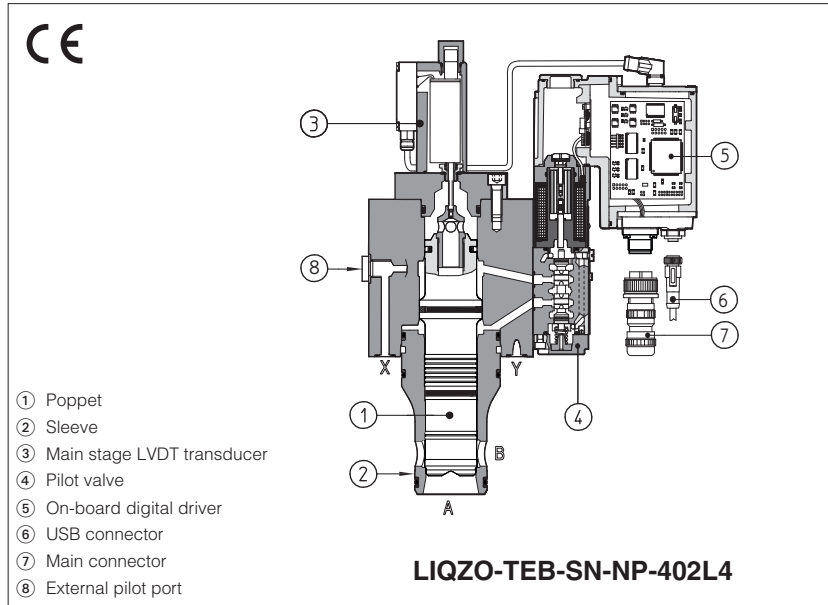


# Digital proportional 2-way cartridges high performance

piloted, with on-board driver, LVDT transducer

**Available only on request**



## LIQZO-TEB, LIQZP-TEB

Digital high performance 2-way proportional cartridges specifically designed for speed controls.

They are equipped with LVDT main stage position transducer for best dynamics in not compensated flow regulations.

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

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

**LIQZO:** Size: **16 ÷ 40** - ISO 7368

Max flow: **600 ÷ 2500 l/min**


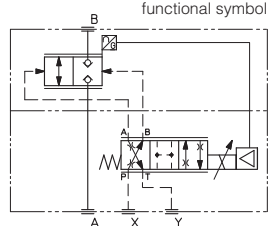
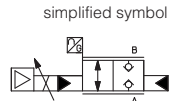
Max pressure: **350 bar**

**LIQZP:** Size: **50 ÷ 100** - ISO 7368

Max flow: **4000 ÷ 16000 l/min**

Max pressure: **420 bar**

### 1 MODEL CODE

*	- LIQZO -	- TEB -	- SN -	- NP -	- 40	2	L4 /	*	/	*
Special code omit for size 16 to 50 <b>10*119</b> for size 63 <b>13*114</b> for size 80 <b>19*110</b> for size 100										Series number
Proportional 2-way cartridge, piloted <b>LIQZO</b> = size 16 to 40, Pmax 350 bar <b>LIQZP</b> = size 50 to 100, Pmax 420 bar										<b>Seals material,</b> see section 7: - = NBR <b>PE</b> = FKM <b>BT</b> = HNBR
<b>TEB</b> = basic on-board digital driver										<b>Electronics options (1):</b> <b>F</b> = fault signal <b>I</b> = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 Vdc) <b>Q</b> = enable signal <b>Z</b> = enable, fault and monitor signals - 12 pin connector
<b>Alternated P/Q controls:</b> <b>SN</b> = none										<b>Poppet type, regulating characteristics:</b> <b>L4</b> = linear 
<b>Fieldbus interfaces,</b> USB port always present: <b>NP</b> = Not present										<b>Configuration:</b> <b>2</b> = 2 way  

Valve size ISO 7368, see section 6:

<b>LIQZO =</b>	<b>16</b>	<b>25</b>	<b>32</b>	<b>40</b>
l/min	250	500	800	1200

<b>LIQZP =</b>	<b>50</b>	<b>63</b>	<b>80</b>	<b>100</b>
l/min	2000	3000	4500	7200

Nominal flow (l/min) at Δp 5 bar

(1) Possible combined options: /FI, /IQ, /IZ

## 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 **11**.


### 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.

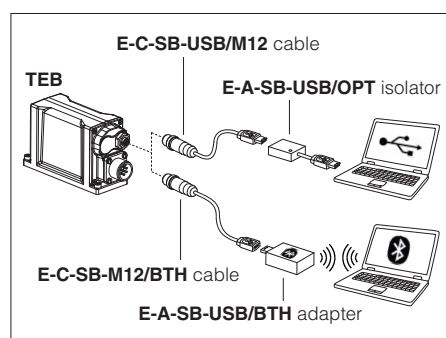
## 3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW-BASIC programming software connected via USB port to the digital driver, see tech. table **GS500**.

 **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 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 2015/863/EU REACH Regulation (EC) n°1907/2006

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

Size	16	25	32	40	50	63	80	100
Nominal flow $\Delta p$ A-B [l/min]								
$\Delta p = 5$ bar	250	500	800	1200	2000	3000	4500	7200
$\Delta p = 10$ bar	350	700	1100	1700	2800	4250	6350	10200
Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	<b>LIQZO</b>		Ports A, B = <b>350</b> X = 350 Y $\leq$ 10					
	<b>LIQZP</b>		Ports A, B = <b>420</b> X = 350 Y $\leq$ 10					
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	43	43	43	50	50	50	50	50
Leakage of pilot valve at P = 100 bar [l/min]	0,5	0,5	0,5	0,6	0,6	0,6	0,6	0,6
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160							
Piloting volume [cm <sup>3</sup> ]	1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow <b>(1)</b> [l/min]	4	4,5	12	16	21	26	27	30
Response time 0 ÷ 100% step signal <b>(2)</b> [ms]	25	30	35	35	50	75	90	100
Hysteresis [% of the max regulation]	$\leq 1$							
Repeatability [% of the max regulation]	$\pm 0,5$							
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$							

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

**(2)** With pilot pressure = 140 bar, see detailed diagrams in section 9.2

**6 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 $\Omega$
Analog input signals	Voltage: range $\pm 10$ VDC (24 VMAX tollerant) Input impedance: Ri > 50 k $\Omega$ Current: range $\pm 20$ mA Input impedance: Ri = 500 $\Omega$
Monitor outputs	Output range: voltage $\pm 10$ VDC @ max 5 mA current $\pm 20$ mA @ max 500 $\Omega$ load resistance
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 k $\Omega$
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 occurring 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	Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables, see section <b>13</b>

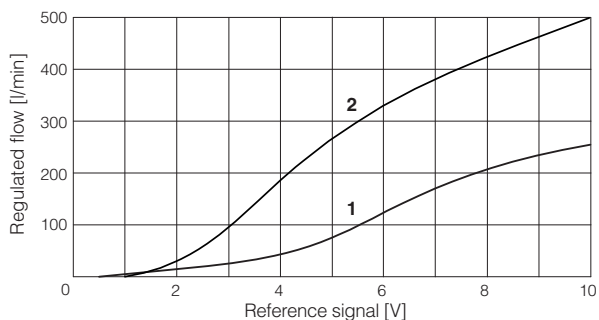
**Note:** a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

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

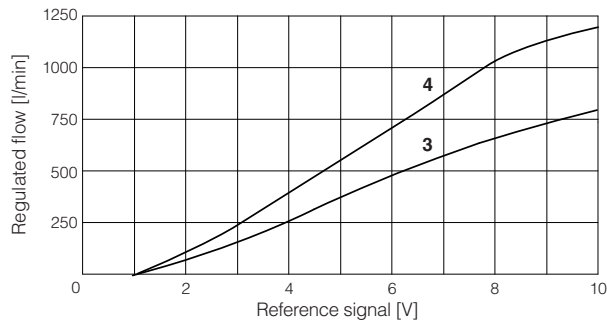
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm <sup>2</sup> /s - max allowed range 15 ÷ 380 mm <sup>2</sup> /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at <a href="http://www.atos.com">www.atos.com</a> 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	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

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

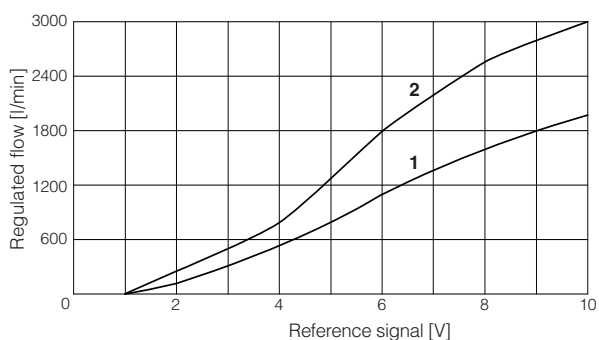
**8.1 Regulation diagrams** (values measured at  $\Delta p$  5 bar)



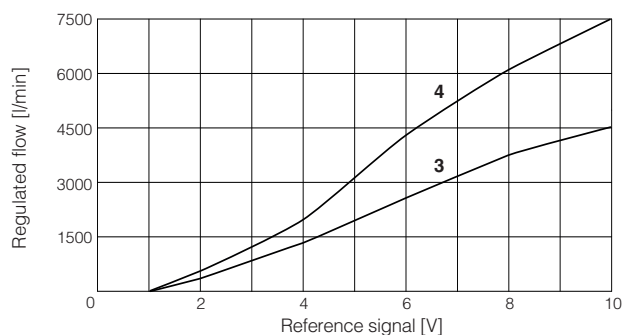
**1** = LIQZO-L\*-162L4  
**2** = LIQZO-L\*-252L4



**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 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 11.6 for signal specifications.

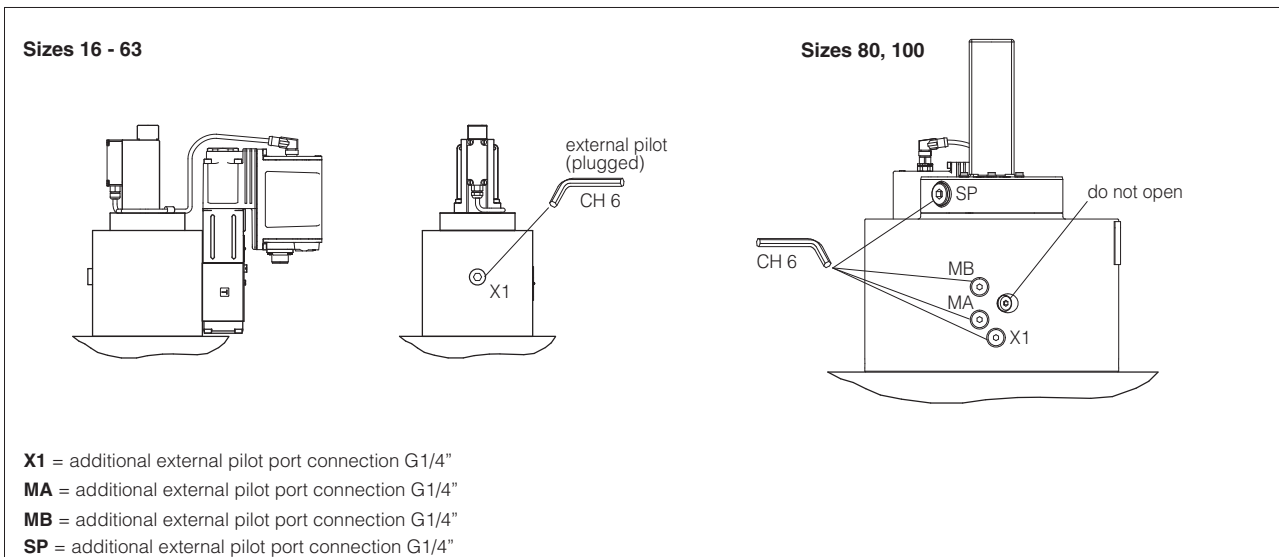
**I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of  $\pm 10$  VDC or  $\pm 20$  mA. It is normally used in case of long distance 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 11.4 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** - (see 11.5)

## 10 ADDITIONAL EXTERNAL PILOT PORT CONNECTION



## 11 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).

### 11.1 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 13.2.

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

### 11.2 Flow reference input signal (Q\_INPUT+)

The driver controls in closed loop the poppet 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.

### 11.3 Flow monitor output signal (Q\_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual poppet position of the cartridge; 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  $\div$  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.

### 11.4 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.

### 11.5 Repeat enable output signal (R\_ENABLE) - only for /Z option

Repeat enable is used as output repeater signal of enable input signal (see 11.4).

### 11.6 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.

## 12 ELECTRONIC CONNECTIONS

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

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

### 12.2 Main connector signals - 12 pin (A2) /Z option

PIN	TEB-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
1	<b>V+</b>	Power supply 24 Vdc	Input - power supply
2	<b>V0</b>	Power supply 0 Vdc	Gnd - power supply
3	<b>ENABLE</b> referred to: V0	Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	<b>Q_INPUT+</b>	Flow reference input signal: $\pm 10$ Vdc / $\pm 20$ mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal <b>Software selectable</b>
5	<b>INPUT-</b>	Negative reference input signal for Q_INPUT+	Input - analog signal
6	<b>Q_MONITOR</b> referred to: AGND	Flow monitor output signal: $\pm 10$ Vdc / $\pm 20$ mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal <b>Software selectable</b>
7	<b>AGND</b>	Analog ground	Output - analog signal
8	<b>R_ENABLE</b>	Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
9	<b>NC</b>	Do not connect	Input - power supply
10	<b>NC</b>	Do not connect	
11	<b>FAULT</b> referred to: V0	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	<b>EARTH</b>	Internally connected to the driver housing	

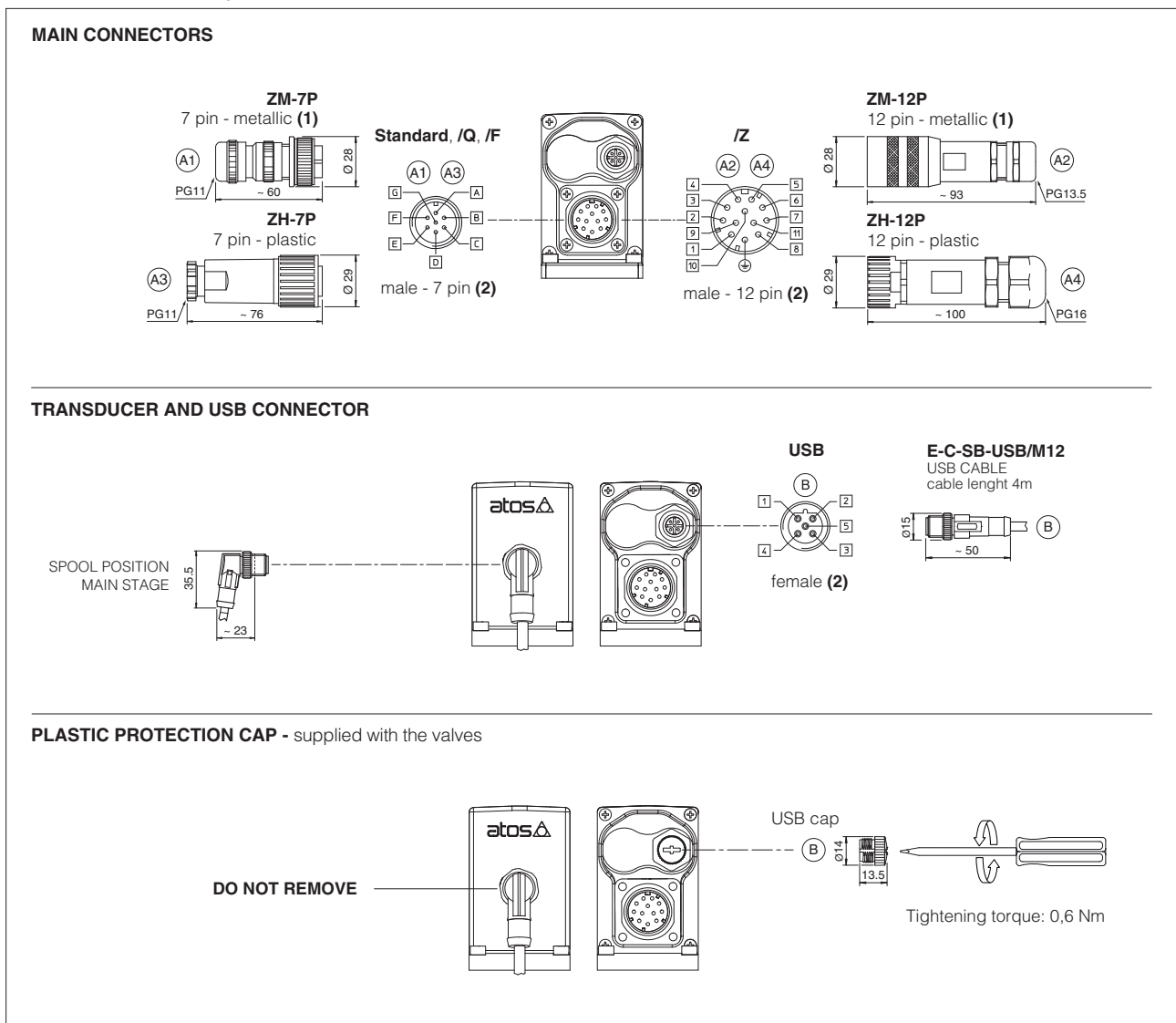
**Note:** do not disconnect VL0 before VL+ when the driver is connected to PC USB port

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

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

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

## 12.4 TEB connections layout



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

### 13 CONNECTORS CHARACTERISTICS - to be ordered separately

#### 13.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
<b>CODE</b>	(A1) <b>ZM-7P</b>	(A3) <b>ZH-7P</b>
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

#### 13.2 Main connectors - 12 pin

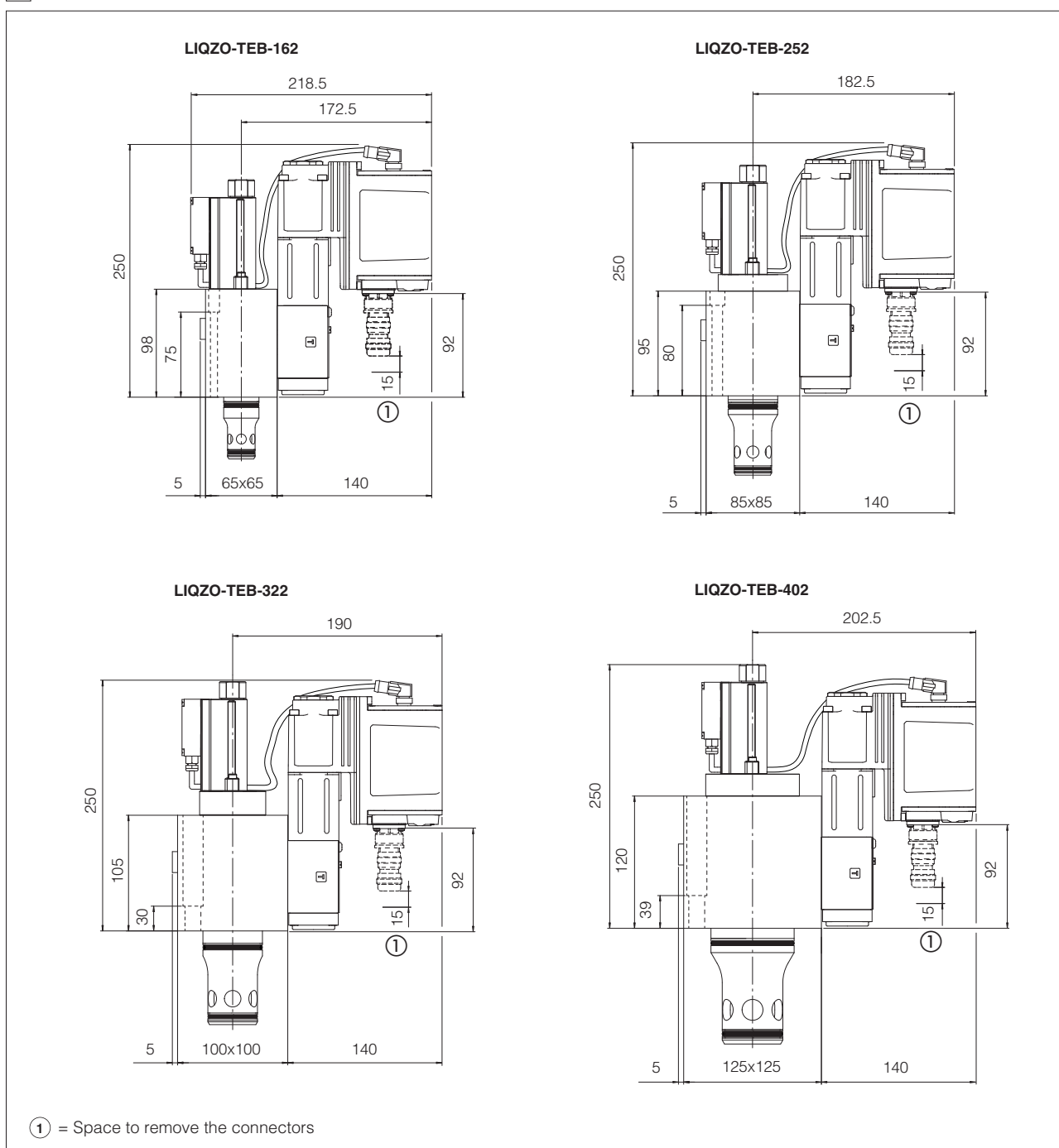
CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
<b>CODE</b>	(A2) <b>ZM-12P</b>	(A4) <b>ZH-12P</b>
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm <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

**14 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	6,2
	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
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	125

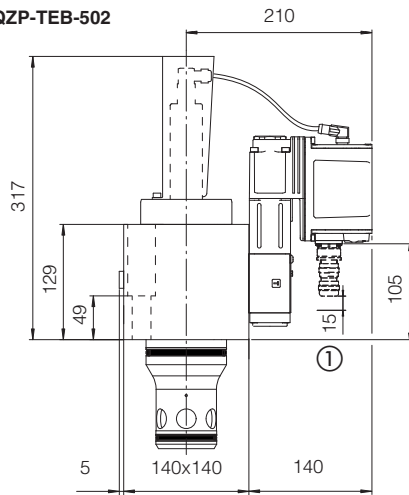
(1) Fastening bolts supplied with the valve

**15 INSTALLATION DIMENSIONS [mm]**

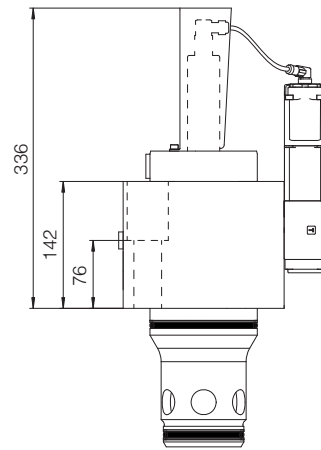




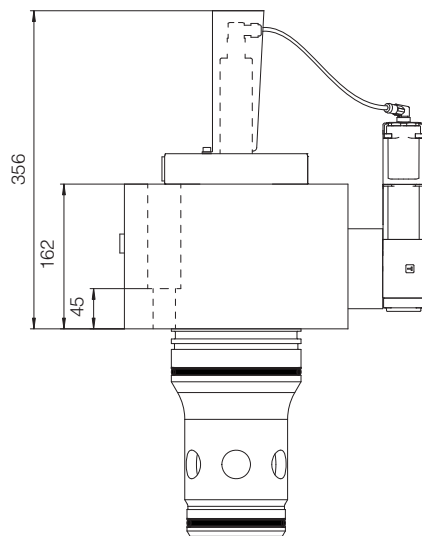
**LIQZP-TEB-502**



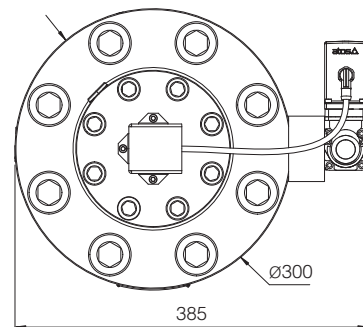
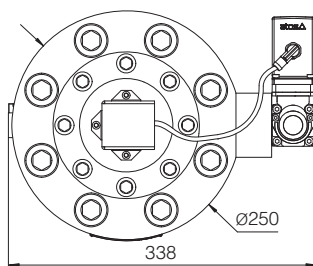
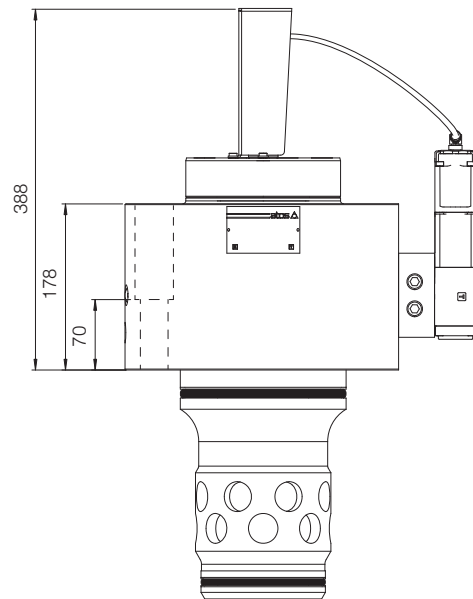
**10\*119 LIQZP-TEB-632**



**131\*114 LIQZP-TEB-802**



**19\*110 LIQZP-TEB-1002**



① Space to remove the 7 or 12 pin main connector. For main connector see section 13

**16 RELATED DOCUMENTATION**

**FS001** Basics for digital electrohydraulics  
**FS900** Operating and maintenance information for proportional valves  
**GS500** Programming tools

**K800** Electric and electronic connectors  
**P006** Mounting surfaces and cavities for cartridge valves