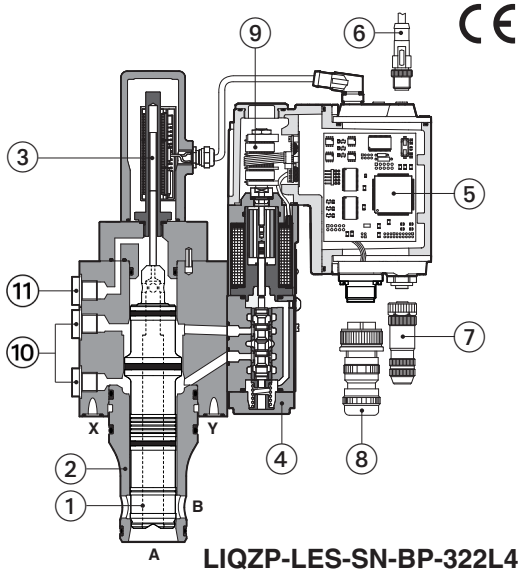
Digital proportional 2-way cartridges high performance

piloted, with on-board driver and two LVDT transducers

SMART TUNING



LIQZP-LES-SN-BP-322L4

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

LIQZP-LEB, 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 or IO-Link interface for valve settings, reference signals and real-time diagnostics.

LES full execution which includes also optional fieldbus interfaces for valve settings, reference signals and real-time diagnostics.

For both **LEB** and **LES**, USB port is always present for valve settings via Atos PC software.

Size: **16** ÷ **125** - ISO 7368
Max flow: **600** ÷ **22000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZP	-	LES	-	SN	-	NP	-	25	2	L4	/	*	*	/	*

LIQZP: Proportional 2-way cartridge, piloted

LES: **LEB** = basic on-board digital driver; **LES** = full on-board digital driver

SN: **Alternated P/Q controls**: **SN** = none

NP: **IO-Link interface**, only for LEB, see section 5: **NP** = Not present; **IL** = IO-Link

Fieldbus interfaces, only for LES, see section 6: **NP** = Not present; **BC** = CANopen; **BP** = PROFIBUS DP; **EH** = EtherCAT; **EW** = POWERLINK; **EI** = EtherNet/IP; **EP** = PROFINET RT/IRT

25: **Valve size** ISO 7368, see section 8:

Size	16	25	32	40	
l/min	250	500	800	1200	
Size	**50**	**63**	**80**	**100**	**125**
l/min	2000	3000	4500	7200	9350

Nominal flow (l/min) at Δp 5 bar

2: **Configuration**: **2** = 2 way

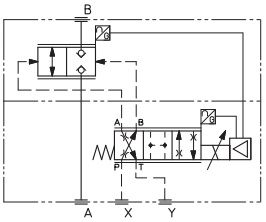
L4: **Poppet type,** regulating characteristics: **L4** = linear

First *: **Electronics options (1)**, not available for LEB-SN-IL: **F** = fault signal; **I** = current reference input and monitor 4 ÷ 20 mA; **Q** = enable signal; **Z** = double power supply (only for LES), enable, fault and monitor signals - 12 pin connector

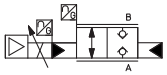
Second *: Series number

Third *: **Seals material**, see section 10: **-** = NBR; **PE** = FKM; **BT** = NBR low temperature

functional symbol



simplified symbol



(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 15 .

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/Bluetooth to the digital driver.
For fieldbus/IO-Link versions, the software permits valve's parameterization through USB/Bluetooth also if the driver is connected to the central machine unit via fieldbus/IO-Link.

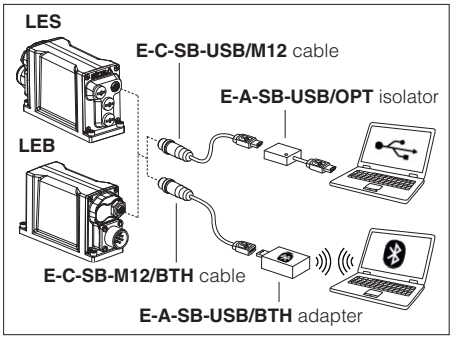
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	IL (IO-Link)	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

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

USB or Bluetooth connection



4 SMART TUNING

Smart tuning allows to adjust the cartridge dynamic response in order to match different performance requirements.

The cartridge is provided with 3 factory settings for the spool control:

- **dynamic** fast response time and high sensitivity for best dynamic performances. Default factory setting for cartridges
- **balanced** average response time and sensitivity suitable for major applications
- **smooth** attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 23.

For Response time and Bode diagrams see section 11.

5 IO-LINK - only for **LEB**, see tech. table **GS520**

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

6 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.

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, for futher details 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
Vibration resistance	See technical table G004
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

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

Size	**16**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**
Nominal flow Δp A-B [l/min]									
Δp = 5 bar	250	500	800	1200	2000	3000	4500	7200	9350
Δp = 10 bar	350	700	1100	1700	2800	4250	6350	10200	13200
Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000	22000
Max pressure [bar]	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	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,3	0,7	0,7	1	1	1	1
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160								
Piloting volume [cm³]	1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5	124,9
Piloting flow **(1)** [l/min]	4	5,3	14	19	35,5	56	60	60	88,1
Response time 0 ÷ 100% step signal **(2)** [ms]	24	25	28	30	30	35	40	50	90
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 11.2

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 (only for LES); poppet position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply				
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19				

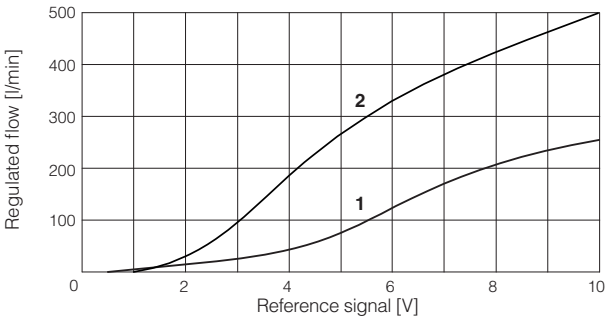
Note: a maximum time of 800 ms (1000 ms just for size 125), depending on communication type, has to be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

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

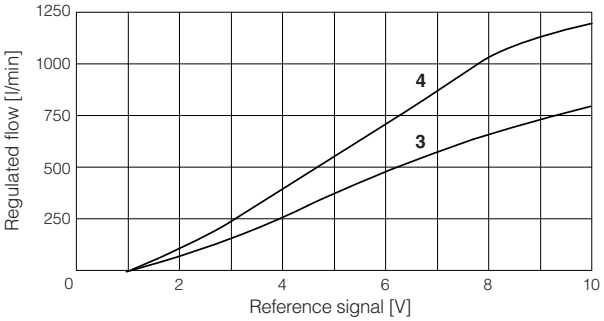
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C NBR low temp. seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C		
Recommended viscosity		20÷100 mm²/s - max allowed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

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

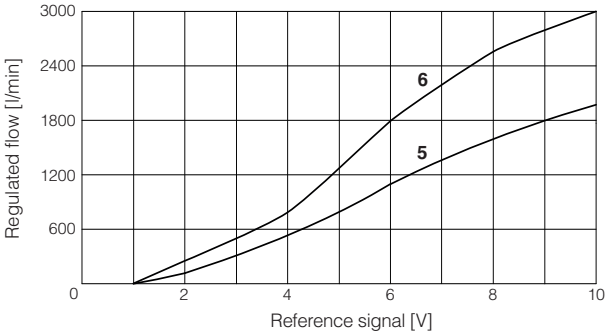
11.1 Regulation diagrams (values measured at Δp 5 bar)



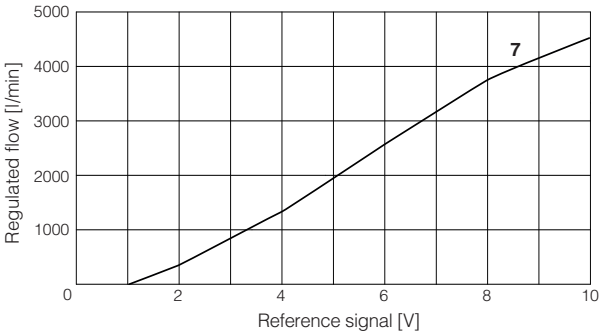
1 = LIQZP-L*-162L4
2 = LIQZP-L*-252L4



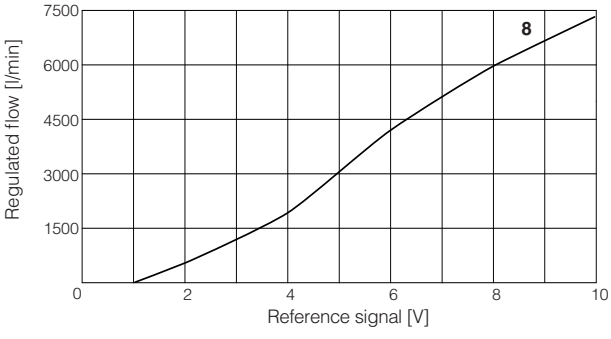
3 = LIQZP-L*-322L4
4 = LIQZP-L*-402L4



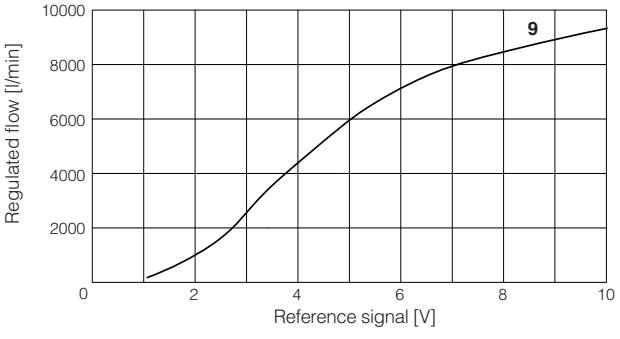
5 = LIQZP-L*-502L4
6 = LIQZP-L*-632L4



7 = LIQZP-L*-802L4



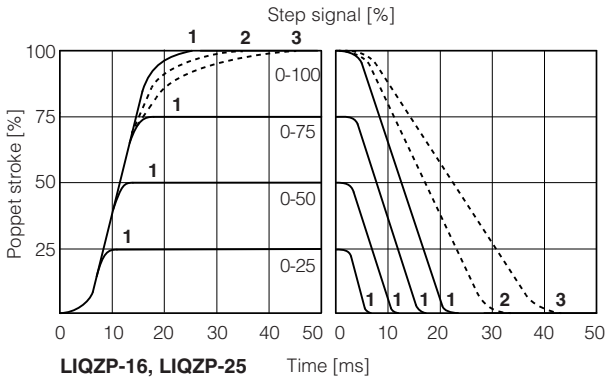
8 = LIQZP-L*-1002L4



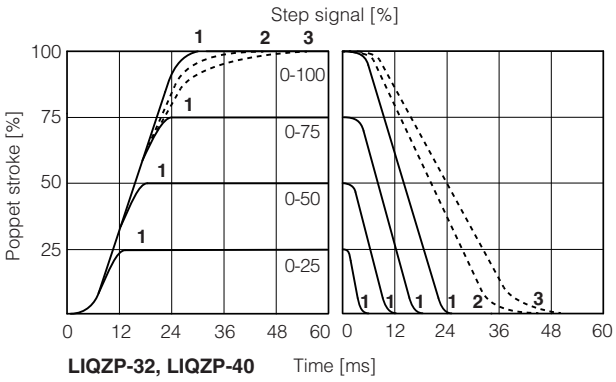
9 = LIQZP-L*-1252L4

11.2 Response time

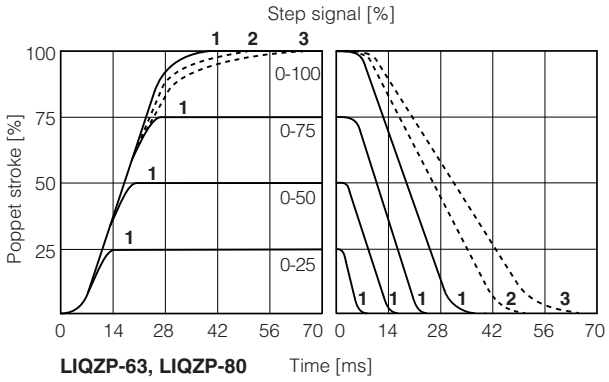
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.



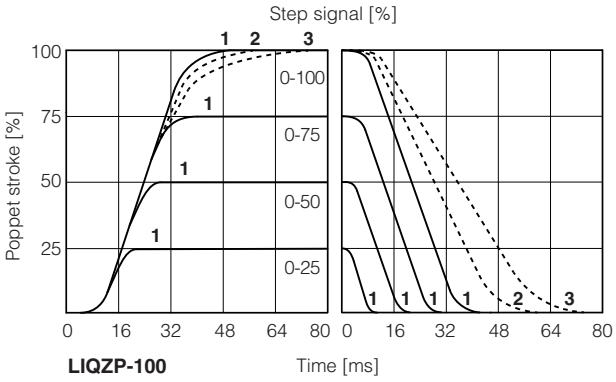
LIQZP-16, LIQZP-25



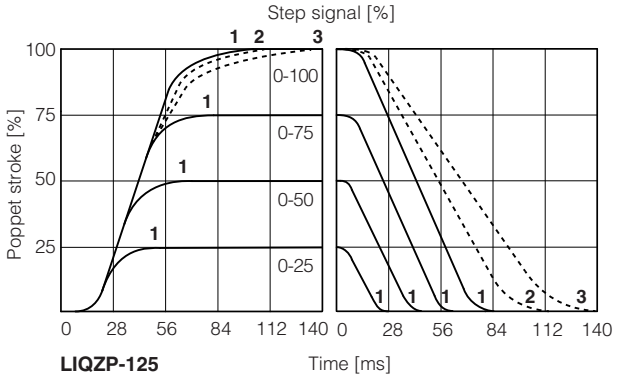
LIQZP-32, LIQZP-40
LIQZP-50



LIQZP-63, LIQZP-80



LIQZP-100



LIQZP-125

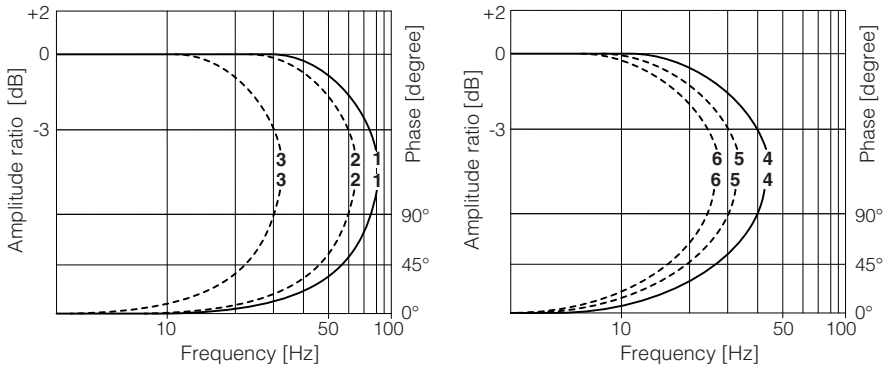
1 = dynamic **2** = balanced (*) **3** = smooth (*)

(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal

11.3 Bode diagrams LIQZP-L*-162L4
Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

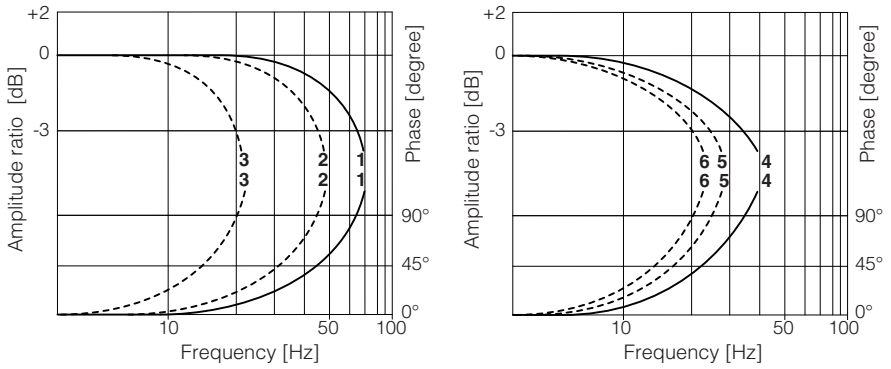
10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth



11.4 Bode diagrams LIQZP-L*-252L4
Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

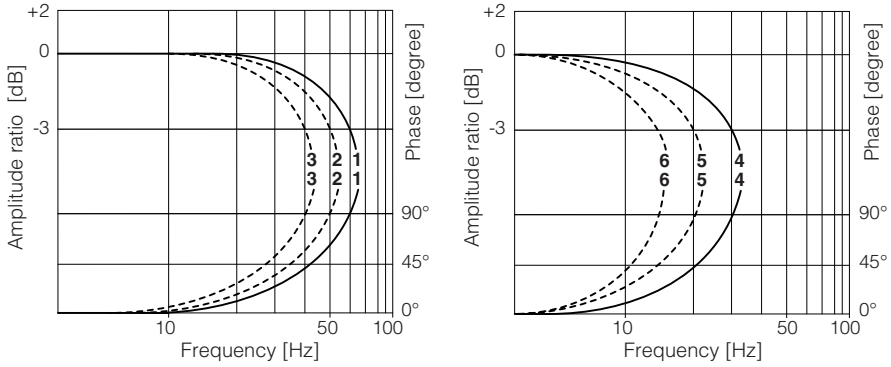
10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth



11.5 Bode diagrams LIQZP-L*-322L4
Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

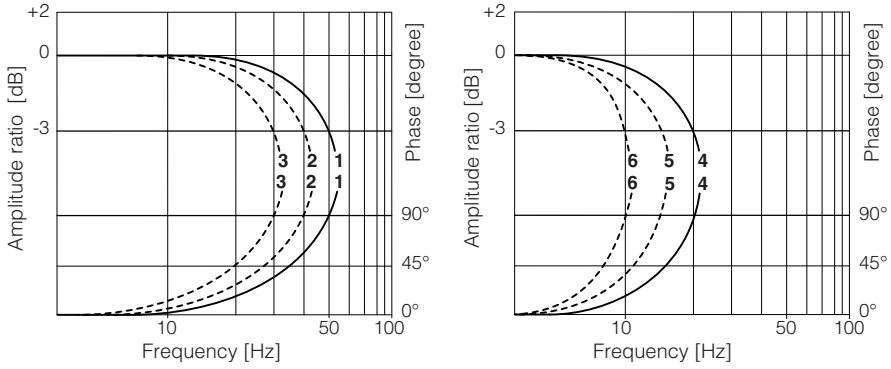
10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth



11.6 Bode diagrams LIQZP-L*-402L4
Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

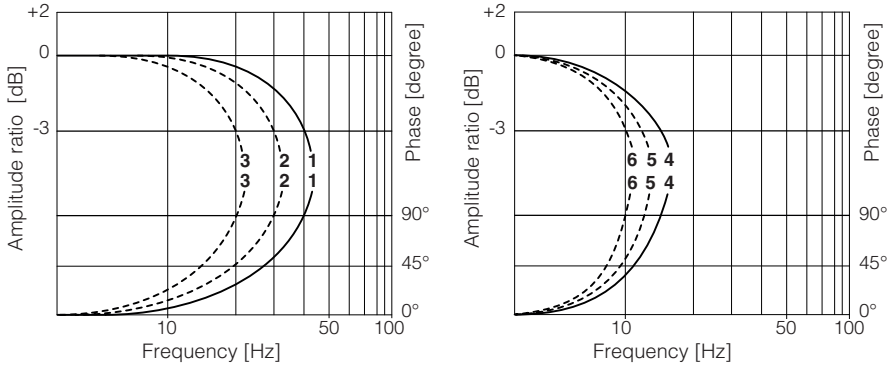
10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth



11.7 Bode diagrams LIQZP-L*-502L4
Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth

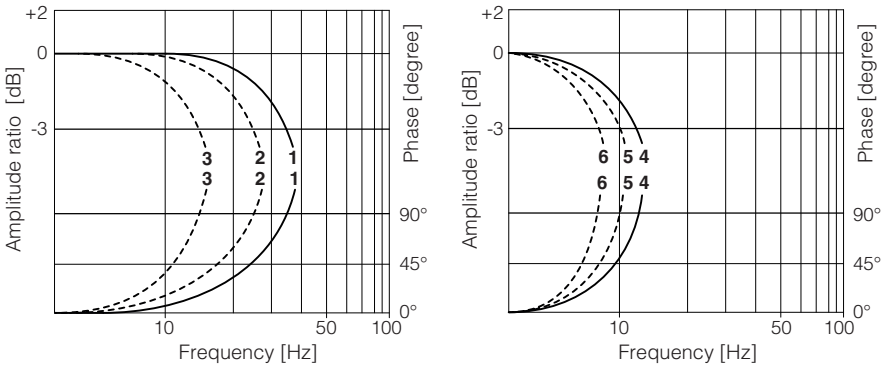


11.8 Bode diagrams LIQZP-L*-632L4

Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth

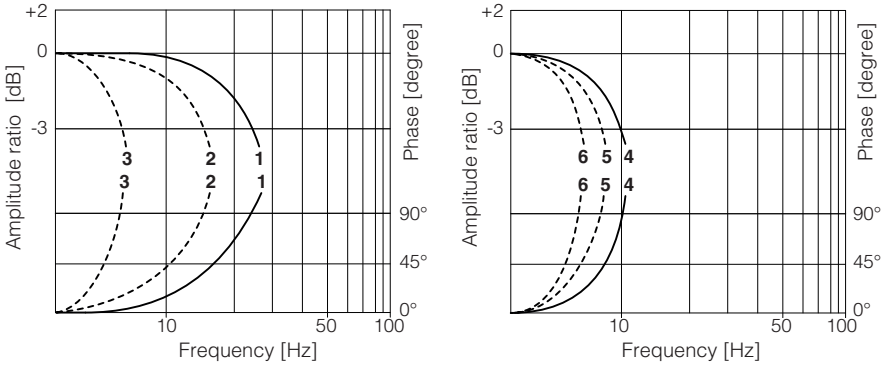


11.9 Bode diagrams LIQZP-L*-802L4

Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth

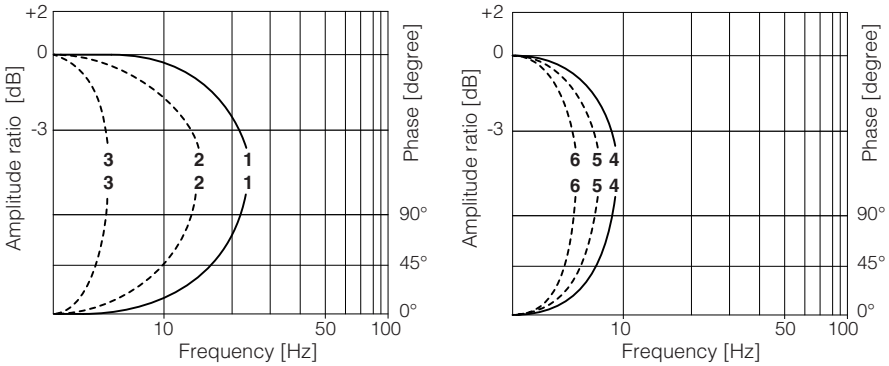


11.10 Bode diagrams LIQZP-L*-1002L4

Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth

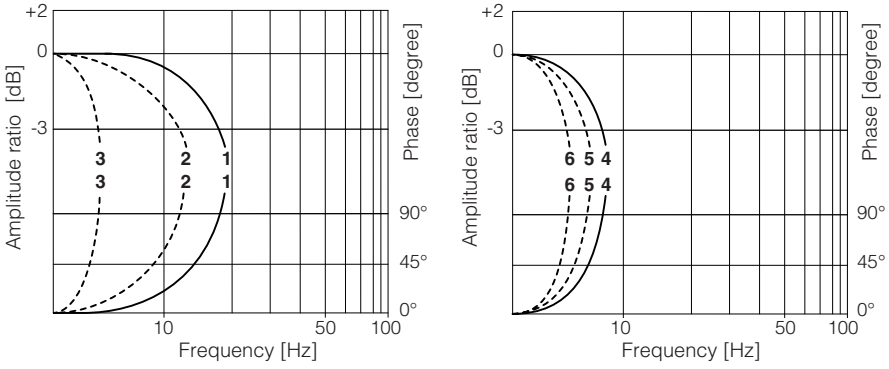


11.11 Bode diagrams LIQZP-L*-1252L4

Stated at nominal hydraulic conditions

50% ± 5% nominal stroke:
1 = dynamic
2 = balanced
3 = smooth

10% ↔ 90% nominal stroke:
4 = dynamic
5 = balanced
6 = smooth



12 ELECTRONICS OPTIONS - not available for **LEB-SN-IL**

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, poppet position transducer broken, etc. - see 15.7 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 poppet 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.

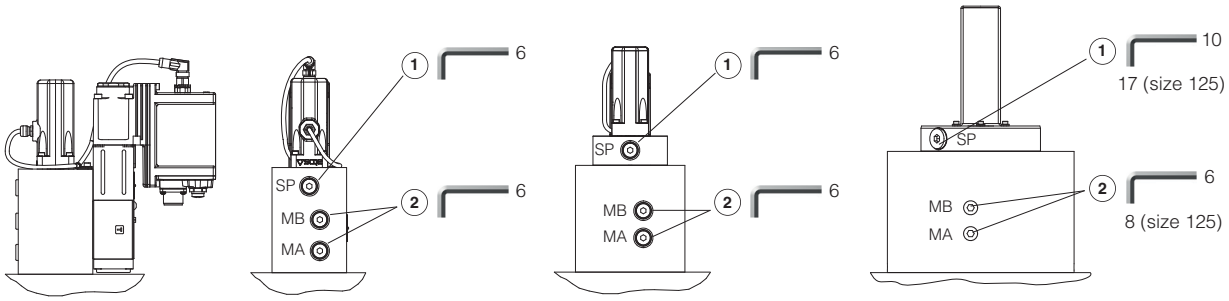
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **LEB-SN-IL** (see 15.6)
Power supply for driver's logics and communication - only for **LES** (see 15.2)

13 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

14 AIR BLEEDING

Size 16 ÷ 25 | **Size 32 ÷ 50** | **Sizes 63 ÷ 125**



(1) Air suction port:

N° 1 plug G1/4" for sizes 16 to 50
N° 1 plug G1/2" for sizes 63 to 100
N° 1 plug G1" for size 125

To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

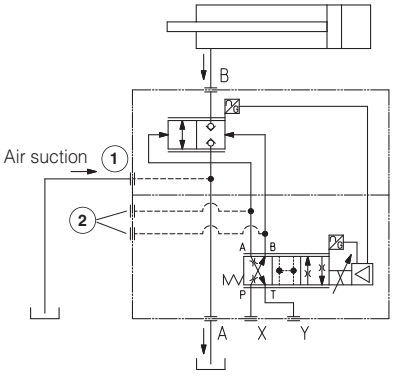
(2) Air bleeding:

N° 2 plugs G1/4" for size 16 to 100

N° 2 plugs G3/8" for sizes 125

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).

For **LEB-SN-IL** signals see section 16

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

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 **LEB-SN-NP** 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 IO-LINK SIGNALS SPECIFICATIONS - only for **LEB-SN-IL**

16.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication.
Maximum power consumption: 2 W
Internal electrical isolation of power L+, L- from P24, N24

16.2 Power supplyfor drive logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.
Maximum power consumption: 50 W
Internal electrical isolation of power P24, N24 from L+, L-

16.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

17 ELECTRONIC CONNECTIONS AND LEDS

17.1 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	

17.2 Main connector signal - 12 pin - /Z option (A2)

PIN	LEB /Z	LES /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

17.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for LEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	**L+**	Power supply 24 VDC for IO-Link communication	Input - power supply
2	**P24**	Power supply 24 VDC for valve regulation, logics and diagnostics	Input - power supply
3	**L-**	Power supply 0 VDC for IO-Link communication	Gnd - power supply
4	**C/Q**	IO-Link data line	Input / Output - signal
5	**N24**	Power supply 0 VDC for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

17.4 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**	

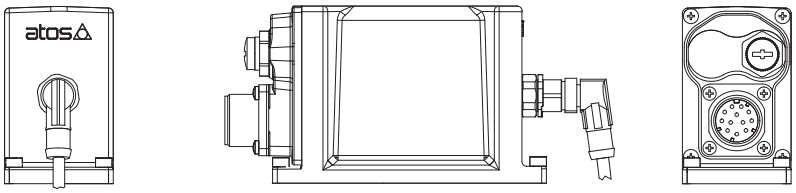
(C1) (C2) **EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
	SHIELD	

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

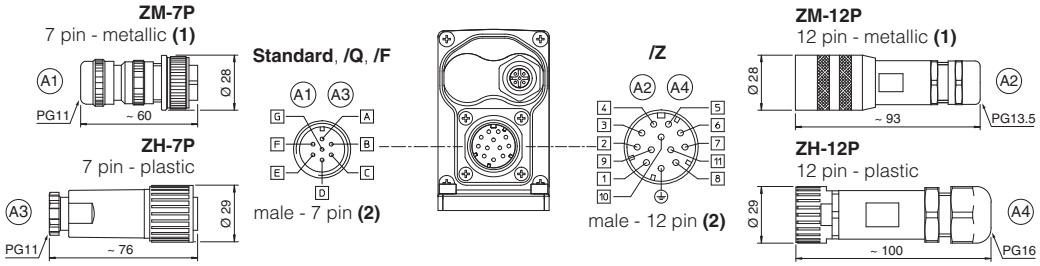
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.5 LEB-SN-NP connections layout

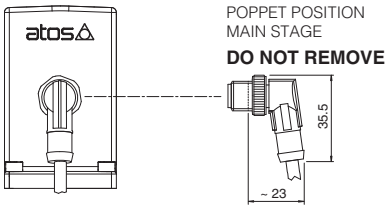
DRIVER OVERVIEW



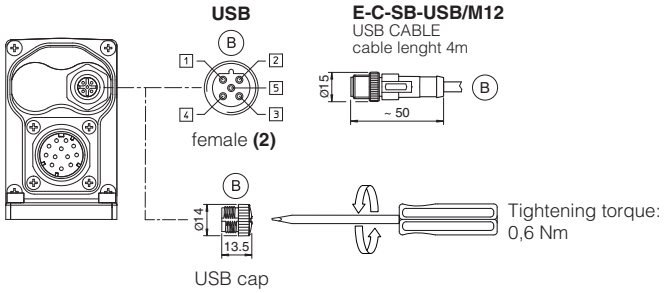
MAIN CONNECTORS



TRANSDUCER CONNECTOR



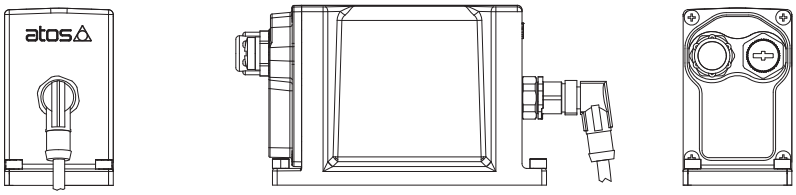
USB CONNECTOR



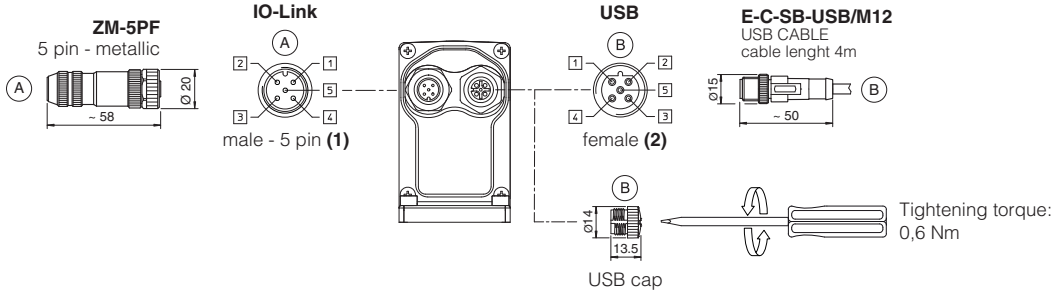
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

17.6 LEB-SN-IL connections layout

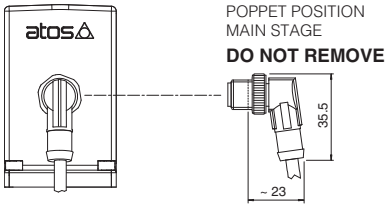
DRIVER OVERVIEW



IO-Link AND USB CONNECTORS



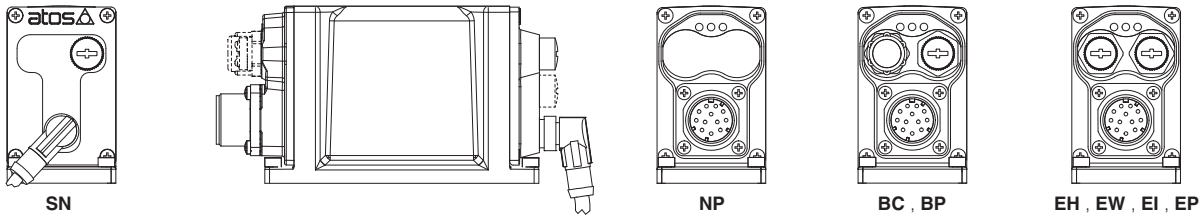
TRANSDUCER CONNECTOR



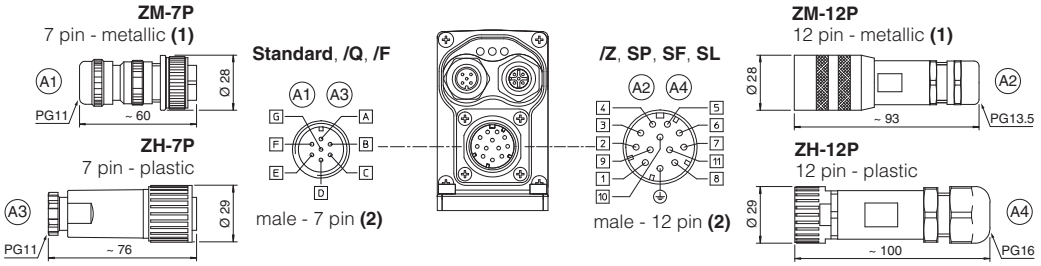
(1) Pin layout always referred to driver's view

17.7 LES connections layout

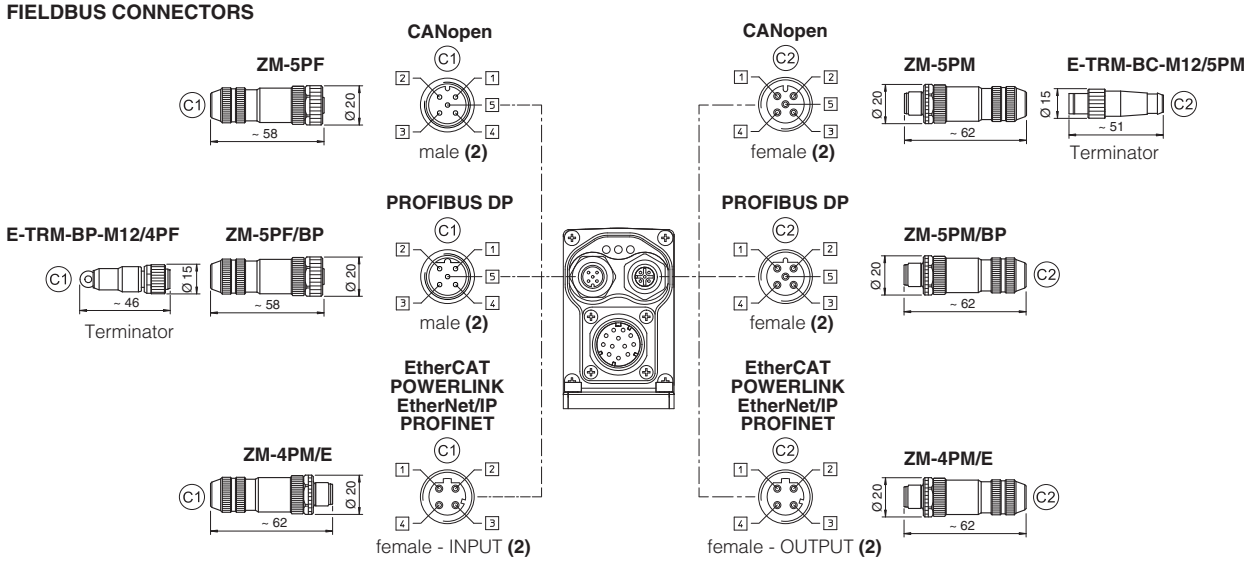
DRIVER OVERVIEW



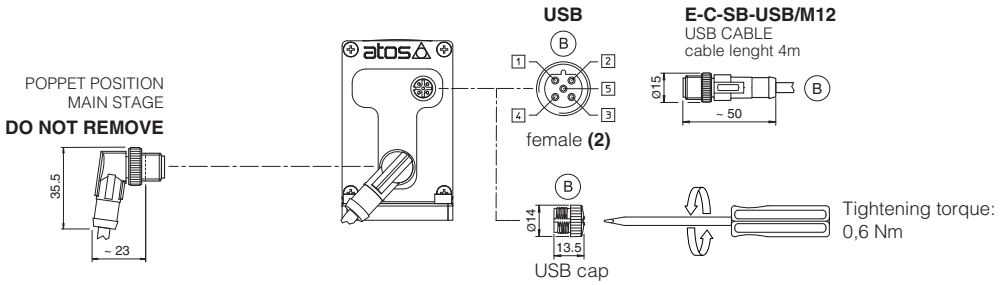
MAIN CONNECTORS



FIELDBUS CONNECTORS



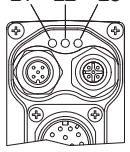
TRANSDUCERS AND USB CONNECTORS



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

17.8 Diagnostic LEDs - only for **LES**

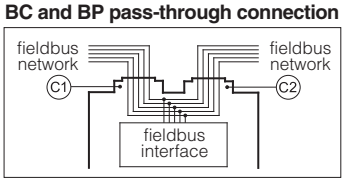
Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

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

18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

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

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	(A1) **ZM-7P**	(A3) **ZH-7P**
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	(A2) **ZM-12P**	(A4) **ZH-12P**
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 IO-Link connector - only for **LEB-SN-IL**

CONNECTOR TYPE	IL IO-Link
CODE	(A) **ZM-5PF**
Type	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

19.4 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

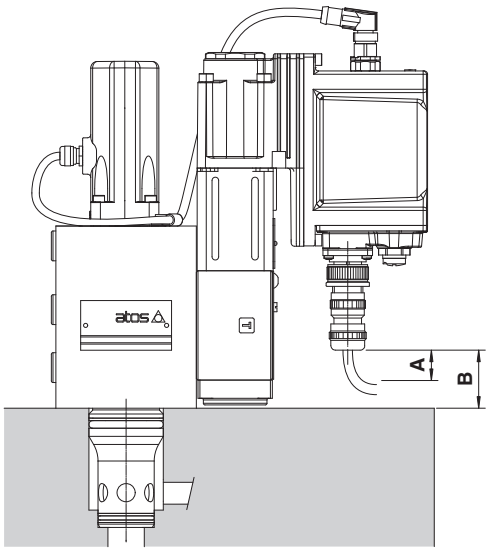
20 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZP	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
	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
	125	8 socket head screws M36x260 class 12.9 Tightening torque = 3600 Nm	375

(1) Fastening bolts supplied with the valve

21 MAIN CONNECTORS INSTALLATION DIMENSIONS

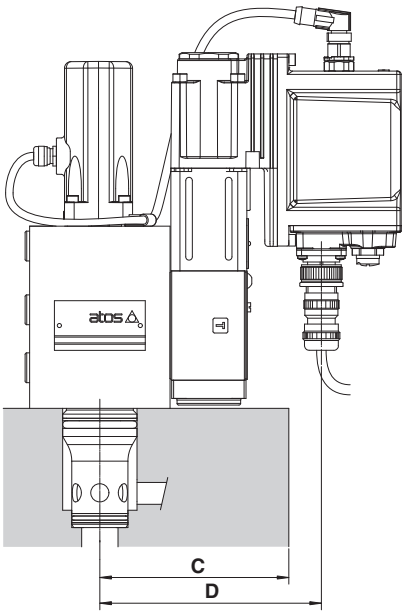
Installation 1 - possible interference between manifold and main connector



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	125
B	ZM-7P	32	32	32	40	45	68	68	80	142
	ZH-7P	**(1)**	**(1)**	**(1)**	**(1)**	29	52	52	64	125
	ZM-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	35	35	47	108
	ZH-12P	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(2)**	40	101
C (max)	-	104	114	121	134	141	172	202	229	271
D	-	124	134	141	154	161	192	222	249	291

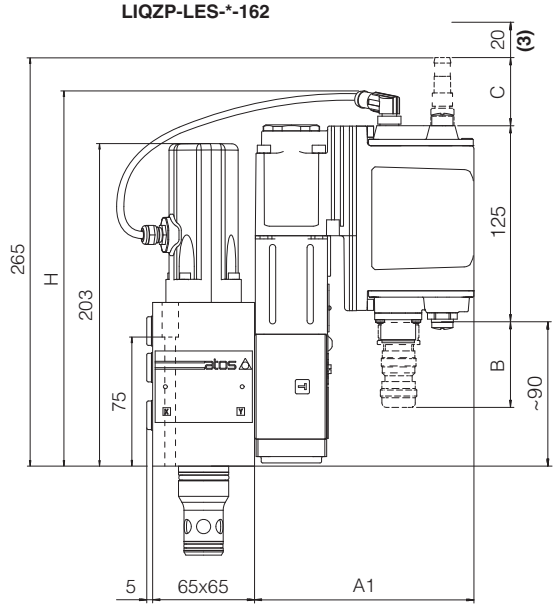
Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered

(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"

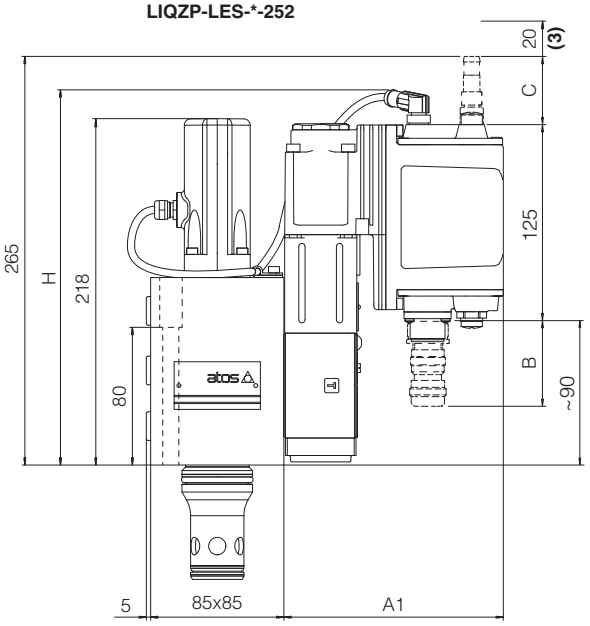
(2) The connector installation may be critic, depending to the cable size and bending radius

22 INSTALLATION DIMENSIONS [mm]

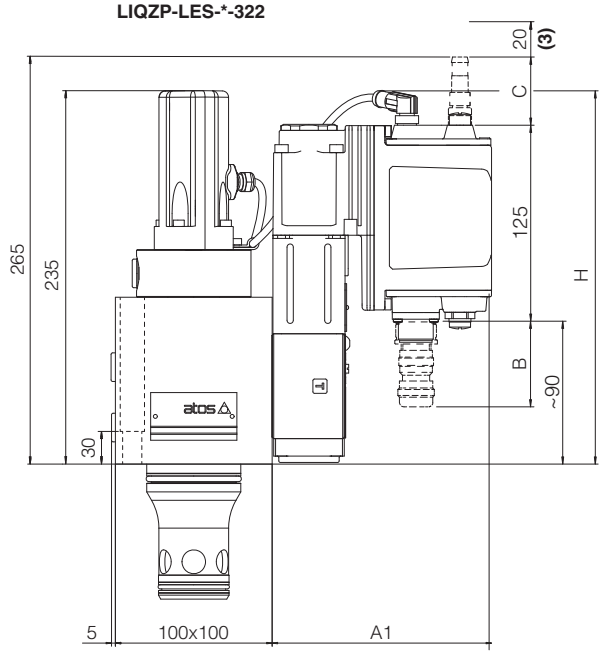
LIQZP-LEB-*-162
LIQZP-LES-*-162



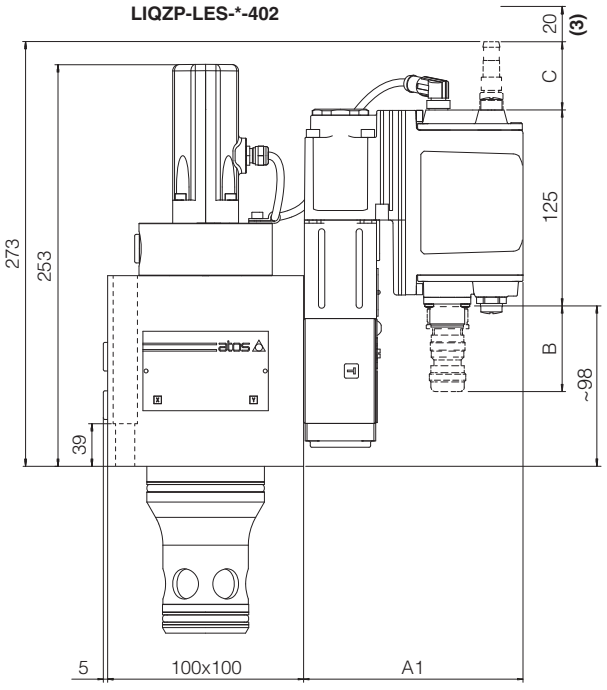
LIQZP-LEB-*-252
LIQZP-LES-*-252



LIQZP-LEB-*-322
LIQZP-LES-*-322



LIQZP-LEB-*-402
LIQZP-LES-*-402

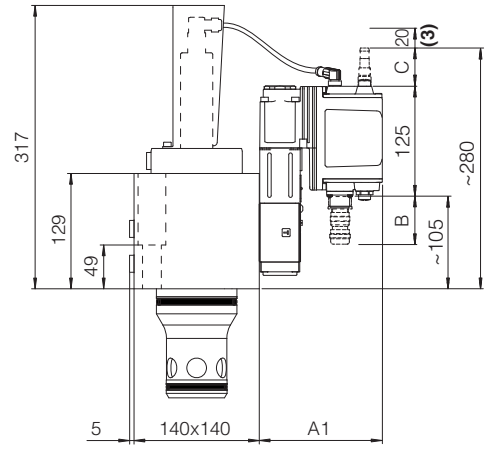


LIQZP	A1	B (1)	C (2)	H
LEB - SN - IL	140	60	-	242
LEB - SN - NP	140	60	-	242
LES - SN - NP, BC, BP, EH	140	60	50	235
LES - SN - EW, EI, EP	155	60	50	235

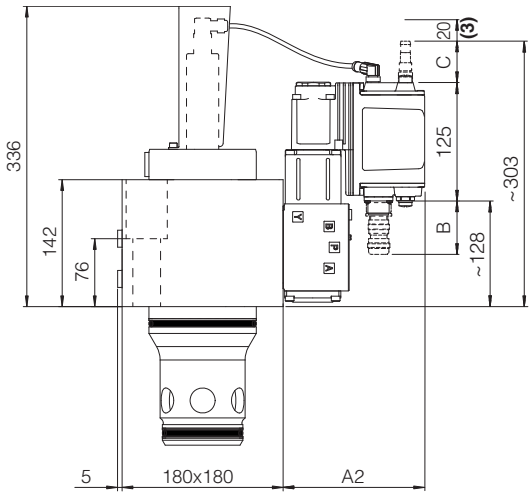
(1) The indicated dimension refers to the main connector ZM-7P. See section 21 for main connectors installation dimensions
(2) The indicated dimension refers to the longer main connector. For dimensions of all connectors, see sections 17.5, 17.6 and 17.7
(3) Space required for connector cable and for connector removal

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

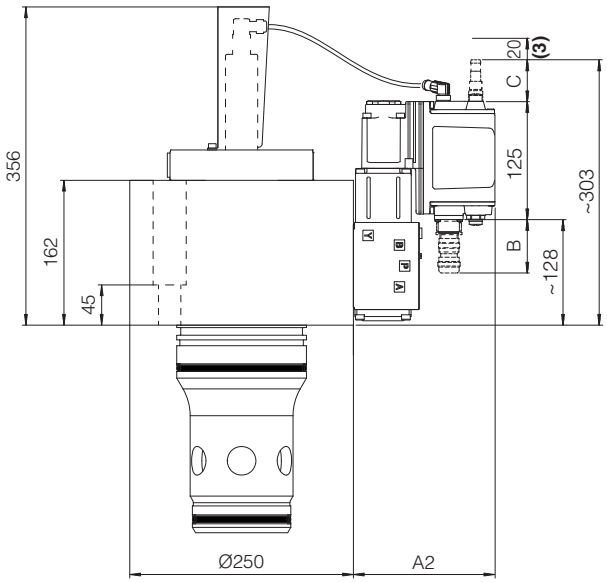
LIQZP-LEB-*-502
LIQZP-LES-*-502



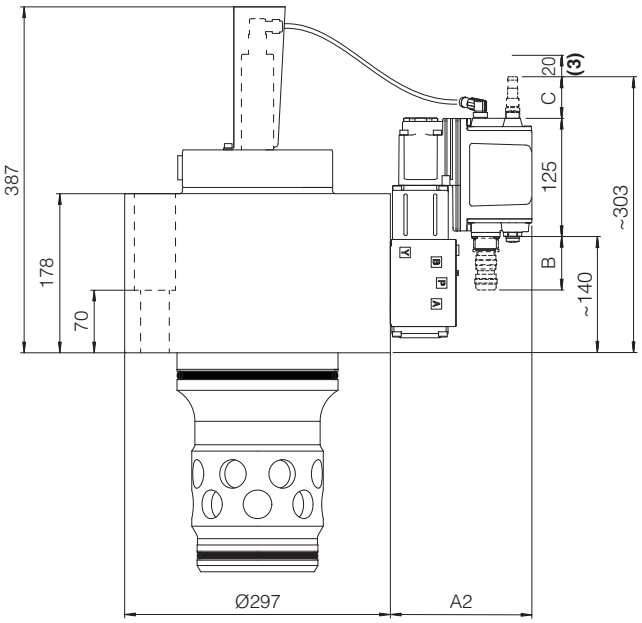
LIQZP-LEB-*-632
LIQZP-LES-*-632



LIQZP-LEB-*-802
LIQZP-LES-*-802



LIQZP-LEB-*-1002
LIQZP-LES-*-1002

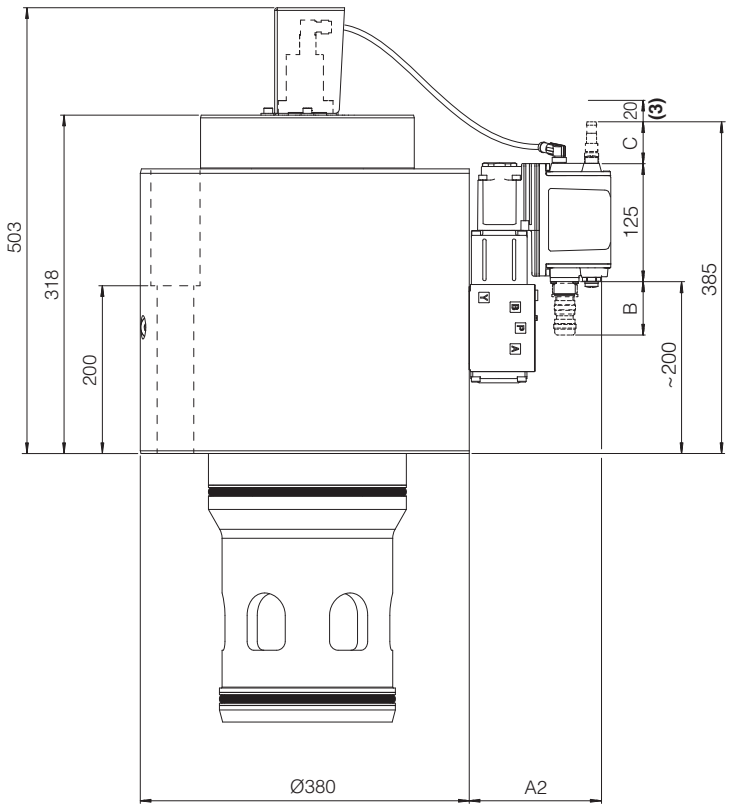


LIQZP	A1	A2	B (1)	C (2)
LEB - SN - IL	140	150	60	-
LEB - SN - NP	140	150	60	-
LES - SN - NP, BC, BP, EH	140	150	60	50
LES - SN - EW, EI, EP	155	165	60	50

(1) The indicated dimension refers to the main connector ZM-7P. See section 21 for main connectors installation dimensions
(2) The indicated dimension refers to the longer main connector. For dimensions of all connectors, see sections 17.5, 17.6 and 17.7
(3) Space required for connector cable and for connector removal

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

LIQZP-LEB-*-1252
LIQZP-LES-*-1252



LIQZP	A2	B (1)	C (2)
LEB - SN - IL	140	60	-
LEB - SN - NP	140	60	-
LES - SN - NP, BC, BP, EH	140	60	50
LES - SN - EW, EI, EP	155	60	50

(1) The indicated dimension refers to the main connector ZM-7P. See section 21 for main connectors installation dimensions
(2) The indicated dimension refers to the longer main connector. For dimensions of all connectors, see sections 17.5, 17.6 and 17.7
(3) Space required for connector cable and for connector removal

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

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus
GS520	IO-Link interface
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
E-MAN-RI-LEB	TEB/LEB user manual
E-MAN-RI-LES	TES/LES user manual