Integral electronic drivers type **E-RI-TES, E-RI-LES**
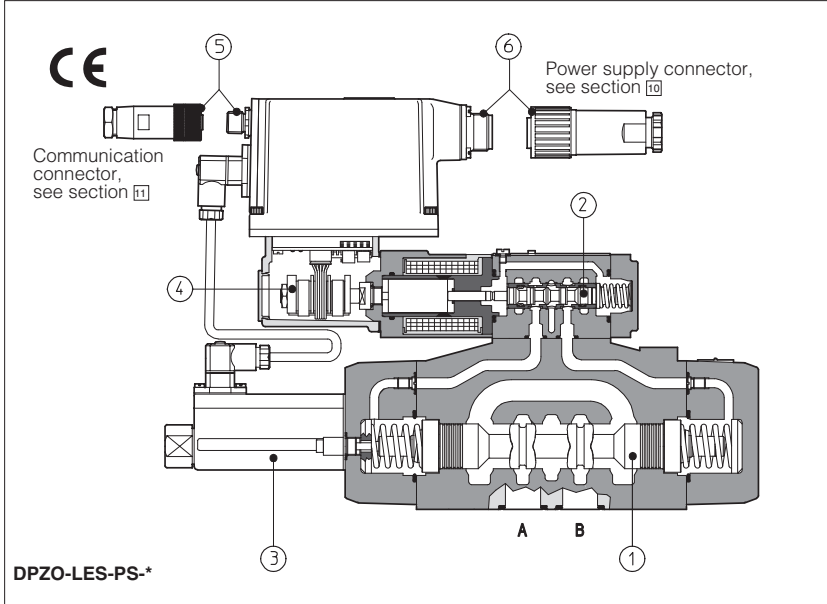
digital, for proportional valves with one or two position transducers

DPZO-LES-PS-*

These digital drivers are integral to the Atos proportional valves and they control in closed loop the spool position ① and ② according to the electronic reference signal.

They are available in two different executions:

- -TES for proportional valves with single position transducer ③
- -LES for proportional valves with double position transducers ③ , ④

Features

- Integral digital electronics, factory preset
- Software setting of the main functional parameters as bias, scale, ramps, by means of the relevant programming devices KIT-E-SW-*, see section 8
- Possibility to optimize the application performances modifying via software the intenal parameters as the dynamic response (P.I.D.) and the regulation characteristic of the valve (linearization)
- Possibility of real time selection of different PID parameters set during the axis motion (options /SP and /ZP)
- Standard execution with 7 pin power supply connector, see section 2
- 12 pin power supply connector for safety option /Z and for P/Q options /SP and /ZP, see section 3.

Following communication interfaces ⑤ are available:

- -PS, RS232 serial communication interface. The valve reference signal is provided with analogue commands via the 7 (or 12) pin connector ⑥
- -BC, CANbus interface
- -BP, PROFIBUS-DP interface

In the -BC and -BP interfaces the valve reference signal is provided via fielbus; during start up or maintenance, the valves can be operated with analogue signals via the 7 (or 12) pin connector ⑥

- IP67 protection degree.
- 3,3A maximum current to the coils.
- CE marking grants the conformity to the EMC Directive (Electromagnetic Compatibility).
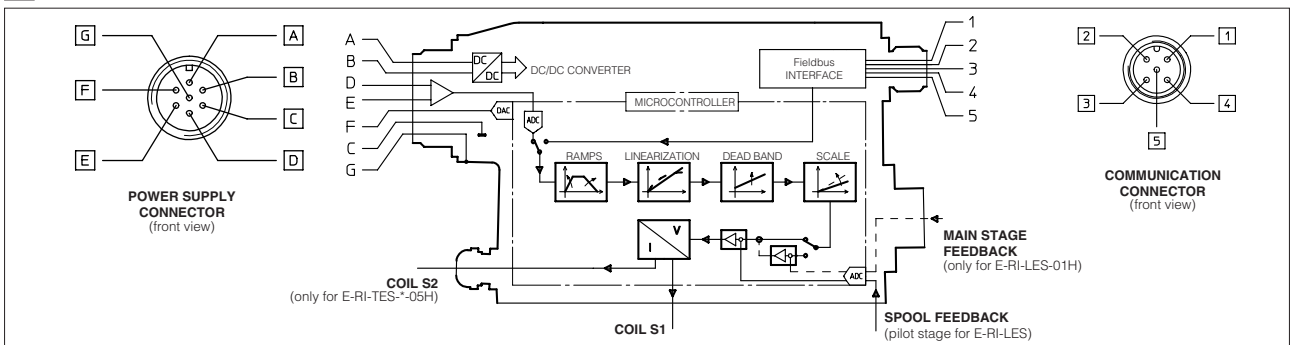
1 MODEL CODE

| E-RI | -TE | S | -PS | -01H | * | ** / * |

Integral electronic driver

TE = for proportional valves with single position transducer

LE = for proportional valves with double position transducers

S = digital electronic

Communication interfaces
PS = RS232 serial **BC** = CAN-Bus **BP** = PROFIBUS-DP

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for -TES)

Set code (see note)

Series number

Options (12 pin connector), see section 4:
C = remote pressure transducer with current feedback 4÷20 mA - **only for options /SP and /ZP**
SP = additional closed loop pressure control with multiple PID parameters set - **only for -PS**
Z = double power supply, enable and fault
ZP = as SP but with double power supply, enable and fault - **only for -BC and -BP**

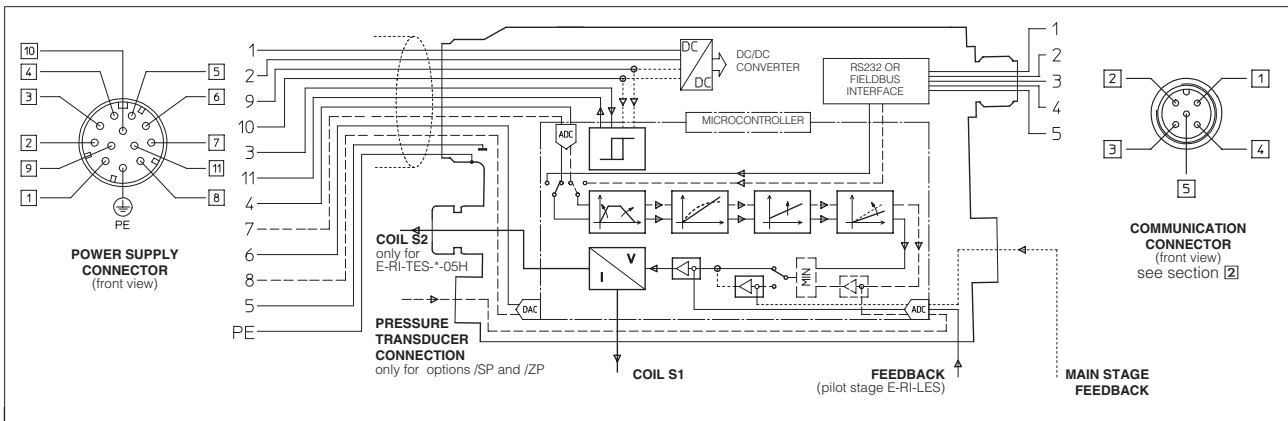**Note:** the set code identifies the corrispondance between the digital integral driver and the relevant valve.

2 ELECTRONIC AND WIRING BLOCK DIAGRAM FOR -TES AND -LES (7 PIN CONNECTOR)

POWER SUPPLY CONNECTOR
(front view)

COIL S2
(only for E-RI-TES-*-05H)

COIL S1

MAIN STAGE FEEDBACK
(only for E-RI-LES-01H)

SPOOL FEEDBACK
(pilot stage for E-RI-LES)

COMMUNICATION CONNECTOR
(front view)

Note: with –BC and –BP options, the connections D-E-F can be used to operate the valve with analogue signals during start-up or maintenance

	POWER SUPPLY CONNECTOR			COMMUNICATION CONNECTOR		
PIN	SIGNAL DESCRIPTION	TECHNICAL SPECIFICATION	Communication options	**–PS** (RS232) male connector	**–BC** (CAN Bus) male connector	**–BP** (PROFIBUS-DP) female connector (reverse key)
A	Power supply 24 V_{DC}	Stabilized: +24V_{DC}	1	NC	CAN_SHLD	+5V
B	Power supply zero	Filtered and rectified: V_{rms} = 21 ÷ 33 (ripple max 2 V_{PP})		Not Connected	Shield	Termination voltage
C	Signal zero	Reference 0 V_{DC}	2	NC	NC	LINE -A
				Not Connected	Not Connected	Bus line (high)
D	Input signal +	0 ÷ 10 V_{DC} Depending to the valve type	3	RS_GND	CAN_GND	DGND Signal zero data line
E	Input signal -	± 10 V_{DC} (see the relevant technical table)		Signal zero data line	Signal zero data line	/ termination voltage
F	Monitor	0 ÷ 10 V Depending to the valve type ± 10 V (see the relevant technical table) 1 V = 10% of spool position	4	RS_RX	CAN_H	LINE-B
				Valves receiving data line	Bus line (high)	Bus line (low)
G	Earth	Connect only when the power supply don't conform to VDE 0551 (CEI 14/6)	5	RS_TX	CAN_L	SHIELD
				Valves transmitting data line	Bus line (low)	Shield

POWER SUPPLY CONNECTOR (front view)

COIL S2 only for E-RI-TES-*-05H

PRESSURE TRANSDUCER CONNECTION only for options /SP and /ZP

COIL S1

FEEDBACK (pilot stage E-RI-LES)

MAIN STAGE FEEDBACK

DC/DC CONVERTER

RS232 OR FIELDBUS INTERFACE

MICROCONTROLLER

COMMUNICATION CONNECTOR (front view) see section 2

PIN	SIGNAL DESCRIPTION	TECHNICAL SPECIFICATION	PIN	SIGNAL DESCRIPTION	OPTION /SP	OPTION /ZP
	POWER SUPPLY CONNECTOR (OPTION /Z)			**POWER SUPPLY CONNECTOR**		
					TECHNICAL SPECIFICATION	
1	Power supply 24 V_{DC} (power stage)	Stabilized: +24 V_{DC}	1	Power supply 24 V_{DC} (power stage)	Stabilized: +24 V_{DC}	
2	Power supply 0 V_{DC} (power stage)	Filtered and rectified: Vrms 21-33 (ripple max 2 Vpp)	2	Power supply 0 V_{DC} (power stage)	Filtered and rectified: Vrms 21-33 (ripple max 2 Vpp)	
3	Enable	Enabling input normal working 24 V_{DC}	3	Enable	Enabling input normal working 24 V_{DC}	
4	Input signal +	± 10 V_{DC} - 0 ÷10 V_{DC}	4	Flow input signal	± 10 V_{DC} - 0 ÷10 V_{DC}	
5	Signal zero	Reference signal 0 V_{DC}	5	Signal zero	Reference 0 V_{DC}	
6	Monitor (spool position)	±10 V_{DC} referred to pin 5 1V = 10% of spool position	6	Flow monitor	± 10 V_{DC} referred to pin 5	
7	NC	Not connected	7	Pressure input signal	± 10 V_{DC} - 0 ÷10 V_{DC}	
8	NC	Not connected	8	Pressure monitor	± 10 V_{DC} referred to pin 5	
9	Power supply 24 V_{DC} (logic stage)	Stabilized: +24 V_{DC}	9	Depending to	PID selection (see 4.2)	Power supply +24 V_{DC} (logic stage)
10	Power supply 0 V_{DC} (logic stage)	Filtered and rectified: Vrms 21-33 (ripple max 2 Vpp)	10	option /SP or /ZP		Power supply 0 V_{DC} (logic stage)
11	Fault	Alarm = 0 V_{DC} Correct functioning = +24 V_{DC}	11	Fault	Alarm = 0 V_{DC} Correct functioning = +24 V_{DC}	
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)	

4   OPTIONS

4.1 Option /Z (12 pin connector)

Safety option, specifically introduced for -BC and -BP communication interfaces, provides two separated electric power supplies for the digital electronic circuits and for the solenoid power supply stage. The Enable and Fault signals are also available.

- **Double power supply - Pin 1, 2 / 9, 10**

  The double power supply allows to interrupt the valve functioning by cutting the solenoid power supply (pin 1 and 2) 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 (pin 9 and 10), thus avoiding fault conditions of the machine fieldbus controller.
  Pin 2 and 10 (zero Volt) are connected together inside the electronics.

- **Enable signal - Pin 3**

  Safety function providing the possibility to enable or disable the valve functioning without cutting the power supply. This is particularly useful when the valve functioning has to be disabled regularly during the machine cycle. Removing the enable command, it is possible to inhibit the valve driver, with the consequent interruption of the valve operations. The driver is active with an enabling signal +9 to +24VDC.

- **Fault signal - Pin 11**

  Safety function providing an output signal which switches to zero in case of interruption of the transducer feedback cable. In this condition the valve functioning is disabled.

4.2 Option /SP (12 pin connector)

Option providing in addition to the standard valve functions, a closed loop control of the max pressure, thus realizing a P/Q regulation. A remote pressure transducer must be installed on the system and its feedback has to be interfaced to the valve. If the real value of the pressure in the system remains below the relevant reference signal, the driver regulates in closed loop the valve's spool 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 permits to realize accurate dynamic pressure profiles. Up to 4 set of PID pressure parameters can be real time selected during the axis motion via on-off signals to the 12 pin connector to optimize the control performances in the different phases of the machine cycle.

The selection of the PID parameters set must be performed according the sequence: set 1 → set 2 → set 3 → set 4 and viceversa.

PID SET SELECTION				
PIN	SET 1	SET 2	SET 3	SET 4
9	0	0	24 V_{DC}	24 V_{DC}
10	0	24 V_{DC}	24 V_{DC}	0

4.3 Option /ZP (12 pin connector)

Integral digital P/Q controller providing the same characteristics of option **/SP** plus additional double power supply, enable and fault, like option **/Z**. In this option the multiple set of PID pressure parameters can be real time selected during the axis motion through the -BC or -BP interfaces.

4.4 Option /C (compatible only with options /SP and /ZP)

The electronics is set to receive 4÷20 mA signal from the remote pressure tranducer instead of standard 0÷10 V. In case of breakage of the transducer feedback cable the driver functioning is disabled.

4.5 Pressure transducer connector (options /SP and /ZP)

The pressure transducer and the 4 pin connector type **SP-ZH-4P-M8/5** have to be ordered separately. See section 11 for the 4 pin connector and tab. G460 for the pressure transducer.

PIN	options /SP and /ZP	options /CSP and /CZP (Ri = 316 Ω)	CONNECTOR (front view)
1	Pressure - real value	Pressure signal	
2	Common zero for power supply and signal	Reserved (do not connect)	
3	Transducer power supply +24 V_{DC}	Power supply	
4	Reserved (do not connect)	Reserved (do not connect)	

### 4.6 Current reference signal (option /I)

The digital drivers type -TES and -LES can be supplied, **on request,** with special execution 4÷20 mA current reference signal and feedback signal, instead of the standard ±10 V.

5 MAIN CHARACTERISTICS OF DIGITAL INTEGRAL ELECTRONIC DRIVERS

Driver section	
Format	Sealed box on the valve - Protection: IP67 DIN 40050 - Insulation: VDE0110
Electromagnetic compatibility (EMC)	Emission: EN 50081-2 - Immunity: EN 50082-2
Max power consumption	50 W
Current supplied to solenoid	Imax= 3.3 A square wave PWM type
Analog input signal impedance	Voltage signal Ri > 50 KΩ
Operating temperature	-20°C ÷ +60°C (storage –20°C ÷ +70°C)
Alarm messages	Electronic overcurrent and overtemperature
Features	Position control by P.I.D. - Rapid solenoid excitation and switching off – Output to solenoids protected against accidental short circuits – Feedback cable break produces an inhibition of the driver, zeroing the current to the solenoid

Communication options	RS232 interface (option -PS)	CAN-Bus interface (option -BC)	Profibus-DP interface (option -BP)
Serial input format	RS232C serial connection	Industrial field-bus with optical insulation type CAN-Bus ISO 11898	Industrial field-bus with optical type PROFIBUS - DP European fieldbus standard EN 50170 part 2
Communication Protocol	Atos protocol with ASCII coding	CANopen EN50325-4 Device Profile DS408	PROFIBUS - DP EN50170-2 IEC61158
Programming interface - see section 8	Software interface (see tab. G500)	Software interface (see tab. G500) or Master CAN-Bus device	Software interface (see tab. G500) or Master PROFIBUS device

Note: A minimum time of 300 to 500 ms have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.
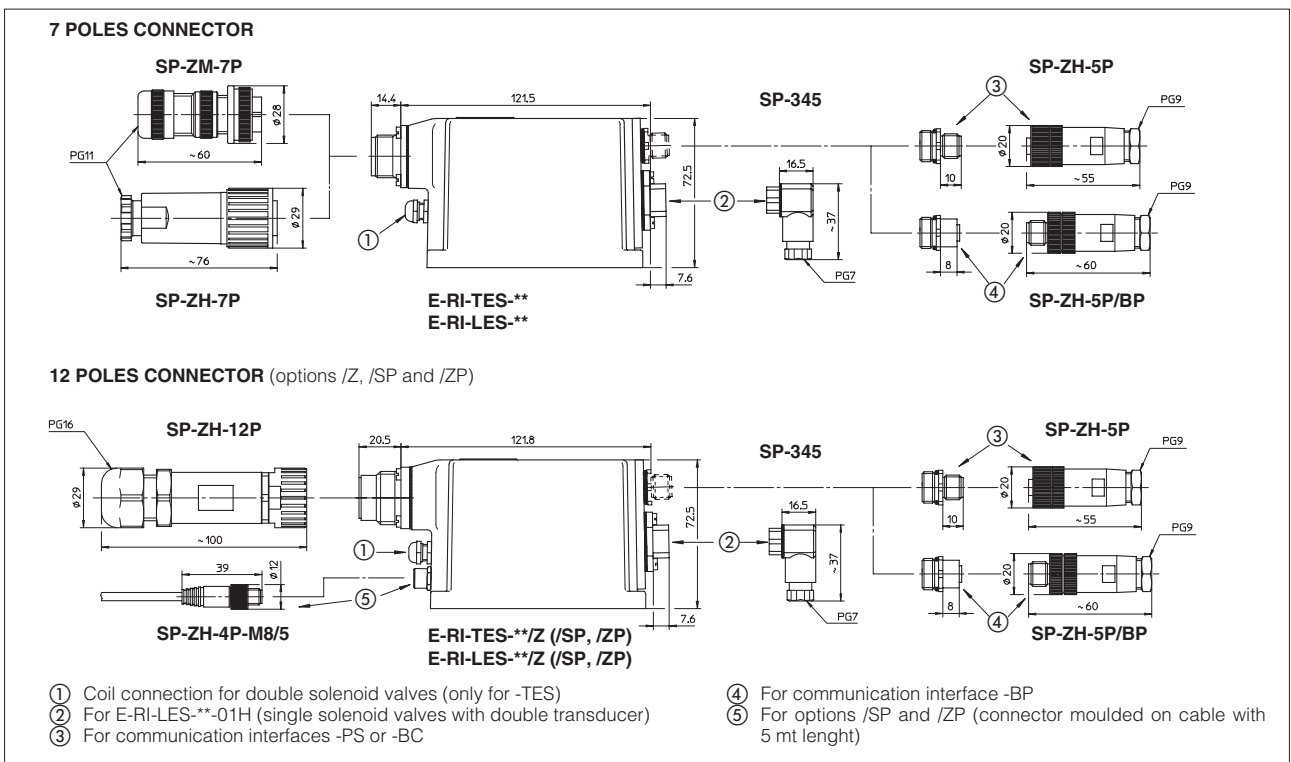
6 SOFTWARE SETTINGS

SCALE AND BIAS   **UP AND DOWN RAMPS**   **LINEARIZATION**
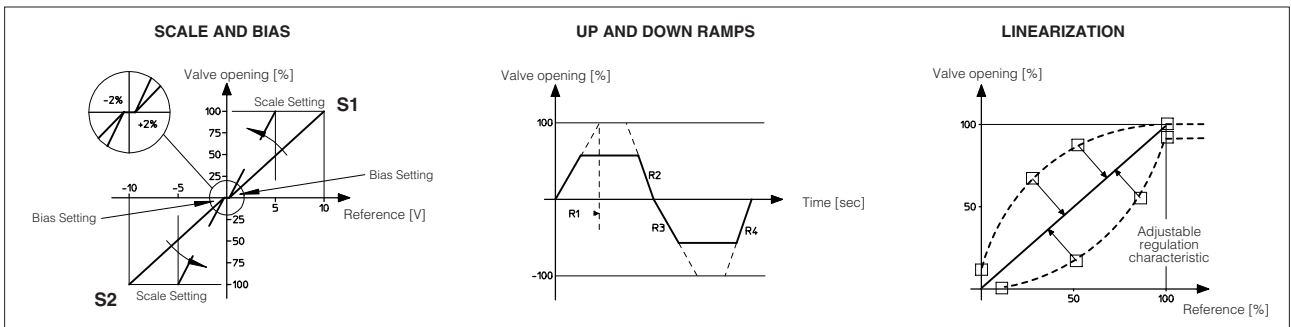
In addition to the above settings, other software regulations are available:
- Customized configuration of the reference signal, instead of standard ± 10V
- Internal self generation of the reference signal. This function is particularly useful during start-up or maintenance
- P.I.D. parameters setting to optimize at the valve dynamic control
- Alarm setting of the high/low limits of the electronics temperature
- Alarm setting of the control deviation (max difference between the reference signal and the spool monitor after a selected time).

7 DIMENSIONS OF DIGITAL INTEGRAL ELECTRONIC DRIVERS AND CONNECTORS [mm]

7 POLES CONNECTOR

SP-ZM-7P   SP-ZH-5P   SP-345
SP-ZH-7P   E-RI-TES-** / E-RI-LES-**   SP-ZH-5P/BP

12 POLES CONNECTOR (options /Z, /SP and /ZP)

SP-ZH-12P   SP-ZH-5P   SP-345
SP-ZH-4P-M8/5   E-RI-TES-**/Z (/SP, /ZP) / E-RI-LES-**/Z (/SP, /ZP)   SP-ZH-5P/BP

① Coil connection for double solenoid valves (only for -TES)
② For E-RI-LES-**-01H (single solenoid valves with double transducer)
③ For communication interfaces -PS or -BC
④ For communication interface -BP
⑤ For options /SP and /ZP (connector moulded on cable with 5 mt lenght)

G210

8 PROGRAMMING DEVICES

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 protocols 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.

9 FIELDBUS FEATURES

9.1 CANbus - CANopen features implemented in Atos protocol

Protocol	CANopen version DS301 V4.02
Network error ctrl	Node Guarding
Boot up process	Minimum boot-up
Node ID, Baudrate	setting via LSS (Layer Setting Services) and via SDO
Number of RPDO	Four Receive PDOs (mappable parameters, default as indicated in DSP408)
Number of TPDO	Four Transmit PDOs (mappable parameters, default as indicated in DSP408)
Number of SDO	One Receive SDO and one Transmit SDO
Device Profile	DSP408 Device Profile Fluid Power Technology
Configuration	Physical Layer: ISO11898 (transmission rates from 10 Kbit/s to 1 Mbit/s)
	Data Link Layer: Based on CAN standard frame with 11-bit identifier (CAN 2.0A)
Info (file)	EDS file (Electronic Device Data Sheet) enclosed in KIT-E-SW-BC or DVD-E-MAN-BC (both in DVD format)

9.2 Profibus DP features implemented in Atos protocol

Protocol	Profibus version DPV0
Error control	SAP 60
Boot up proces	SAP 61, SAP 62
Node ID	SAP 55 or dip-switches hardware
Cyclic and Acyclic communication	PPO Telegrams: Type 3, Type 5 (for P/Q drivers) for real-time and parameter communication (string management is realized with an Atos algorithm, see KIT-MAN-S-BP).
Device profile	PROFIBUS Profile: Fluid Power Technology
Configuration	Physical Layer: (lev.1 - EN50170 part. 2) rates from 9,6 Kbit/s to 12 Mbit/s, up to 126 stations (with repeaters)
	Data Link Layer: (lev.2 - EN50170 part3/4)
Info (file)	GSD file (Electronic Device Data Sheet) enclosed in KIT-E-SW-BP or DVD-E-MAN-BP (both in DVD format)

10 CHARACTERISTICS OF POWER SUPPLY CONNECTORS (to be ordered separately)

CONNECTOR TYPE	POWER SUPPLY CONNECTOR		
CODE	**SP-ZH-7P**	**SP-ZM-7P**	**SP-ZH-12P**
Type	Female straight circular socket plug 7 pin		Female straight circular socket plug 12 pin
Material	Plastic reinforced with fiber glass	Aluminium alloy with cadmiun plating	Plastic reinforced with fiber glass
Cable gland	PG11		PG16
Cable	LiYCY 7x 0.75 mm² max 20m		LiCY 10 x 0,14 mm² (signal)
	7 x 1 mm² max 40m		LiYY 3 x 1 mm² (alimentation)
Connection type	to solder		to crimp
Standard	DIN 43563-BF6-3-PG11	Secondo MIL-C-5015 G	DIN 43651
Protection (DIN 40050)	IP 67	IP 66	IP 65

11 CHARACTERISTICS OF COMMUNICATION AND OF PRESSURE TRANSDUCER CONNECTORS (to be ordered separately)

CONNECTOR TYPE	RS232 CONNECTOR (-PS) or CAN-Bus (-BC)	PROFIBUS CONNECTOR (-BP)	PRESSURE TRANSDUCER CONNECTOR OPTIONS /SP AND /ZP
CODE	**SP-ZH-5P**	**SP-ZH-5P/BP**	**SP-ZH-4P-M8/5** (1)
Type	Female straight circular socket plug 5 pin	Male straight circular socket plug 5 pin	Male straight circular socket plug 4 pin
Material	Plastic	Plastic	Plastic
Cable gland	PG9	PG9	(1)
Cable	for -BC: CANBus Standard (301 DSP) for -PS: LiYCY 5 x 0,25 shielded	PROFIBUS Standard	4x0,25 mm²
Connection type	screw terminal	screw terminal	to solder
Standard	M12 – IEC 60947-5-2	M12 – IEC 60947-5-2	M8 – IEC 60947-5-2
Protection (DIN 40050)	IP 67	IP 67	IP 67

(1) Connector moulded on cable with 5 mt lenght