
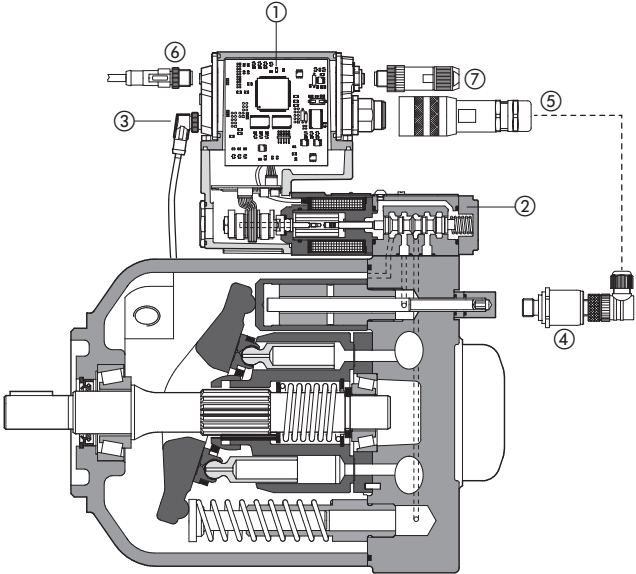


Digital electronic PES drivers with S option


integral-to-valve format, for variable displacement axial piston pumps with alternated P/Q control

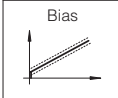


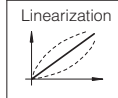


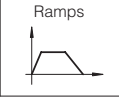
NP Not Present
BC CANopen
BP PROFIBUS DP
EH EtherCAT
EW POWERLINK


PVPC - PES-SP -

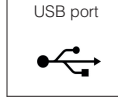

Scale

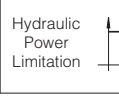

Bias

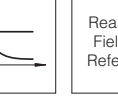

Linearization



Ramps


Enhanced Diagnostic


USB port


Hydraulic Power Limitation


Real Time Fieldbus Reference



E-SW
programming software

Transducer ④, connectors ⑤, ⑥, ⑦ not included, to be ordered separately

PES-S

Digital drivers ① are integral to the servoproportional valve ② which pilot the variable displacement of axial piston pumps performing in closed loop, the control of flow and pressure of the pump outlet line according to the two electronic reference input signals.

The P/Q alternated control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time. Flow regulation is active when the actual system pressure is lower than the relevant input reference signal - the valve works normally to regulate the flow by controlling in closed-loop the spool/poppet position through the integral LVDT transducer ③.

Pressure control is activated when the actual system pressure, measured by remote transducers ④, grows up to the relevant input reference signal - the driver reduces the pump's flow regulation in order to keep steady the system pressure.

If the pressure tends to decrease under its input reference signal, the flow control returns active.

The dynamic response of pressure control can be adapted to different system's characteristics, by setting the internal PID parameters using Atos PC software.

Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.

Electrical features:

- 12 pin main connector ⑤ for power supply, additional double power supply, enable and fault signals
- 5 pin USB connector ⑥ always present
- 3 leds for diagnostic (see 3.1)
- IN / OUT fieldbus communication connectors ⑦ (see section ⑤)
- /S option adds two on-off inputs for multiple pressure PID selection (NP execution) or double power supply (BC, BP, EH, EW execution) and dedicated 5 pin connector for remote pressure transducer
- /X option integral pressure transducer with preconfigured pressure settings
- Electrical protection against reverse polarity of power supply
- Operating temperature range -40° ÷ +60°
- IP66 / IP67 protection degree
- Rugged construction
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of pump's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- Setting of PID gains
- Hydraulic power limitation
- Selection of analog IN / OUT range
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 PUMPS RANGE

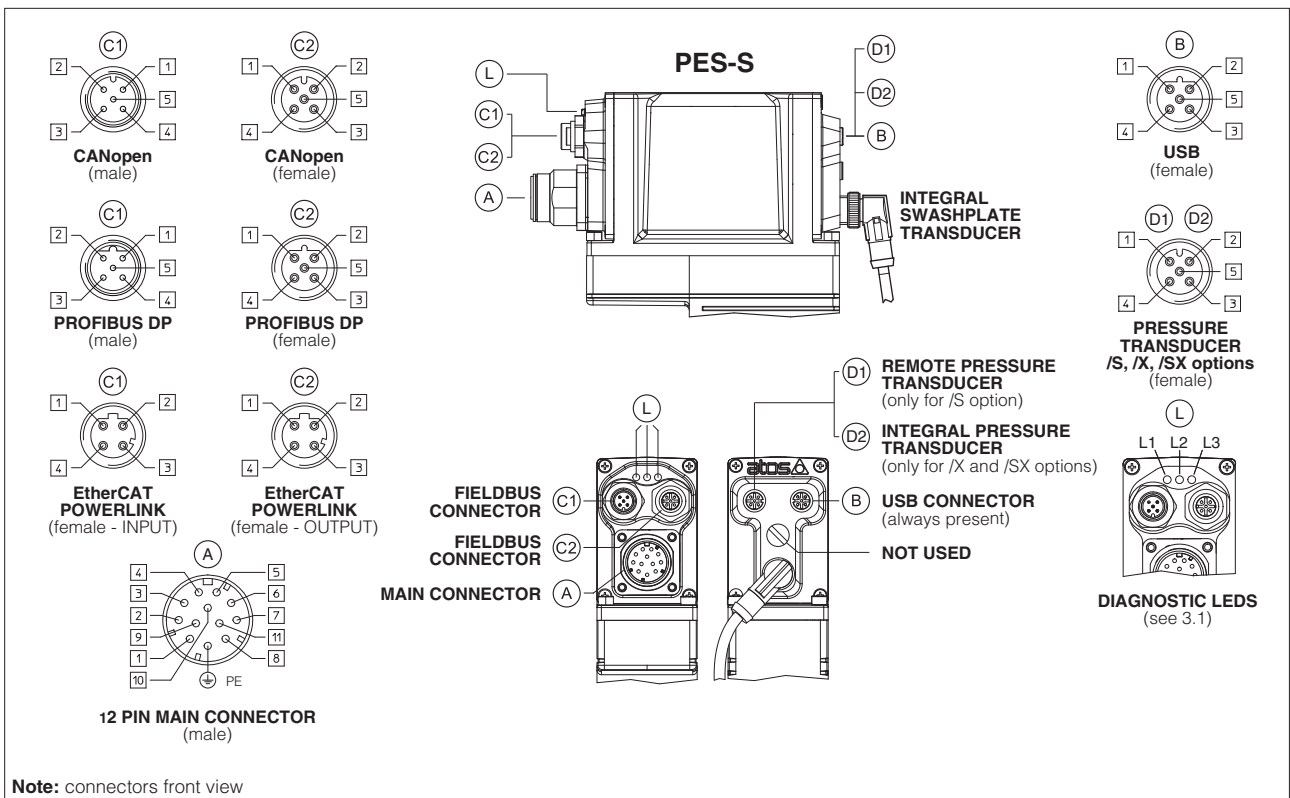
Pumps model	Proportional electrohydraulic control
	PVPC
Data sheet	A170
Driver model	PES-S

2 MAIN CHARACTERISTICS

Power supplies (see 4.1, 4.4)	Nominal : +24 V _{DC} Rectified and filtered : V _{RMS} = 20 ÷ 32 V _{MAX} (ripple max 10 % V _{PP})			
Max power consumption	50 W			
Reference input signals (see 4.2)	Voltage: range ±10 V _{DC} (24 V _{MAX} tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor outputs (see 4.3)	Output range: voltage ±10 V _{DC} @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 4.8)	Range: 0 ÷ 5 V _{DC} (OFF state), 9 ÷ 24 V _{DC} (ON state), 5 ÷ 9 V _{DC} (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 4.7)	Output range: 0 ÷ 24 V _{DC} (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			
Pressure transducers power supply	+24 V _{DC} @ max 100 mA			
Format	Sealed box on the valve; IP66 / IP67 protection degree with mating connectors			
Tropicalization	Tropical coating on electronics PCB			
Operating temperature	-40 ÷ +60 °C (storage -40 ÷ +70 °C)			
Mass	Approx. 510 g			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2004/108/CE (Immunity: EN 61000-2; Emission: EN 61000-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS 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 100 Base TX
Recommended wiring cable (see 9)	LiYCY shielded cables			

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

3 CONNECTIONS AND LEDS



Note: connectors front view

3.1 DIAGNOSTIC LEDS (L)

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

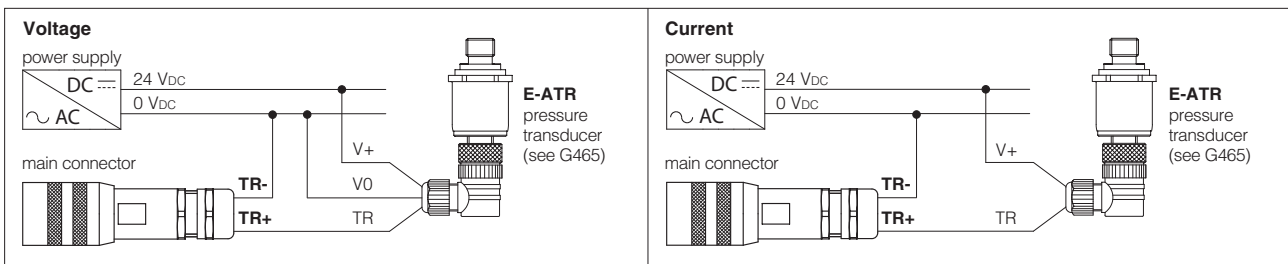
FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	L1 L2 L3
L1		VALVE STATUS		LINK/ACT		
L2		NETWORK STATUS		NETWORK STATUS		
L3		SOLENOID STATUS		LINK/ACT		

3.2 Main connector signals - 12 pin - standard and standard with /X option (A) - see 9.1

PIN	Standard	/X	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc (see 4.1)	Input - power supply
2	V0		Power supply 0 Vdc (see 4.1)	Gnd - power supply
3	FAULT		Fault (0 Vdc) or normal working (24 Vdc), referred to V0 (see 4.7)	Output - on/off signal
4	INPUT-		Negative reference input signal for Q_INPUT+ and P_INPUT+	Input - analog signal
5	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range (see 4.2)	Input - analog signal Software selectable
6	Q_MONITOR		Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to V0 (see 4.4)	Output - analog signal Software selectable
7	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range (see 4.3)	Input - analog signal Software selectable
8	P_MONITOR		Pressure monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to V0 (see 4.5)	Output - analog signal Software selectable
9	D_IN		Function software selectable between: power limitation enable (default), multiple pressure PID selection or pump Enable (24 Vdc) / disable (0 Vdc). Referred to V0 (see 4.10)	Input - on/off signal
10	TR+		Remote pressure transducer input signal: ± 10 Vdc / ± 20 mA maximum range (see 4.9) Differential mode input	Input - analog signal Software selectable
		NC	Do not connect	
11	TR-		Negative pressure transducer input signal for TR+ Differential mode input	Input - analog signal
		NC	Do not connect	
PE	EARTH		Internally connected to driver housing	

Note: these connections are the same of Rexroth A10VSO axial piston pumps, model SYDFEE and SYDFEC

Remote pressure transducer connections - only for standard



3.3. Main connector signals - 12 pin - /S and /SX option (A) - see 9.1

PIN	/S and /SX		TECHNICAL SPECIFICATIONS	NOTES
	NP	BC, BP, EH		
1	V+		Power supply 24 Vdc (see 4.1)	Input - power supply
2	V0		Power supply 0 Vdc (see 4.1)	Gnd - power supply
3	ENABLE referred to: V0	VLO	Enable (24 Vdc) or disable (0 Vdc) the pump (see 4.8)	Input - on/off signal
4	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range (see 4.2)	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+ and P_INPUT+	Input - analog signal
6	Q_MONITOR referred to: V0	VLO	Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range (see 4.4)	Output - analog signal Software selectable
7	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range (see 4.3)	Input - analog signal Software selectable
8	P_MONITOR referred to: V0	VLO	Pressure monitor output signal: ± 10 Vdc / ± 20 mA maximum range (see 4.5)	Output - analog signal Software selectable
9	D_IN0		Function software selectable between: multiple pressure PID selection (default) or power limitation enable. Referred to V0	Input - on/off signal
		VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	D_IN1		Function software selectable between: multiple pressure PID selection (default) or power limitation enable. Referred to V0	Input - on/off signal
		VL0 (1)	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT referred to: V0	VLO	Fault (0 Vdc) or normal working (24 Vdc) (see 4.7)	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Notes: these connections are the same of Moog radial piston pumps, model RKP-D

(1) do not disconnect VL0 before VL+ when the driver is connected to PC USB port

3.4 Communication connectors (B) - (C) - see 9.3

(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 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

3.5 Pressure transducer connector - M12 - 5 pin - only for /S, /X, /SX options (D1) - (D2) - see 9.2

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vdc	Connect	Connect
2	TR	Signal transducer ± 10 Vdc / ± 20 mA maximum range, software selectable - see 4.9	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

4 SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity/Emission EMC Directive).

Installation, wirings and start-up procedures must be performed according to the prescriptions shown in tech table **F003** and in the user manuals included in the E-SW programming software.

The electrical signals of the driver (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.

4.1 Power supply (V+ and V0)

The power supply to the solenoids must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

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

4.2 Flow reference input signals (Q_INPUT+)

Functionality of Q_INPUT+ signal, is used as reference for the pump's flow.

Reference input signal is factory preset according to selected pump code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH, EW) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

4.3 Pressure reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal, is used as reference for the driver pressure closed loop.

Reference input signal is factory preset according to selected pump code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH, EW) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

4.4 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual pump swashplate position; 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 pump code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

4.5 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure on the pump outlet line; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, pressure reference).

Monitor output signal is factory preset according to selected pump code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

4.6 Power supply for driver's logic and communication (VL+ and VL0) - only for /S and /SX options for BC, BP, EH, EW executions

The power supply to the solenoids must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, USB and fieldbus communication.

A safety fuse is required in series to each driver power supply: 500 mA fast fuse.

4.7 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference or pressure/swashplate/pilot transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.

Fault status is not affected by the status of the Enable input signal.

Fault output signal can be used as digital output by software selection.

4.8 Enable input signal (ENABLE) - only for /S and /SX options

To enable the driver, supply 24 Vdc on pin 3: 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 European Norms EN13849-1 (ex EN954-1).

Enable input signal can be used as digital input by software selection.

4.9 Pressure transducer input signal

Analog pressure transducers can be directly connected to the driver.

Analog input signal is factory preset according to selected pump code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Refer to the pump technical table to transducer characteristics to select the transducer's maximum pressure.

Standard:

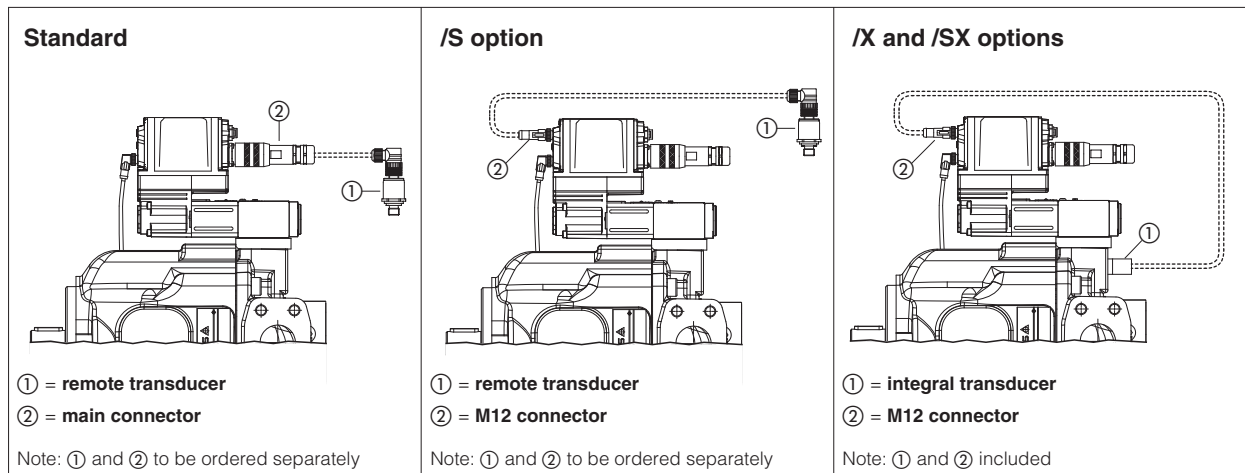
Remote pressure transducer can be directly connected to the main connector on the driver (see 3.2)

/S option

Remote pressure transducer can be directly connected to a dedicated M12 connector (see 3.5)

/X and /SX options

Integral-to-pump transducer is directly connected with a dedicated M12 connector and no remote transducer is required; current input signal ($4 \div 20$ mA) of the integral transducer allows cable break detection functionality



4.10 Logic Input Signal (D_IN) - only for standard and standard with /X option

D_IN on-off input signal can be software set to perform one of the following functions:

- enable and disable the driver functioning (apply 0 Vdc to disable and 24 Vdc to enable the driver) - see 4.8
- switch between two pressure PID settings (apply 0 Vdc to select SET1 pressure PID and 24 Vdc to select SET2) - see 4.11
- enable and disable the power limitation function (default setting, apply 0V to disable and 24Vdc to enable the power limitation) - see 7.7

4.11 Multiple PID selection (D_IN0 and D_IN1) - only for /S and /SX options in NP execution

Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 Vdc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

4.12 Possible combined options: /SX

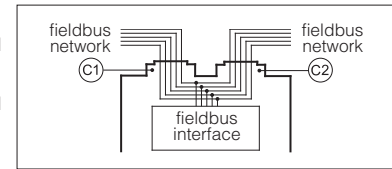
5 IN / OUT FIELDBUS COMMUNICATION CONNECTOR

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW. 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 and EW execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



6 PROGRAMMING TOOLS - see tech table **GS500**

Pump'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 pump's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

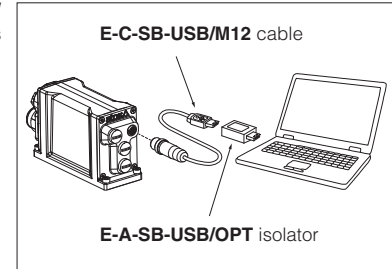
The software is available in different versions according to the driver's options:

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



Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.download.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.download.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*/N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.download.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers with alternated P/Q control.

For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-RI-PES - user manual for **PES-S** digital drivers

7.1 Scale

Scale function allows to set the maximum pump flow and pressure at maximum reference signal value. This regulation allows to reduce the maximum pump regulations in front of maximum reference signal. Two different Scale regulations are available for flow and pressure.

7.2 Bias

The Bias function can be set to limit internally the minimum flow and pressure references independently from the external reference value thus optimizing pumps's performances. Refer to the programming manuals for a detailed description of other software selectable Bias functions.

7.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of both pump regulations.

Different ramp mode can be set (separately for flow and pressure):

- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the pump is driven by a closed loop driver, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

7.4 Linearization

Linearization function allows to set the relation between the reference input signal and the controlled pump's regulation (separately for flow and pressure).

Linearization is useful for applications where it is required to linearize the pump's regulation in a defined working condition.

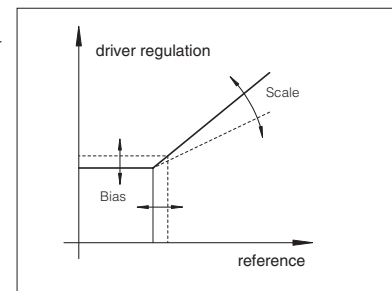
7.5 Dither

The dither is an high frequency modulation added to the pump reference signal (flow and pressure) to reduce the hysteresis of the pump regulations; in fact a small vibration in the pump hydraulic regulation considerably reduces the mechanical friction effects (e.g. due to cylinder seals).

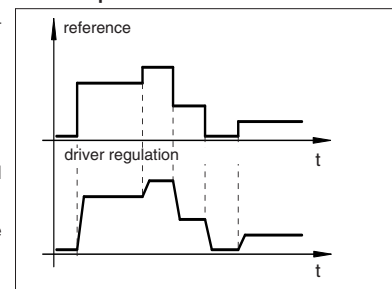
Dither frequency and amplitude are software selectable; the amplitude is automatically reduced at high reference values (high regulated flow) to avoid possible instability.

Lower frequency and higher amplitude reduce hysteresis but also reduce the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup. Dither default setting is disabled.

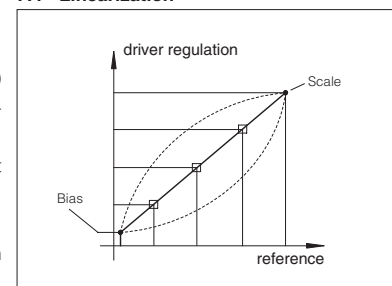
7.1, 7.2 - Scale, Bias



7.3 - Ramps



7.4 - Linearization



7.6 Multiple pressure PID

Four sets for pressure PID parameters are stored into the driver: switching in real-time the active pressure PID parameters during machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

The available commands to switch these PID pressure sets depend on the driver execution:

Fieldbus	Driver	Commands
NP	Standard and Standard with /X option	1 on-off input on main connector allow to switch the 2 PID parameters (SET1 and SET2, see 4.10)
	/S and /SX options	2 on-off inputs allow to switch the 4 PID parameters set (SET1.. SET4 - see 4.11)
BC, BP, EH, EW	All versions	real-time fieldbus communication can switch between the 4 PID parameters set (SET1 - SET4 - see driver manuals)

7.7 Hydraulic Power Limitation

A limit to the maximum pump's hydraulic power can be software set into the driver thus limiting the electric power consumption of the motor coupled to the pump: when the actual requested hydraulic power $p \times Q$ (pressure transducer feedback x flow reference value) reaches the max power limit ($p_1 \times Q_1$), the driver automatically reduces the flow pump regulation.

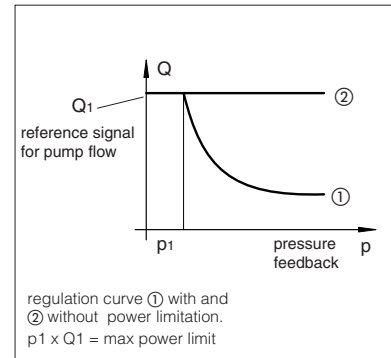
The higher is the pressure feedback the lower is the pumps's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [kW]}}{\text{Pressure Feedback [bar]} \times \frac{1}{\text{Flow Full Scale [l/min]}}}; \text{Flow Reference} \right)$$

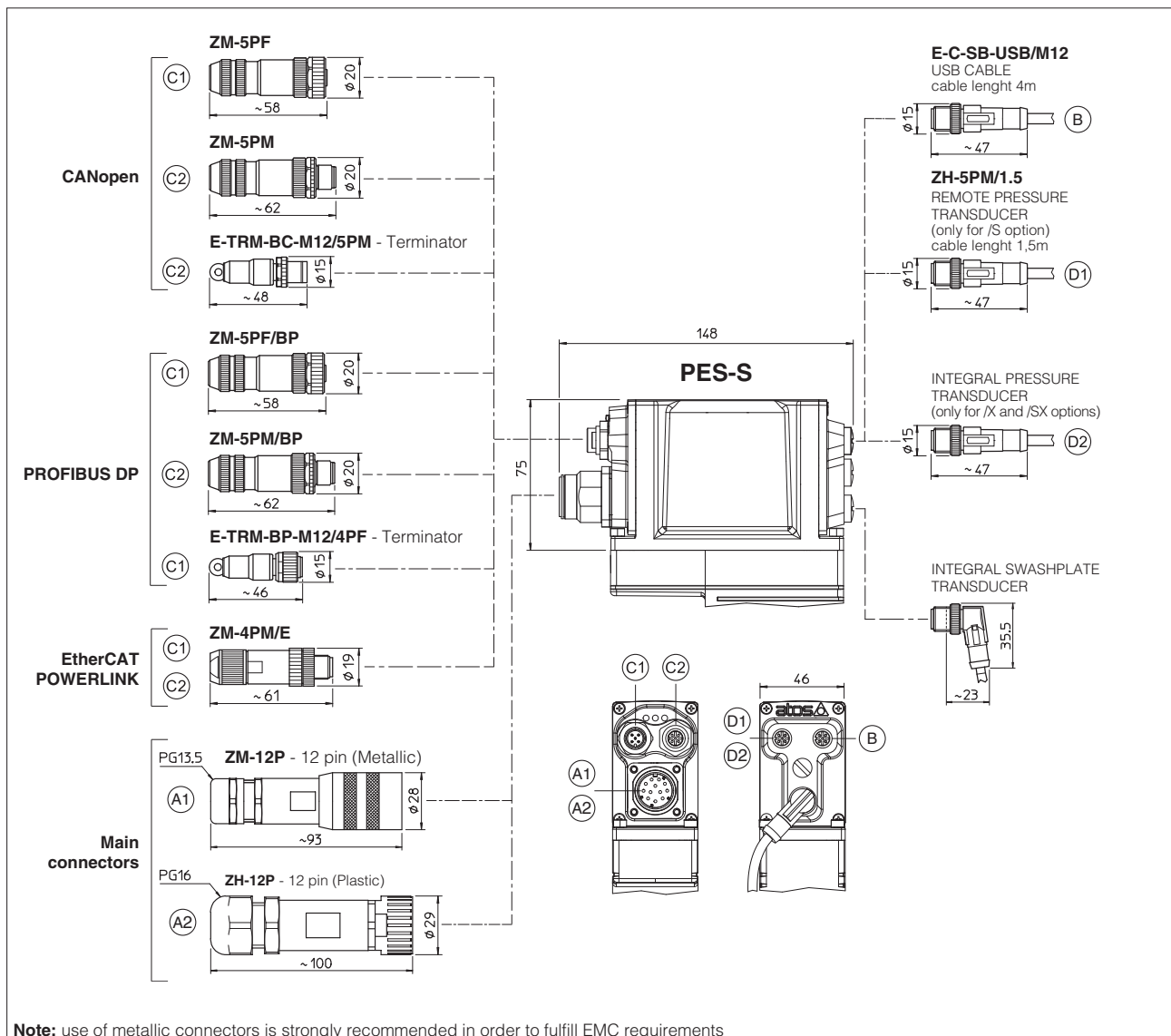
The hydraulic power limitation, disabled as default, can be enabled using the Atos pc software or the fieldbus communication (BC, BP, EH executions).

Standard and standard with /X option allow also to enable and disable this function during the machine cycle, using the D_IN on-off input available on the main connector (see 4.10).

7.7 - Hydraulic Power Limitation



8 OVERALL DIMENSIONS [mm]



9 CONNECTORS CHARACTERISTICS - to be ordered separately

9.1 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	A1 ZM-12P	A2 ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5 ()	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

9.2 Remote pressure transducer connectors

CONNECTOR TYPE	D1 PRESSURE TRANSDUCER
CODE	ZH-5PM/1.5
Type	5 pin male straight circular
Standard	M12 coding A – IEC 60947-5-2
Material	Plastic
Cable gland	Connector moulded on cables 1,5 m length
Cable	3 x 0,25 mm ²
Connection type	molded cable
Protection (EN 60529)	IP 67

9.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK (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 60947-5-2		M12 coding B – IEC 60947-5-2		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)	IP 67		IP 67		IP 67

Notes: (1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) internally terminated

10 MODEL CODE FOR SPARE PARTS

Integral drivers are available as spare parts only for Atos authorized service centers.

E-RI	-	P	-	ES	-	S	-	NP	-	01H	/	*	*	*
Integral electronic driver P = closed loop integral digital P/Q driver with 1 LVDT angular transducer and 1 remote pressure transducer ES = full Alternated P/Q control: S = closed loop pressure control Fieldbus interface , USB port always present: NP = Not Present BC = CANopen BP = PROFIBUS DP EH = EtherCAT EW = POWERLINK													Series number	Set code (1)
Options , see section 3 : - = standard with pressure transducer included on main connector X = integral pressure transducer with pre-configured pressure settings S = with 2 on-off inputs for multiple pressure PID selection for NP execution or double power supply for BC, BP, EH, EW execution, plus dedicated connector for remote pressure transducer													01H = for single solenoid proportional valves	

(1) set code identifies the correspondance between the integral driver and the relevant valve; it is assigned by Atos when the driver is ordered as spare part