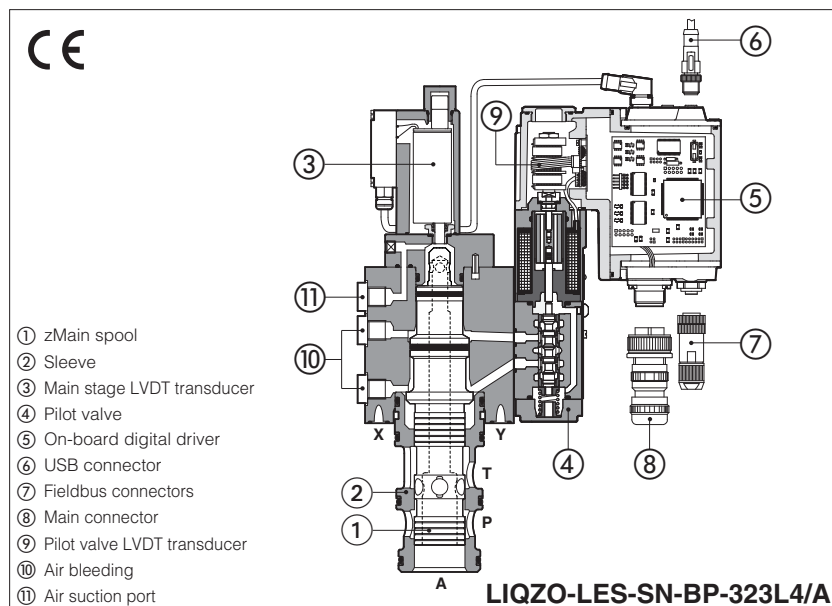


# Digital servoproportional 3-way cartridges

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-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.


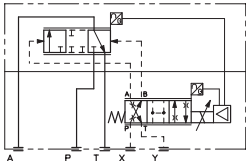
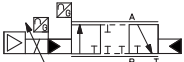
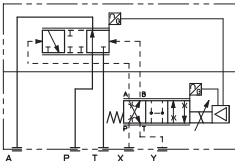

**LEB** basic execution with analog reference signal and USB port for software functional parameters setting.

**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	/	*	/	*																
<div>Servoproportional 3-way cartridge, piloted</div> <div>LIQZO = size 25 to 40, Pmax 350 bar</div> <div>LIQZP = size 50 to 80, Pmax 420 bar</div> <div>LEB = basic on-board digital driver (1)</div> <div>LES = full on-board digital driver</div> <div>Alternated P/Q controls:</div> <div>SN = none</div> <div>SP = pressure control (1 pressure transducer)</div> <div>SL = force control (1 load cell)</div> <div>Fieldbus interfaces, USB port always present:</div> <div>NP = Not present</div> <div>BC = CANopen</div> <div>BP = PROFIBUS DP</div> <div>EH = EtherCAT</div> <div>EW = POWERLINK</div> <div>EI = EtherNet/IP</div> <div>EP = PROFINET RT/IRT</div> <div>Valve size, see section 7 :</div> <table><tr><td>LIQZO =</td><td>25</td><td>32</td><td>40</td></tr><tr><td>l/min</td><td>185</td><td>330</td><td>420</td></tr><tr><td>LIQZP =</td><td>50</td><td>63</td><td>80</td></tr><tr><td>l/min</td><td>780</td><td>1250</td><td>2100</td></tr></table> <div>Nominal flow (l/min) at Δp 5 bar</div>															LIQZO =	25	32	40	l/min	185	330	420	LIQZP =	50	63	80	l/min	780	1250	2100
LIQZO =	25	32	40																											
l/min	185	330	420																											
LIQZP =	50	63	80																											
l/min	780	1250	2100																											
<div>Seals material, see section 9 :</div> <div>- = NBR</div> <div>PE = FKM</div> <div>BT = HNBR</div> <div>Series number</div> <div>Hydraulic options (2):</div> <div>A = reversal hydraulic configuration of main spool: P-A in rest position</div> <div>Electronic options (2):</div> <div>C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10Vdc) - only LES-SP, SL</div> <div>F = fault signal</div> <div>I = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc)</div> <div>Q = enable signal</div> <div>Z = double power supply, enable, fault and monitor signals - 12 pin connector (3)</div> <div>Spool type regulating characteristics:</div> <div>L4 = linear</div> <div></div> <div>Configuration: 3 = 3 way</div> <div>functional symbol: Standard</div> <div></div> <div>simplified symbol: Standard</div> <div></div> <div>option /A</div> <div></div> <div>option /A</div> <div></div>																														

(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**):

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

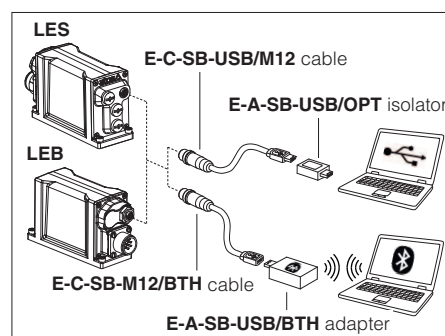


**WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



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

### USB or Bluetooth connection



## 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	<b>Standard</b> = -20°C ÷ +60°C <b>/PE</b> option = -20°C ÷ +60°C <b>/BT</b> option = -40°C ÷ +60°C
Storage temperature range	<b>Standard</b> = -20°C ÷ +70°C <b>/PE</b> option = -20°C ÷ +70°C <b>/BT</b> 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 $\Delta p$ P-A or A-T [l/min]						
$\Delta p = 5$ bar	185	330	420	780	1250	2100
$\Delta p = 10$ bar	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	<b>LIQZO</b> Ports P, A, T = <b>350</b> X = 350 Y ≤ 10 <b>LIQZP</b> Ports P, A, T = <b>420</b> X = 350 Y ≤ 10					
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume [cm³]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow <b>(1)</b> [l/min]	6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal <b>(2)</b> [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 $\Delta T = 40^\circ\text{C}$					

**(1)** With step reference input 0÷100%

**(2)** With pilot pressure = 140 bar, see detailed diagrams in section 10.2

## 8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (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 <b>GS465</b> )			
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 <b>18</b>			

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

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

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
<b>Hydraulic fluid</b>	<b>Suitable seals type</b>	<b>Classification</b>	<b>Ref. Standard</b>
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

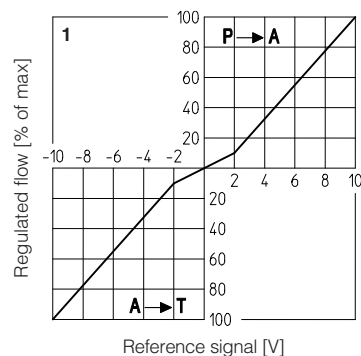
## 10 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

### 10.1 Regulation diagrams, see note

1 = LIQZO, LIQZP (all sizes)

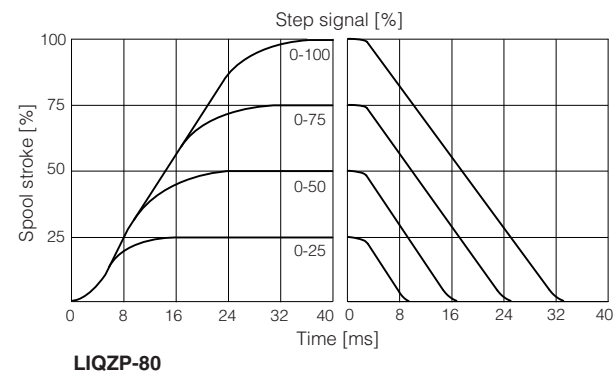
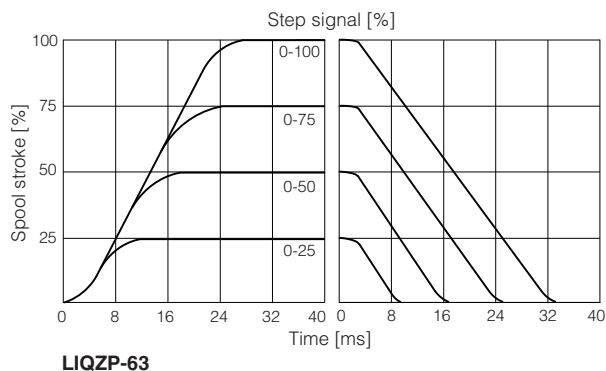
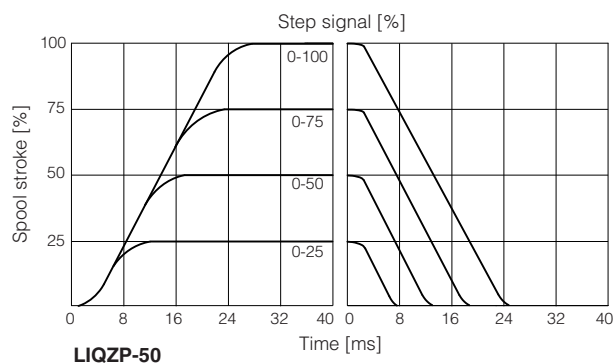
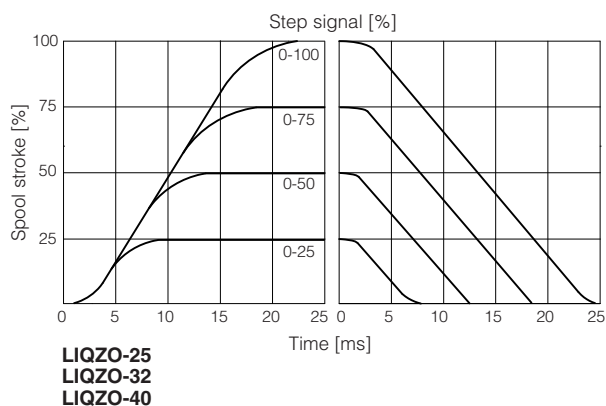
Hydraulic configuration vs. reference signal:

	standard	option /A
Reference signal $0 \div +10 \text{ V}$ $12 \div 20 \text{ mA}$	$P \rightarrow A$	$A \rightarrow T$
Reference signal $0 \div -10 \text{ V}$ $4 \div 12 \text{ mA}$	$A \rightarrow T$	$P \rightarrow A$

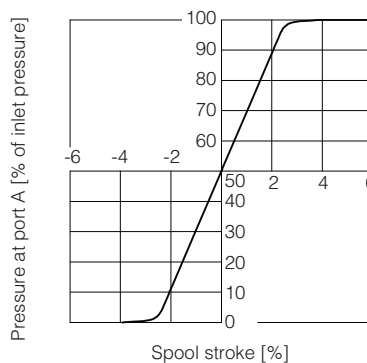
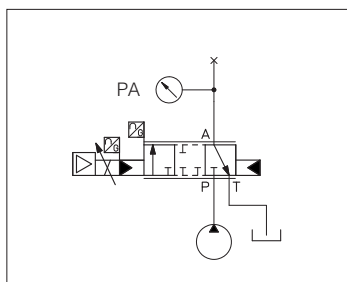


### 10.2 Response time

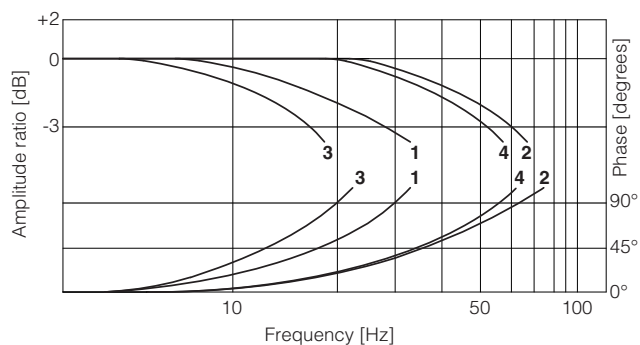
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



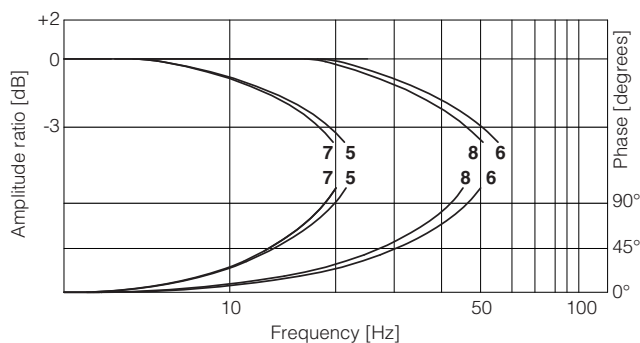
### 10.3 Pressure gain diagram



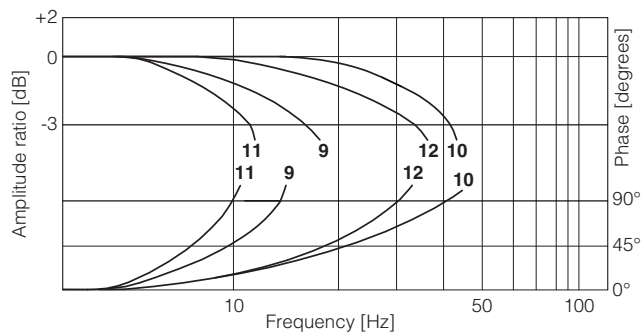
### 10.4 Bode diagrams



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



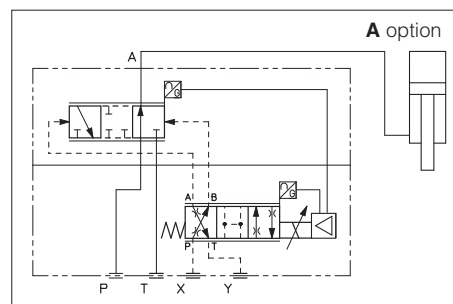
- 5 = LIQZO-L\*-403L4:  $\pm 90\%$
- 6 = LIQZO-L\*-403L4:  $\pm 5\%$
- 7 = LIQZP-L\*-503L4:  $\pm 90\%$
- 8 = LIQZP-L\*-503L4:  $\pm 5\%$



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

## 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

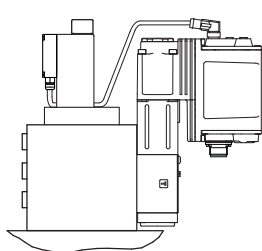
/AF, /AI, /AQ, /AZ, /FI, /IQ, /IZ, /AFI, /AIQ, /AIZ

### LES-SP, SL

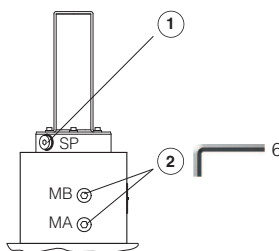
/AC, /CI, /ACI

## 14 AIR BLEEDING

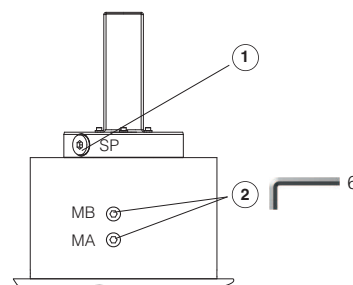
Size 25 to 40



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  $\mu$ F/40 V capacitance to single phase rectifiers or a 4700  $\mu$ F/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  $\mu$ F/40 V capacitance to single phase rectifiers or a 4700  $\mu$ F/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  $\div$  10 VDC for standard and 4  $\div$  20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of  $\pm 10$  VDC or  $\pm 20$  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  $\div$  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  $\div$  10 VDC for standard and 4  $\div$  20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of  $\pm 10$  VDC or  $\pm 20$  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  $\div$  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  $\pm 10$  VDC for standard and 4  $\div$  20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of  $\pm 10$  VDC or  $\pm 20$  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  $\div$  10 VDC for standard and 4  $\div$  20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of  $\pm 10$  VDC or  $\pm 20$  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  $\div$  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  $\pm 10$  VDC for standard and 4  $\div$  20 mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of  $\pm 10$  VDC or  $\pm 20$  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.

PIN	PID SET SELECTION			
	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: $V_{RMS} = 20 \div 32 V_{MAX}$ (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: $\pm 10 Vdc / \pm 20 mA$ maximum range Defaults are $0 \div 10 Vdc$ for standard and $4 \div 20 mA$ for /I option	Input - analog signal <b>Software selectable</b>
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND	V0		Flow monitor output signal: $\pm 10 Vdc / \pm 20 mA$ maximum range Defaults are $0 \div 10 Vdc$ for standard and $4 \div 20 mA$ for /I option	Output - analog signal <b>Software selectable</b>
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

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

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

### 16.3 Communications connectors (B) - (C)

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

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

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

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

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

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

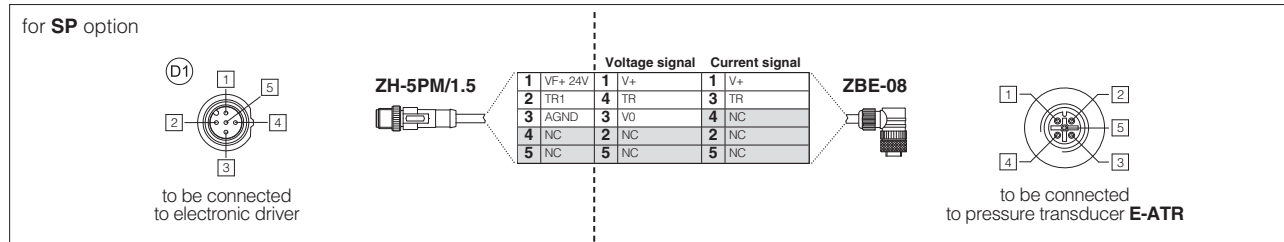


## 16.4 Remote pressure transducer connector - M12 - 5 pin - only for SP, SL D

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

(1) Single/double transducer configuration is software selectable

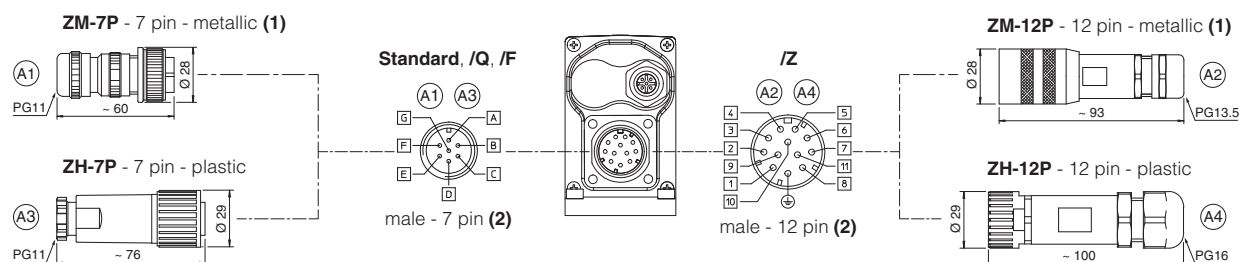
### Remote pressure transducers connection - example



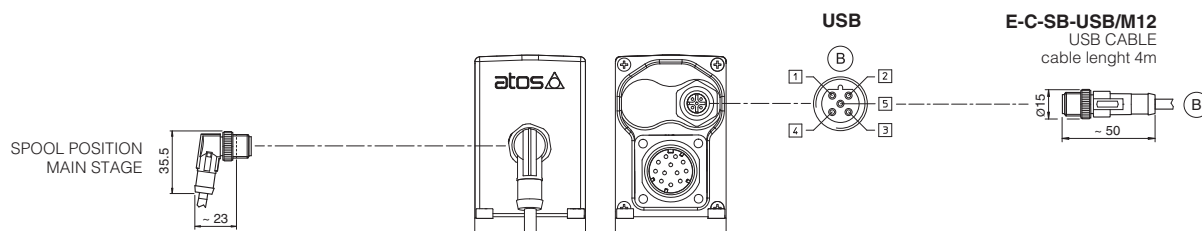
**Note:** pin layout always referred to driver's view

## 16.5 LEB connections layout

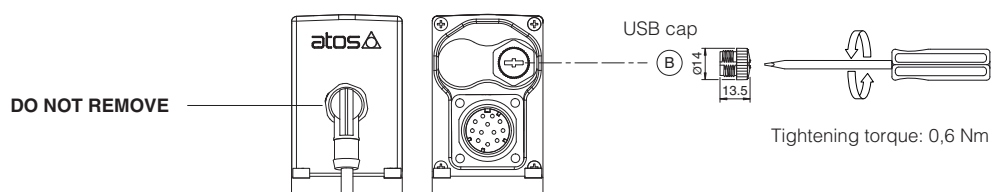
### MAIN CONNECTORS



### TRANSDUCER AND USB CONNECTOR



### PLASTIC PROTECTION CAP - supplied with the valves

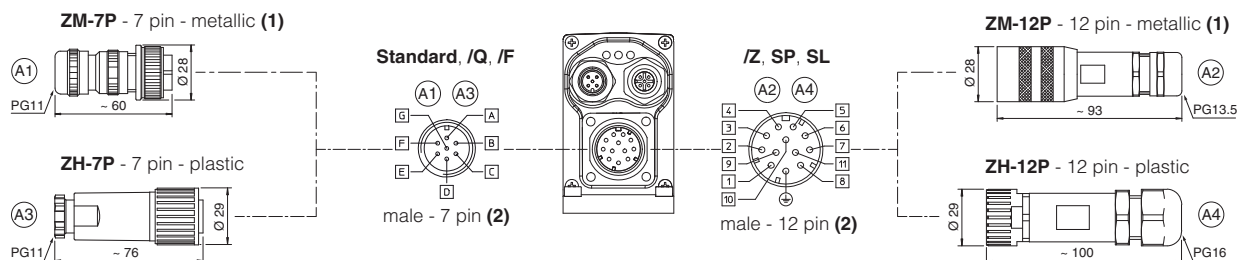


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

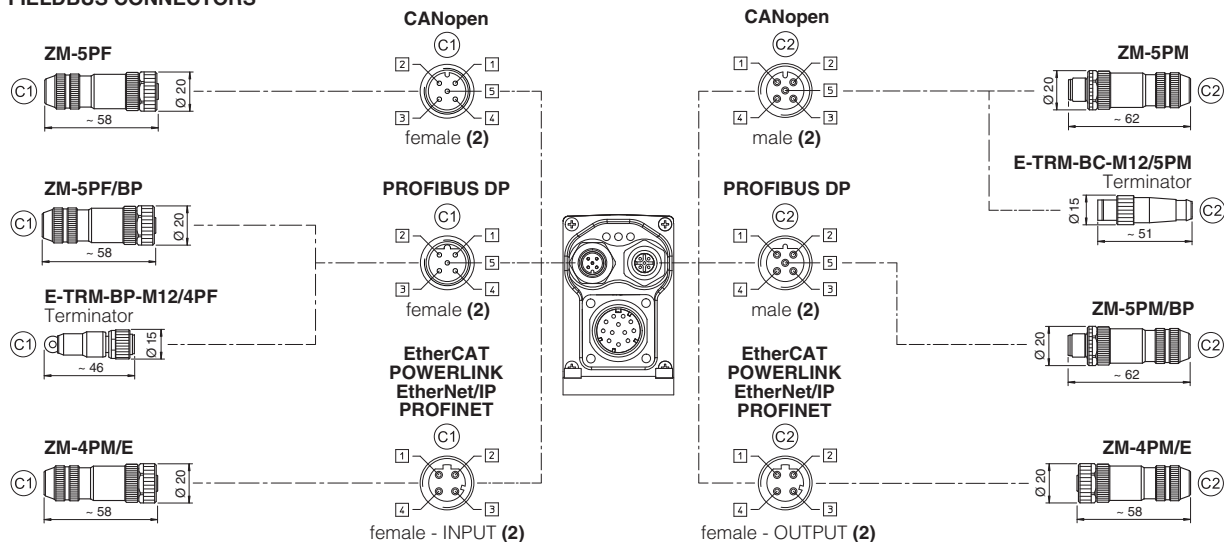
(2) Pin layout always referred to driver's view

## 16.6 LES connections layout

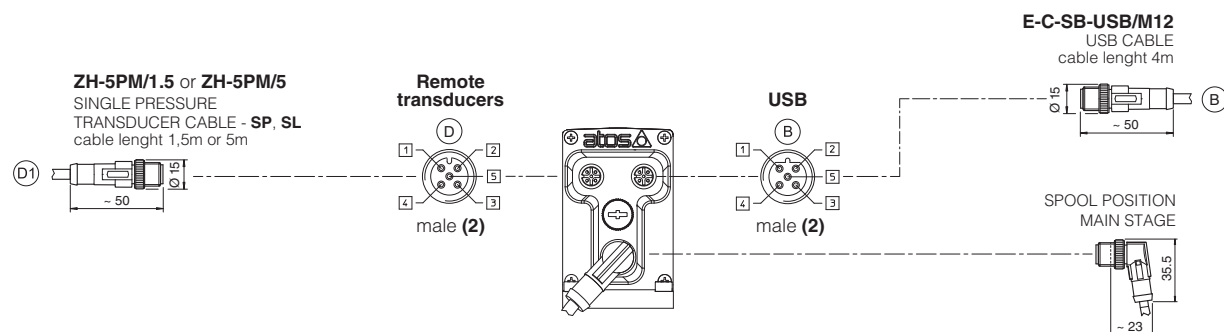
### MAIN CONNECTORS



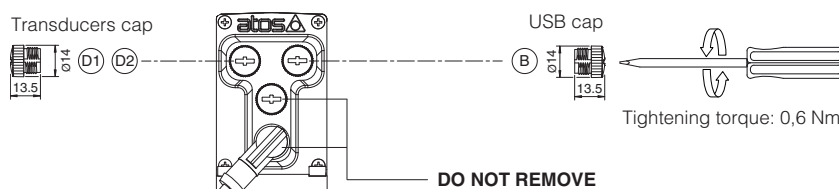
### FIELDBUS CONNECTORS



### 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 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

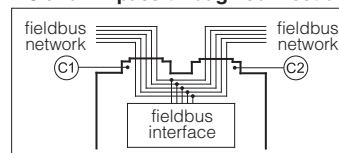
## 17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

### BC and BP pass-through connection



## 18 CONNECTORS CHARACTERISTICS - to be ordered separately

### 18.1 Main connectors - 7 pin

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

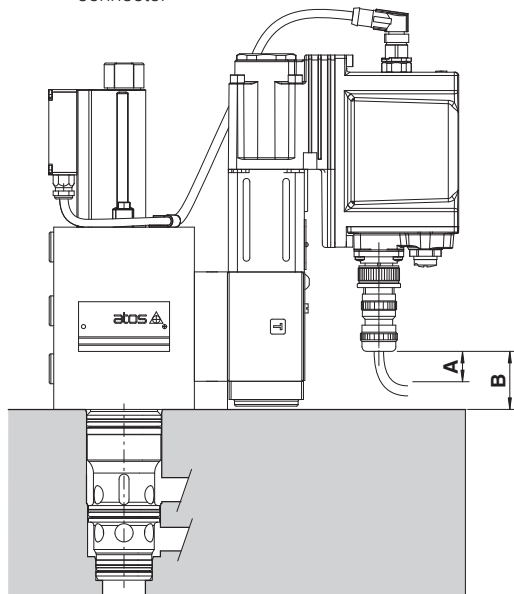
## 19 FASTENING BOLTS AND VALVE MASS

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

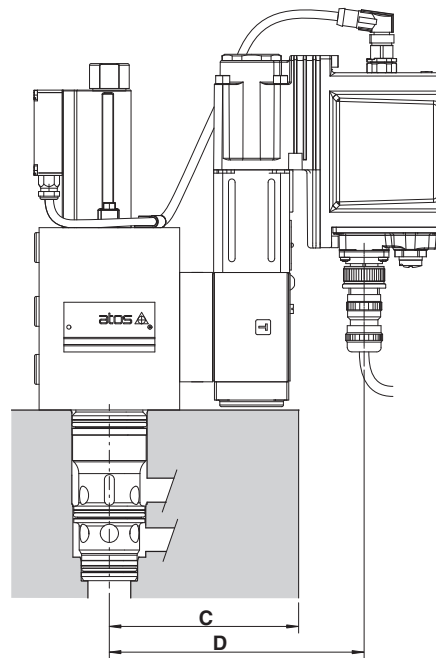
**Installation 1** - possible interference between manifold and main connector



**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

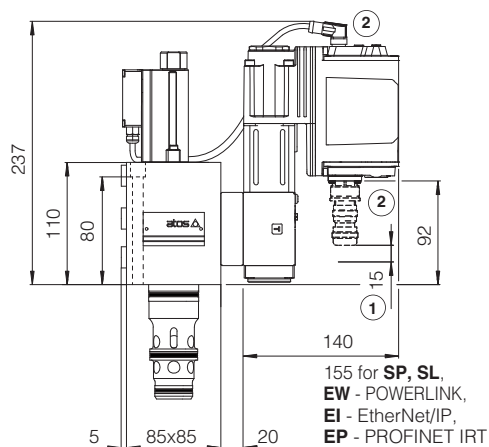
Reference dimension	Main connector code	Valve size					
		25	32	40	50	63	80
<b>B</b>	ZM-7P	32	32	32	45	68	68
	ZH-7P	(1)	(1)	(1)	29	52	52
	ZM-12P	(1)	(1)	(1)	(1)	35	35
	ZH-12P	(1)	(1)	(1)	(1)	(1)	(2)
<b>C (max) for standard valve</b>	-	134	141	154	161	192	222
<b>C (max) for /A option</b>	-	114	121	134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

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

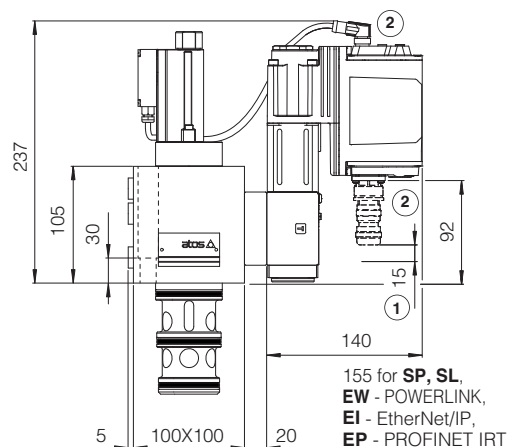
(1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as represented in above "Installation 2"

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

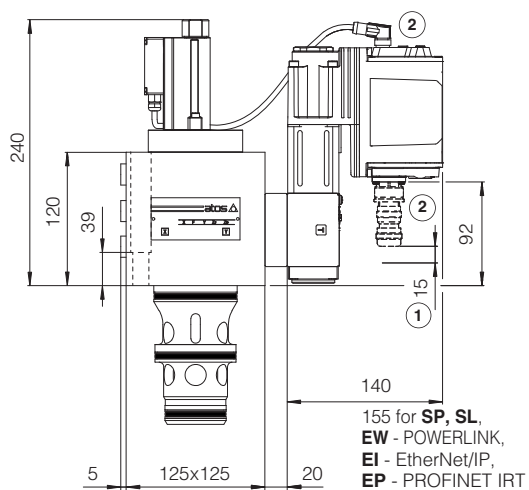
**LIQZO-LEB-253**  
**LIQZO-LES-253**



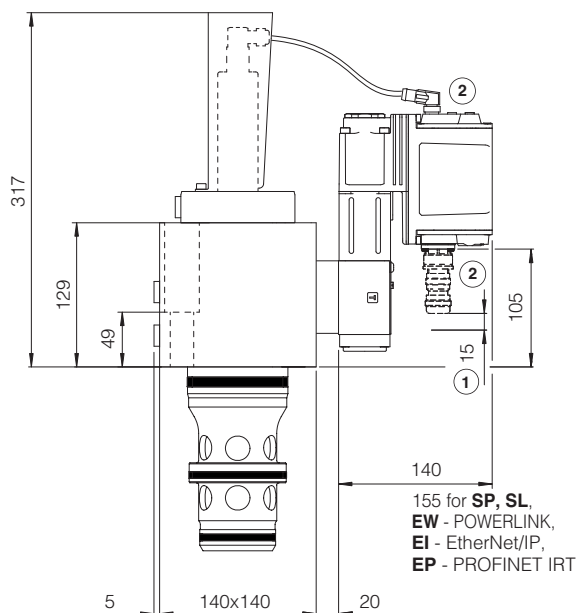
**LIQZO-LEB-323**  
**LIQZO-LES-323**



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



**LIQZP-LEB-503**  
**LIQZP-LES-503**



① = Space to remove the connectors

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

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

