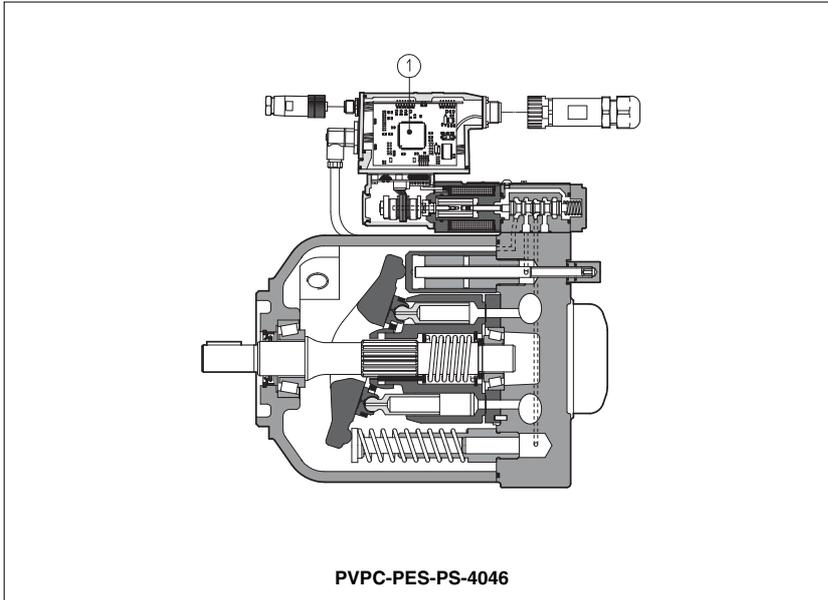


# Proportional electrohydraulic controls for PVPC pumps

pressure-flow combined P/Q controls, analog or digital



The variable displacement axial piston pumps type PVPC, can be supplied with advanced electrohydraulic proportional controls:

- open loop pressure control;
- load sensing control of the flow;
- P/Q controls, a complete range with open or closed loop regulation of pressure and flow.

These controls perform high dynamics and fine regulations, directly commanded from PC or from the machine controller. They are available with separated driver or with integral electronics ①.

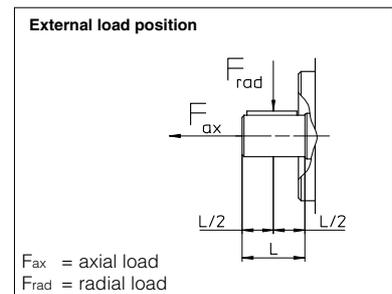
New PES digital controllers, integrated to the pump, realize combined closed loop controls of pressure, flow and max power limitation and they are also available with optional sequence module (PERS version) that allows to operate the pump with minimum pressure in the circuit close to zero. Following communication interfaces are available for the digital PE(R)S execution, see section ⑦:

- **-PS:** RS232 serial communication interface
- **-BC:** CANbus interface
- **-BP:** PROFIBUS-DP interface

For technical characteristics and features of the PVPC pumps, see table A160.

## 1 MODEL CODE

<b>PVPC</b>	<b>X2E</b>	<b>- PERS</b>	<b>- BC</b>	<b>- 4</b>	<b>046</b>	<b>/31044 /</b>	<b>*</b>	<b>/1</b>	<b>D / 18</b>	<b>10</b>	<b>/*</b>
Variable displacement axial piston pump											
Additional suffix for double pumps <b>X2E</b> = with a fixed displacement pump type PFE (see tab. A005)											
Type of control (see section ⑤, ⑥ and ⑦): <b>CZ</b> = proportional pressure compensator <b>LQZ</b> = proportional flow control (load sensing) <b>LZQZ</b> = proportional pressure & flow control (load sensing) <b>LZQZR</b> = as LZQZ plus sequence module <b>PES</b> = closed loop integral digital P/Q controller <b>PERS</b> = as PES plus sequence module											
Communication interface, only for PES and PERS versions <b>PS</b> = RS232 serial <b>BP</b> = PROFIBUS-DP <b>BC</b> = CAN-Bus											
Size: <b>3</b> = for displacement 029 <b>4</b> = for displacement 046 <b>5</b> = for displacement 073 and 090											
Max displacement of axial piston pump: <b>029</b> = 29 cm <sup>3</sup> /rev <b>046</b> = 46 cm <sup>3</sup> /rev <b>073</b> = 73 cm <sup>3</sup> /rev <b>090</b> = 88 cm <sup>3</sup> /rev											
Type of PFE (for double pumps), see tab. A005											
Pressure setting (only for PERS): <b>200</b> = 200 bar <b>250</b> = 250 bar <b>280</b> = 280 bar											
<b>1) pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request</b>											
<b>2 OPERATING CHARACTERISTICS</b>											
<b>Pump model</b>	<b>PVPC*-3029</b>	<b>PVPC*-4046</b>	<b>PVPC*-5073</b>	<b>PVPC*-5090</b>							
Displacement [cm <sup>3</sup> /rev]	29	46	73	88							
Theoretical max flow at 1450 rpm [l/min]	42	66,7	105,8	127,6							
Max working pressure / Peak pressure [bar]	280/350	280/350	280/350	250/315							
Min/Max inlet pressure [bar abs.]	0,8 / 25	0,8 / 25	0,8 / 25	0,8 / 25							
Max pressure on drain port [bar abs.]	1,5	1,5	1,5	1,5							
Power consumption at 1450 rpm and at maximum pressure and displacement [kW]	19,9	31,6	50,1	54,1							
Max torque on the first shaft [Nm]	Type 1 155	Type 5 190	Type 1 220	Type 5 330	Type 1 400	Type 5 620	Type 1 400	Type 5 620			
Max permissible load on drive shaft [N]	$\frac{F_{ax}}{F_{rad}}$		$\frac{F_{ax}}{F_{rad}}$		$\frac{F_{ax}}{F_{rad}}$		$\frac{F_{ax}}{F_{rad}}$				
Speed rating [rpm]	600 ÷ 3000		600 ÷ 2600		600 ÷ 2200		600 ÷ 1850				
Synthetic fluids: <b>WG</b> = water-glycol <b>PE</b> = phosphate ester See notes, section ⑦											
Series number											
<b>Options, see sections ④ and ⑦:</b> <b>18</b> = with 18 VDC coil instead of standard 12 VDC coil (only for CZ, LQZ, LZQZ) <b>for versions PES and PE(R)S:</b> <b>C</b> = predisposed to receive 4 ÷ 20 mA feedback signal from the remote pressure transducer <b>X</b> = with integral pressure transducer (only for PERS) <b>S</b> = additional closed loop pressure control with multiple PID parameters set - <b>only for -PS</b> <b>Z</b> = as S but with double power supply, enable and fault - <b>only for -BC and -BP</b>											
Direction of rotation (viewed at the shaft end) <b>D</b> = clockwise <b>S</b> = counterclockwise											
Shaft (SAE Standard): <b>1</b> = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090) <b>5</b> = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)											



**Notes:** For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes. Maximum pressure for all models with option /WG is 160 bar, with option /PE is 190 bar. Max speed with options /WG and /PE is 2000/1900/1600/1500 rpm respectively for the four sizes.

### 3 MAIN CHARACTERISTICS OF VARIABLE DISPLACEMENT AXIAL PISTON PUMP TYPE PVPC

Installation position	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line length is 3 m.		
Ambient temperature	from -20°C to +70°C for versions with separated electronics / from -20°C to + 60°C for versions PES/PERS		
Fluid	Hydraulic oil as per DIN 51524...535; for other fluids see section 11		
Recommended viscosity	15÷100 mm <sup>2</sup> /sec at 40°C (ISO VG 15÷100). Maximum start-up viscosity: 1000 mm <sup>2</sup> /sec		
Fluid contamination class	ISO 16/13 (filters at 10 µm value with β <sub>10</sub> ≥ 75 recommended)		
Fluid temperature	-20°C +60°C	-20°C +50°C (seals /WG)	-20°C +80°C (seals /PE)
LVDT electric characteristics (PES, PERS versions)	Supply +15 Vdc / 25 mA; -15 Vdc / 25 mA; Signal 0 ÷ 5,5 Vdc		

#### 3.1 Coils characteristics

Coil resistance R at 20°C	Pump size 3	<b>3 ÷ 3,3 Ω</b> for standard <b>12 Vdc</b> coil; <b>13 ÷ 13,4 Ω</b> for <b>18 Vdc</b> coil (only for version CZ, LQZ, LZQZ*)
	Pump sizes 4, 5	<b>3,8 ÷ 4,1 Ω</b> for standard <b>12 Vdc</b> coil; <b>12 ÷ 12,5 Ω</b> for <b>18 Vdc</b> coil (only for version CZ, LQZ, LZQZ*)
Max solenoid current	<b>2,6 A</b> for standard <b>12 Vdc</b> coil; <b>1,5 A</b> for <b>18 Vdc</b> coil (available only for version CZ, LQZ, LZQZ*)	
Max power	35 Watt	
Protection degree (CEI EN-60529)	IP65 for -CZ, LQZ and LZQZ; IP65÷67 for versions with integral electronics (see section 4.5)	
Duty factor	Continuous rating (ED = 100%)	

### 4 OPTIONS FOR PES AND PERS

#### 4.1 Option /X (only for -PERS)

Option providing the presence of the pressure transducer, with output signal 4÷20 mA, integral to the pump and factory wired to the PERS electronics through a cable gland.

#### 4.2 Option /C

The pump electronics is set to receive 4÷20 mA feedback signal from the remote pressure transducer, instead of the standard 0÷10 V.

#### 4.3 Option /S (only for version -PES-PS)

Option providing up to 4 set of PID pressure parameters real time selectable during the axis motion via on-off signals to the 12 poles connector to optimize the control performances in the different phases of the machine cycle. For additional information and for the electrical wiring, see sez 9.

#### 4.4 Option /Z (only for versions -PES-BC and -BP)

Option providing the same characteristics of option /S plus additional double power supply, enable and fault. The multiple set of PID pressure parameters can be real time selected during the axis motion through the -BC or -BP interfaces, to optimize the control performances in the different phases of the machine cycle.

The double power supply is specifically introduced for -BC and -BP fieldbus interfaces and it provides two separated power supplies for the digital electronic circuits and for the pilot valve power supply stage. It allows to interrupt the pump functioning by cutting the solenoid power supply of the pilot valve (e.g. for emergency, as provided by the European Norms EN954-1 for components with safety class 2), but keeping energized the digital electronic circuits, thus avoiding fault conditions of the machine fieldbus controller. For additional information and for the electrical wiring, see sez 9.

#### 4.5 Model codes of power supply and communication connectors

PUMP VERSION	CZ, LQZ, LZQZ	PES, PERS	-RS232 (-PS) OR CANBUS (-BC) only for PES and PERS	PROFIBUS (-BP) only for PES and PERS	PRESSURE TRANSDUCER only for PE/S, /Z
CONNECTOR CODE	SP-666	SP-ZH-12P (1)	SP-ZH-5P (1)	SP-ZH-5P/BP (1)	SP-ZH-4P-M8 /5 (1)(2)
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP67

(1) to be ordered separately (2) M8 connector moulded on cable 5 mt length

### 5 PROGRAMMING DEVICES FOR PVPC-PES-\* AND PVPC-PERS-\*

The functional parameters of the digital valves, as the bias, scale, ramp and linearization of the regulation characteristic, can be easily set and optimized with graphic interface by using the following software programming devices suitable for standard PC:

**KIT-E-SW-PS** for electronics with RS232 interface (option -PS)

**KIT-E-SW-BC** for electronics with CANbus interface (option -BC)

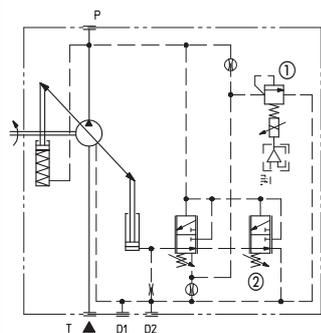
**KIT-E-SW-BP** for electronics with PROFIBUS-DP interface (option -BP)

see tab. G500 for complete information about the programming device kits and for the PC minimum requirements.

Only for the -BC and -BP communication options, the functional parameters can be alternatively set via fieldbus through the machine control unit, using the standard communication protocol implemented by Atos.

The protocol operating instructions to be implemented in the standard protocols (DS301V4.02, DSP408 for CANbus and DPVO for PROFIBUS-DP) are described in the user manuals MAN-S-BC (for -BC option) and MAN-S-BP (for -BP option) supplied with the relevant programming device kits.

**The above programming devices have to be ordered separately.**

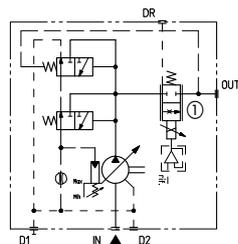
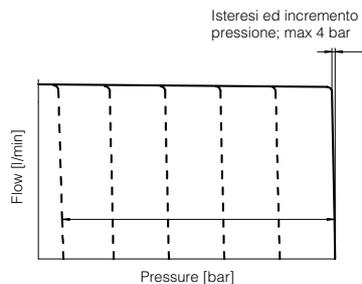


**CZ**

**Proportional pressure compensator**

The pumps displacement, and thus the flow, remains constant as far the pressure in the circuit reaches the value set on the proportional pilot valve (1), then the flow is reduced to maintain the circuit pressure to the value set by the electronic reference signal to the proportional valve. In this conditions the pressure in the circuit can be continuously modulated by means of the reference signal.

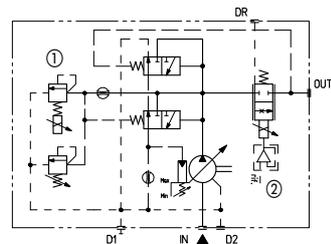
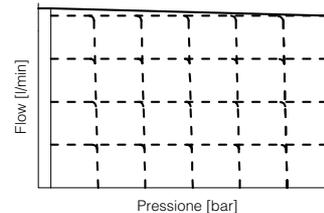
Proportional pressure setting range: see below pressure control diagram.  
 Compensator setting range (2): 20-350 bar (315 bar for 090)  
 Compensator factory setting (2): 280 bar (250 bar for 090)



**LQZ**

**Proportional flow (load-sensing)**

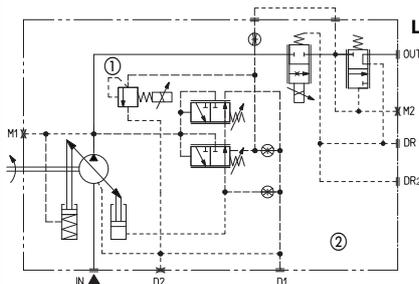
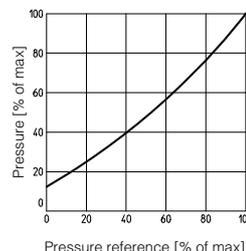
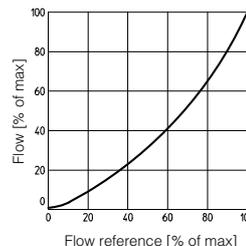
Open loop control of the flow rate via an reference signal to the electronic driver of the pilot proportional valve. This energy saving control regulates the outlet pressure up to the minimum level required to operate the flow set by the reference signal to the proportional valve (1).



**LZQZ**

**Proportional pressure & flow (load sensing)**

Open loop control of pressure (1) and flow (2) via two reference signals to the electronic drivers of the two pilot proportional valves. This energy saving control regulates the outlet pressure up to the minimum level required to operate the flow set by the reference signal. In addition the proportional pressure control reduces the outlet flow, as per CZ control once max pressure is reached. Minimum regulated pressure: 15 bar. For lower minimum regulated pressure, consult our technical office. Maximum allowed pressure: 250 bar



**LZQZR**

**Flow and pressure proportional control with sequence module.**

Same construction concept of LZQZ control, in addition it is equipped with RES (2) sequence module which ensures the minimum pump piloting pressure in case the system pressure drops below the minimum value (18 bar).

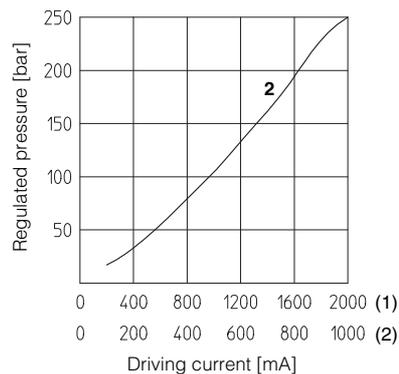
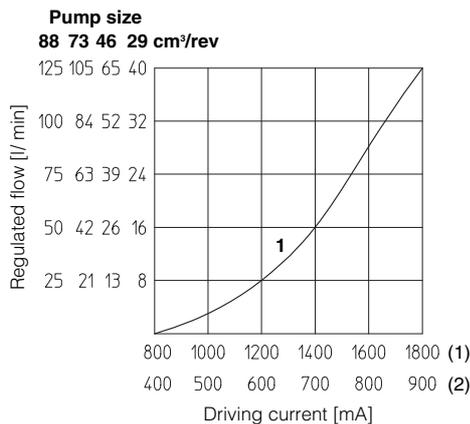
**Note:** DR2 is available only for size 50.

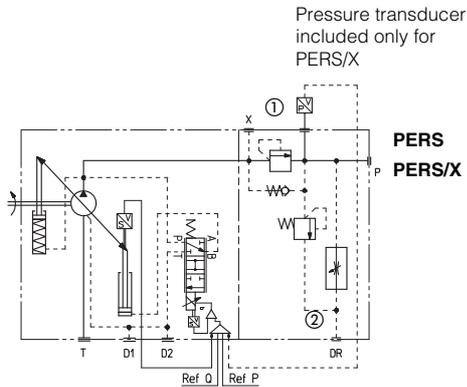
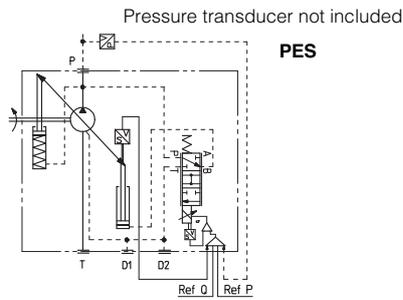
**Diagrams for CZ, LQZ, LZQZ**

**Regulation diagrams**

- 1 = Flow control
- 2 = Pressure control

- (1) for standard 12 Vdc coil
- (2) for 18 Vdc coil





Digital P/Q controller integrates the combined pressure and flow regulation with the electronic max power limitation.

A remote pressure transducer must be installed on the system and its feedback has to be interfaced to the pump digital driver. If the real value of the pressure in the system (measured by the pressure transducer) remains below the relevant reference signal, provided by the machine controller, then the digital driver regulates in closed loop the pump swash plate position, according to the flow reference signal. When the real pressure become close to the relevant reference signal, the driver automatically performs the closed loop control of the pressure. This option allows to realize accurate dynamic pressure profiles.

Following communication interfaces are available:

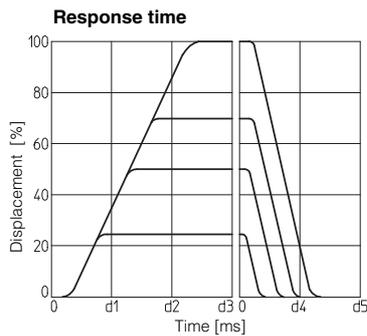
- -PS, RS232 serial communication interface. The pump reference signals are provided with analog commands via the 12 pins connector
- -BC, CANbus interface
- -BP, PROFIBUS-DP interface

In the -BC and -BP executions the pump reference signal are provided via fielbus; during start up or maintenance, the pump can be operated with analog signals via the 12 pins connector.

The digital control ensures high performances as flow and pressure linearity (see diagram 1), better flow knee (see diagram 2), internal leakage compensation (controlled flow independent to the load variations).

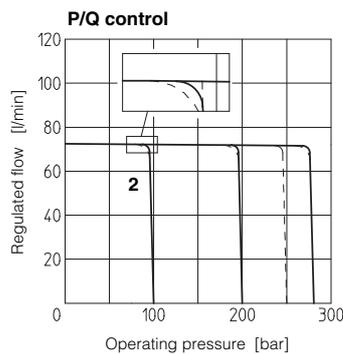
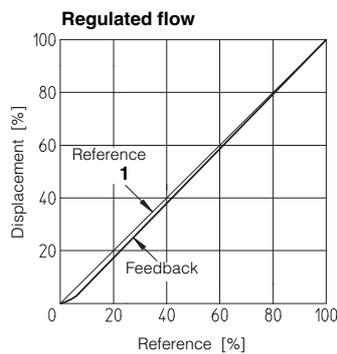
**PVPC-PES** basic version, without sequence module and without pressure transducer, which has to be installed on the main line and wired to the 12 poles connector of the integral digital electronics.

**PVPC-PERS** version with sequence module RES ② which grant a minimum piloting pressure (18 bar) when the actual pressure falls below that value. Without pressure transducer.



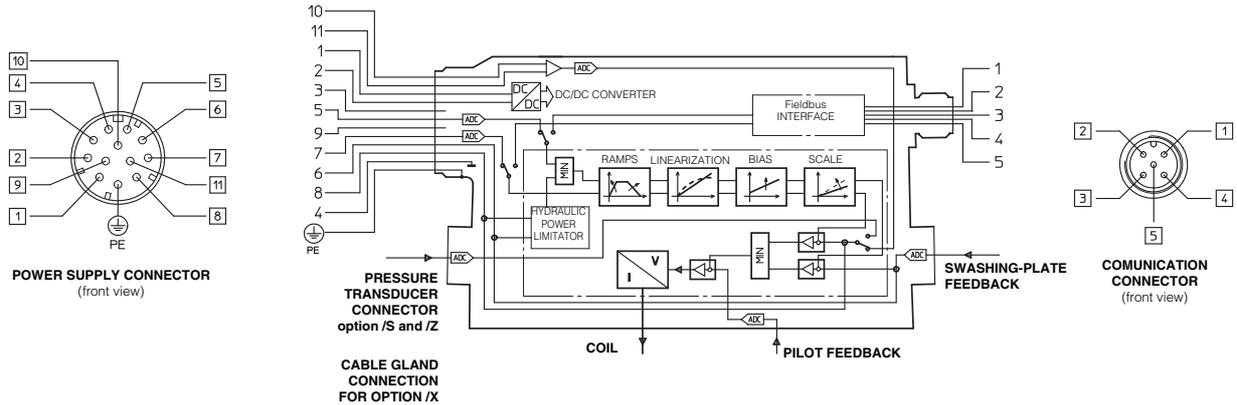
Type pump	d1	d2	d3	d4	d5
	[ms]				
<b>PVPC-PE(R)S-3029</b>	30	60	90	30	60
<b>PVPC-PE(R)S-4046</b>	40	80	120	40	80
<b>PVPC-PE(R)S-5073</b>	50	100	150	50	100
<b>PVPC-PE(R)S-5090</b>	60	120	170	60	120

Response time of displacement variation for a step change of the electronic reference signal.



## 8 ELECTRONIC AND WIRING BLOCK DIAGRAM PVPC-PE(R)S

For the electric wiring shielded cables must be provided: the shield must be connected to the power supply zero **on the generator side**, see tab. **F003**



POWER SUPPLY CONNECTOR			COMMUNICATION CONNECTOR				
PIN	DESCRIPTION SIGNAL	SIGNAL	Communication option	-PS (RS232) Male connector	-BC (CAN Bus) Male connector	-BP (PROFIBUS-DP) Female connector (reverse key)	
1	power supply 24 V <sub>DC</sub>	Stabilized: +24 V <sub>DC</sub>	PIN number - Signal description	1	CAN_SHLD	+5V Termination voltage	
2	power supply zero	Filtered-rectified: V <sub>rms</sub> 21-33 (ripple max 2 V <sub>pp</sub> )		2	NC	NC	LINE -A Bus line (high signal)
3	Fault	Alarm = 0 V <sub>DC</sub> Correct functioning = +24 V <sub>DC</sub>		3	RS_GND Signal zero data line	CAN_GND Signal zero data line	DGND Signal zero data line / termination voltage
4	Signal zero	Reference 0 V <sub>DC</sub>		4	RS_RX valves receiving data line	CAN_H Bus line (high signal)	LINE-B Bus line (low signal)
5	Input Q	0 ÷ 10 V <sub>DC</sub> (referred to pin 4)		5	RS_TX valves transmitting data line	CAN_L Bus line (low signal)	SHIELD
6	Monitor Q	0 ÷ 10 V <sub>DC</sub> (referred to pin 4)					
7	Pressure input signal	0 ÷ 10 V <sub>DC</sub> (referred to pin 4)					
8	Pressure monitor	0 ÷ 10 V <sub>DC</sub> (referred to pin 4)					
9	Power limitation enable	> 9 to +24 V <sub>DC</sub>					
10	Pressure feedback + V <sub>DC</sub>	0 ÷ 10 V <sub>DC</sub> pressure feedback (not connected with option /X)					
11	Pressure feedback 0	4 ÷ 20 mA with option /C					
PE	Earth	Connect only with supply not conforming to VDE 0551 (CEI 16/6)					

**Notes:** - Electrical signals (e.g. feedback signals) acquired via valve electronics must not be used to switch off the machine safety functions. This is in accordance with the European standards (Safety requirements of fluid technology systems and components - hydraulics, EN 982).  
- Installation notes with basic information for commissioning and start-up are always supplied with the relevant components, together with the specific technical tables.

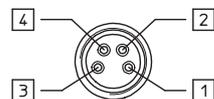
## 9 CONNECTION PVPC-PE(R)S/S and PVPC-PE(R)S/Z for detailed information, see tab. G215

POWER SUPPLY CONNECTOR (OPTION /S) only for /PS			POWER SUPPLY CONNECTOR (OPTION /Z) only for /BC and /BP		
PIN	SIGNAL DESCRIPTION	TECHNICAL SPECIFICATION	PIN	SIGNAL DESCRIPTION	TECHNICAL SPECIFICATION
1	Power supply 24 V <sub>DC</sub> (power stage)	Stabilized: +24 V <sub>DC</sub>	1	Power supply 24 V <sub>DC</sub> (power stage)	Stabilized: +24 V <sub>DC</sub>
2	Power supply 0 V <sub>DC</sub> (power stage)	Filtered and rectified: V <sub>rms</sub> 21-33 (ripple max 2 V <sub>pp</sub> )	2	Power supply 0 V <sub>DC</sub> (power stage)	Filtered and rectified: V <sub>rms</sub> 21-33 (ripple max 2 V <sub>pp</sub> )
3	Enable	Enabling input normal working 24 V <sub>DC</sub>	3	Enable	Enabling input normal working 24 V <sub>DC</sub>
4	Flow input signal	± 10 V <sub>DC</sub> - 0 ÷ 10 V <sub>DC</sub>	4	Flow input signal	± 10 V <sub>DC</sub> - 0 ÷ 10 V <sub>DC</sub>
5	Signal zero	Reference 0 V <sub>DC</sub>	5	Signal zero	Reference 0 V <sub>DC</sub>
6	Flow monitor	± 10 V <sub>DC</sub> referred to pin 5	6	Flow monitor	± 10 V <sub>DC</sub> referred to pin 5
7	Pressure input signal	± 10 V <sub>DC</sub> - 0 ÷ 10 V <sub>DC</sub>	7	Pressure input signal	± 10 V <sub>DC</sub> - 0 ÷ 10 V <sub>DC</sub>
8	Pressure monitor	± 10 V <sub>DC</sub> referred to pin 5	8	Pressure monitor	± 10 V <sub>DC</sub> referred to pin 5
9	PID selection	Zero or +24 V <sub>DC</sub>	9	Power supply 24 V <sub>DC</sub> (logic stage)	Stabilized: +24 V <sub>DC</sub>
10	(see section 4.3)		10	Power supply 0 V <sub>DC</sub> (logic stage)	Filtered and rectified: V <sub>rms</sub> 21-33 (ripple max 2 V <sub>pp</sub> )
11	Fault	Alarm = 0 V <sub>DC</sub> Correct functioning = +24 V <sub>DC</sub>	11	Fault	Alarm = 0 V <sub>DC</sub> Correct functioning = +24 V <sub>DC</sub>
PE	Earth	Connect only when the power supply is not conform to VDE 0551 (CEI 14/6)	PE	Earth	Connect only when the power supply is not conform to VDE 0551 (CEI 14/6)

### 9.1 Pressure transducer connector (options /S and /Z)

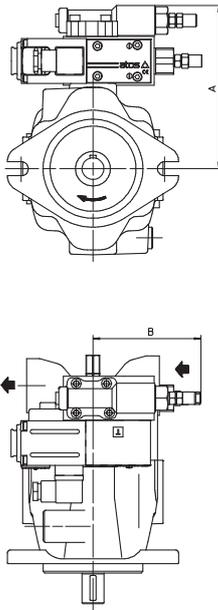
The pressure transducer and the 4 poles connector type **SP-ZH-4P-M8/5** have to be ordered separately. See tab. G460 for the pressure transducer.

PIN	options /S and /Z	option /C (R <sub>i</sub> = 316 Ω)
1	Pressure - real value	Pressure signal
2	Common zero for power supply and signal	Reserved (do not connect)
3	Transducer power supply 24 VDC	Power supply
4	Reserved (do not connect)	Reserved (do not connect)

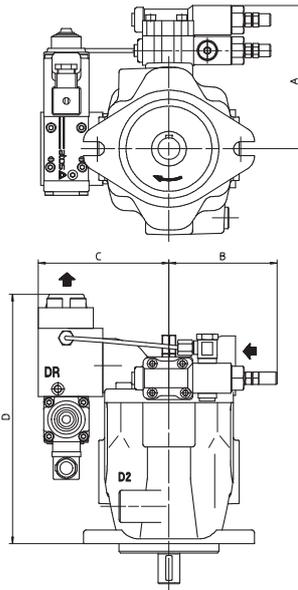


**PRESSURE TRANSDUCER CONNECTOR options /S and /Z**  
(front view)

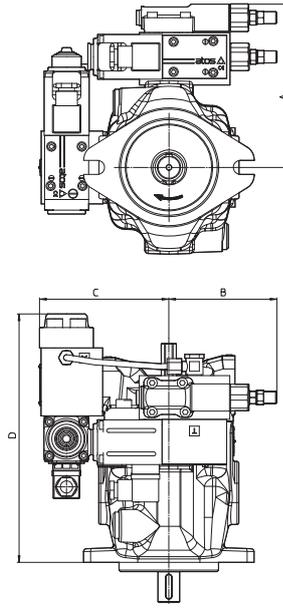
VERSION CZ



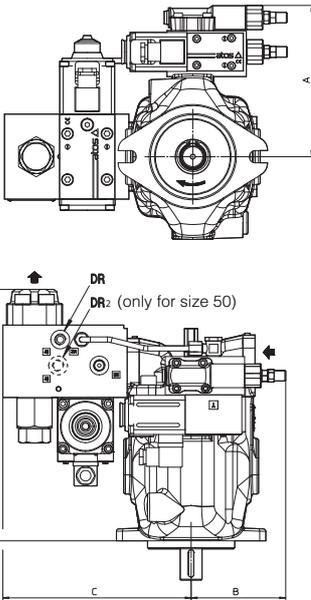
VERSION LQZ



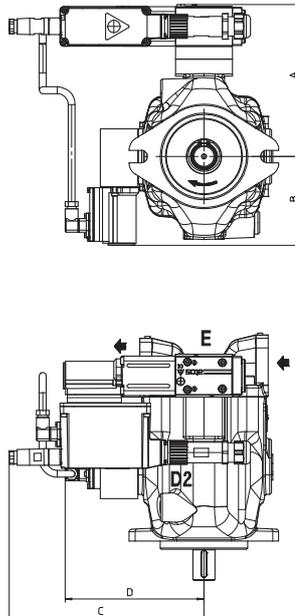
VERSION LZQZ



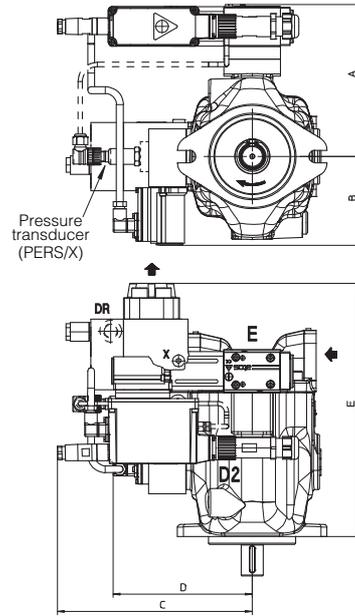
VERSION LZQZR



VERSION PES



VERSION PERS  
VERSION PERS/X (dotted line)



① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement (not available for versions PES, PERS and PERS/X).  
In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D); pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

Pump type	Version	A	B	C	D	E	Mass (kg)
PVPC-*-3029	CZ	168	111	-	-	-	22
	LQZ	144	111	132	257	-	24
	LZQZ	168	111	132	257	-	27,5
	LZQZR	168	111	185	185	-	29
PVPC-*-4046	CZ	177	111	-	-	-	28
	LQZ	153	111	156	293	-	33,6
	LZQZ	178	111	156	293	-	37,4
	LZQZR	178	111	220	296	-	39,5
PVPC-*-5073	CZ	190	111	-	-	-	36,9
	LQZ	166	111	163	328	-	44
PVPC-*-5090	LZQZ	190	111	163	328	-	47,6
	LZQZR	190	111	226	328	-	49,6
PVPC-*-3029	PES	170	103,5	246	155	-	21,6
	PERS	170	103,5	246	155	262,5	26
	PERS/X	190	103,5	246	226	262,5	26,4
	PERS	178	103,5	246	162	-	27,6
PVPC-*-4046	PERS	178	103,5	246	162	299	33,7
	PERS/X	178	103,5	246	162	299	34,1
	PES	190	103,5	246	171	-	36,6
PVPC-*-5073	PERS	190	103,5	246	171	337	46,7
	PERS/X	190	103,5	246	171	337	47,1