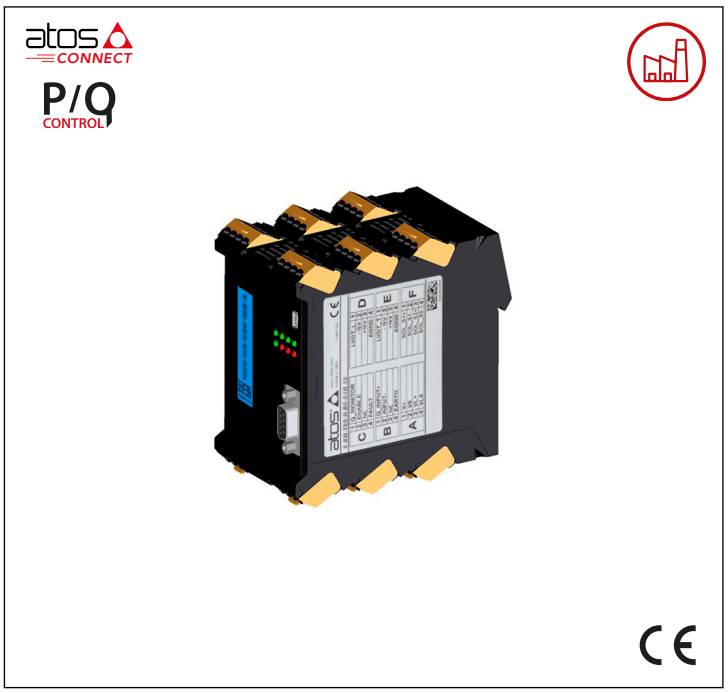
E-BM-TES, E-BM-LES

Electronic drivers

Off-board digital driver for directional and flow valves with LVDT transducers, fieldbus, p/Q control, DIN-rail format



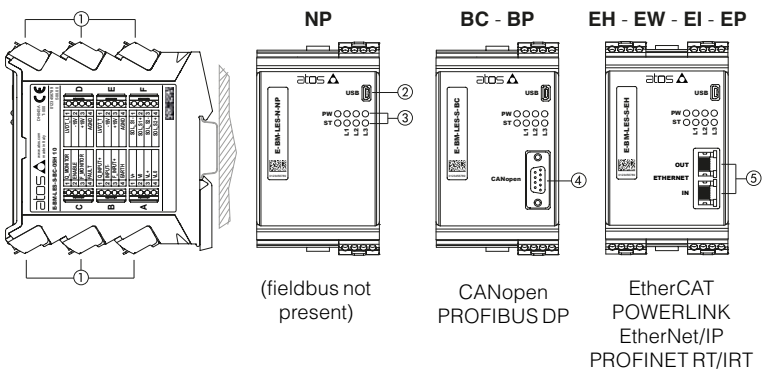
Features

- Analog or Fieldbus interfaces
- Bluetooth / USB connectivity
- Atos CONNECT App for smartphones and tablets
- E-SW-SETUP programming software for PC
- Internal oscilloscope function
- Alternated p/Q control
- Ambient temperature range -20 ÷ +50 °C
- IP20 plastic box protection degree
- DIN-rail format

Description

Digital drivers control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.
TES execution controls direct operated directional/flow valves with one LVDT transducer.
LES execution controls pilot operated directional valves with two LVDT transducers.
Option S adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation (see section 4).
Bluetooth/USB connection is always present for valve settings via mobile App and Atos PC software.

Overview



1 - Fast plug-in connectors - factory plugged
2 - Bluetooth/USB connection
3 - Leds for diagnostic
4 - CANopen, PROFIBUS DP connector
5 - EtherCAT, POWERLINK, Ethernet/IP, PROFINET RT/IRT connectors

1 MODEL CODE

E-BM	-	TES	-	N	-	NP	-	01H	/	*		*	/	*
1		2		3		4		5		6		7		8

1 - **Driver format**	
E-BM	off-board electronic driver in DIN-rail format

2 - **Digital driver**	
TES	full digital driver, for valves with one LVDT transducer
LES	full digital driver, for valves with two LVDT transducers

3 - **Alternated p/Q controls**	
N	none
S	closed loop pressure/force (see tech table **FS500**)

4 - **Fieldbus interface**	
NP	Not present
BC	CANopen
BP	PROFIBUS DP
EH	EtherCAT
EW	POWERLINK
EI	EtherNet/IP
EP	PROFINET RT/IRT

5 - **Solenoid configuration**	
01H	single solenoid direct valves or piloted valves with 2 LVDT
05H	double solenoid direct valves
01HP	single solenoid piloted valves with 1 LVDT
05HP	double solenoid piloted valves with 1 LVDT

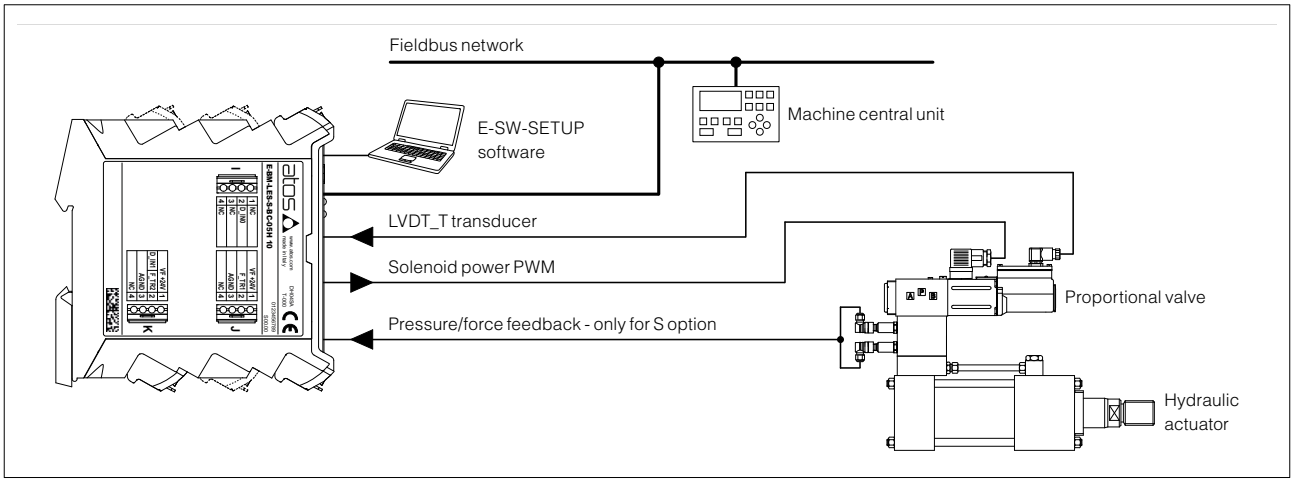
6 - **Electronic options**	
A	max current limitation for Ex-proof valves
C	current feedback 4 ÷ 20 mA for pressure/force transducers (only for option **S**) and LVDT transducers (only for option **A**)
I	current reference input and monitor 4÷20mA

7 - **Series identification** - not required for ordering	
.....	series number

8 - **Set code**	
.....	basic calibration factory preset

See section 9

2 BLOCK DIAGRAM EXAMPLE



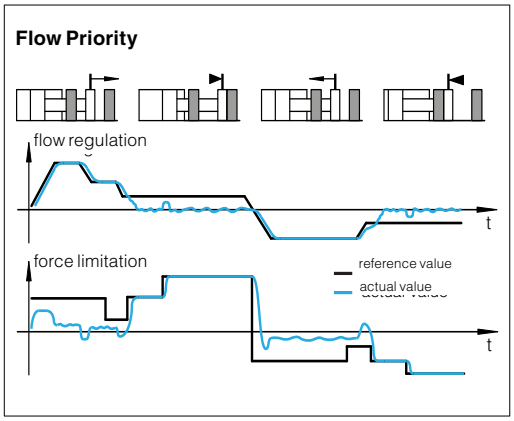
3 VALVES RANGE

Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	**DHZO-T, DKZOR-T** F165, F168	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172 **(1)**	**QVHZO-T, QVKZOR-T** F412 **(1)**	**DPZO-L** F175, F178	**LIQZP-L** F330, F340
Ex-proof Tech table	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220 **(1)**	**QVHZA-T, QVKZA-T** FX420 **(1)**	**DPZA-L** FX232, FX237	**LIQZA-L** FX350, FX370
Driver model	**E-BM-TES**				**E-BM-LES**	

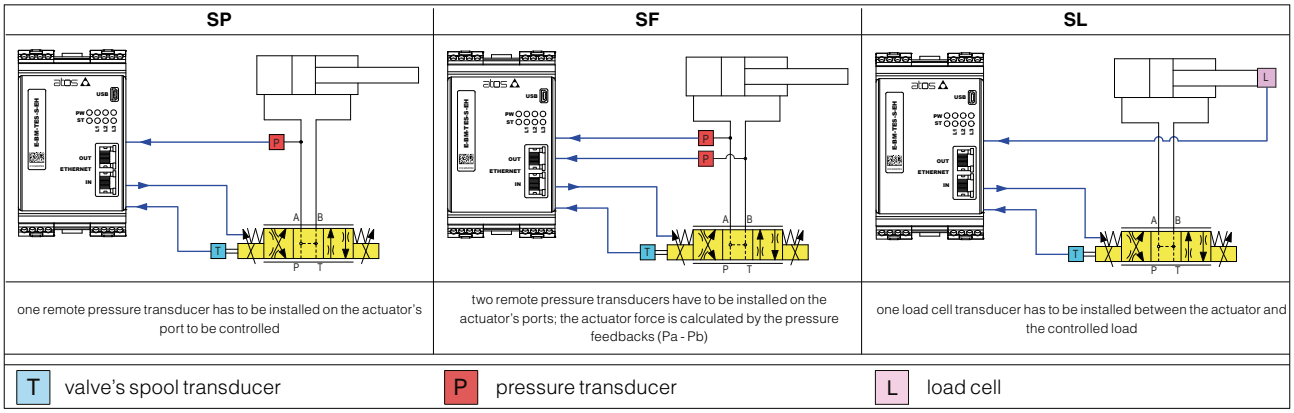
(1) Option S not available

4 ALTERNATED p/Q CONTROL - only for **S** option

S option on digital drivers adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation. The alternated p/Q control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time. The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations. Flow regulation is active when the actual system pressure/force 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. Pressure/force control is activated when the actual system pressure/force, measured by remote transducers, grows up to the relevant input reference signal - the driver reduces the valve's flow regulation in order to keep steady the system pressure/force. If the pressure/force tends to decrease under its input reference signal, the flow control returns active. The dynamic response of pressure/force 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.



Alternated control configurations - software selectable



SP - flow/pressure control
Adds pressure control to standard flow control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.
SF - flow/force control
Adds force control to standard flow control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.
SL - flow/force control
Adds force control to standard flow control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.
General Notes:
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

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

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time.
Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.

Download on the App Store

GET IT ON Google Play

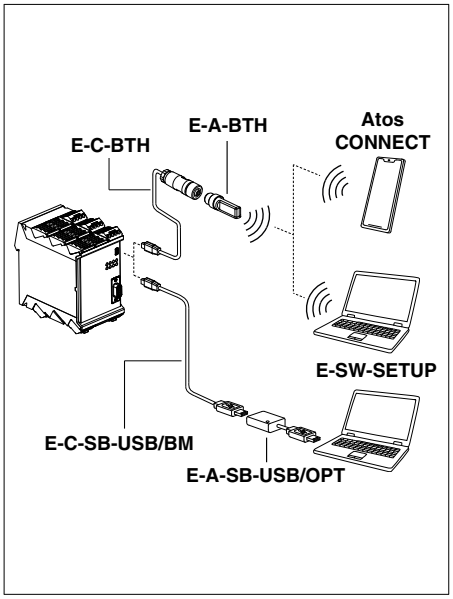
EXPLORE IT ON AppGallery

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available in MyAtos area at www.atos.com

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

Bluetooth or USB connection



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

6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

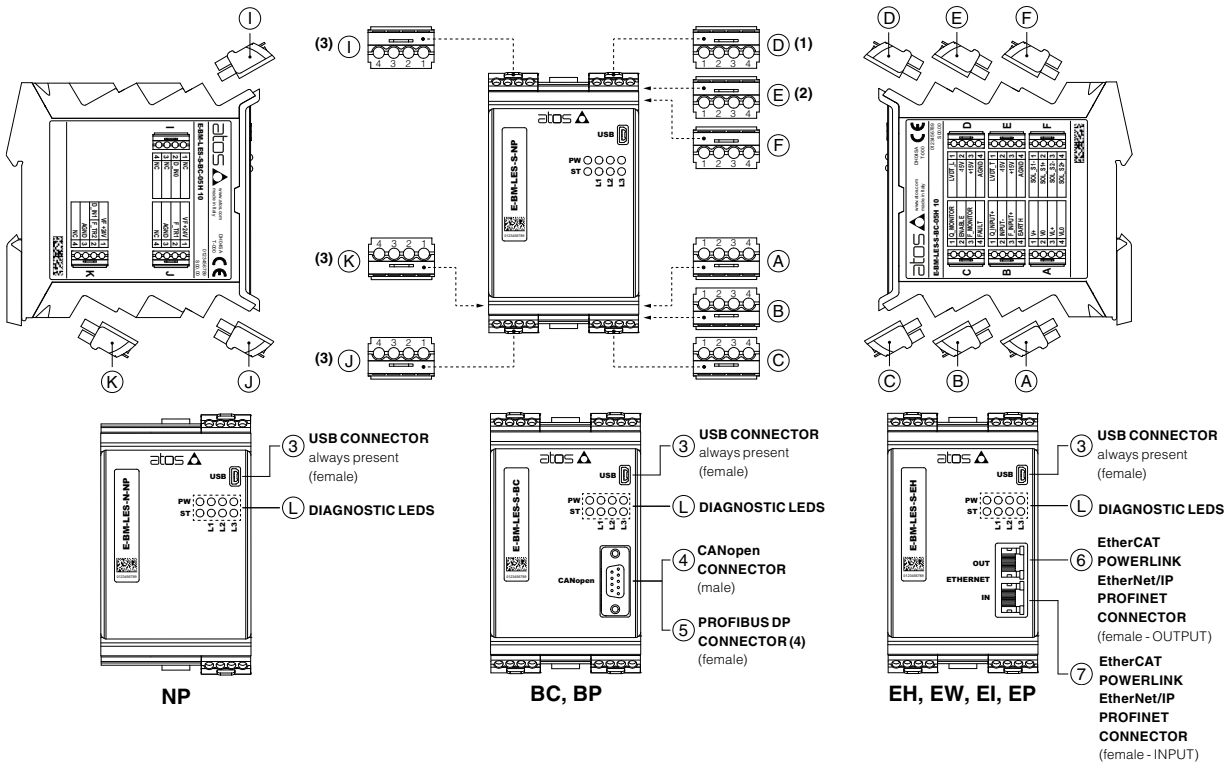
Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoids	IMAX = 3.0 A for standard driver IMAX = 2.5 A for ex-proof driver (**/A option**)
Analog input signals	Voltage: range ±10 VDC (24 VMAX tolerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Monitor output	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ
Digital inputs	
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Pressure/Force transducer power supply (only for S option)	+24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Ambient temperature range	-20 ÷ +50 °C (storage -25 ÷ +85 °C)
Mass	Approx. 400 g
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) Comply with Directive 2011/65/EU as amended (RoHS 2), including Delegated Directive (EU) 2015/863 and all subsequent delegated directives in force on the date of this statement REACH Regulation (EC) n°1907/2006
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply
Recommended wiring cable	LiYCY shielded cables: 0,5 mm² max 50 m for logic 1,5 mm² max 50 m for power supply and solenoids Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size	2,5 mm²

Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP,PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

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

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

8 CONNECTIONS AND LEDS



A,B,C,D,E,F,I,J,K connectors included

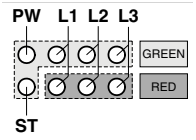
(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S

(4) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector:
DG909MF1 - the connector will be oriented upwards
DG909MF3 - the connector will be oriented downwards

8.1 Diagnostic LEDs (L)

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

LED	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet\IP	EP PROFINET
L1	VALVE STATUS			LINK/ACT			
L2	NETWORK STATUS						
L3	SOLENOID STATUS			LINK/ACT			
PW	OFF = Power supply OFF ON = Power supply ON						
ST	OFF = Fault present ON = No fault						



Connectors - 4 pin

CONNECTOR	PIN	ALTERNATED P/Q CONTROL		TECHNICAL SPECIFICATIONS	NOTES
		N none	**S** pressure/force		
A	A1	**V+**		Power supply 24 VDC	Input - power supply
	A2	**V0**		Power supply 0 VDC	Gnd - power supply
	A3	**VL+**		Power supply 24 VDC for driver's logic and communication	Input - power supply
	A4	**VL0**		Power supply 0 VDC for driver's logic and communication	Gnd - power supply
B	B1	**Q_INPUT+**		Flow reference input signal: ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	B2	**INPUT-**		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	B3	**NC**		Do not connect	-
			F_INPUT+	Pressure/Force reference input signal ±10 VDC / ±20 mA maximum range Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	B4	**EARTH**		Connect to system ground	-
C	C1	**Q_MONITOR**		Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND. Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	C2	**ENABLE**		Enable (24 VDC) or disable (0 VDC) the controller, referred to VL0	Input - on/off signal
	C3	**NC**		Do not connect	-
			F_MONITOR	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Default are ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	C4	**FAULT**		Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
D	D1	**LVDT_L**		Main stage valve position transducer signal	Input - analog signal
	D2	**-15V**		Main stage valve position transducer power supply -15V	Output power supply
	D3	**+15V**		Main stage valve position transducer power supply +15V	
	D4	**AGND**		Common gnd for transducer power and monitor outputs	Common gnd

Note: **D** connector is available only for TES-N versions 01HP / 05HP and LES-*

E	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal	Input - analog signal
	E2	**-15V**	Direct valve or pilot valve position transducer power supply -15V	Output power supply
	E3	**+15V**	Direct valve or pilot valve position transducer power supply +15V	
	E4	**AGND**	Common gnd for transducer power and monitor outputs	Common gnd

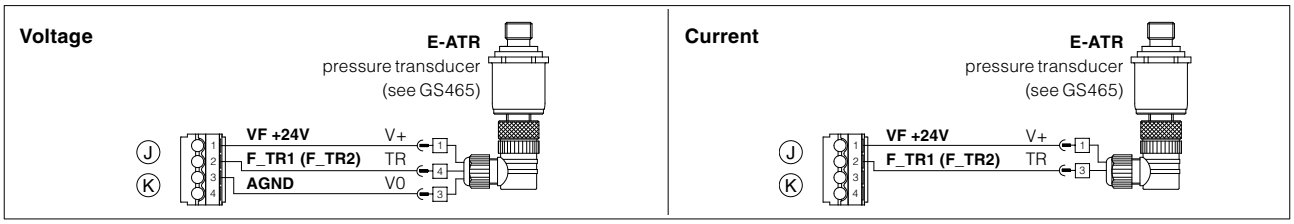
Note: **E** connector is available only for TES-* versions 01H / 05H and LES-*

F	F1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	F2	**SOL_S1+**	Positive current to solenoid S1	
	F3	**SOL_S2-**	Negative current to solenoid S2	
	F4	**SOL_S2+**	Positive current to solenoid S2	

CONNECTOR	PIN	ALTERNATED P/Q CONTROL		TECHNICAL SPECIFICATIONS	NOTES
		N none	**S** pressure/force		
I	I1		**NC**	Do not connect	-
	I2		**D_IN0**	NP execution: multiple pressure/force PID selection, referred to VL0 Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	I3		**NC**	Do not connect	-
	I4				
J	J1		**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	J2		**F_TR1**	1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
	J3		**AGND**	Common gnd for transducer power and signals	Common gnd
	J4		**NC**	Do not connect	-
K	K1		**VF +24V**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	K2		**F_TR2 (1)**	2nd signal pressure transducer: ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**
			D_IN1 (2)	NP execution: multiple pressure/force PID selection, referred to VL0 Fieldbus execution: general purpose digital input 0 ÷ 24VDC, referred to VL0	Input - on/off signal
	K3		**AGND**	Common gnd for transducer power and signals	Common gnd
	K4		**NC**	Do not connect	-

(1) Only for SF control
(2) Only for SP or SL control

8.2 **Pressure/force transducers connection** - example - only for **S** option



8.3 **Communication connectors** - shield connection on connector's housing is recommended

③ **USB - Mini USB type B** - always present		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATIONS**
1	**+5V_USB**	Power supply
2	**D-**	Data line -
3	**D+**	Data line +
4	**ID**	Identification
5	**GND_USB**	Signal zero data line

④ **BC fieldbus execution** - DB9 - 9 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATIONS**
2	**CAN_L**	Bus line (low)
3	**CAN_GND**	Signal zero data line
5	**CAN_SHLD**	Shield
7	**CAN_H**	Bus line (high)

⑤ **BP fieldbus execution** - DB9 - 9 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATIONS**
1	**SHIELD**	-
3	**LINE-B**	Bus line (low)
5	**DGND**	Data line and termination signal zero
6	**+5V**	Termination supply signal
8	**LINE-A**	Bus line (high)

⑥⑦ **EH, EW, EI, EP fieldbus execution** - RJ45 - 8 pin		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATIONS**
1	**TX+**	Transmitter - white/orange
2	**RX+**	Receiver - white/green
3	**TX-**	Transmitter - orange
6	**RX-**	Receiver - green

9 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code. For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

10 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

10.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.



A safety fuse is required in series to each power supply: 2.5 A time lag fuse.

10.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

10.3 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position. Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

10.4 Pressure or force reference input signal (F_INPUT+) - only for **S** option

Functionality for pressure or force input reference signal (pin B3), is used as reference for the driver pressure/force closed loop, see section 4. Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

10.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, valve spool position). Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

10.6 Pressure or force monitor output signal (F_MONITOR) - only for **S** option

The driver generates an analog output signal (C3) proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA

10.7 Enable input signal (ENABLE)

To enable the driver, supply 24 Vdc on pin C2: 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 activate the communication and the other driver functions when the valve must be disabled for safety reasons. This command **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as digital input by software selection.

10.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuit/not connected, reference or 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.

10.9 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using a ±15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /AC option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

10.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - only for **S** option

Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are ±10 VDC for standard and 4 ÷ 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 pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).
Note: F_TR2 (pin K2) analog input signal is available only SF control.

10.11 Multiple PID selection or digital input signals (D_IN0 and D_IN1) - only for **S** option

Two on-off input signals are available on the connectors I and K.
For NP executions pin I2 and/or pin K2 are used to select one of the four pressure (force) PID parameters settings, 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 Vcc or a 0 Vcc on pin I2 and/or pin K2, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.
For fieldbus executions pin I2 and/or K2 can be used as generic purpose on-off input signals.
Note: D_IN1 (pin K2) on-off input signal is available only for SP or SL control.

	PID SET SELECTION			
PIN	**SET 1**	**SET 2**	**SET 3**	**SET 4**
I2	0	24 VDC	0	24 VDC
K2	0	0	24 VDC	24 VDC

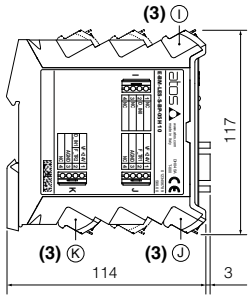
10.12 Possible combined options: /AC, /AI, /ACI, /CI - combined options **/CI** is available only for E-BM-TES/LES-S

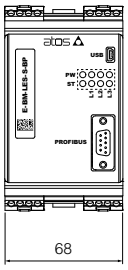
11 MAIN SOFTWARE PARAMETER SETTINGS

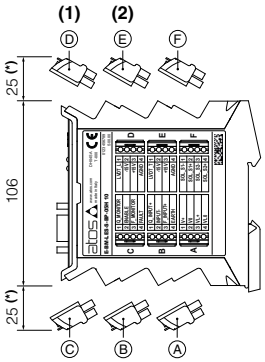
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW-SETUP programming software:
E-MAN-BM-LES - user manual for **E-BM-TES-N** and **E-BM-LES-N** digital drivers
E-MAN-BM-LES-S - user manual for **E-BM-TES-S** and **E-BM-LES-S** digital drivers

12 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors







DIN rail dimensions



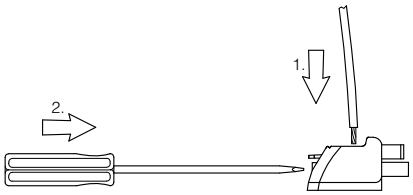
A,B,C,D,E,F,I,J,K connectors included

(*) Space to remove the connectors

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S

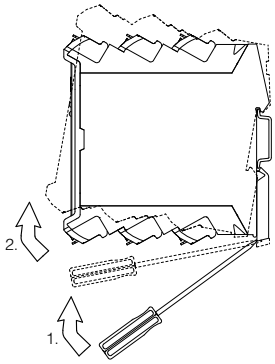
13 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2.5 mm^2
tightening torque: 0.4 ÷ 0.6 Nm

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



To extract the connectors:
1. push lever
2. pull connector



To insert the connectors:
1. push the connector in its slot



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (e.g. connector A can not be inserted into connector slot of B,C,D,E,F,I,J,K)