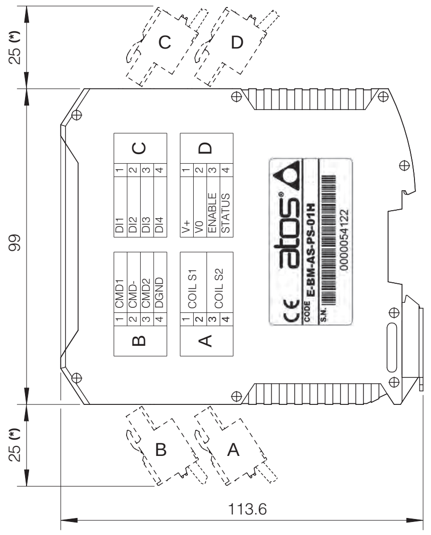


10 DIAGNOSTIC LEDS

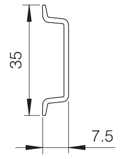
Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION	
L1	GREEN	POWER	OFF	Power supply OFF	
			ON	Power supply ON	
L2	GREEN	STATUS	OFF or ON	Fault conditions	
			Slow blinking	Driver disabled	
			Fast blinking	Driver enabled	
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF	
			ON	PWM command ON	
			Slow blinking	Coil not connected	
			Fast blinking	Short circuit on the solenoid	

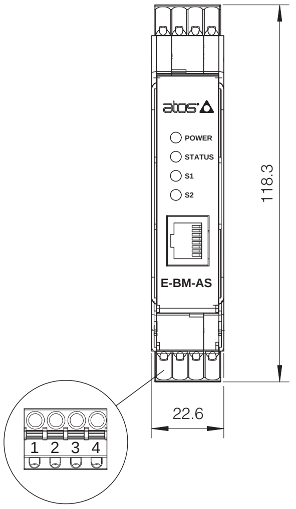
11 OVERALL DIMENSIONS [mm]



DIN rail dimensions



overall dimension with assembled connectors

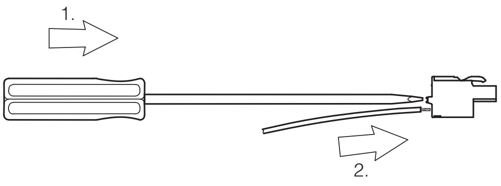


A, B, C, D connectors included

(*) Space to remove the connectors

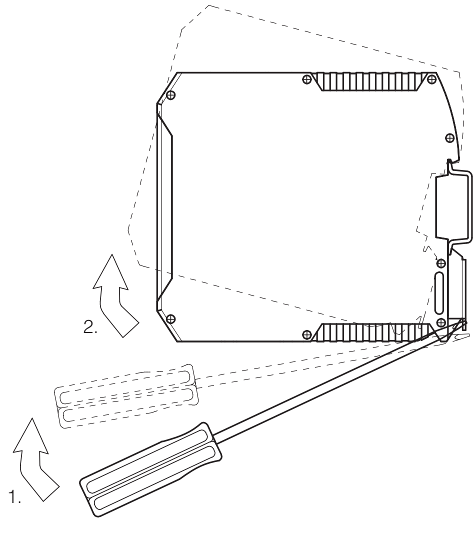
12 INSTALLATION

To wire cables in the connectors:
1. press the button with a screwdriver
2. insert the cable termination



Note: max conductor size: 2,5 mm²

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



Digital electronic E-MI-AS-IR drivers

DIN 43650 plug-in format, for proportional valves without transducer

E-MI-AS-IR

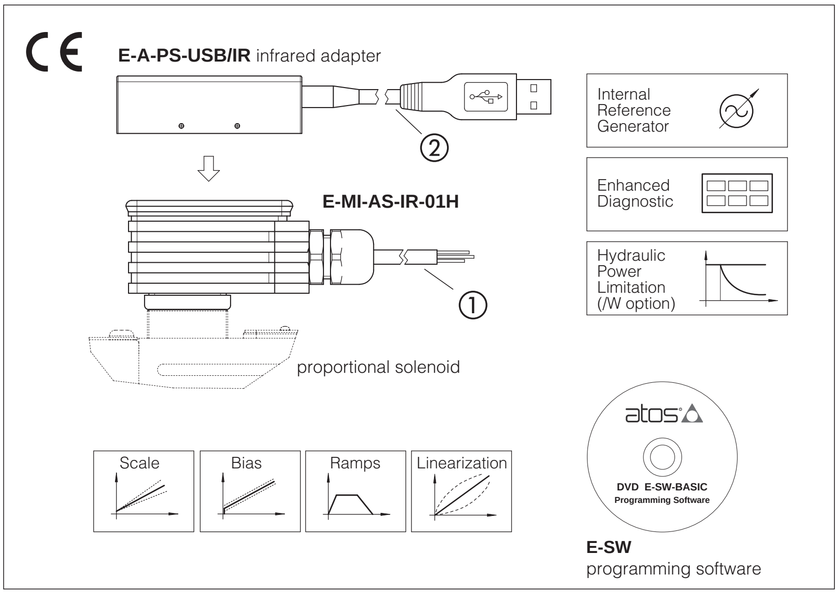
Digital drivers are designed for mounting on the solenoid's DIN connector of proportional valves without transducer. They supply and control the current to the solenoid according to the electronic reference input signal. The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the valve's hydraulic regulation.
E-MI-AS drivers can drive single or double solenoid proportional valve.

Electrical Features:

- Standard 5m cable connection ① or M12 connector (/M12 option)
- Infrared communication interface ② to program the driver with Atos PC software
- 2 leds for diagnostics (see 9)
- +5 VDC output supply for external reference potentiometer (not available for /M12 option)
- Operating temperature range: -20° ÷ +50°
- Current reference input (/I option)
- Plastic box with IP65 protection degree and standard DIN43650 plug-in format with double earth connection to allow double-side orientation
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function (see 6.7)
- Complete diagnostics of driver status


CE
E-A-PS-USB/IR infrared adapter
②
E-MI-AS-IR-01H
①
proportional solenoid
Internal Reference Generator
Enhanced Diagnostic
Hydraulic Power Limitation (/W option)
Scale
Bias
Ramps
Linearization
atos
DVD E-SW-BASIC Programming Software
E-SW
programming software

1 MODEL CODE

E-MI - A S - IR - 01H / * *

On-board driver
DIN 43650 plug-in format

A = driver for valves without transducer

S = digital execution

IR = Serial infrared communication interface

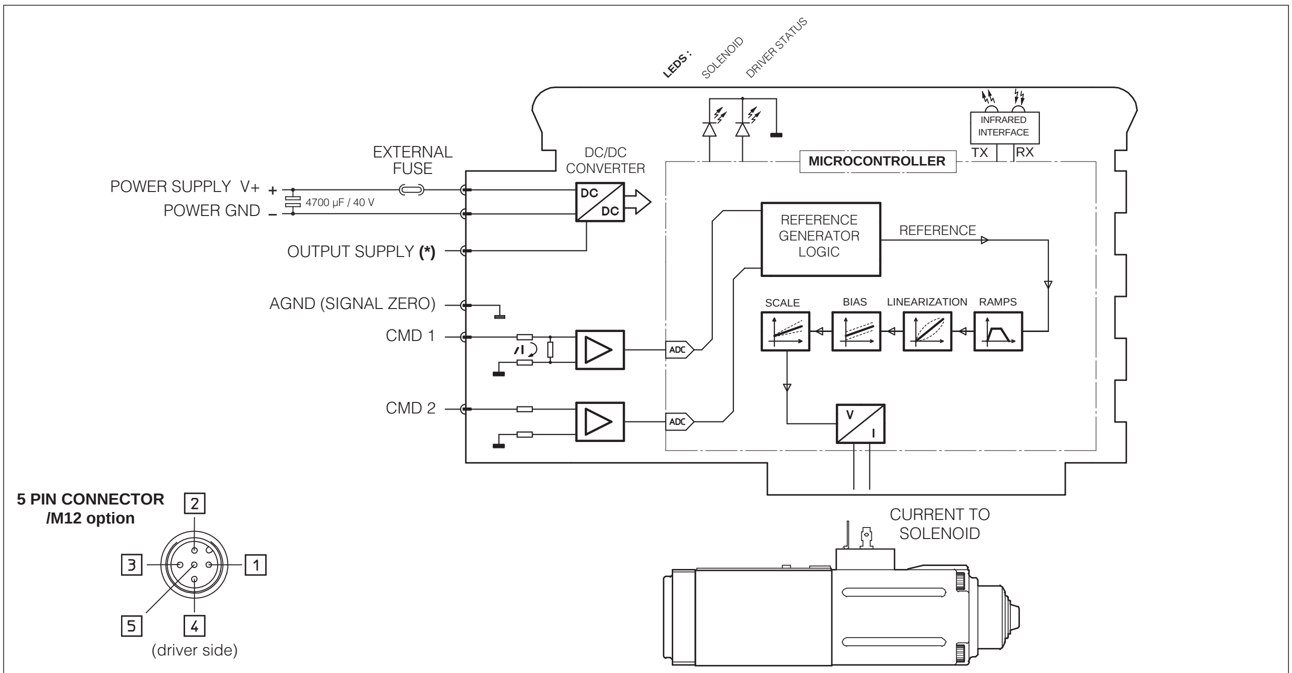
01H = for single solenoid proportional valves

Options, see section 4 **:**
- = standard version (with 5 m cable)
I = current reference input
M12 = with 5 poles M12 connector **(1)**
W = power limitation function (see 6.7)

Series number

(1) ZH-5P female connector must be ordered separately

2 BLOCK DIAGRAM



(*) +5 VDC / 5 mA output supply for external potentiometer not available for /M12 option

3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 VDC Rectified and filtered: VRMS = 20 ÷ 27 VMAX (ripple max 10 % VPP) Nominal: +12 VDC Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply to drive standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply to drive proportional valves with /6 option (2,1 Ω solenoid)
Reference input signal **(1)** (CMD1 - see 4.2)	Standard (voltage) Input range: 0 ÷ 10 VDC Input impedance: Ri > 50 kΩ **/I option** (current) Input range: 4 ÷ 20 mA / 0 ÷ 20 mA Input impedance: Ri = 500 Ω
Enble Input Signal (CMD2 - see 4.5) ON/OFF Input Signal (CMD1,CMD2 - see 4.6)	Input range: 0 ÷ 24 VDC (OFF state: 0 ÷ 5 VDC; ON state: 9 ÷ 24 VDC) Input impedance: Ri > 10 kΩ
Pressure transducer input (CMD2 - see 4.3)	**/W option** Input range: 0 ÷ 10 VDC Input impedance: Ri > 50 kΩ
Output supply (see 4.4)	+5 V @ max 5 mA: output supply for external potentiometer (not available for **/M12 option**)
Alarms	Solenoid coil not connected, short circuit and cable break with current reference signal (**/I option**)
Format	Plastic box ; IP65 protection degree (when fixed on solenoid); DIN43650 format
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)
Mass	Standard version: 450 g; /M12 option: 70 g
Additional characteristics	Short circuit protection of current output to solenoid
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	Infrared, Atos protocol with ASCII coding; E-A-PS-USB/IR adapter is required (see section 5)
Wiring cable characteristics	2 poles x 0,5 mm^2 plus 4 poles x 0,35 mm^2, external diameter 7,4 mm

(1) Negative reference input signal not allowed

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
According to power supply value, a safety fuse is required in series to each driver:
+24 VDC - 2,5 A time lag fuse
+12 VDC - 4 A time lag fuse

4.2 Reference Input Signal (CMD1: yellow/pin 4, referred to AGND: white/pin 3)

The driver proportionally transforms the external reference signal input into the current supplied to the solenoid.
The driver is designed to receive one analog reference input (CMD1 on yellow/pin 4) referred to the analog electric ground (AGND on white/pin3) and with a maximum range of 0 ÷ 10 VDC . Internal reference generation is software selectable (see 6.6).

Option /I (current reference input)
The reference input signal maximum range is software selectable among current 4 ÷ 20 mA (with cable break detection) or 0 ÷ 20 mA.

4.3 Pressure Input Signal (CMD2: blue/pin 5) - only for /W option

When hydraulic power limitation is active (see 6.7), enable input (CMD2) is managed as an analog input and has to be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 VDC.

4.4 Output supply for external potentiometer - (OUTPUT SUPPLY: green, referred to AGND: white) - not available for /M12 option

The reference analog signal can be generated by an external potentiometer directly connected to the driver, using the +5VDC supply output available at green wire thus generating the desired reference signal.

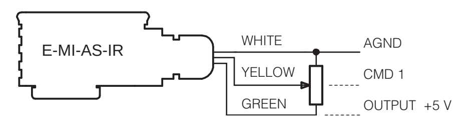
4.5 Enable Input Signal (CMD2: blue/pin 5, referred to AGND: white/pin 3)

Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to maintain active the infrared connection and the other driver functions when the valve must be disabled for safety reasons.
To enable the driver, supply a 24VDC on CMD2 (blue/pin 5, referred to white/pin 3).
The polarity of the enable input can be customized and the enable function can be deactivated, see table at side.

4.6 ON/OFF Input Signals (CMD1: yellow/pin 4, CMD2: blue/pin 5)

When the driver is configured in internal reference generation mode (see 6.6), both reference input (CMD1) and enable input (CMD2) are managed as ON/OFF input signals. In this mode they are used to select the active reference signal, among the available stored values.

4.7 Possible combined options: /IM12, /IM12W, /IW and /M12W



ENABLE CONFIGURATION

Signal	default polarity	reverse polarity	deactiveted
9 ÷ 24 VDC	solenoid ON	solenoid OFF	solenoid ON
0 ÷ 5 V	solenoid OFF	solenoid ON	solenoid ON

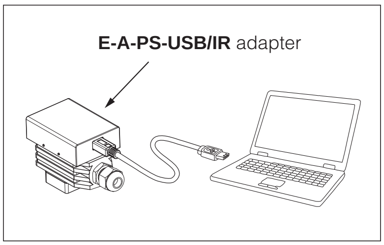
5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table **FS900**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

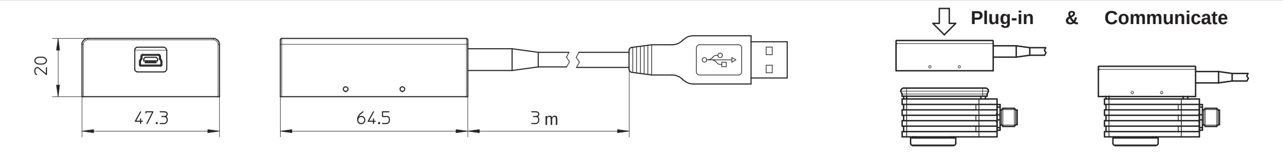
Connection



⚠ **WARNING: drivers USB port is not isolated!**

Adapter, to be ordered separately :

E-A-PS-USB/IR = adapter from USB connector (PC communication port) to driver infrared communication interface: plug the adapter on the driver to establish the infrared communication



6 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers.
For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-MI-AS - user manual for **E-MI-AS-IR**

6.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.
This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also usefull to reduce the maximum valve regulation in front of maximum reference signal.

6.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.
This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).
The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.
The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.
If internal reference generation is active (see 6.6), threshold should be set to 0.

6.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.
Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.
If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

6.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.
Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).
Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup.
Default dither is a valid setting for a wide range of hydraulic applications

6.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

6.6 Internal Reference Generation

Internal generation of reference values is software selectable.
In this mode the 2 driver inputs (see 4.6) allow to select the desired solenoid current reference signal, among the different internal stored values: external control unit can thus manage complex machine profile by simple switching of the reference signal, by 2 digital inputs (see 4.6).
Each digital input combination corresponds to a different reference value; up to 4 different internal values are available:

	Internal generated references			
	REF1	REF2	REF3	REF4
CMD1	0	24 V_{DC}	24 V_{DC}	0
CMD2	0	0	24 V_{DC}	24 V_{DC}

A different ramp time value can be set by software for each available stored reference value.

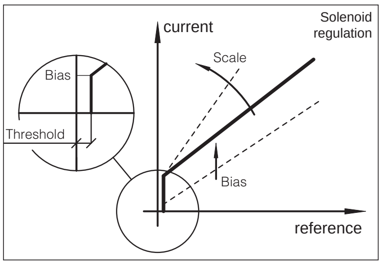
6.7 Hydraulic Power Limitation (**/W option**)

E-MI-AS drivers with /W option electronically perform hydraulic power limitation on single solenoid valves:
- flow control valves (direct and pilot operated)
- directional control valves (direct and pilot operated) + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tab. A170)

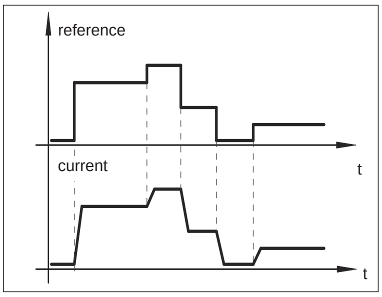
The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2 (see 4.3).
When the actual requested hydraulic power **p**x**Q** (CMD2xCMD1) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure transducer feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}}; \text{Flow Reference [CMD1]}\right)$$

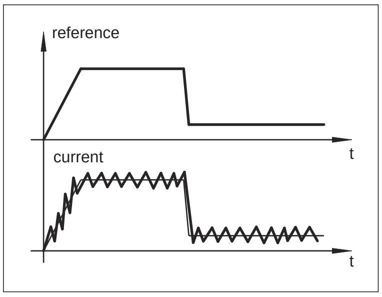
6.1, 6.2 - Scale, Bias & Threshold



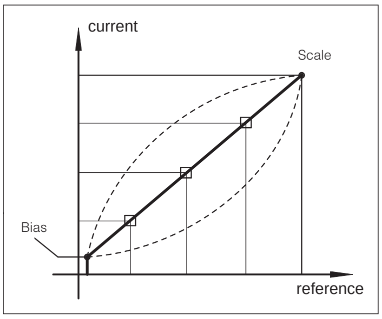
6.3 - Ramps



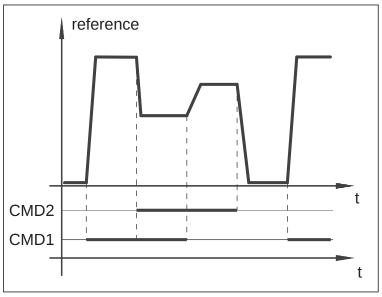
6.4 - Dither



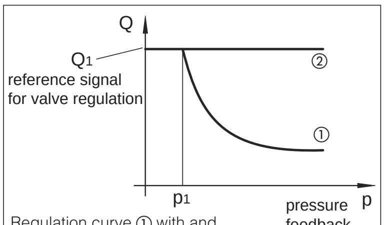
6.5 - Linearization



6.6 - Internal Reference Generation



6.7 - Hydraulic Power Limitation



Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

7 CONNECTIONS

Standard cable wire color	**/M12 option** pin	**SIGNAL**	**TECHNICAL SPECIFICATIONS**	**NOTES**
RED	1	V+	Power supply +24 VDC or +12 VDC (see 4.1)	Input - power supply
BLACK	2	V0	Power supply 0 VDC	
WHITE	3	AGND (Signal zero)	Ground for CMD1,CMD2 and OUTPUT SUPPLY	Input - analog signal
GREEN	N.A.	OUTPUT SUPPLY	+5 VDC @ 5 mA output supply for external potentiometer (not available for option /M12) (see 4.4)	Output - analog signal

The two input signals CMD1 and CMD2 can be managed as analog input or ON/OFF signals; their function depends on the selected software setting:

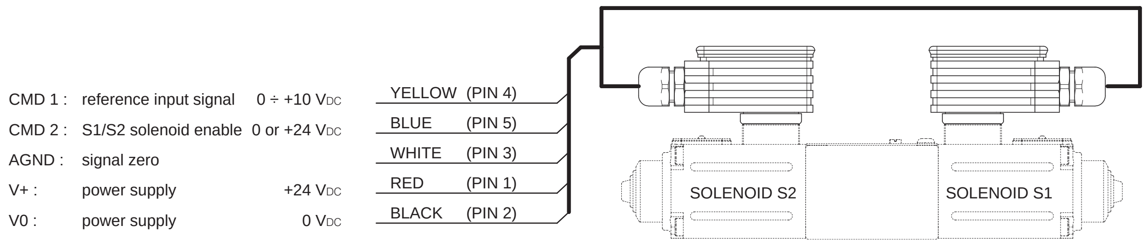
Standard cable wire color	**/M12 option** pin	**SIGNAL**	**TECHNICAL SPECIFICATIONS** (software setting dependent)			**NOTES**
			Default (see 4.2 ; 4.5)	**Internal Reference Generation** (see 4.6 ; 6.6)	**Hyraulic Power Limitation** (only for /W option - see 4.3 ; 6.7)	
YELLOW	4	CMD 1	Reference analog input: 0 ÷ 10 VDC (4 ÷ 20 mA; 0 ÷ 20 mA for /I option)	ON/OFF: 24 VDC / 0 VDC	Reference analog input: 0 ÷ 10 VDC (4 ÷ 20 mA; 0 ÷ 20 mA for option /I)	Input - analog or digital
BLUE	5	CMD 2	Enable/disable the driver: 24VDC / 0VDC	ON/OFF: 24 VDC / 0 VDC	Pressure transducer input: 0 ÷ 10 VDC	

8 DOUBLE SOLENOID VALVES OPERATION

It is possible to use two E-MI-AS drivers to operate one double solenoid proportional valve supplying the same analog signal to both CMD1 inputs reference. The enable input signal is used to select which driver/solenoid has to be active.

To operate double solenoid valves it is required to:

- parallel wire the two drivers (see following scheme).
- select opposite polarity (default and reverse) for the two enable signals (see 4.5)
- manage from PLC or machine unit: 1 analog reference signal corresponding to desired valve's regulation and 1 ON/OFF signal to select the active solenoid.

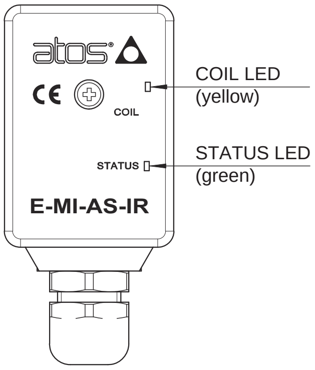


Numbers inside brackets are referred to 5 poles connector (option /M12)

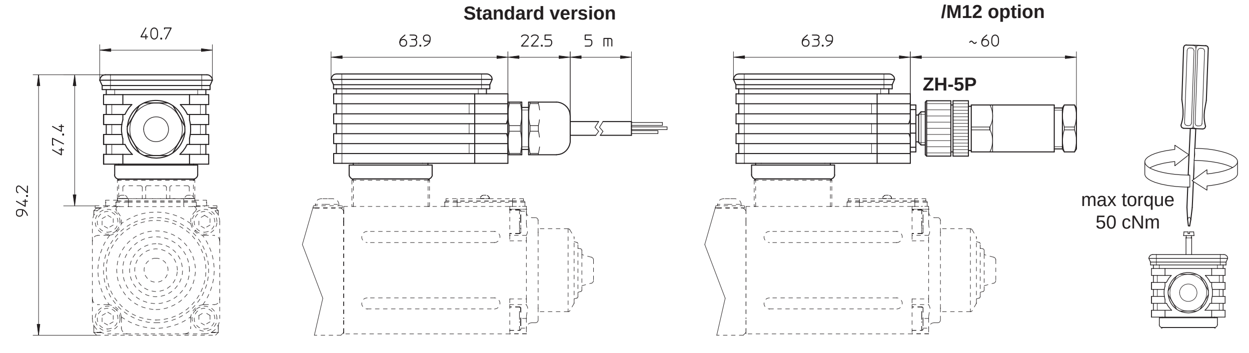
9 DIAGNOSTIC LEDS

It is possible to verify the actual status of solenoid command (yellow LED) and the driver status (green LED).
The following table details the possible displayed conditions:

COIL (YELLOW LED)	
Light signal displayed	Coil status
Light Off	PWM command OFF
Light On	PWM command ON
Slow blinking	Solenoid not connected
Fast blinking	Short circuit on the solenoid
STATUS (GREEN LED)	
Light signal displayed	Driver status
Light Off	Absence of power supply
Light On	Malfunctioning
Slow blinking	Driver disabled or Alarm present
Fast blinking	Driver enabled

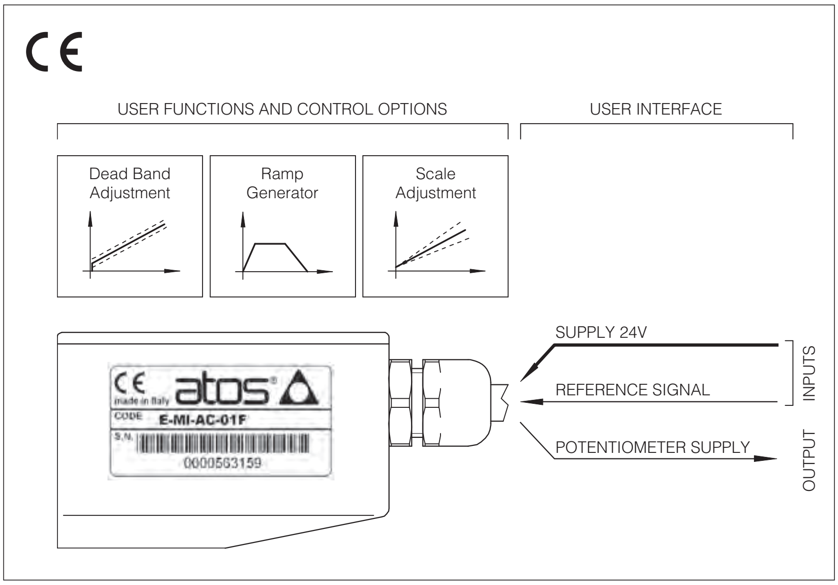


10 OVERALL DIMENSIONS [mm] AND INSTALLATION



Analog electronic E-MI-AC drivers

DIN 43650 plug-in format, for proportional valves without transducer



E-MI-AC

Analog drivers control the current to the solenoid of Atos proportional valves without pressure or LVDT position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

Features:

- bias and scale regulations by potentiometers
- symmetrical (standard) or dissymmetrical (/RR option) rising and falling ramp generator
- factory pre-set
- alluminium box with IP65 protection degree
- electronic filters on input and output lines
- CE mark according to EMC directive

Applications:

Pressure, flow, position open or closed-loop systems, according to the block diagram 2.

1 MODEL CODE

E-MI - **AC** - **01F** / * * / *

E-MI: On-board electronic driver DIN 43650 plug-in format

AC = for proportional valve without transducer

01F = for single solenoid proportional valve

Options:

- = standard symmetrical ramps

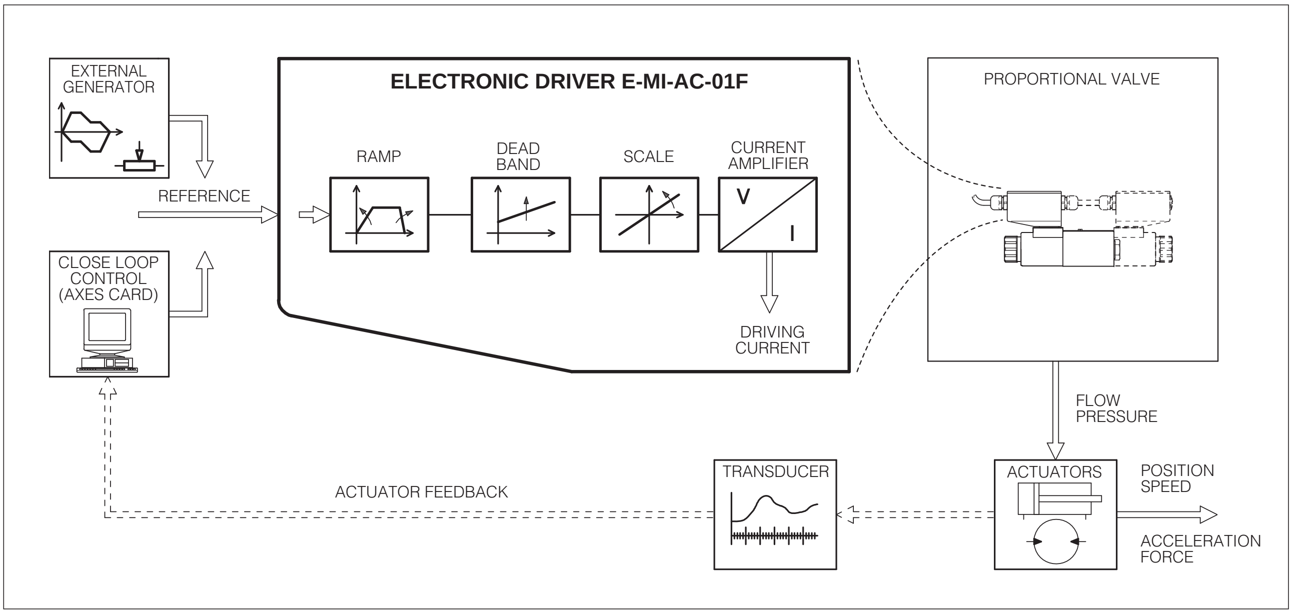
RR = adjustable dissimmetrical ramps, adjustable dither, suitable also for current signal 0÷20 mA

7 = pre arranged for double solenoid valves control

Series number

Set code (see 4.4)

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 VDC Rectified and filtered: VRMS = 21 ÷ 33 VMAX (ripple max 10 % VPP) Nominal: +12 VDC Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoid	IMAX= 2,7 A type PWM square wave (with solenoid type ZO(R)-A with resistance 3,2 Ω)
Nominal reference signal (factory preset)	0 ÷ 10 VDC
Reference signal variation range (scale adjustment)	0 ÷ 10 VDC (0 ÷ 5 VMIN) – (0 ÷ 20 mA for current signal)
Input signal impedence	Voltage signal Ri > 50 kΩ – (Ri = 250 Ω for current signal)
Potentiometers supply	+5 V / 10 mA at contact 3
Ramp time	10 sec. max (0 ÷ 10 V of reference signal)
Format	Box equipped with DIN 43650-IP65 plug; VDE 0110 wired on solenoid
Operating temperature	0 ÷ +50 °C (storage -20 ÷ +70 °C)
Mass	190 g
Additional characteristics	Outputs to solenoids protected against accidental short circuits
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Connections	7 contacts – terminal strip
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 up to 1,0 mm^2 (20 AWG - 18 AWG)

4 GENERAL SPECIFICATIONS

4.1 Power supply and wiring

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier use a 10000 µF/40V capacitor; if pulse voltage is generated by a three phase rectifier, connect a 4700 µF capacitor (see 11).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC), connecting the shield to noiseless earth (TE), see 13. It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.).

The 12 VDC electric voltage supply is allowed only after evaluation of the performances required from the proportional valves, and however after check with our technical office.

According to power supply value, a safety fuse is required in series to each driver:
+24 VDC - 2,5 A time lag fuse
+12 VDC - 4 A time lag fuse

4.2 Reference signal, see 5.

The electronic driver is designed to receive a voltage reference signal according to the following options:

- potentiometers mounted externally and wired according to the application diagrams.
- external reference signals generated by PLC, see 11.
- voltage from 0 to 10V
- current from 0 to 20 mA (only with **/RR** option).

4.3 Monitor signal

This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter between the test point M and pin 2 (see 9).
Reading scale is 1 mV = 10 mA (eg.: if the voltage signal is 70 mV, coil current is 700 mA).
To visualize the signals use voltmeters with impedance >10 KΩ.

4.4 Set code

Basic calibration of the electronic driver is factory pre-set, according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:

1 = RZGO (KZGO)	2 = RZMO, AG*ZO, LI*ZO
3 = DHZE, DHZO, DKZOR	4 = DPZO-A-*5
6 = QV*ZO(R), LEQZO	8 = DKZE

4.5 Calibrations available to the user, see 7, 8, 9, 11.

Scale
The relation between driving current and reference signal can be regulated with the Scale adjustment.

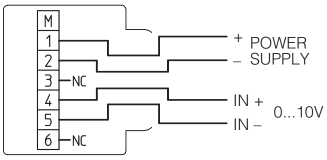
Bias (dead band)
Regulation of dead band adjusts the hydraulic zero of the valve (starting position adjustment) to the corresponding electrical zero. The electronic card is factory pre-set for the valve it is coupled with, according to the set code (see section 4.4). An output current is obtained when the input voltage is 100 mV or greater.

Ramps see 7, 9.
The internal ramp generator circuit converts a step input signal into a slowly increasing output signal (solenoid current).
The rise/fall time of the current is set via internal potentiometer P1 up to a max. time of 10 sec. for 0-10V of reference signal. The **/RR** option provides dissimmetrical ramps, ramp up is set via P1 potentiometer and ramp down is set via P2.

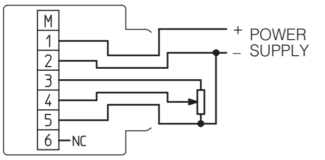
Dither
With the **/RR** option the dither frequency adjust is allowed from 100 Hz to 500 Hz.

5 EXTERNAL REFERENCE SIGNALS

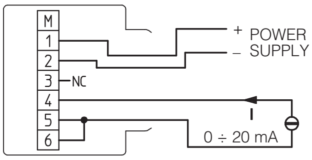
EXTERNAL GENERATOR VOLTAGE SIGNAL



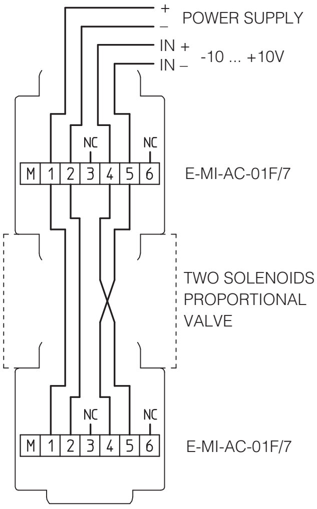
EXTERNAL POTENTIOMETER CONNECTION
POTENTIOMETER



EXTERNAL GENERATOR CURRENT SIGNAL
(**/RR** OPTION)



CONNECTION FOR TWO SOLENOIDS
PROPORTIONAL VALVE
(**/7** OPTION, necessary two /7 drivers)



6 INSTALLATION AND START-UP

It is advisable to perform calibration procedures in the order given below:

6.1 Warning

- Never insert or remove the driver while the electronic system is powered on.
- Refer to $\boxed{9}$ to identify components mentioned in calibration procedures.
- The E-MI-AC electronic drivers are designed to work in open loop system, where the coupled proportional valve is not required to work at its limits.

6.2 Start-up

Factory pre-set adjustments might not meet the requirements desired for the specific application. Performances can be optimized by on-site re-adjustments of Bias, Scale and Ramps potentiometers, in sequence.

- Remove the cover and connect the electronic driver according to the desired connection diagram, see $\boxed{5}$.

For double solenoid valves two electronic drivers type E-MI-AC-01F/7 must be used connected as shown in $\boxed{5}$.
Start-up instructions are the same for each driver.
On the first driver two cable clamps must be mounted, one for the external wirings and one to give power and signal to the second driver which is equipped with one cable clamp and one blind plug.
A differential voltage signal -10 V ÷ +10 V must be supplied to the first driver.
Note that the first driver will work with signal from 0 to 10V while the second driver will work with signal from 0 to -10 V.

- The current supplied to the coil can be measured by a voltmeter connected between pins M and 2 of the screw terminal. The reading range will be: I[mA]=10xV[mV] (for example reading 70 mV the current in the coil will be 700 mA).

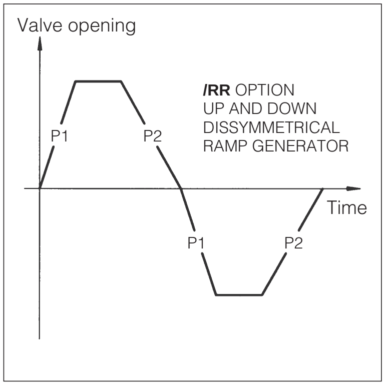
Bias adjustment (dead band compensation) see $\boxed{8}$, $\boxed{9}$.

- Supply electrical power to the driver; supply a reference signal voltage = 0,1 VDC. Gradually turn the P4 bias potentiometer until a movement of the controlled actuator is obtained.
- Turn in the opposite direction until the actuator is stopped.

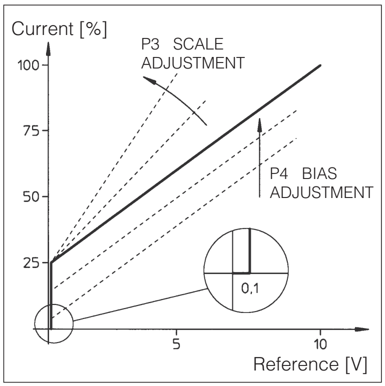
Scale adjustment, see $\boxed{8}$, $\boxed{9}$.
Supply max. current reference signal; check if the current in the coil reaches the max. value desired, turning P3 clockwise (see the regulation curve of the employed valve used).

Ramps see $\boxed{7}$, $\boxed{9}$.
Turning the ramp potentiometer clockwise, acceleration and deceleration time can be increased to obtain the optimization of the complete system.

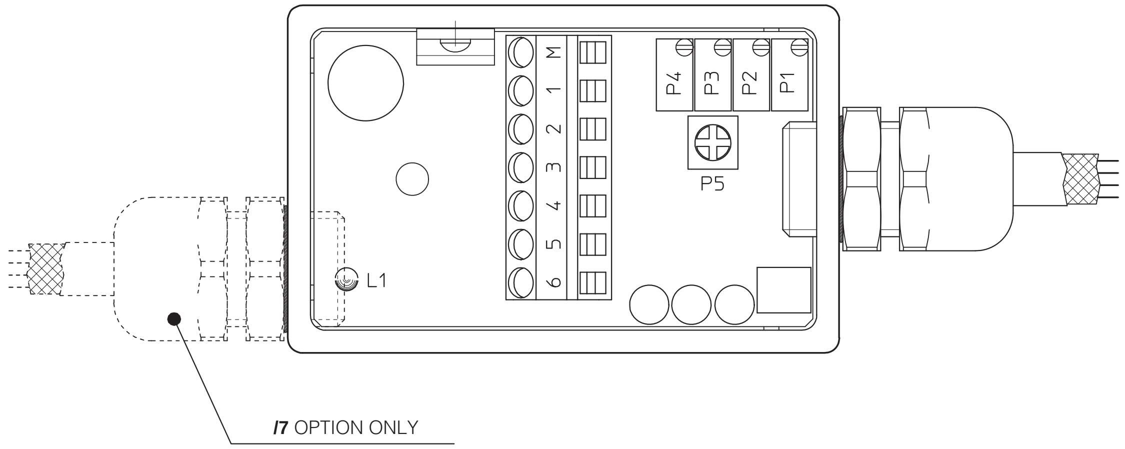
7 RAMPS



8 BIAS AND SCALE



9 REGULATIONS LAYOUT



CONNECTIONS

M = Monitor (driving current)
1 = Power V+ } supply 24 VDC
2 = Power GND } supply 24 VDC
3 = Output +5VDC (10mA)
4 = Reference signal input +
5 = Reference signal input –
6 = Connect to contact 5 for current signal (**/RR** option only)

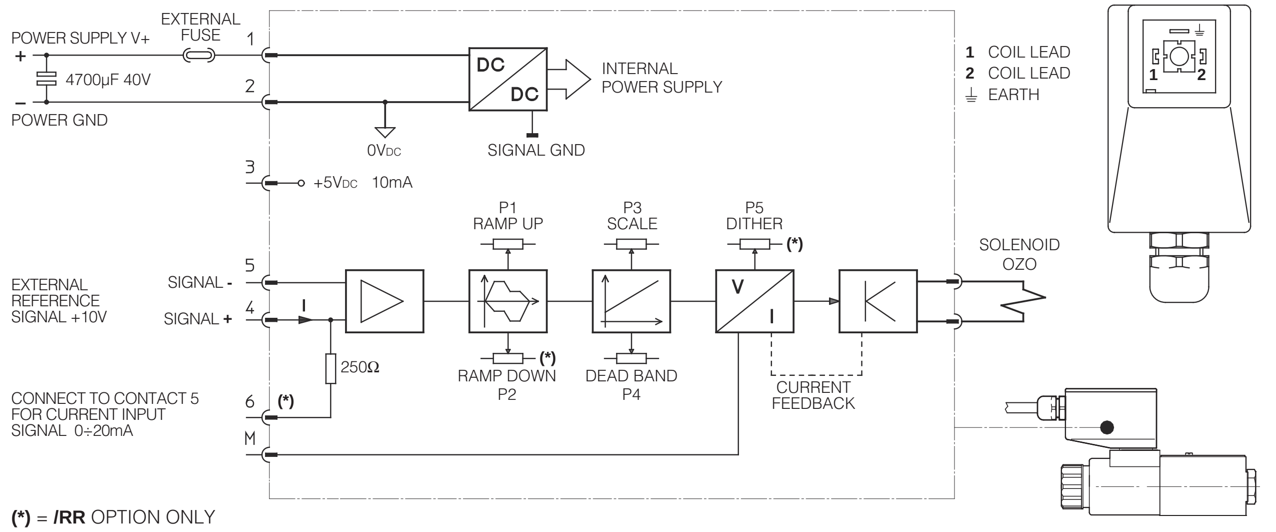
ADJUSTMENTS

P1 = Ramp up
P2 = Ramp down (**/RR** option only)
P3 = Scale
P4 = Bias
P5 = Dither (**/RR** option only)
L1 = Channel enabled led

10 IMPORTANT INSTRUCTIONS

ELETTROMAGNETIC COMPATIBILITY
Atos electronic drivers and proportional valves are designed according to the 2014/30/UE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.
The device must be verified on the machine because the magnetic field may be different from the test conditions.
SAFETY
The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of European directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be payed to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

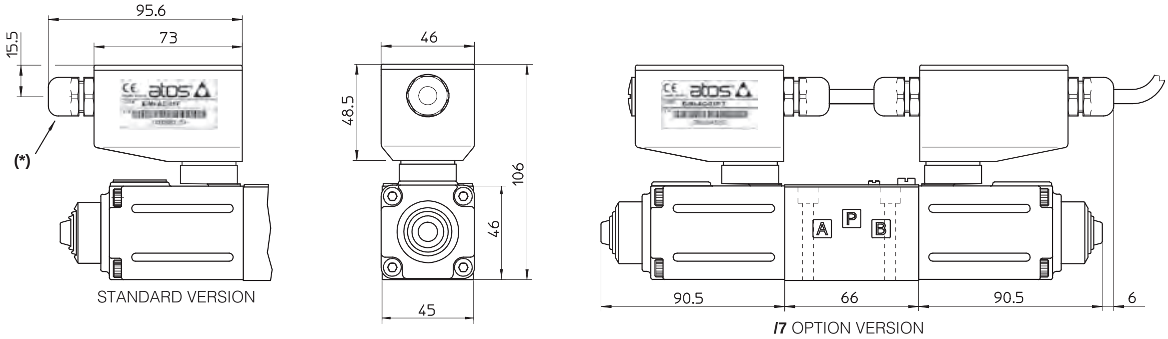
11 WIRING BLOCK DIAGRAM



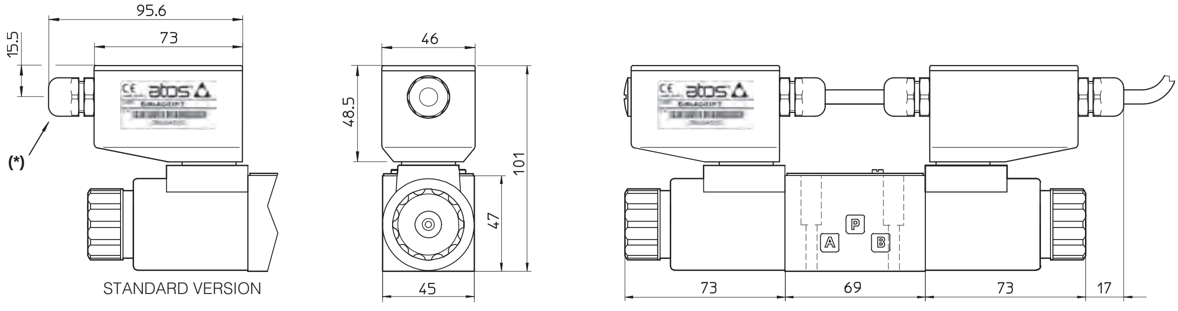
(*) = **/RR** OPTION ONLY

12 OVERALL DIMENSIONS [mm]

DHZO

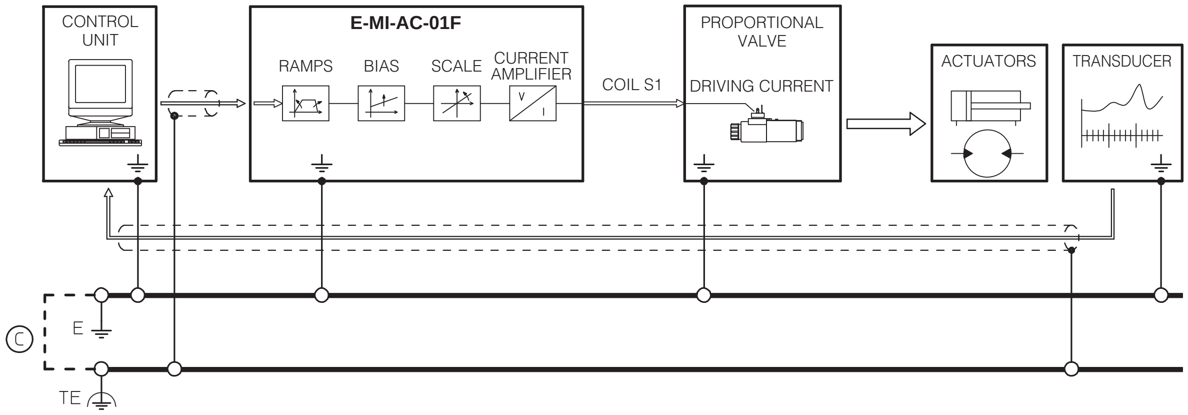


DHZE



(*) cable clamp PG9 hex. 19

13 EARTH CONNECTIONS



E: PROTECTIVE EARTH **TE**: NOISELESS EARTH Ⓒ : ALTERNATIVE BONDING CONNECTION TO NOISELESS EARTH TERMINAL

Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89

Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
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