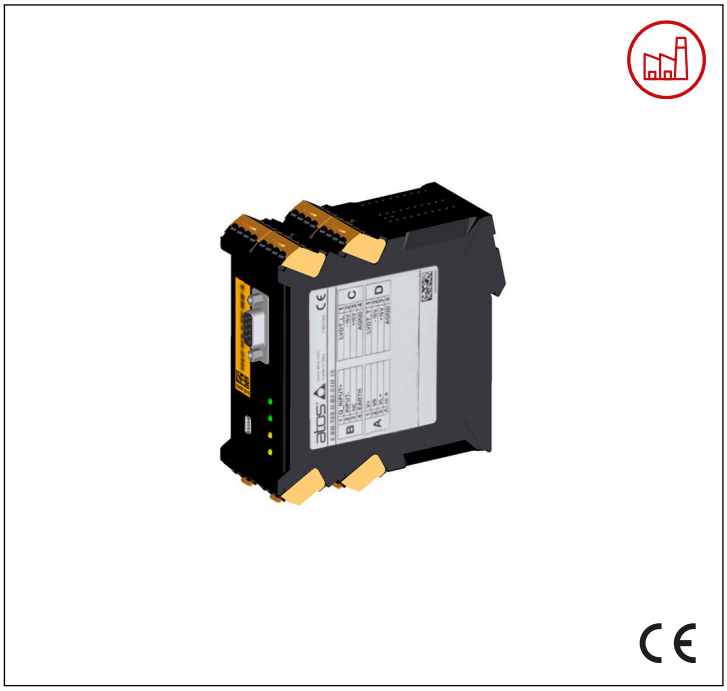
E-BM-AES

Electronic drivers

Off board digital driver for valves without transducer, fieldbus, DIN-rail format



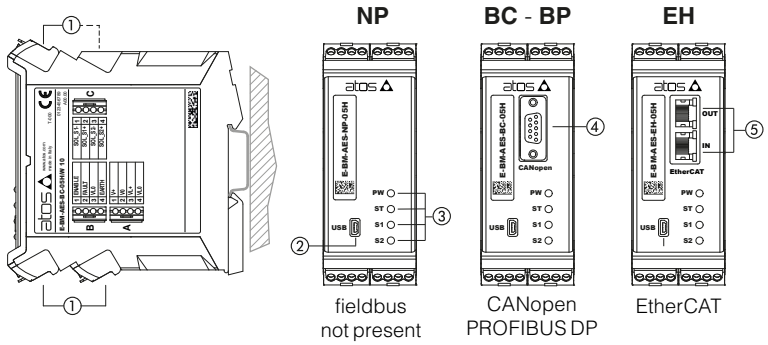
Features

- E-SW-SETUP programming software for PC
- Internal oscilloscope function
- USB connectivity
- Analog or Fieldbus interfaces
- Ambient temperature range -20 ÷ +60 °C
- IP20 plastic box protection degree
- DIN-rail format

Description

Digital drivers control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.
E-BM-AES operate direct and pilot operated proportional valves ZO-A without transducer.
USB connection is always present for valve settings via Atos PC software.

Overview



1 - Fast plug-in connectors - factory plugged
2 - USB connection
3 - Leds for diagnostic
4 - CANopen, PROFIBUS DP connector
5 - EtherCAT connectors

1 MODEL CODE

E-BM	-	AES	-	NP	-	01H	/	*	*
1		2		3		4		5	6

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

2 - **Digital driver**	
AES	full digital driver, for valves without transducer

3 - **Fieldbus interface**	
NP	Not present
BC	CANopen
BP	PROFIBUS DP
EH	EtherCAT

4 - **Pilot operated valves with one LVDT transducer**	
01H	for single solenoid proportional valves
05H	for double solenoid proportional valves

5 - **Electronic options**	
A	max current limitation for Ex-proof valves
C	current feedback 4 ÷ 20 mA for pressure transducer, only in combination with option **W**
I	current reference input and monitor 4÷20mA
W	power limitation function

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

2 VALVES RANGE

Valves	Directional			Flow	
Industrial Tech table	**DHZO** **DKZOR** FS160	**DHZE** **DKZE** F150	**DPZO** **DPZE** FS170 F171	**QVHZO** **QVKZOR** FS410	**QVHZE** **QVKZE** F400
Ex-proof Tech table	**DHZA** **DKZA** FX100	-	**DPZA** **FX200**	**QVHZA** **QVKZA** FX400	-

Valves	Pressure									Cartridge
Industrial Tech table	**RZMO** **HMZO** FS007 FS065	**RZME** **CART** **RZME** F005	**RZGO** **HZGO** **KZGO** FS015 FS070	**RZGE** **CART** **RZGE** F012	**AGMZO** FS035	**AGMZE** F030	**AGRCZO** FS050	**DHRZO** FS025	**DHRZE** F022	**LIMZO LIRZO** **LICZO** FS300
Ex-proof Tech table	**RZMA** **HZMA** FX010	-	**RZGA** **HZGA** **KZGA** FX040	-	**AGMZA** FX010	-	**AGRCZA** FX040	**DHRZA** FX070	-	**LIMZA LIRZA** **LICZA** FX300

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

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

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

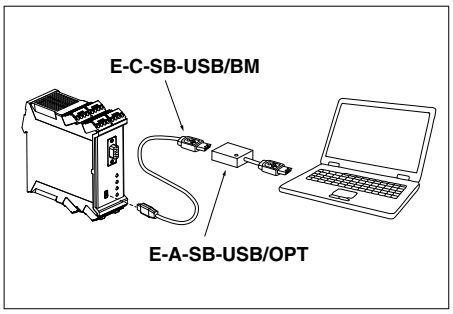
4.1 E-SW-SETUP PC software

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

⚠ **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

Note: Bluetooth connection is not available for E-BM-AES drivers

USB connection



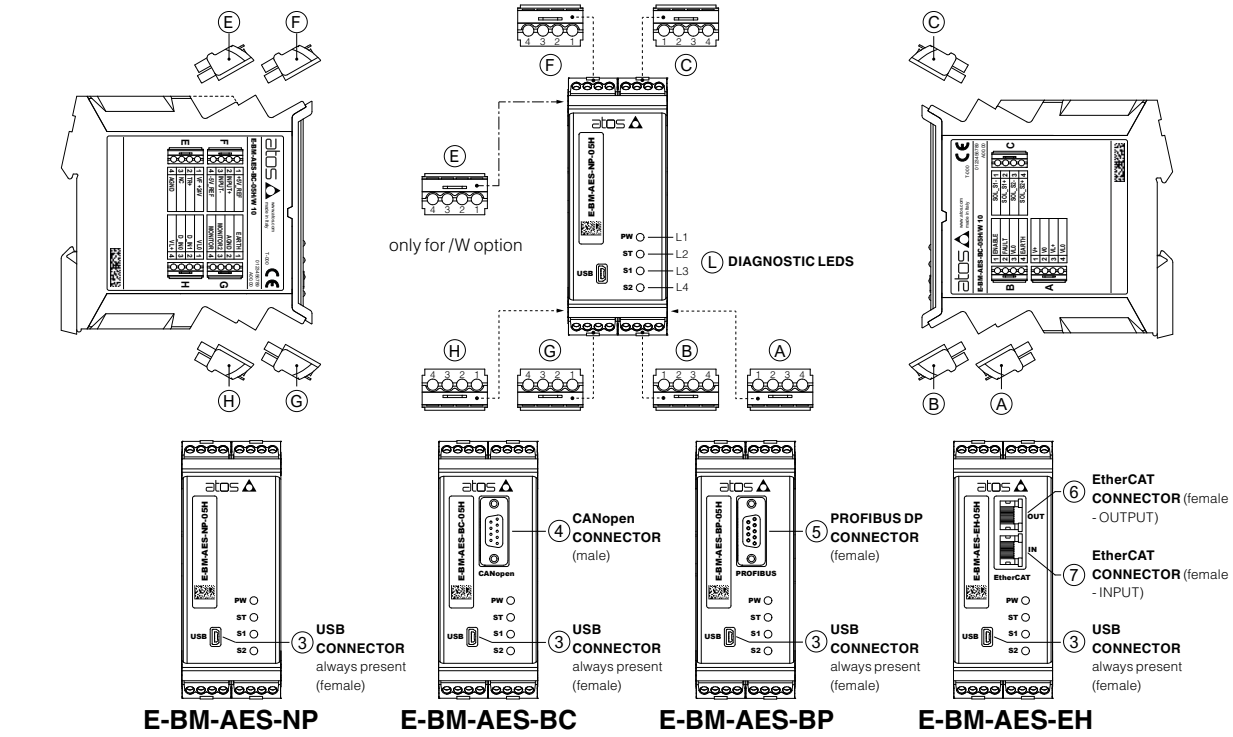
5 GENERAL CHARACTERISTICS

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 = 2.7 A with +24 VDC power supply to drive standard proportional valves (3,2 Ω solenoid) IMAX = 2.5 A with +24 VDC power supply to drive ex-proof proportional valves (3,2 Ω solenoid) for /A option
ON/OFF Input Signal	Input impedance: Ri > 10 kΩ
Analog input signals	Voltage: maximum range ±10 VDC Input impedance: Ri > 50 kΩ Current: maximum range ±20 mA Input impedance: Ri = 500 Ω
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance
Enable input	Range : 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ
Output supply	±5 VDC @ max 10 mA : output supply for external potentiometer
Fault output	Output range : 0 ÷ 24 VDC (ON state ≈ VL+ [logic power supply] ; OFF state ≈ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Pressure Transducer	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465; E-ATRA-7 for ex-proof, see tech table GX800)
Pressure Transducer input	/W option Input range: 0 ÷ 10 VDC Input impedance: Ri > 50 kΩ
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)
Mass	Approx. 330 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	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 max 50 m for logic 1,5 mm^2 max 50 m for power supply and solenoids
Max conductor size	2,5 mm^2

Note: a maximum time of 500 ms (depending on communication type) 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.

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.

6 CONNECTIONS AND LEDS

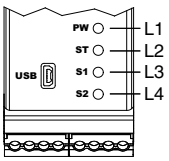


A,B,C,F,G,H connectors included; E connector is available only for /W option

6.1 Diagnostic LEDs (L)

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

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	POWER	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	STATUS	OFF	Fault present
			ON	No fault
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON



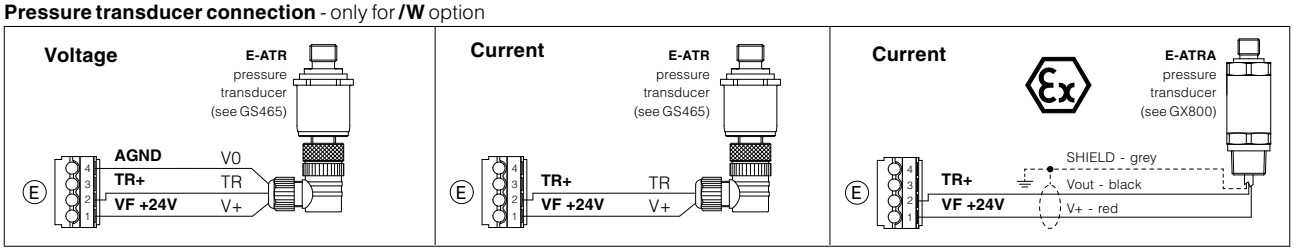
6.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
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	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	B2	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	B3	**VL0**	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	**EARTH**	Connect to system ground	
C	C1	**SOL_S1-**	Negative current to solenoid S1	Output - power PWM
	C2	**SOL_S1+**	Positive current to solenoid S1	Output - power PWM
	C3	**SOL_S2-**	Negative current to solenoid S2	Output - power PWM
	C4	**SOL_S2+**	Positive current to solenoid S2	Output - power PWM
E	E1	**VF +24V**	Power supply +24 VDC	Output - power supply
	E2	**TR+**	Positive pressure transducer input signal: ±10 VDC / ±20 mA maximum range. Default are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option	Input - analog signal **Software selectable**
	E3	**NC**	Do not connect	
	E4	**AGND**	Common gnd for signals and external potentiometer	

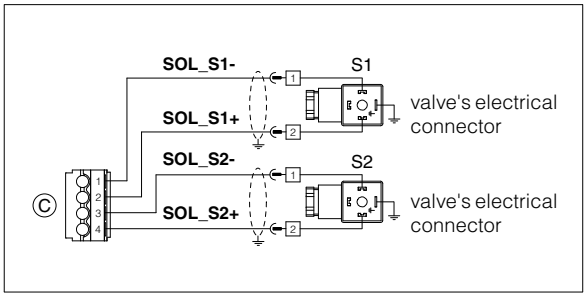
Note: **E** connector is available only for **/W** option

F	F1	**+5V_REF**	External potentiometer power supply +5 VDC @ 10mA	Output - power supply
	F2	**INPUT+**	Positive 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**
	F3	**INPUT-**	Negative pressure reference input signal for P_INPUT+	Input - analog signal
	F4	**-5V_REF**	External potentiometer power supply -5 VDC @ 10mA	Output - power supply
G	G1	**EARTH**	Connect to system ground	
	G2	**AGND**	Analog ground for monitor and external potentiometer	Gnd - analog signal
	G3	**MONITOR2**	Only for /W option, 2nd monitor output signal: ±5 VDC maximum range. Default is 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	G4	**P_MONITOR**	Monitor output signal: ±5 VDC maximum range. Default is ±5 VDC (1V = 1A)	Output - analog signal **Software selectable**
H	H1	**VL0**	Power supply 0 VDC for digital input	Gnd - power supply
	H2	**D_IN1**	Pressure PID selection, referred to VL0	Input - on/off signal
	H3	**D_IN0**	Pressure PID selection, referred to VL0	Input - on/off signal
	H4	**VL+**	Power supply 24 VDC for digital input	Output - power supply

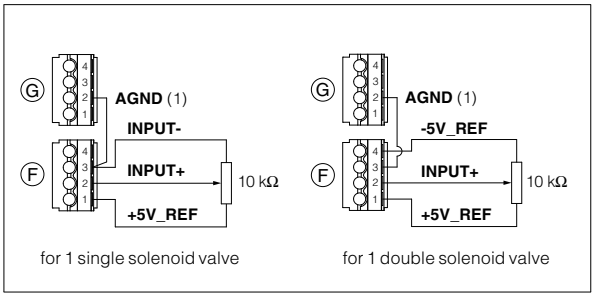
Pressure transducer connection - only for **/W** option



Coils connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used (only for /W option)

6.3 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 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

7 POWER SUPPLY AND SIGNALS SPECIFICATIONS

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

7.1 Power supply (V+ and V0)

The power supply 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.
In case of double power supply see 7.2.


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

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

The power supply 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 on pin A3 and A4, 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.

7.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are +10 Vcc 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 Vcc or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24Vcc.

7.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 Vcc (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 Vcc.
Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 Vcc; default setting is 0 ÷ 5 Vcc.

7.5 Enable input signal (ENABLE)

To enable the driver, supply 24 Vcc on pin B1: 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 condition does not comply with European Norms EN13849-1 (ex EN954-1).

7.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuit/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 Vcc, normal working corresponds to 24 Vcc.
Fault status is not affected by the Enable input signal.

7.7 Remote pressure transducer input signal (TR) - only for **/W** option

Analog pressure transducers can be directly connected to the driver.
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 10 Vcc 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 Vcc or ± 20 mA.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

7.8 Output supply for external potentiometer (±5V_REF) - not available for **EH** version

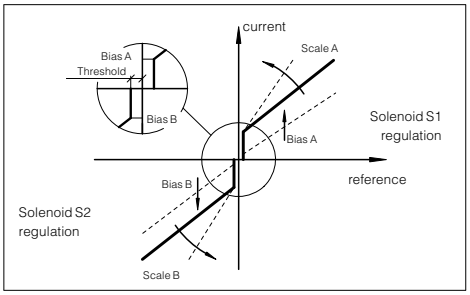
The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 Vcc supply output available at pin F1 and F4.
Note: using an external potentiometer, the reference input signal must be set via software at ±5 Vcc (default ±10 Vcc, see section 7.3)

8 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the manuals included in the E-SW-SETUP programming software. **E-MAN-BM-AES** - user manual for **E-BM-AES**

8.1 Scale, Bias & Threshold

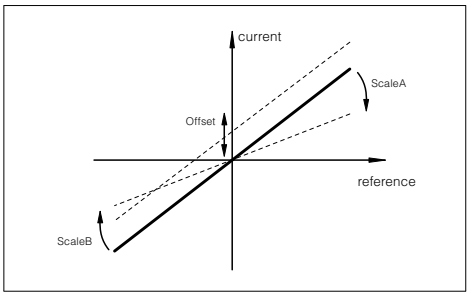
Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value. This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal. Two different Scale regulations are available for double solenoid valves: ScaleA for positive reference signal and ScaleB for negative reference signal.



Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status. This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input). The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver. The Bias setting allows to calibrate the Bias current to the specific proportional valve to which the driver is coupled. The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal; smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence. If fieldbus reference signal is active (see 7.3), threshold should be set to zero. Two different Bias regulations are available for double solenoid valves: positive reference signals activate BiasA and negative reference signals activate BiasB. Refer to the programming manuals for a detailed description of other software selectable Bias functions.

8.2 Offset

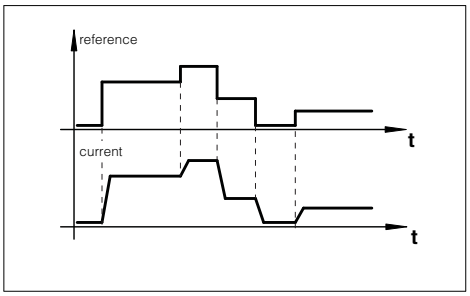
Proportional valves may be provided with zero overlapping in the hydraulic regulation corresponding to zero reference input signal (valve's central spool position). The Offset function allows to calibrate the Offset current, required to obtain valve's spool central position, to the specific hydraulic system setup (e.g. valve applied to cylinder with differential areas).



8.3 Ramps

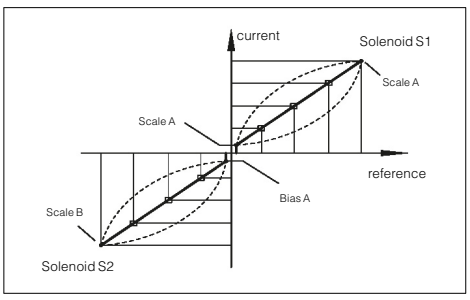
The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid. Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks. If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).



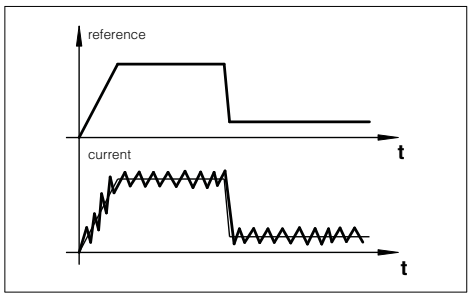
8.4 Linearization

Linearization function allows to set the relation between the reference input signal and the controlled valve's regulation. Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition.



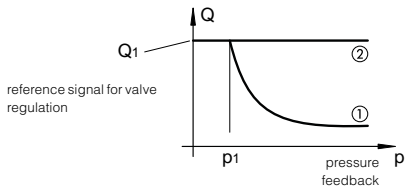
8.5 Variable Dither

Dither is the frequency modulation of the current supplied to the solenoid. To reduce the hysteresis should be selected a lower value of frequency, despite a lower regulation stability, because a small vibration in the valve regulating parts considerably reduces static friction effects. To improve the regulation stability, should be selected a high value of frequency, despite a higher hysteresis. This solution in some application can lead to vibration and noise. Normally, the right setting is a compromise and depends on system setup. E-BM-AES drivers allow to realize a variable dither frequency that linearly depends on the demanded current: variable dither frequency allows an higher degree to optimize the valve hysteresis.



8.6 Hydraulic Power Limitation - only for /W option

Digital E-BM-AES drivers with W option electronically perform hydraulic power limitation on: - direct and pilot operated flow control valves - direct and pilot operated directional control valves + mechanical pressure compensator - variable displacement pumps with proportional flow regulator (e.g. PVPC*-LQZ, tech table **A170**) The driver receives the flow reference signal by the analog external input INPUT+ (see 7.3) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR (see 7.7). When the actual requested hydraulic power **pxQ** (Q TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow.

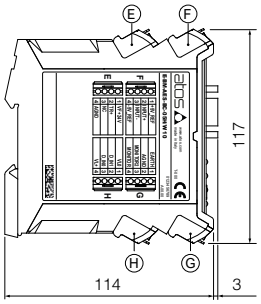


Regulation curve **1** with and **2** without power limitation.
p1 x Q1 = max power limit

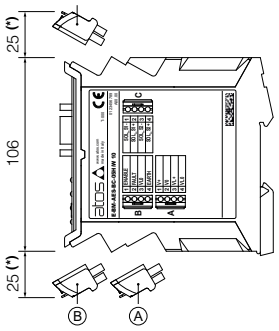
$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\ ;\ \text{Flow Reference [INPUT+]}\right)$$

9 OVERALL DIMENSIONS [mm]

overall dimension
with assembled connectors







DIN rail dimensions

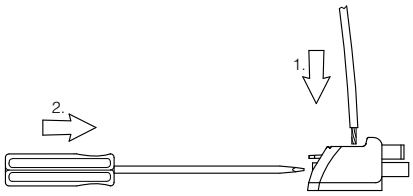


A,B,C,F,G,H connectors included; E connector is available only for /W option

(*) Space to remove the connectors

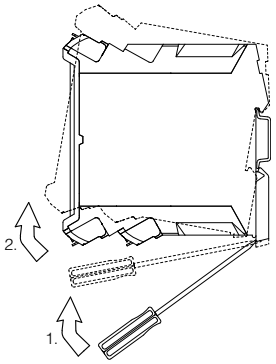
10 INSTALLATION DIMENSIONS

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



Note: max conductor size: 2.5 mm²
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.
(eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)