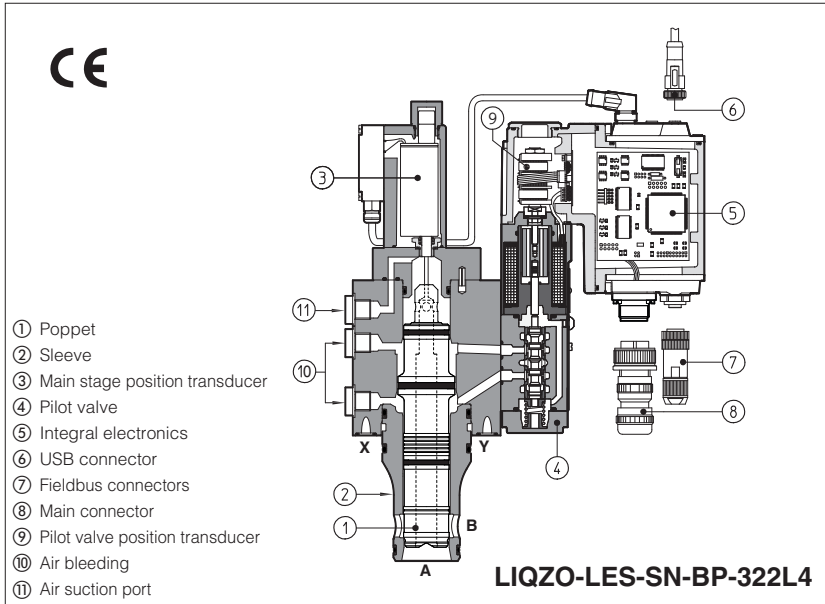


# Proportional 2-way cartridges high performance

digital, with two position transducers, ISO 7368 sizes from 16 to 100, rugged design



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

High Performance 2-way proportional cartridge valves 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. The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting. High performances valves are available in LEB basic execution with analog reference signals and USB port for software functional parameters setting or in LES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics

**LIQZO:** sizes from **16** to **40**,  
Max flow: **600** to **2500** l/min  
Max pressure: **350** bar

**LIQZP:** sizes from **50** to **100**,  
Max flow: **4000** to **16.000** l/min  
Max pressure: **420** bar

## 1 MODEL CODE

<b>LIQZO</b>	-	<b>L</b>	<b>ES</b>	-	<b>SN</b>	-	<b>NP</b>	-	<b>25</b>	<b>2</b>	<b>L4</b>	/	<b>*</b>	<b>**</b>	/	<b>*</b>
Flow control valve <b>LIQZO</b> = size 16 to 40, Pmax 350 bar <b>LIQZP</b> = size 50 to 100, Pmax 420 bar																Seals material, see sect. [5], [6]: - = NBR <b>PE</b> = FKM <b>BT</b> = HNBR
<b>L</b> = closed-loop two LVDT transducers																Series number
<b>Integral digital drivers:</b> <b>EB</b> = basic (1) <b>ES</b> = full																<b>Electronic options</b> , see sections [9] <b>I</b> = current reference input and monitor 4÷20 mA (omit for standard voltage reference input and monitor ±10 V) <b>F</b> = fault signal <b>Q</b> = enable signal <b>Z</b> = double power supply (2), enable, fault and monitor signals (12 pin connector)
<b>Alternated P/Q controls</b> - see section [3] <b>SN</b> = none																
<b>Fieldbus interfaces</b> USB port always present: <b>NP</b> = Not present (1) <b>BC</b> = CANopen <b>BP</b> = PROFIBUS DP <b>EH</b> = EtherCAT <b>EW</b> = POWERLINK																

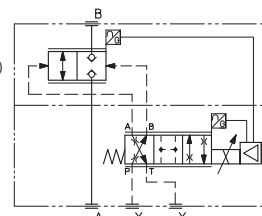
Poppet type - regulating characteristics:

L4 = linear

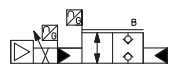


Configuration: 2 = 2 way

LIQZO-LEB  
LIQZO-LES  
(functional symbol)



LIQZO-LEB  
LIQZO-LES  
(simplified symbol)



Valve size, see section [3]

<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) LEB available only in version SN-NP (2) Double power supply only for LES

## 2 GENERAL NOTES

LIQZO-LEB, LES and LIQZP-LEB, LES proportional cartridges are **CE** marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).



### 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 9



### 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 FIELDBUS - only for LES

Fieldbus allows the direct communication of the proportional valve with machine control unit for digital reference signal, diagnostics and settings of functional parameters. Analog reference signal remain available on the main connector for quick commissioning and maintenance. For detailed information about fieldbus features and specification see tech table **GS510**.

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

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	standard execution = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C			
Storage temperature range	Standard execution = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Max. solenoid current	2,6 A			
Max. power	50 Watt			
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	IP66/67 with mating connectors			
Tropicalization	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK IEC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Size	16	25	32	40	50	63	80	100	
Max regulated flow [l/min]									
Δp P-T at Δp = 5 bar at Δp = 10 bar	250	500	800	1200	2000	3000	4500	7200	
	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 ≤ 10		
	<b>LIQZP</b>				Ports A, B = <b>420</b>	X = 350	Y ≤ 10		
Nominal flow of pilot valve at Δp = 70 bar [l/min]	4	7	14	40	40	100	100	100	
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,3	0,7	0,7	1	1	1	
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	59,4	
Piloting flow (1) [l/min]	7,5	9,5	28	32	54	82	80	72	
Response time 0 ÷ 100% step signal (2) [ms]	13	14	15	18	20	24	30	50	
Hysteresis [% of the max regulation]	≤ 0,1								
Repeatability [% of the max regulation]	± 0,1								
Thermal drift	zero point displacement < 1% at ΔT = 40°C								

### Note:

above performance data refer to valves coupled with Atos electronic drivers, see section 6.

(1) with step reference input 0÷100%

(2) see detailed diagrams in section 7.2

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

Seals, recommended temperature fluid	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		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 µm (β10 ≥75 recommended)		
<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	

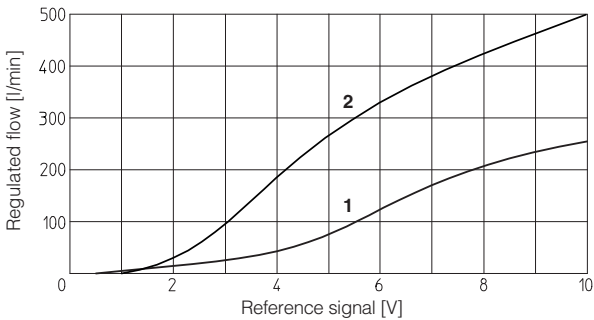
**6 ELECTRONIC DRIVERS**

Valve model	<b>LEB</b>	<b>LES</b>
Drivers model	E-RI-LEB-N	E-RI-LES-N
Type	Digital	
Format	Integral to valve	
Data sheet	GS208	GS210

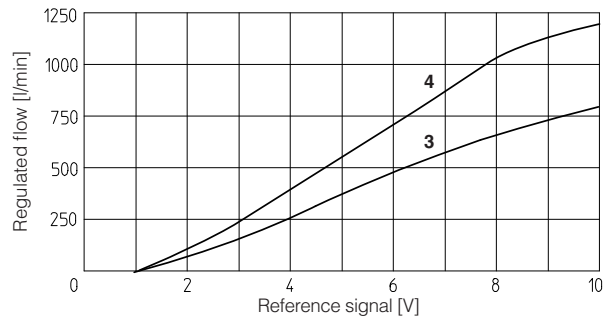
**Note:** for main and communication connector see sections **11**, **12**

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

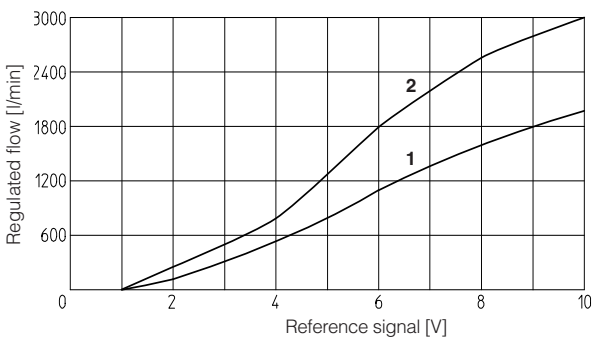
**7.1 Regulation diagrams** (values measured at Δp 5 bar)



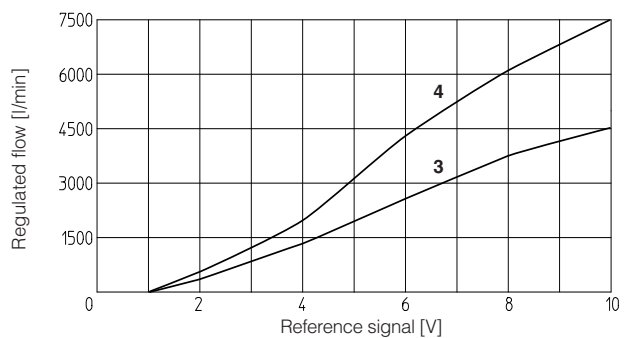
**1** = LIQZO-L\*-16\*  
**2** = LIQZO-L\*-25\*



**3** = LIQZO-L\*-32\*  
**4** = LIQZO-L\*-40\*



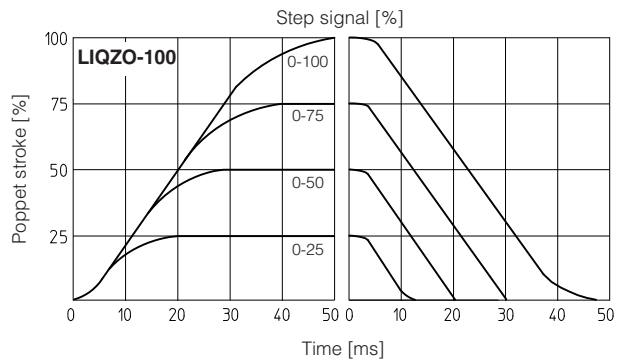
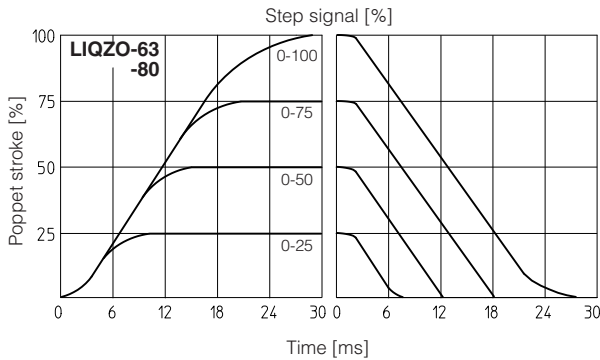
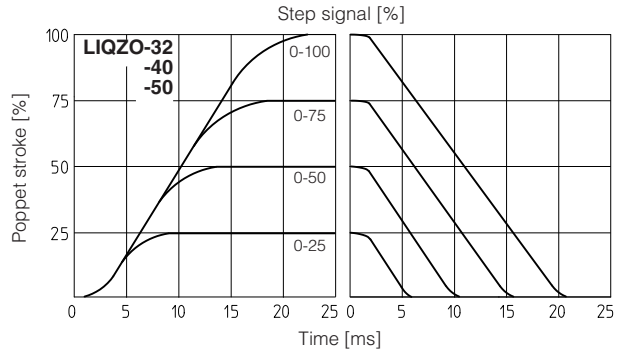
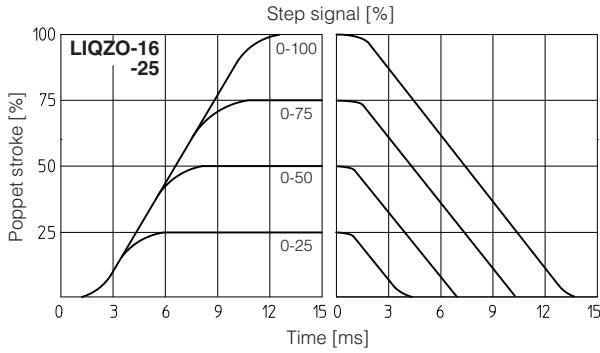
**1** = LIQZP-L\*-50\*  
**2** = LIQZP-L\*-63\*



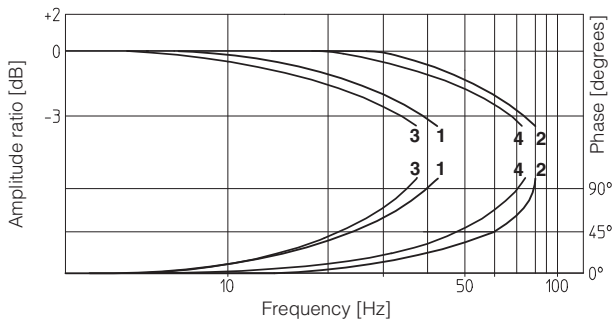
**3** = LIQZP-L\*-80\*  
**4** = LIQZP-L\*-100\*

## 7.2 Response time

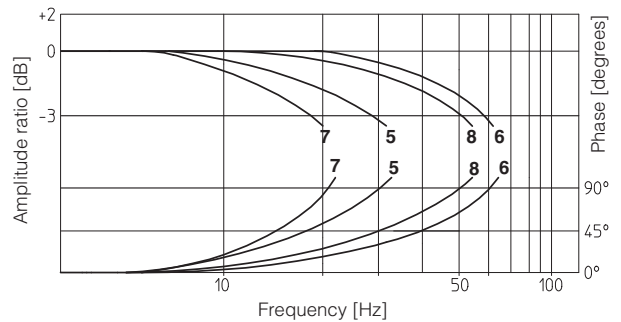
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



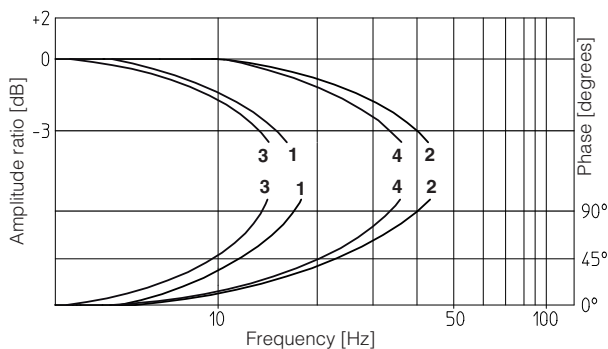
## 7.3 Bode diagrams - stated at nominal hydraulic conditions



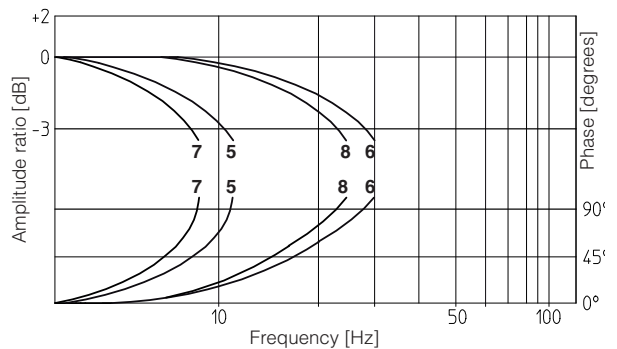
- 1** = LIQZO-L\*-16\*: 10% ↔ 90%    **3** = LIQZO-L\*-25\*: 10% ↔ 90%  
**2** = LIQZO-L\*-16\*: 50% ± 5%    **4** = LIQZO-L\*-25\*: 50% ± 5%



- 5** = LIQZO-L\*-32\*: 10% ↔ 90%    **7** = LIQZO-L\*-40\*: 10% ↔ 90%  
**6** = LIQZO-L\*-32\*: 50% ± 5%    **8** = LIQZO-L\*-40\*: 50% ± 5%

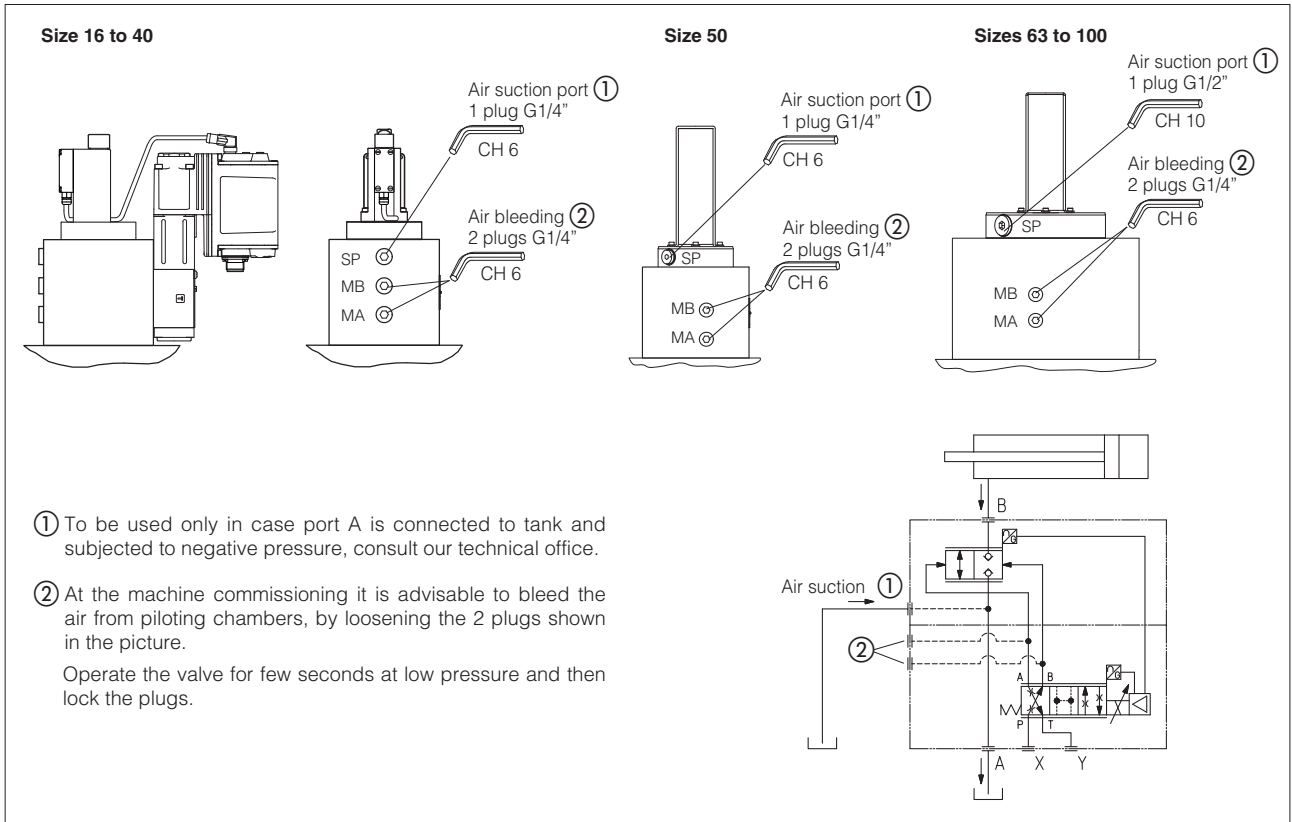


- 1** = LIQZP-L\*-50\*: 10% ↔ 90%    **3** = LIQZP-L\*-63\*: 10% ↔ 90%  
**2** = LIQZP-L\*-50\*: 50% ± 5%    **4** = LIQZP-L\*-63\*: 50% ± 5%



- 5** = LIQZP-L\*-80\*: 10% ↔ 90%    **7** = LIQZP-L\*-100\*: 10% ↔ 90%  
**6** = LIQZP-L\*-80\*: 50% ± 5%    **8** = LIQZP-L\*-100\*: 50% ± 5%

## 8 AIR BLEEDING



## 9 ELECTRONIC OPTIONS

Standard driver execution provides on the 7 pin main connector:

**Power supply** - 24 VDC must be appropriately stabilized or rectified and filtered; **2.5 A** fuse time lag is required in series to each driver power supply. 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

**Reference input signal** - analog differential input with  $\pm 10$  VDC nominal range (pin D, E), proportional to desired valve poppet position

**Monitor output signal** - analog output signal proportional to the actual valve's poppet position with  $\pm 10$  VDC nominal range

**Note:** a minimum booting time between 400 and 800 ms has been considered from the driver energizing with the 24 Vdc power supply before the valve has been ready to operate. During this time the current to the valve coils is switched to zero.

### 9.1 Option /F

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

### 9.2 Option /I

It provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard  $\pm 10$  V.

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

### 9.3 Option /Q

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

### 9.4 Option /Z

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

#### Enable Input Signal

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

#### Fault Output Signal

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

#### Power supply for driver's logics and communication - only for LES

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).

Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition aids to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

### 9.5 Possible combined options

/FI, /IQ and /IZ

## 10 ELECTRONIC CONNECTIONS AND LEDS

### 10.1 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: $\pm 10$ 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>
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 $\pm 10$ 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	

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

PIN	LEB-SN /Z	LES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0   VL0		Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	Q_INPUT+		Flow reference input signal: $\pm 10$ 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>
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND   VL0		Flow 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	Input - analog signal <b>Software selectable</b>
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	
		NC	Do not connect	Output - on/off signal
9	NC		Do not connect	
10		VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
	NC		Do not connect	
11		VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
	FAULT referred to: V0   VL0		Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH		Internally connected to the driver housing	

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

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

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Supply for external USB Flash Drive
2	ID	USB Flash Drive 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)

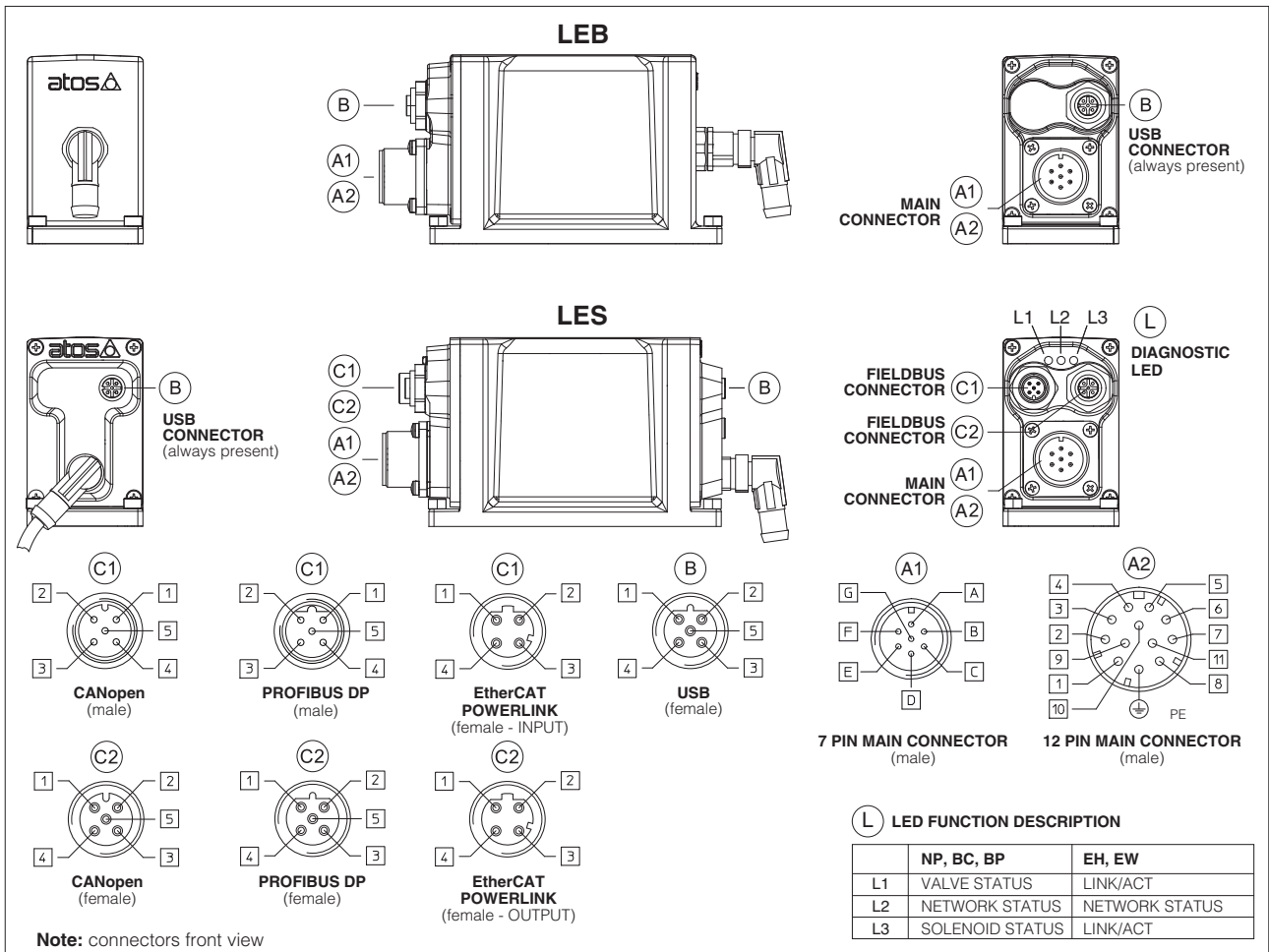
(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

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

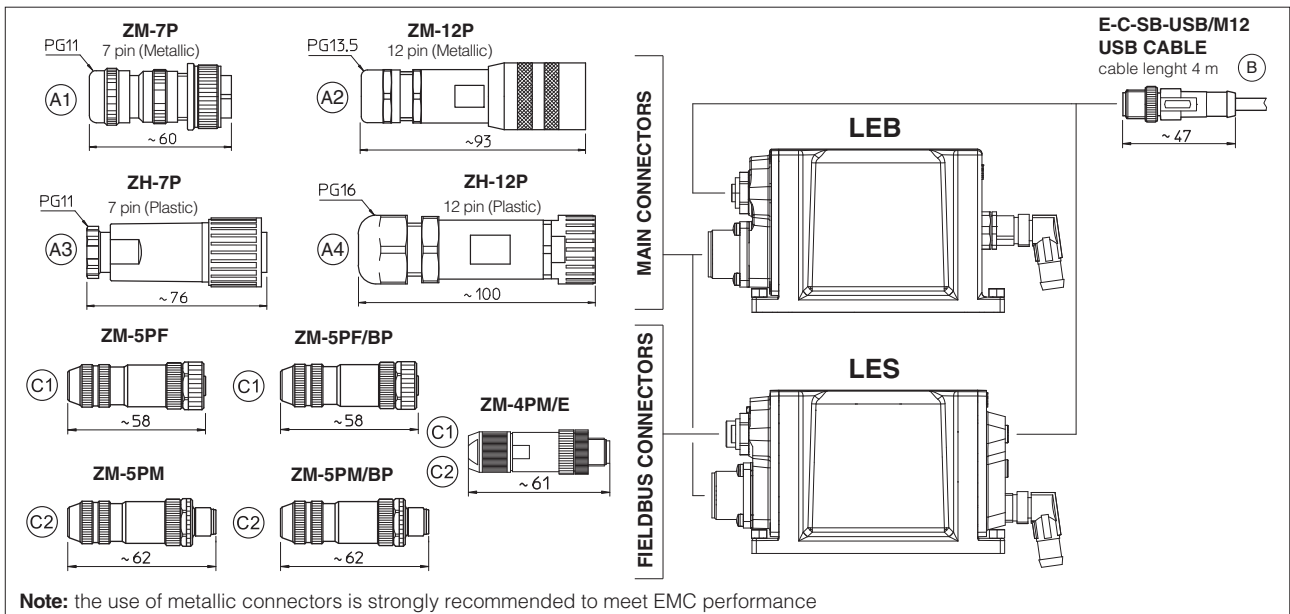
**Notes:** (1) shield connection on connector's housing is recommended

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

## 10.5 Connections layout



## 11 CONNECTORS



## 12 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	LEB LES	LEB /Z LES /Z	BC - CANopen	BP - PROFIBUS DP	EH - EtherCat EW - POWERLINK
CONNECTOR CODE	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PF/BP (C1)	ZM-4PM/E (C1)
	ZH-7P (A3)	ZH-12P (A4)	ZM-5PM (C2)	ZM-5PM/BP (C2)	ZM-4PM/E (C2)
PROTECTION DEGREE	IP67				
DATA SHEET	GS208, GS210, K500				

only for LES

**13 PROGRAMMING TOOLS** - see table **GS500**

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

The software is available in different versions according to the driver's options:

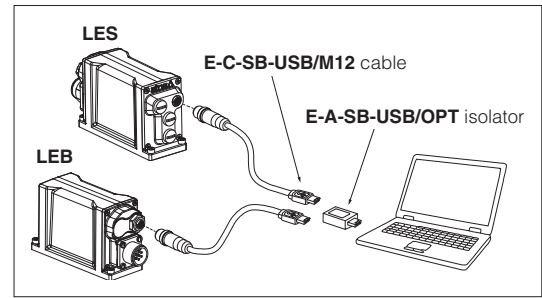
**E-SW-BASIC** support: NP (USB) PS (Serial) IR (Infrared)  
**E-SW-FIELDBUS** support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)  
 EW (POWERLINK)

**E-SW-\*/PQ** support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

**WARNING: drivers USB port is not isolated!**

The use of isolator adapter is highly recommended for PC protection (see table **GS500**)

**USB connection**



**14 FASTENING BOLTS and VALVE MASS**

LIQZO				
Size	Fastening bolts class 12.9 (1)	Tightening torque	Mass (Kg)	
16	N°4 M8x90	35 Nm	5,6	6,2
25	N°4 M12x100	125 Nm	8,2	8,8
32	N°4 M16x60	300 Nm	10,9	11,2
40	N°4 M20x70	600 Nm	16,7	17,3

LIQZP				
Size	Fastening bolts class 12.9 (1)	Tightening torque	Mass (Kg)	
50	N°4 M20x80	600 Nm	23,9	24,6
63	N°4 M30x120	2100 Nm	44	44,6
80	N°8 M24x80	1000 Nm	71,6	72,2
100	N°8 M30x120	2100 Nm	122,5	123,1

(1) Fastening bolts supplied with the valve

**15 MOUNTING SURFACE AND CAVITY** - see table P006 for detailed dimensions

**Mounting surface**

**Sizes 16 ÷ 63**

**Size 80, 100**

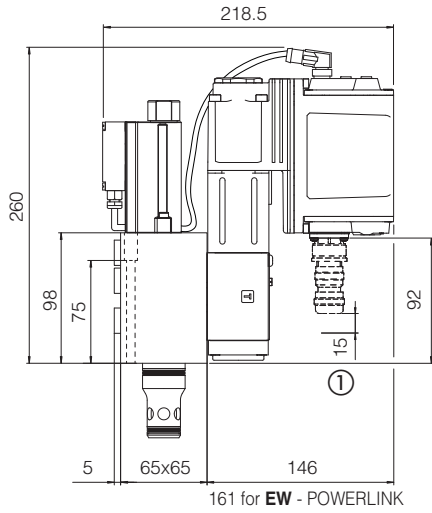
Sizes	A	B	C	D	E	F	G	J min	K	L min	M	ØN	ØP max	R	S max	T	V
16	2	12,5	23	46	48	46	23	-	-	65	M8	4	4	22	8	2	48
25	4	13	29	58	62	58	29	-	-	85	M12	6	6	30	8	4	62
32	6	18	35	70	76	70	35	-	-	102	M16	6	8	38	8	6	76
40	7,5	19,5	42,5	85	92,5	85	42,5	-	-	125	M20	6	10	46	8	7,5	92,5
50	8	20	50	100	108	100	50	-	-	140	M20	8	10	46	8	8	108
63	12,5	24,5	62,5	125	137,5	125	62,5	-	-	180	M30	8	12	66	8	12,5	137,5
80	-	-	-	-	-	-	-	250	200	-	M24	10	16	50	8	-	-
100	-	-	-	-	-	-	-	300	245	-	M30	10	20	66	10	-	-

**Cavity**

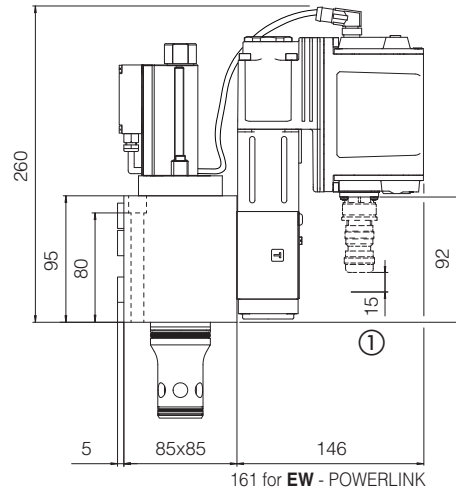
Size	ød1	ød2	ød3 max	ød4 max	L1	L2	L3	L4	L5	L6	L7	U	W
16	32	25	16	22,5	43 <sup>+0,1</sup>	56 <sup>+0,1</sup>	54	42,5	20	2	2	0,03	0,05
25	45	34	25	27	58 <sup>+0,1</sup>	72 <sup>+0,1</sup>	70	57	30	2,5	2,5	0,03	0,05
32	60	45	32	38,5	70 <sup>+0,1</sup>	85 <sup>+0,1</sup>	83	68,5	30	2,5	2,5	0,03	0,1
40	75	55	40	54,5	87 <sup>+0,1</sup>	105 <sup>+0,1</sup>	102	84,5	30	3	3	0,05	0,1
50	90	68	50	62,5	100 <sup>+0,1</sup>	122 <sup>+0,1</sup>	117	97,5	35	3	3	0,05	0,1
63	120	90	63	87	130 <sup>+0,1</sup>	155 <sup>+0,1</sup>	150	127	40	4	4	0,05	0,2
80	145	110	80	100	175 <sup>+0,2</sup>	205 <sup>+0,2</sup>	200	170,5	40	5	5	0,05	0,2
100	180	135	100	120	210 <sup>+0,2</sup>	245 <sup>+0,2</sup>	239	205,5	50	5	5	0,05	0,2



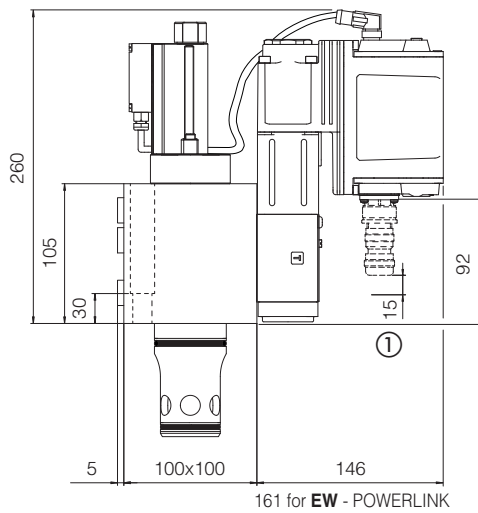
LIQZO-LEB-162  
LIQZO-LES-162



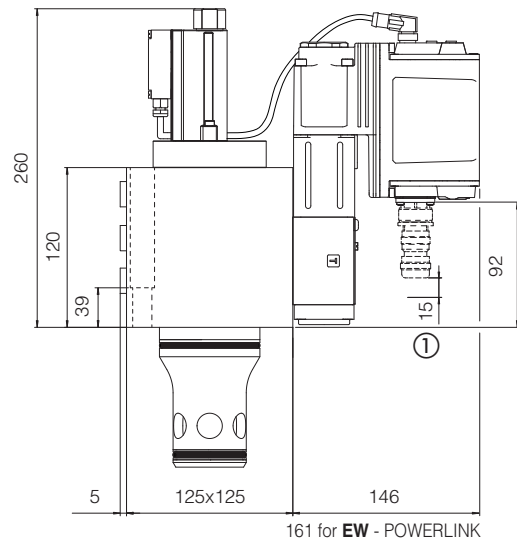
LIQZO-LEB-252  
LIQZO-LES-252



LIQZO-LEB-322  
LIQZO-LES-322



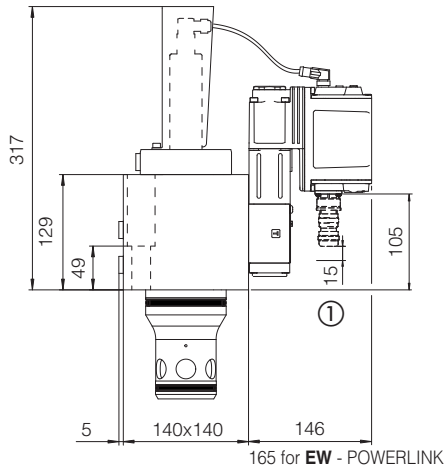
LIQZO-LEB-402  
LIQZO-LES-402



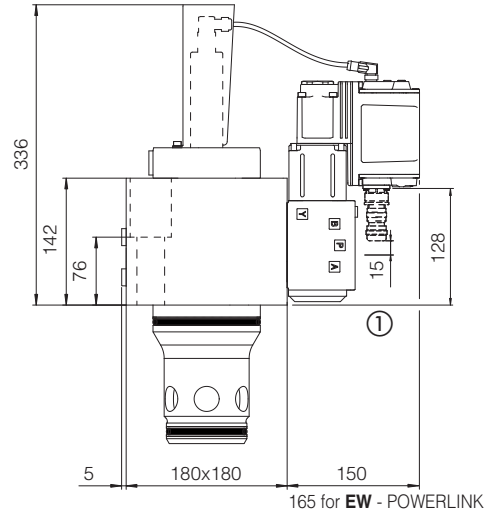
① Space to remove the 7 or 12 pin main connector. For main and communication connectors see section 11, 12

**Note:** for mounting surface and cavity dimensions, see section 15 and table P006

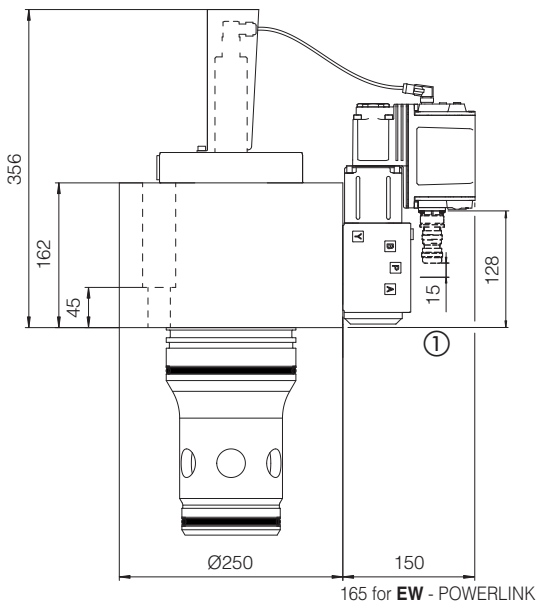
LIQZP-LEB-502  
LIQZP-LES-502



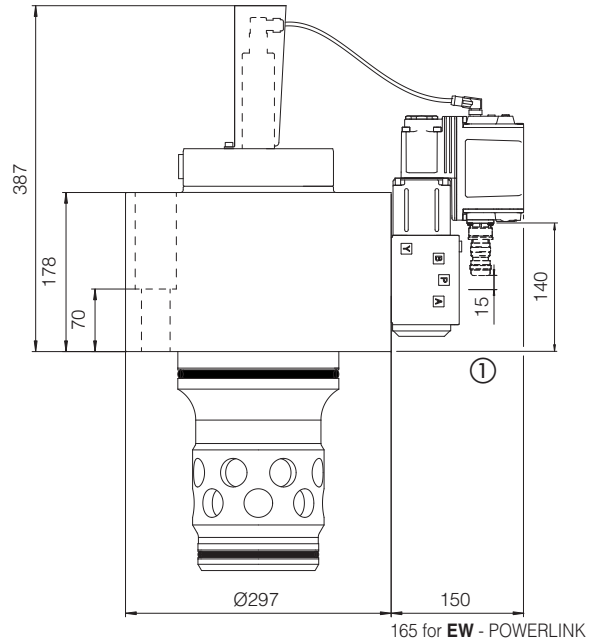
LIQZP-LEB-632  
LIQZP-LES-632



LIQZP-LEB-802  
LIQZP-LES-802



LIQZP-LEB-1002  
LIQZP-LES-1002



① Space to remove the 7 or 12 pin main connector. For main and communication connectors see section [11](#), [12](#)

**Note:** for mounting surface and cavity dimensions, see section [15](#) and table P006