

E-MAN-BM-TEB/LEB

DIN-RAIL DIGITAL DRIVER SERIES 20 OR HIGHER
FOR DIRECTIONAL AND FLOW PROPORTIONAL
VALVES WITH LVDT TRANSDUCERS



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1 **GENERAL**

1.1 **About this user manual**

This manual describes the required operations to install and configure Atos driver with Atos E-SW-SETUP programming software for PC.

This manual must be used for closed loop proportional valves with one or two spool position transducers and DIN-rail format electronic drivers— Atos E-SW-SETUP software version 10.0 or greater is required (see 20).

Before installing or operating the driver for the first time, read this manual.

The purpose of this manual is not to cover all the details or variations of Atos drivers and software, and it does not provide complete details for all possible working conditions; if any further information or technical support are required, please contact the Technical Sales Support of Atos Electronic Division (ele-support@atos.com).

The manual contains important safety instructions (see 1.4.3), whose knowledge is required to:

- avoid hazards and dangers
- minimize service and downtime
- increase the working and reliability of the driver

In addition please follow up all the running regulations of the country/community where the drivers will be used.

A basic skill in using personal computers and Windows® operating system is required.

1.2 **Documentation**

Additional information about valves, electronic drivers and Atos software can be found in the MyAtos - Download area (see 1.2.2).

1.2.1 **Related documentations**

- STARTUP BLUETOOTH Installation and connection for E-A-BTH and E-A-SB-USB/BTH (phase-out)
- FS*** Proportional valves - technical tables
- GS230 Digital electronic E-BM-TEB/LEB drivers, DIN-rail panel format, for proportional valves with one or two spool position transducer - technical table
- GS500 Programming tools for digital electronics - technical table

1.2.2 MyAtos area – Download area electronics

Latest releases of the programming software, manuals, USB drivers, configuration files and level passwords are available on MyAtos at www.atos.com.

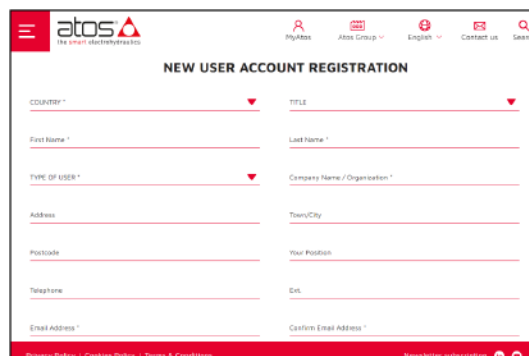


It is mandatory perform the login to web site Atos. See the steps below.

Step 1: My Atos – Register – New user account registration

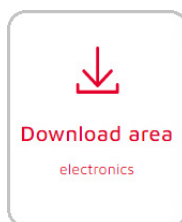
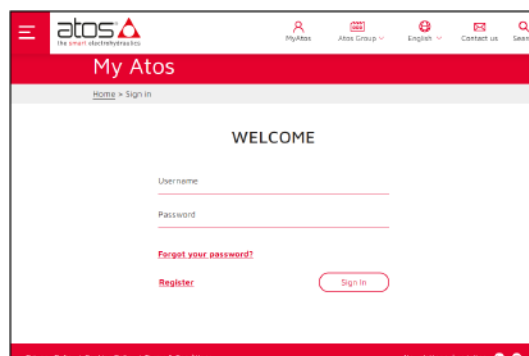
In order to have the access in MyAtos, perform the registration at <https://www.atos.com/en-it/register> by filling the form.

Upon first access set a personal password through the link received by email and access the MyAtos section at <https://www.atos.com/en-it/login>



Step 2: My Atos – Download Area

In MyAtos area, perform login with personal username and password and then press the **Download area electronics** button.

With the first access to the download area, the following will be available:

- E-SW-SETUP
- Z-SW-SETUP
- S-SW-SETUP
- S-SW-SIZING
- USB Drivers
- Fieldbus Configuration Files **(1)**
- User Manuals

(1) Configuration files for IO-Link and fieldbus: IO-Link (*.Iodd), CANopen (*.EDS), PROFIBUS DP (*.GSD), EtherCAT (*.XML), POWERLINK (*.XDD), EtherNet/IP (*.EDS), PROFINET RT/IRT (*.GSDML)



For EtherNet/IP and PROFINET RT/IRT addressing procedure is available the IPconfig program, downloadable from MyAtos - Download area (see 1.2.2).

1.2.3 Trademarks

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1.3 About proportional electrohydraulics

1.3.1 Electrohydraulics: hydraulics plus electronics

Atos is a leading manufacturer of electrohydraulic components & systems: the advanced technology that integrates hydraulics and electronics to improve performance and flexibility of the modern machinery.

Electrohydraulic proportional controls modulate hydraulic parameters according to the electronic reference signals; they are the ideal interface between hydraulic and electronic systems to perform fast, smooth and accurate motions required by today's modern machines and plants.

Operating principle

The core of electrohydraulic controls is the proportional valve that modulates pressure or flow according to the electronic input signal (standard: external analog signal ± 10 V_{DC}).

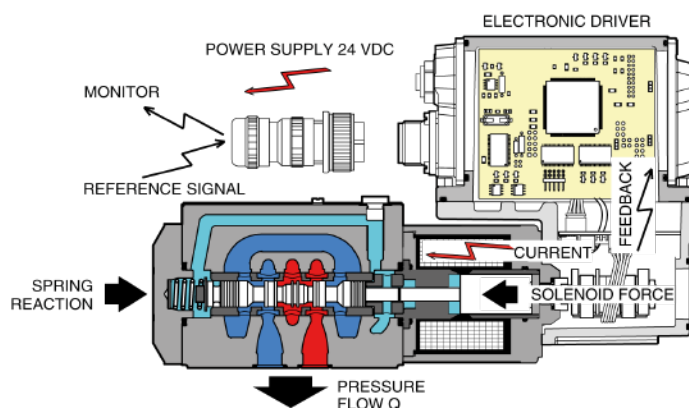
The force of the solenoid is proportional to the reference signal, thus properly moving the spool against a return spring to modulate hydraulic parameters.

When electrical failure occurs, the spring restores the neutral position according to the valve configuration.

Proportional valves are available with different neutral position to achieve the required fail-safe configuration.

The wide range of Atos proportional valves is available with or without integral feedback transducer.

The sketch at side shows a proportional directional valve with spool feedback transducer.



1.3.2 Controls

Without LVDT transducer

Drivers control is actuated by modulating the current supplied to valve solenoid, without evaluating the valve response.

With LVDT transducer

High performance drivers control is actuated by modulating the current supplied to valve solenoid, evaluating the valve response through the transducer in order to compensate the environment variables.

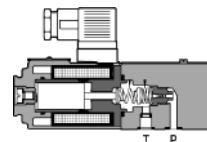
1.3.3 Digital proportional controls

Atos offers today one of the most advanced lines of proportional valves which allow performances close to servovalves still maintaining the typical benefits of proportional electrohydraulics: less sensitivity, low filtration requirements, intrinsic stability, easier servicing and lower cost.

The wide range of Atos proportional electrohydraulics is available in different executions to match the specific application requirements and to allow simple upgrade of machine performances:

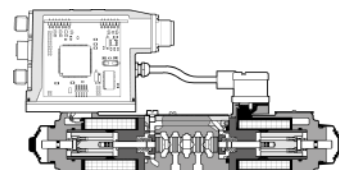
ZO-A

Open loop proportional valves to control direction/flow, pressure or flow; separate electronic drivers are required.



ZO-AES

As ZO-A execution plus digital integral electronic driver, factory preset to ensure fine functionality, valve-to-valve interchangeability and easier set-up.

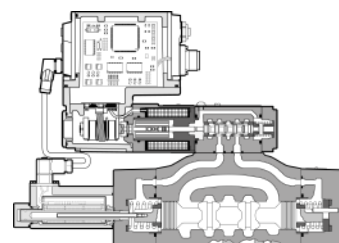


ZO-TES; ZO-LES

Closed loop proportional valves to control direction/flow or flow.

Digital integral electronic driver (factory preset) and integral spool position transducers (1 for ZO-TES, 2 for ZO-LES) assure valve-to-valve interchangeability, easier set-up and high response dynamics.

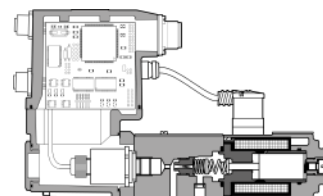
SP/SF/SL options add alternated pressure/force control to the valve standard spool-flow control.



ZO-RES

Closed loop proportional valves to control maximum relieved or reduced pressure.

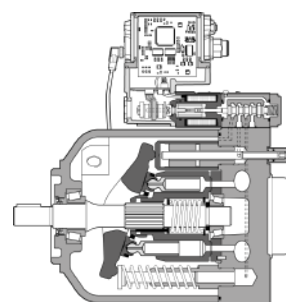
Digital integral electronic driver (factory preset) and integral pressure transducer assure valve-to-valve interchangeability, easier set-up and high response dynamics.



ZO-PES

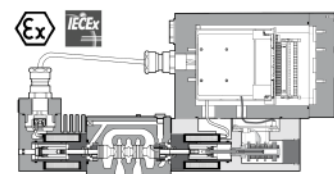
Variable displacement pumps with digital integral electronic driver, control in closed loop flow and pressure; a dedicated algorithm selects which control (flow/pressure) is active time by time.

Digital integral electronic driver (factory preset) and integral pump displacement/pressure transducers assure pump-to-pump interchangeability, easier set-up and high response dynamics.



ZA-**

Ex-proof executions equipped with specific solenoids certified to ATEX 94/9/CE and IECEx, available with and without integral ex-proof driver and transducer.



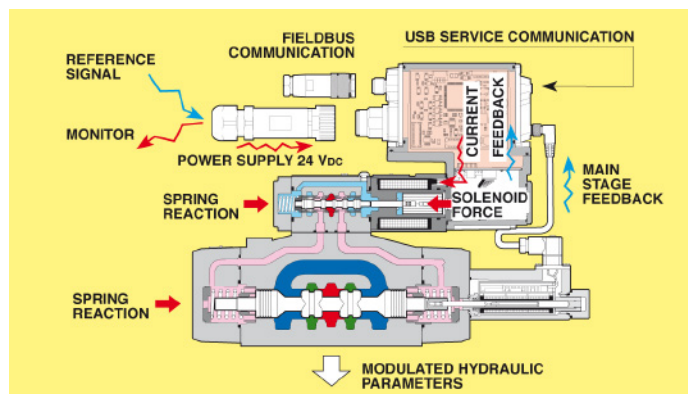
1.3.4 Digital electronic drivers

Atos electronics include analog or digital drivers both in off-board or on-board format.

They supply proportional valve solenoid with current to align the valve regulation and the reference signal thus obtaining an ideal interface between hydraulic and electronic systems of modern machine and plants.

Digital electronics add many plus to proportional electrohydraulics:

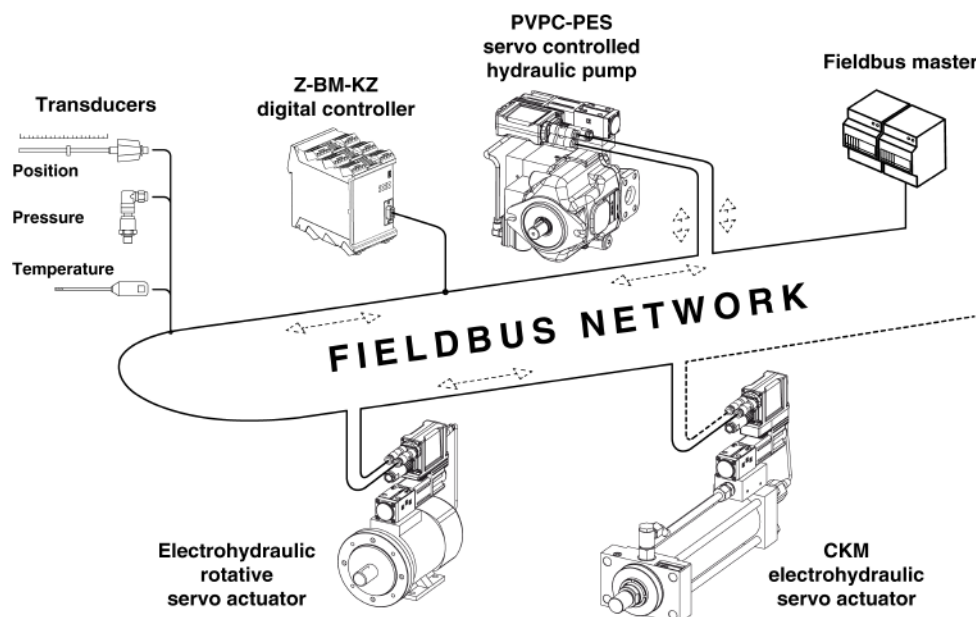
- better performances: hysteresis, response time, linearity
- software setting of hydraulic parameters: scale, bias, ramp, non-linearity
- diagnostics and computer assisted maintenance
- high immunity to electromagnetic noise
- easy interfacing to fieldbus systems



1.3.5 Fieldbus systems

Atos digital electronics allow to integrate hydraulic components into machines equipped with the digital communication system commonly known as fieldbus (i.e. CANopen, PROFIBUS DP, EtherCAT, POWERLINK, EtherNet/IP, PROFINET RT/IRT etc.). Up to now the connection and the control of hydraulic valves were mainly done by point-to-point analog connections with expensive wiring and starting-up costs. Thanks to the fieldbus systems it is possible to interface reference, monitor and diagnostic signals with proportional valves by means of cheap 2-wire cables. Atos digital electronics is available as standard with Serial communication interface (drivers/controllers with PS execution) or with USB communication interface (drivers/controllers with NP execution) to a notebook or desktop PC:

- option BC allows integration into CANopen fieldbus systems
- option BP allows integration into PROFIBUS DP fieldbus systems
- option EH allows integration into EtherCAT fieldbus systems
- option EW allows integration into POWERLINK fieldbus systems
- option EI allows integration into EtherNet/IP fieldbus systems
- option EP allows integration into PROFINET RT/IRT fieldbus systems



1.3.6 IO-Link systems

IO-Link is a low cost / short distance communication standard used for connecting digital sensors and actuators to the fieldbus network.

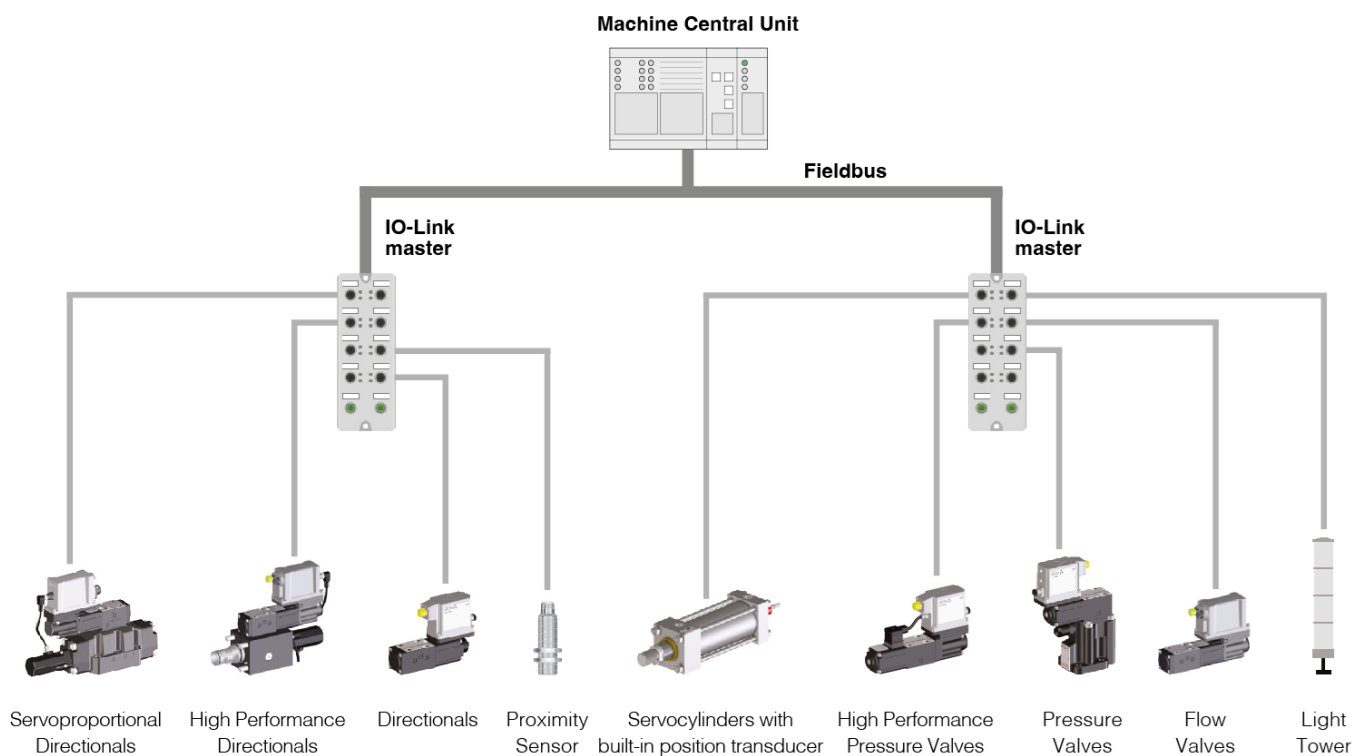
An IO-Link system consists of the following components:

- IO-Link master
- IO-Link master devices (valves, transducers...)
- unshielded cables

Each device is connected to a single port of the master via low cost unshielded cables (point-to-point communication) and the master works as a hub establishing the communication between the devices and the machine central unit which manages the automation system. IO-Link masters support various fieldbuses for the communication with the machine central unit (CANopen, PROFIBUS, EtherCAT, POWERLINK, PROFINET, EtherNET/IP, ...).

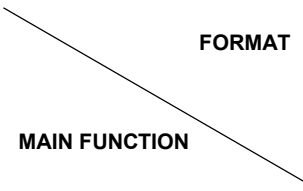



The IO-Link system offers several advantages as a digital communication interface:

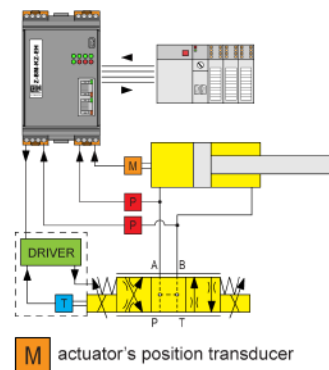
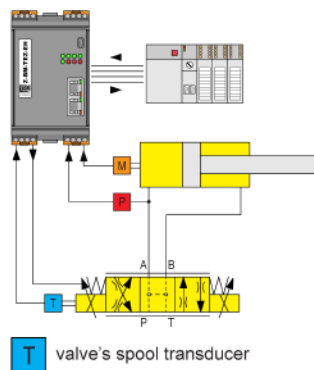
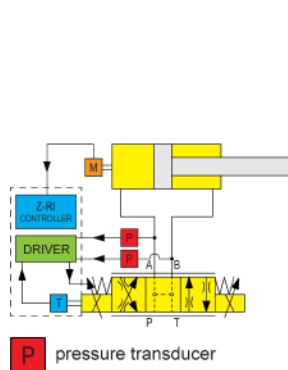
- low cost standardized wiring
- improved accuracy and robustness of digital transmitted information
- more information available for machine optimization, diagnostics and troubleshooting
- dynamic change of device parameters for increasing machine flexibility and performances
- automatic device identification and parametrization for simplifying commissioning and maintenance operations



1.3.7 Axis controls

The modern architecture of industrial machinery strongly increases the demand of accuracy, repeatability and performance. This leads to the need of devices that integrate to the traditional axis positioning also the pressure/force controls. Atos focuses the integration of axis cards functions with proportional electrohydraulics either in on-board or off-board format. They improve motion performance, simplify the automation architecture and may be integrated in the fieldbus network.

TYPE		ON BOARD AXIS CARD AND DRIVER	AXIS CARD WITH DRIVER FUNCTION	AXIS CARD
				
			DIN-rail format	DIN-rail format
Technical table		FS610 FS620 FS630	GS330	GS340
Valve's driver function		•	•	n.a.
Nr. of controlled Axis		1	1	1
Internal programmable cycles		simple	simple	complete
Graphic programming software		•	•	•
Position control		•	•	•
Position transducer Interface:	Analog	•	•	•
	Digital (SSI or Encoder)	•	•	•
P/Q control		•	•	•
Analog transducer interface, pressure or force		2	2	2
Performance parameters setting (e.g. Dither, PID)		•	•	•
Valve parameters setting (e.g. Bias, Ramp, Scale)		• factory preset	• factory preset	•
USB interface		•	•	•
CANopen		•	•	•
PROFIBUS DP		•	•	•
EtherCAT		•	•	•
POWERLINK		•	•	•
EtherNet/IP		•	•	•
PROFINET RT/IRT		•	•	•
Digital input		1	1	3
Digital output		1	1	1
Analog input reference		2	2	2
Analog output monitor		2	2	up to 3



 = options

1.4 **About E-SW-SETUP programming software**

E-SW-SETUP programming software is the entry door to the Atos digital driver technology: it is free and available in Download Area (see 1.2.2).

The software automatically recognizes the connected valve model and it adapts the displayed parameters.

The graphic interface is organized in pages and levels related to different specific functional groups and it allows to:

- simply access all the functional parameters of Atos digital proportional valves and drivers
- numerically adapt the factory preset parameters to the application requirements
- verify the actual working conditions
- identify and quickly solve fault conditions
- store the customized setting into the valve/driver and into the PC

E-SW-SETUP supports the following communication interfaces:

NP	USB
IR	Infrared
PS	Serial RS232
IL	IO-Link via USB
BC	CANopen
BP	PROFIBUS DP
EH	EtherCAT
EW	POWERLINK via USB
EI	Ethernet/IP via USB
EP	PROFINET via USB

1.4.1 **Minimum requirements for PC software**

- Pentium® processor 1GHz or equivalent
- Windows® 10 or higher
- 1024x768 or higher
- 8 GB RAM + Hard Disk with 1 GB free space
- USB port / Bluetooth Low Energy (BLE), version 4.2

1.4.2 **Installation**

After downloading the E-SW-SETUP from the Download Area (see 1.2.2) on your PC, install the software following the wizard.



To install Atos software, the user must have administrator rights on the system.

1.4.3 Programming tools – Bluetooth or USB connection

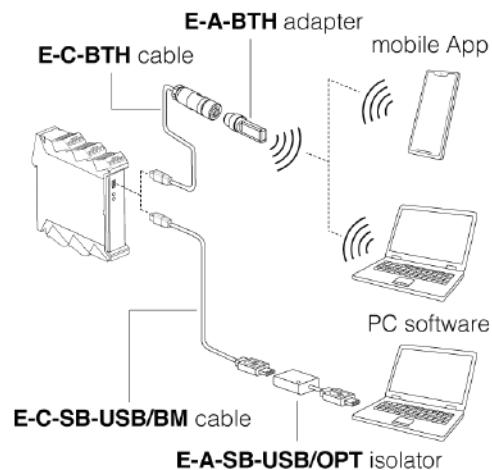
Proper adapter, cables and isolators must be used to connect the PC software to the specific driver and communication protocol.



Adapters, cables and isolators must be ordered separately.



For E-C-SB-USB/BM cable, the use of USB isolator adapter is highly recommended for PC protection (see 5.4.2).



WARNING: see tech table GS500 for the list of countries where the Bluetooth adapter has been approved. For more information about E-A-BTH Bluetooth adapter please refer to STARTUP-BLUETOOTH guide.

E-SW-SETUP software – required communication tools:

Driver	Bluetooth		USB, Serial, Infrared			
	Adapter	Cable	Adapter	Cable	Terminator	
E-MI-AS-IR	-	-	E-A-PS-USB/IR	-	-	
E-BM-AS-PS			E-A-PS-USB/DB9	E-C-PS-DB9/RJ45		
E-BM-AES			E-A-SB-USB/OPT	E-C-SB-USB/BM		
E-BM-RES						
E-BM-TEB/LEB	E-A-BTH	E-C-BTH				
E-BM-TES/LES		-		E-C-SB-USB/M12		
E-RJ-**						
E-RI-TID-N-BC	-	-	E-A-BC-USB/DB9	E-C-BC-DB9/M12	E-TRM-BC-DB9/DB9	



For more information on adapters, cables and terminators type, please refer to technical table GS500.



The previous versions of the Bluetooth adapter and cables are still compatible.

1.5 About 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.

1.5.1 Minimum requirements for mobile App

- iOS 14
- Android 9
- Bluetooth Low Energy (BLE), version 4.2


1.5.2 Installation

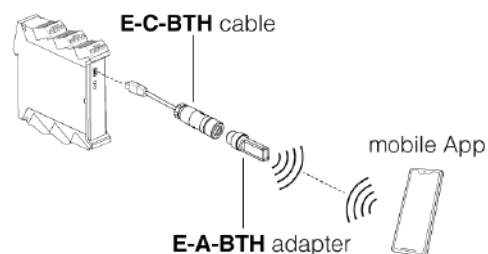
Download Atos CONNECT mobile app on the **App store** or get it on **Google Play**.




1.5.3 Programming tools –Bluetooth connection

Bluetooth adapter and cable must be used to connect the Atos CONNECT mobile App to the specific driver.


 Bluetooth adapter can be supplied with the valve through /T option or can be purchased separately.



 **WARNING:** see tech table GS500 for the list of countries where the Bluetooth adapter has been approved. For more information about E-A-BTH Bluetooth adapter please refer to STARTUP-BLUETOOTH guide.

Atos CONNECT mobile app – required communication tools:

Driver	Bluetooth	
	Adapter	Cable
E-BM-TEB/LEB	E-A-BTH	E-C-BTH
E-BM-TES/LES		
E-RI-**		-

 For more information on adapter and cable type, please refer to technical table GS500.

 The previous versions of the Bluetooth adapter and cables are still compatible.

1.6 Safety prescriptions

1.6.1 General warning

- all information and instructions reported in this manual and in the supplementary documentation (see 1.2.1), must always be observed to avoid damage and injury



During the save/load operations of the driver permanent memory (see 8.1.1) do not turn off power supply (driver parameter lose may occur) and the driver must be disabled or in hydraulic null regulation.



Driver's faults may compromise safety or change operating conditions, shut down the driver immediately and notify qualified personnel.

- all of the relevant local and plant/machine specific regulations must be always observed

Hazardous situations may occur whenever the driver:

- is not properly transported and stored
- is altered or modified
- is not installed, commissioned and operated by qualified personnel
- is not used properly

1.6.2 Personnel selection and qualification

Qualified personnel, in the sense of this document, are:

- personnel properly trained and authorized to install, start-up and operate the digital driver in accordance with the established safety prescriptions and procedures
- personnel who, based on their technical/standards knowledge and training, are able to evaluate their tasks, to recognize potential hazards and to carry out the correct safety measures

1.6.3 Electrical installation warning

Following recommendations on electrical installation must be always observed:

- Switch-off power supply before connecting or disconnecting the driver
- Do not use electrical signals of the driver (e.g. reference, monitor and enable signals) for safety purpose
- Take care when switch-on/off the driver because it could produce uncontrolled movements of the actuators operated by the driver
- Always shield analog signal wirings
- Use low-capacitance cables and do not use intermediate connections
- Do not wire any power cables close to control electronics or command/signal wirings
- Protect the driver and other control electronics from electromagnetic noises
- Maintain a proper distance from antenna lines, RF devices and radio equipment




WARNING: USB port of valve drivers / axis controls is not isolated!


Use of USB isolator adapter is highly recommended for PC protection (see 5.4.2): wrong earthing connections may cause high potential difference between GNDs, generating high currents that could damage valve drivers / axis controls or the connected PC. Before connecting valve drivers / axis controls to PC USB port, check the correct potential level of earthing connection.

1.6.4 Electromagnetic compatibility

Atos electronic driver and proportional valves have been tested according to EMC directives.

The EMC Directive identifies the ability of a device, equipment or system to function in an electromagnetic environment in a satisfactory manner (immunity), without produce intolerable electromagnetic interferences into any equipment in same environment (emission). For further information please refer to specific technical tables for related product code.

 The electromagnetic compatibility of the drivers is valid only if wirings are realized according to the recommended electric connections (refer also to section 5).

 Electromagnetic fields of machine environment may be different from test conditions: always verify the device functionality once installed.

1.6.5 Electrostatic discharge protection

Electrostatic discharge (ESD) can damage electronic components of the driver; to prevent damage observe the following recommendations:

- Discharge static voltage from your body before handling the valve/driver
- Work in a safe environment (do not use any device or surface that can generate or hold static charge)
- Avoid touching any exposed pins or electronic components



1.6.6 Repair and Troubleshooting

Repair and troubleshooting require specialized skills: these activities must be performed only by Atos or authorized service centers.

Please contact Atos technical services of Atos Electronic Division (ele-support@atos.com) communicating complete electronic code plus serial number printed on driver's label:

Example:

① Driver code

e.g.: **E-BM-LEB-N-NP-05H 20**

② Factory set code

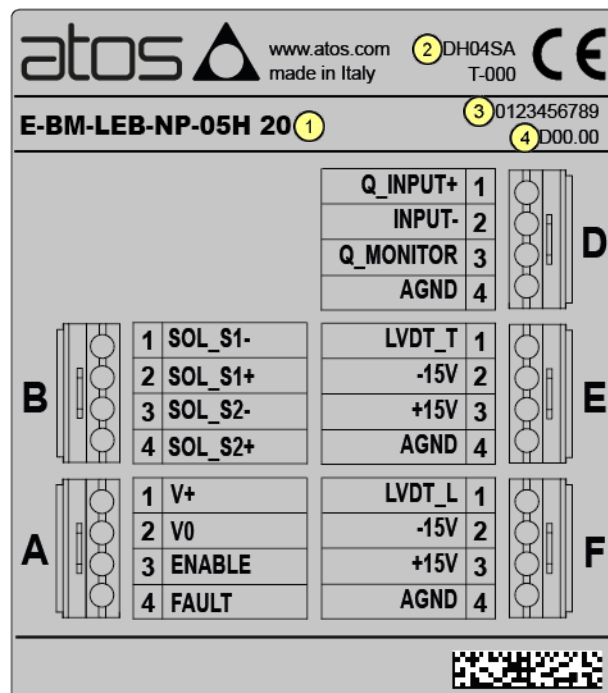
e.g.: **DH04SA**

③ Driver serial number

e.g.: **0123456789**

④ Factory firmware version

e.g.: **D00.00**



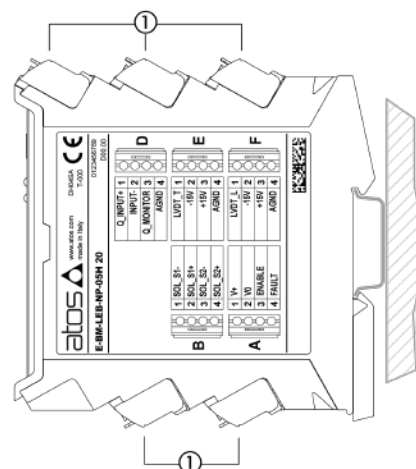
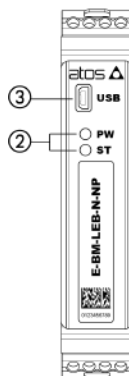
2 ABOUT E-BM-TEB/LEB DRIVERS

Digital drivers supply and 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.

TEB execution operates direct operated directional/flow control valves with one integral spool position transducer.

LEB execution operates pilot operated directional valves with two integral spool position transducers.

Atos PC software allows to customize the driver configuration to the specific application requirements.



Bluetooth/USB connection is always present for valve settings via mobile App and Atos PC software.

Digital communication interface allows to set the driver parameters with the Atos E-SW-SETUP software.

2.1 Model Code

E-BM	-	TEB	-	N	-	NP	-	01H	*	/	*	*	*
Off-board electronic driver in DIN rail format												Set code	
TEB = digital basic driver, for valves with one LVDT transducer LEB = digital basic driver, for valves with two LVDT transducers												Series number	
Alternated P/Q control: N = none													
Fieldbus interface: NP = Not Present													
												Options: A = max current limitation for Ex-proof valves C = current feedback 4 ÷ 20 mA for LVDT transducers only in combination with option A I = current reference input and monitor 4 ÷ 20 mA	
												- = omit for direct valves and for pilot operated valves with two LVDT transducers P = for pilot operated valves with one LVDT transducer (only for TEB)	
												01H = for single solenoid proportional valves 05H = for double solenoid proportional valves (only for TEB)	

2.2 Electrical Features

- Functional parameters are factory preset for best performances
- 5 fast plug-in connectors
- Mini USB type B for USB communication interface (always available)
- 2 leds for diagnostic
- Electrical protection against reverse polarity of power on
- Operating temperature range: $-20^{\circ} \div +60^{\circ}$
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark to EMC directive

3 GETTING STARTED

This section contains a brief review of the main operations required to install and configure the drivers by PC software.

3.1 Programming tools installation

Registration

Perform the registration on MyAtos at www.atos.com to download the software (see 1.2.2).

Adapters and cables

Make sure you have the correct adapters and cables to connect the driver to your PC (see 1.4.3).

Software installation

Install the E-SW-SETUP software on PC (see 1.4.2).



For minimum requirements for PC software, see 1.4.1.

3.2 Driver installation

- Wire the driver to main control unit (see 5.3)
- Connect the required adapter or cable to the driver (see 1.4.3)

3.3 Driver configuration (Serial-USB)

- Apply power supply to the driver (driver must be in hydraulic null regulation) (see 5.3)
- Start E-SW-SETUP software and connect it to the driver (see 10)
- Configure communication parameters (see 17.2)
- Apply hydraulic power and complete the driver setting whenever required:
 - Bias and scale (see 16.1 and 16.3)
 - Ramps (see 16.4)
 - Linearization (see 16.6)
 - PID parameters (see 16.9)
- Save the valve parameters changes into the driver permanent memory (see 13)



To speed up the configuration process you can use parameter setting previously saved into the personal computer (see 21.1).

4 VALVE INSTALLATION

4.1 General prescriptions

The following instructions are general indications and procedures for the correct installation and commissioning of proportional valves in modern electrohydraulic systems.

Hydraulic fluid

The hydraulic fluid is used to transmit power and to provide components lubrication in hydraulic systems.

To extend system reliability select high quality fluid with high viscosity index, with antifoaming and antioxidant additives according to the international standards: DIN 51524 and 51535.

Oil viscosity rating depends on the installed pumps/motors characteristics and on the working temperature.

Use lower viscosities with low system pressure to limit pressure drops and higher viscosities for high system pressure to limit internal leakage:

- High viscosity could cause air-emulsion in the oil and therefore cavitation and noise problems in continuous operation
- Low viscosity decreases the system efficiency and it affects the lubrication

HLP mineral oil according to DIN 51524 - part 2 are recommended (viscosity range: $15 \div 100 \text{ mm}^2/\text{sec}$ at 40°C).

Oil must be periodically controlled and normally changed every 2000 hours (see 'Circuit cleaning, filling and flushing').

Fluid temperature conditioning

A high-performance system must be properly conditioned to maintain the fluid temperature within specific range (generically between 40 and 50°C) thus obtaining a constant fluid viscosity during the operation.

The machine working cycle should start once the recommended temperature has been reached.

Fluid temperatures higher than 60°C , require components with Viton seals (valve option /PE).

Fluid temperature must not exceed 80°C .

Fluid filtration

An efficient fluid filtration prevents breakdowns of the system by protecting the components from solid particle contamination that may affect hydraulic fluid. Cleanliness class must be equal or better than ISO 18/15, NAS 1632 class 9, by fitting in line filters of $10\mu\text{m}$ and $\beta_{10}=75$.

In line pressure filters must be mounted, if possible, immediately before the proportional valve and should be of high pressure type; clogging electrical indicator without by-pass valve are recommended.

Additional warnings have to be considered: make sure that the filters are properly sized to ensure efficiency; one of the main sources of contamination is air exchange into the tank: proper breather filters on the power unit tank have to be always provided; filter the fluid when filling the power unit tank (new fluids are always contaminated).

During system working operation the frequent cleaning or replacing of filters cartridges are required.

Circuit cleaning, filling and flushing

Power unit tank has to be accurately cleaned before filling it by removing all the contaminants and any extraneous object; piping has to be cold bended and pickled.

Once assembled, an accurate washing of the whole circuit (flushing) has to be performed to eliminate the contaminants:

- replace proportional valves with appropriate by-pass plates or with on-off valves
- by-pass the actuator user ports by means flexible pipes
- shutoff the accumulators from the other parts of the circuit
- replace filters cartridge after flushing procedures

Hydraulic connections

The flexible hoses on pressure line must be shielded and secured by using proper restrain devices to prevent damages of machine, system and injuries to the operator.

The proportional valve must be installed as close as possible to the actuator to ensure the maximum stiffness of the circuit and the best dynamic performances.

Hydraulic return and drains lines

Return lines must be connected to the tank with low counterpressures in order to not affect the components regulation: return lines from proportional valve to tank must be properly sized to limit counterpressures to max 5 bar.

High flow regulation may require drain connections to realize separate piping to the tank and to maintain proper components functionality: external drain connection port is available as standard on servocylinders rod side, piloted directional valves and pressure reducing valves (use option /Y valves when drain port is not available as standard).

Piloting pressures

Standard configuration of piloted valves is with piloting line internally connected to line pressure:

- use option /E valve with external pilot connection when line pressure is less than 30 bar

For directional control valve or throttle cartridge:

- use option /G valve with integral pressure reducing valve when line pressure is greater than 100 bar

Air bleeds

The air in the hydraulic circuits affects the hydraulic stiffness and it causes malfunctioning: air bleeds are provided for both proportional valves and servocylinders (cylinder rod side); in addition proper air bleed valves should be also installed in the hydraulic system points where the air could remain trapped.

Additional warnings at first start-up or after maintenance of the system

- Unscrew all the air bleeds to allow the complete removal of air
- Tight piping connections
- Use a check valve on the main return line to tank maintain to avoid the self emptying of the pipes following a long service stop

4.2 Mounting

- Once removed valve packaging take care to protect valve ports, connectors and cables
- Do not pull valve integral transducer cables
- Removed valve ports plastic protection before mounting the valve into the system
- Do not touch any electric components while handling the valve
- Tighten valves to the manifold without exceeding the recommended max torque

5 DRIVER ELECTRICAL CONNECTIONS

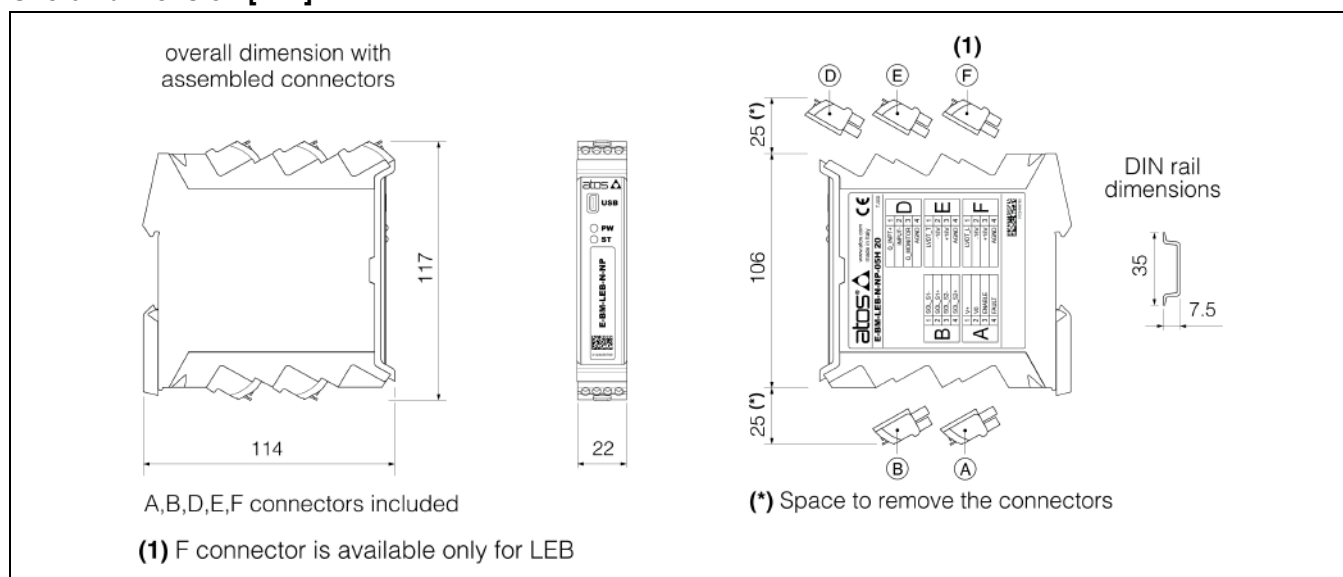
5.1 General prescriptions

- Switch-off power supply before any wiring operation
- During the system start-up, verify electrical noise level and apply protection to avoid reference signals interference from electrical noise
- Use recommended shielded cable size: 1,5 mm² max 50m for power supply and solenoid; 0,5 mm² for logic
- It is recommended to use current signals for distance longer than 20m (software configurable)
- Use a 2,5 A fuse on power supply line

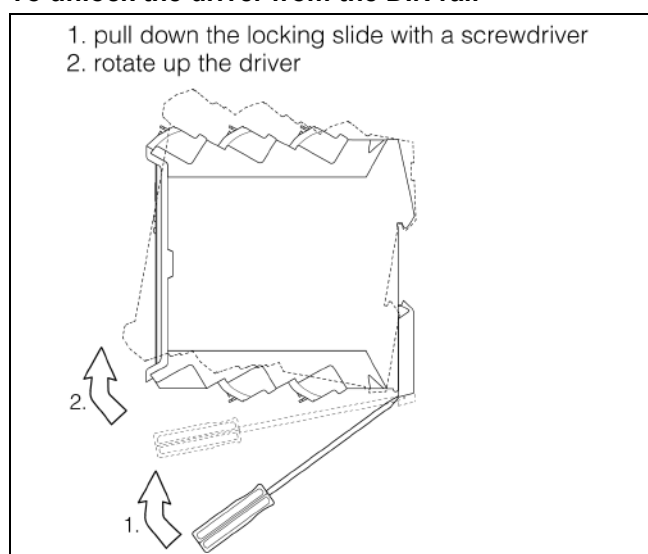
Controller Installation

Remove the E-BM-TEB/LEB driver from its packaging only in a protected working area.

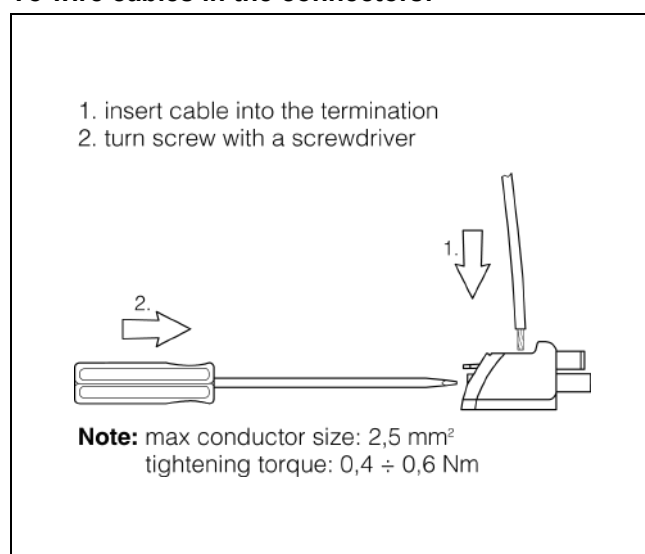
Overall dimension [mm]



To unlock the driver from the DIN rail



To wire cables in the connectors:



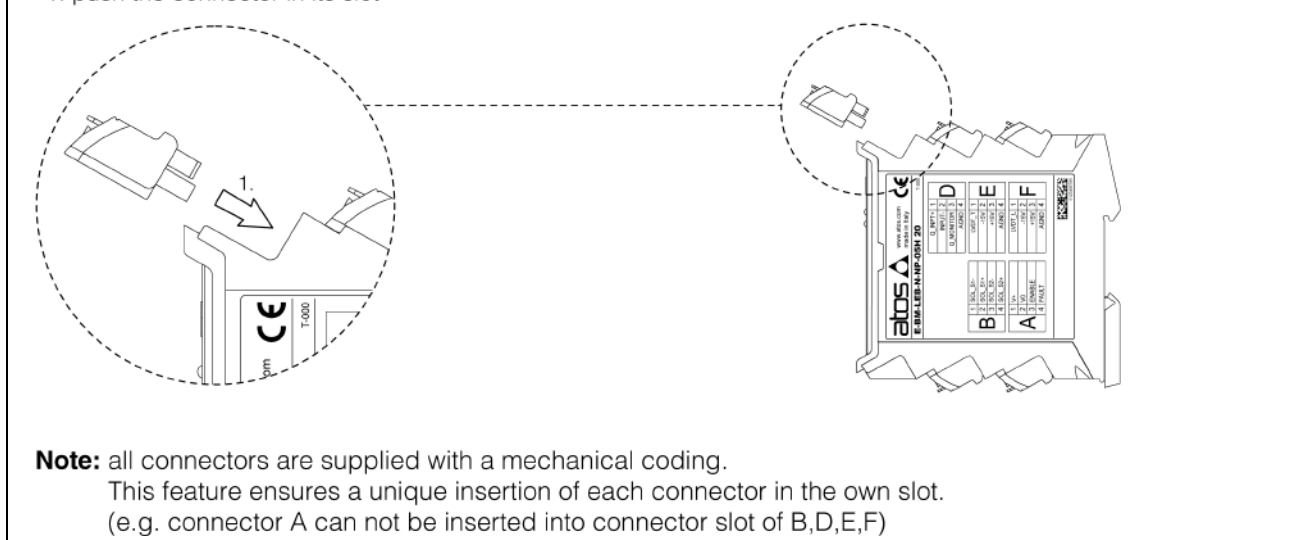
To extract the connectors

1. push lever
2. pull connector



To insert the connectors

1. push the connector in its slot

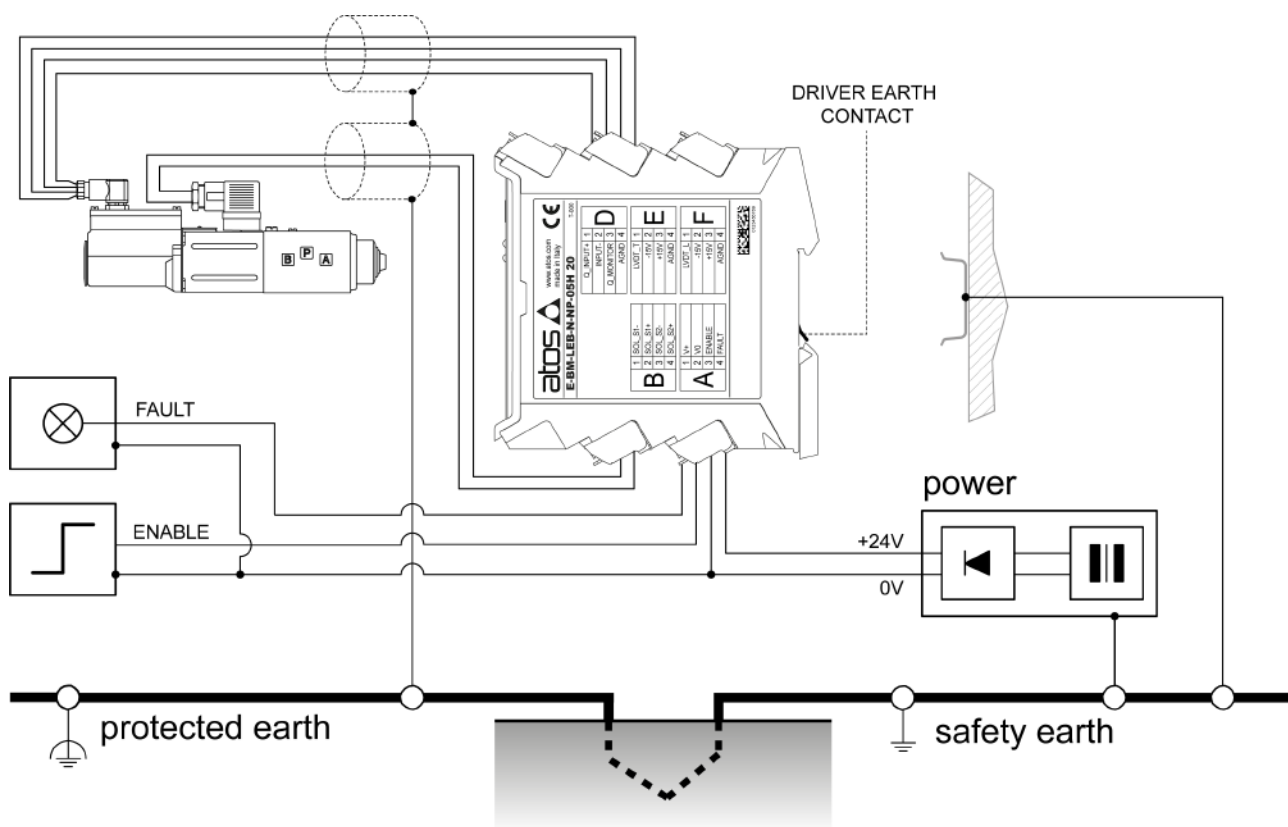


Cable shielding and earthing

Use Shielded wirings to avoid electromagnetic noise: it is an essential part of the EMC protection from the noises that could otherwise bring disturbance through the signal and power supply connections.

To avoid any interference, the driver cables must be separated from system power cables (connected to transformers, electrical motors, drivers, etc.) and must be correctly shielded (see below scheme):

- Connect cable shield at PLC/machine side and leave the other end (driver side) open to prevent ground loops
- If possible, connect shields to a *protected earth* (a noise-free connection with a different path from safety earth and power supply ground); it is just designed to connect command signals ground, cables shields and all other noise sensitive devices
- If *protected earth* is not available, use the power supply ground
- Verify that all the ground/earth points are equipotential otherwise position and dimension of the connections must be checked
- Earth connection of the drivers is available on the rear connector; take care to the correct earthing also the valve or cylinder
- In case of high noise levels, use additional shields and filters to allow the correct working of the electronic driver

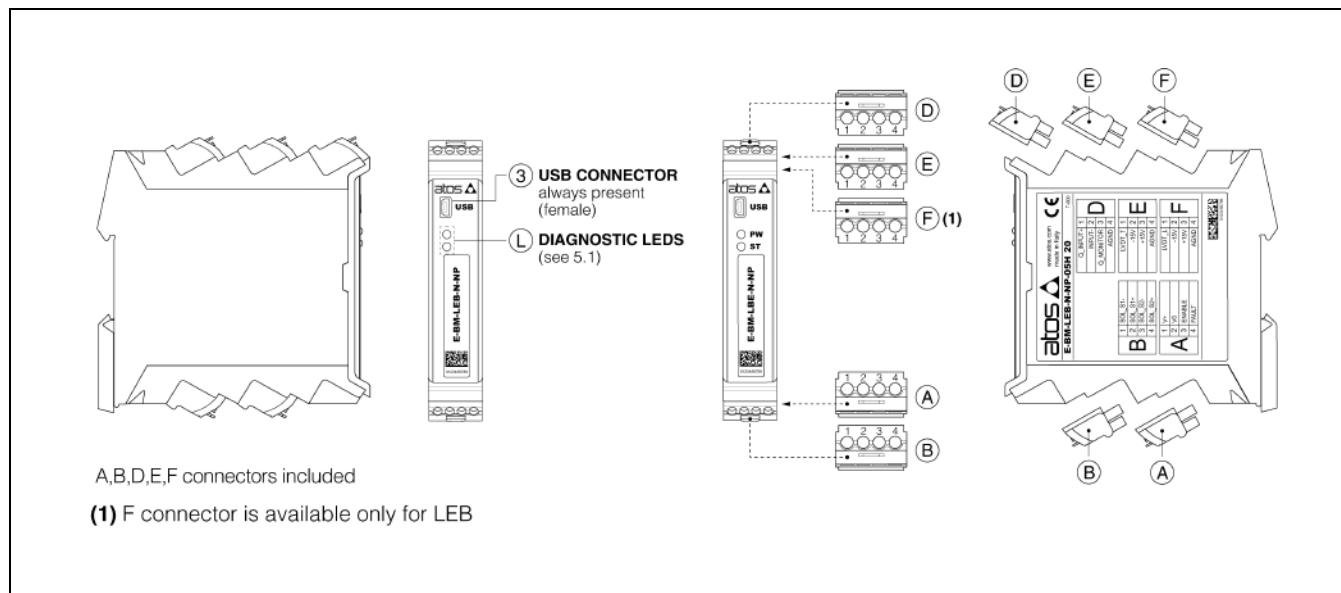


5.2 General connection

E-BM-TEB/LEB digital drivers can be equipped with several connectors. See below the complete overview of available connectors.



All connectors are identified with a capital letter as fast reference (see 9.3).



5.3 Main connection – connectors A - B - D - E - F

Main connectors are the driver interface to the machine control unit: wire their to the driver power supply and the input/output signals (analog or on-off) for reference and diagnostic functions.

Connector A – Power supply, Enable and Fault

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 V _{DC}	Input - power supply
	2	V0	Power supply 0 V _{DC}	Gnd - power supply
	3	ENABLE	Enable (24 V _{DC}) or disable (0 V _{DC}) the driver, referred to V0	Input - on/off signal
	4	FAULT	Fault (0 V _{DC}) or normal working (24 V _{DC}), referred to V0	Output - on/off signal

Connector B – Solenoids S1 and S2

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
B	1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
	2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
	3	SOL_S2-	Negative current to solenoid S2 – only for double solenoid valve	Output - power PWM
	4	SOL_S2+	Positive current to solenoid S2 – only for double solenoid valve	Output - power PWM

Connector D – Flow reference signal and flow Monitor

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
D	1	Q_INPUT+	Flow reference input signal: ± 10 V _{DC} / ± 20 mA maximum range Default are ± 10 V _{DC} for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
	2	INPUT-	Negative reference input signal for Q_INPUT+	Input - analog signal
	3	Q_MONITOR	Flow monitor output signal: ± 10 VDC / ± 20 mA maximum range, referred to AGND Default are ± 10 VDC for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
	4	AGND	Common gnd for monitor output	Common gnd

Connector E – LVDT_T transducer

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
E	1	LVDT_T	Direct valve or pilot valve position transducer signal	Input - analog signal
	2	-15V	Direct valve or pilot valve position transducer power supply -15V	Output - power supply
	3	+15V	Direct valve or pilot valve position transducer power supply +15V	Output - power supply
	4	AGND	Common GND for transducer power	Common gnd

Connector D – LVDT_L transducer

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
F	1	LVDT_L	Main stage valve position transducer signal	Input - analog signal
	2	-15V	Main stage valve position transducer power supply -15V	Output - power supply
	3	+15V	Main stage valve position transducer power supply +15V	Output - power supply
	4	AGND	Common GND for transducer power	Common gnd



F connector is available only for LEB

5.3.1 Power supply (V+ and V0)

The power supply +24 V_{DC} (pin A1 and A2, maximum range 20 ÷ 32 V_{DC}) must be properly stabilized or rectified and filtered (ripple max 10% V_{PP}) and must grant at least 50W for each connected driver:

- apply at least a 10000 µF/40 V capacitance near the driver in case of single phase rectifiers
- apply at least a 4700 µF/40 V capacitance near the driver in case of three phase rectifiers



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



A maximum time of 400 ms have be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

5.3.2 Flow reference input signal (Q INPUT+)

The driver is designed to receive an analog reference input signal (pin D1) for the valve's spool position.

Reference input signal is factory preset according to selected valve code, defaults are ±10 V_{DC} 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 V_{DC} or ± 20 mA.



Do not use power supply ground (V0) as reference for input signals: the absorbed current of the driver's power stage can affect analog signal quality. Use INPUT- (pin D2) to connect as reference for input signal.



Small values of input range settings can be more affected by electrical noise.

5.3.3 Flow monitor output signal (Q MONITOR)

The driver generates an analog output signal (pin D3) proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ±10 V_{DC} 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 V_{DC} or ± 20 mA.

5.3.4 Enable input signal (ENABLE)

To enable the driver, supply a 24 V_{DC} 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 active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with norms IEC 61508 and ISO 13849.

5.3.5 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.

Fault status is not affected by the Enable input signal.

5.3.6 Main stage and direct or pilot position transducer signals (LVDT L / LVDT T)

Main stage (LVDT_L pin F1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 V_{DC} supply output available at pin F2, F3 and pin E2, E3.

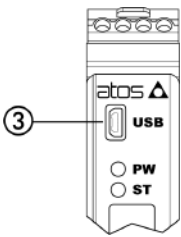


Transducer input signals working range is ±10 V_{DC} for standard or 4 ÷ 20 mA for /C option and cannot be reconfigured via software (input signals setting depends to the driver set code).

5.4 Bluetooth/USB communication connection – connector n. 3

USB communication port is always present to program the driver by the Atos E-SW-SETUP software. All the functional parameters of digital driver as internal reference generation, driver dynamics, I/O configurations, can be easily set and optimized by the user.


USB communication connectors Mini USB type B is always available.

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	
1	GND_USB	Signal zero data line	
2	ID	Identification	
3	D+	Data line +	
4	D-	Data line -	
5	+5V_USB	Power supply	

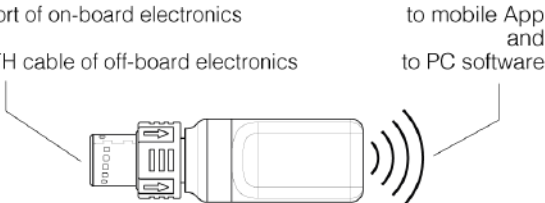

5.4.1 Bluetooth adapter connection


Bluetooth connection permits the functional parameters programming through mobile App or PC software.

For more info please refer technical table GS500.

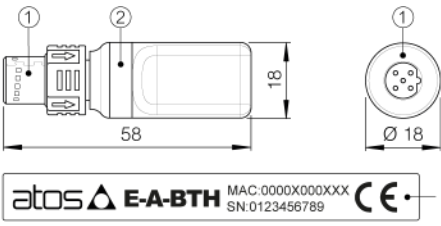
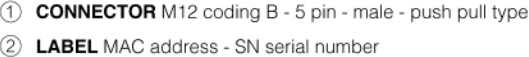
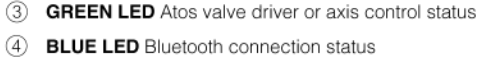
 The previous version of Bluetooth adapter and cables are still compatible.

E-A-BTH – Bluetooth adapter

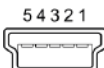

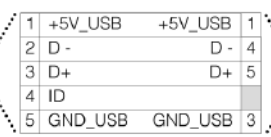

	TECHNICAL SPECIFICATIONS
	M12 male connector, coding B, 5pin, push pull type
	Operating temperature: $-40 \div +60$ °C (storage $-40 \div +70$ °C)
	Bluetooth technology: Bluetooth Low Energy (BLE) 5.4
	Max RF transmission power: +6 dBm
	Frequency: 2.402 GHz to 2.480 GHz
	Format: IP66 / IP67 protection degree
	Mass: 14 g
	Two LEDs for an immediate basic diagnostic
	External power supply not required (from Atos digital electronics only)

 **WARNING:** see tech table GS500 for the list of countries where the Bluetooth adapter has been approved. For more information about E-A-BTH Bluetooth adapter please refer to STARTUP-BLUETOOTH guide.

Overview and dimensions [mm]

			
			
① CONNECTOR M12 coding B - 5 pin - male - push pull type		③ GREEN LED Atos valve driver or axis control status	
② LABEL MAC address - SN serial number		④ BLUE LED Bluetooth connection status	

E-C-BTH – cable – 10 cm length

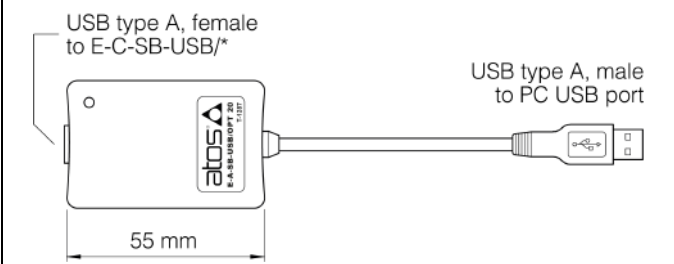
Connector to off-board electronics side	Connector to Bluetooth adapter side
Mini USB type B - male	M12 - 5pin - female
	
Shield connected to the housing	Shield connected to the housing
	

5.4.2 USB cable connection

USB connection permits the functional parameters programming through PC software.

For more info please refer technical table GS500.

E-A-SB-USB/OPT – isolator adapter

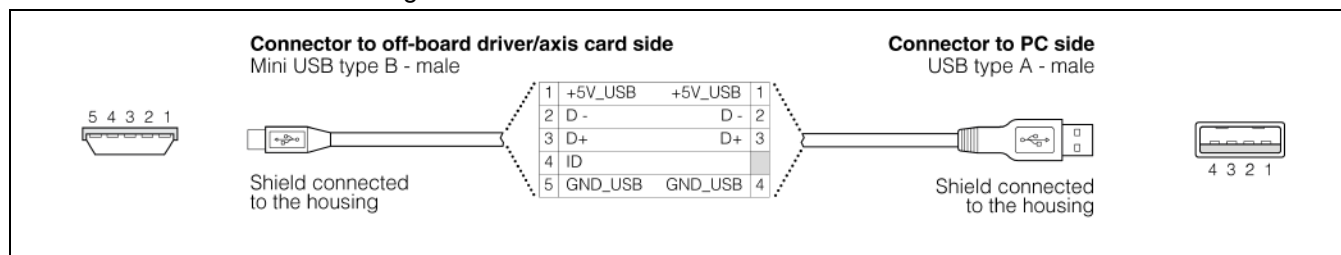
<div><div>USB type A, female to E-C-SB-USB/*</div><div></div><div>USB type A, male to PC USB port</div></div>	<table><tr><th>TECHNICAL SPECIFICATIONS</th></tr><tr><td>USB 2.0 Full speed (12 MBps)</td></tr><tr><td>electrical isolation 3 kV</td></tr><tr><td>temperature range, -40° ÷ +80°</td></tr><tr><td>external power supply not required</td></tr><tr><td>PC drive not required</td></tr><tr><td>status LED</td></tr></table>	TECHNICAL SPECIFICATIONS	USB 2.0 Full speed (12 MBps)	electrical isolation 3 kV	temperature range, -40° ÷ +80°	external power supply not required	PC drive not required	status LED
TECHNICAL SPECIFICATIONS								
USB 2.0 Full speed (12 MBps)								
electrical isolation 3 kV								
temperature range, -40° ÷ +80°								
external power supply not required								
PC drive not required								
status LED								



WARNING: USB port of valve drivers / axis controls is not isolated!

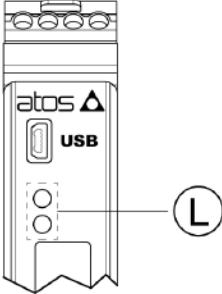
Use of USB isolator adapter is highly recommended for PC protection: wrong earthing connections may cause high potential difference between GNDs, generating high currents that could damage valve drivers / axis controls or the connected PC. Before connecting valve drivers / axis controls to PC USB port, check the correct potential level of earthing connection.

E-C-SB-USB/BM – cable 3 m length



6 DRIVER LEDS

Driver operative conditions are shown by 2 leds for an immediate basic diagnostics of driver power supply and fault condition.

LED	COLOR	STATUS	DESCRIPTION	
PW	GREEN	OFF	Power supply OFF	
		ON	Power supply ON	
ST	GREEN	OFF	Fault present	
		ON	No fault	

7 DRIVER ALARMS

When driver detects an alarm condition (see 7.2), it is displayed with proper led, alarm/fault pin is set and driver state can change according to alarm reaction (see 7.1).

7.1 Alarm Reaction

This system determines the reaction of the driver depending on the seriousness of various alarms.

The driver classifies alarms into seven classes with different priorities.



In case of several alarms simultaneously active, the alarm with the higher priority will be used.



The 'Message' alarm is used to send a diagnostic message without modify the states of the driver and Fault pin A4 status: it is identified in 'Signals' area through 'Alarm' indicator and 'Alarm Present' led (see 12.2.4) and in 'Signals – Extended Page' through 'Stored Alarms History' indicator and dedicated led (see 22.1.3).

State Machine

Priority	Class	Active control mode	Active reference	Fault acknowledge	State machine	Fault pin A4 status
0	No reaction	Spool closed loop	(*)	None	(**)	24 VDC
1	Message	Spool closed loop	(*)	None	(**)	
2	Warning	Spool closed loop	(*)	None	(**)	0 VDC
3	Minor error	No mode	Solenoid switched off	Enable transition	Fault	
4	Serious error	No mode	Solenoid switched off	Enable transition	Fault	
5	Critical error	No mode	Solenoid switched off	Enable transition	Fault	
6	Fatal error	No mode	Solenoid switched off	Power supply off	Fault Fatal	

(*) The driver maintains the reference type selected by the user; refer to 'Working Signals' (see 12.1).

(**) The driver maintains the state selected by the user; refer to 'State Machine' (see 16.14).



Fault can be acknowledged only if its cause has been eliminated.

7.2 Alarm Management

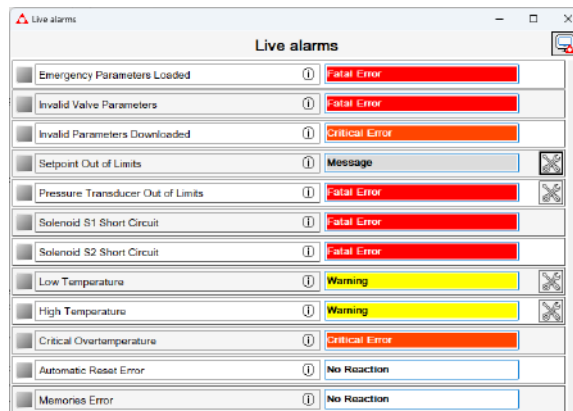
A complete diagnostic of driver alarm conditions is available through a dedicated software window page. To access at this page click on related button located on Home Page (see 14).



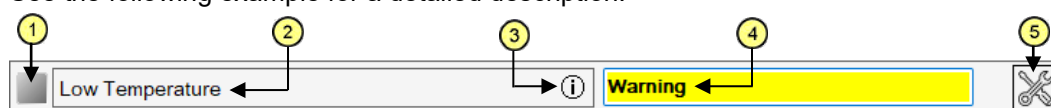
Alarm Management Access button






Return to 'Main Window' button: the 'Alarm Management' window will not be closed.



See the following example for a detailed description:



- ①: Led displays the alarm status:  no alarm ;  alarm present (the led flashes)
- ②: In this area appear the description of the alarm condition (see 7.3)
- ③: Pass mouse on  : a pop up opens with cause/troubleshooting description of the alarm (see 7.3)
- ④: In this area are displayed the seriousness of alarms through different colours and descriptions (see 7.1)
- ⑤: This button allows to directly access on software page where alarm is present and change its reaction eventually

Alarm colour classification

Priority	Class
0	No Reaction
1	Message
2	Warning
3	Minor Error
4	Serious Error
5	Critical Error
6	Fatal Error

7.3 Alarms Conditions

Following the relevant information to verify and solve alarm and fault conditions.

7.3.1 Memories Alarms

Alarm	Reaction	Cause/Troubleshooting
Emergency Parameters Loaded	Fatal Error	Emergency parameters are loaded. Please contact Atos service for troubleshooting.
Invalid Valve Parameters	Fatal Error	Requested parameters are not valid. Please contact Atos service for troubleshooting.
Invalid Parameters Downloaded	Critical Error	Downloaded parameters are not valid (see 8.1.3): restart the driver to reset fault, without making any store operation. If a store operation has been performed, use restore preset function. The driver remains locked in Init state (see 16.14).

7.3.2 Setpoint Alarms

Alarm	Reaction	Cause/Troubleshooting
Flow Analog Setpoint Out of Limits (voltage signal)	Message (*)	Flow analog setpoint exceeds admissible range: verify the correct wirings and voltage signal (see 16.7, to verify admissible range settings – high/low limits).
Flow Analog Setpoint Out of Limits (current signal)	Minor Error (*)	Flow analog setpoint exceeds admissible range: verify the correct wirings and current signal (see 16.7, to verify admissible range settings – high/low limits).



(*) The reaction is software selectable.

7.3.3 Transducer Alarms

Alarm	Reaction	Cause/Troubleshooting
Main Spool Transducer Out of Limits	Fatal Error	Main spool analog actual input signal exceeds admissible range. Please contact Atos service for troubleshooting. Only for LEB driver: spool position transducer cable broken detected; verify transducer wirings.
Pilot Spool Transducer Out of Limits [only for E-BM-LEB driver]	Fatal Error	Pilot spool position analog actual input signal exceeds admissible range. Please contact Atos service for troubleshooting.

7.3.4 Control Monitoring Alarms

Alarm	Reaction	Cause/Troubleshooting
Main Spool Position Control Error (direct valve)	Fatal Error (*)	Main spool position control monitoring error (see 16.10). Please contact Atos service for troubleshooting.
Main Spool Position Control Error (pilot operated valve)	No Reaction (*)	Main spool position control monitoring error; verify valve wirings, voltage or current signal and control monitoring parameters (see 16.10).
Pilot Spool Position Control Error [only for E-BM-LEB driver]	Fatal Error (*)	Pilot spool position control monitoring error (see 16.10). Please contact Atos service for troubleshooting.



(*) The reaction is software selectable.

7.3.5 Solenoids Alarms

Alarm	Reaction	Cause/Troubleshooting
Solenoid S1 Short Circuit	Fatal Error	Driver has detected solenoid S1 short circuit of the valve. Please contact Atos service for troubleshooting.
Solenoid S2 Short Circuit	Fatal Error	Driver has detected solenoid S2 short circuit of the valve. Please contact Atos service for troubleshooting.
Solenoids Current Control Error	No Reaction	Current control monitoring error. Please contact Atos service for troubleshooting.
Solenoids Current Fault	Fatal Error	Current value exceeds admissible range. Please contact Atos service for troubleshooting.

7.3.6 Temperature Alarms

Alarm	Reaction	Cause/Troubleshooting
Low Temperature	Warning (*)	Internal low temperature, verify correct installation and working conditions (ambient temperature – see 16.13)
High Temperature	Warning (*)	Internal high temperature, verify correct installation and working conditions (ambient and fluid temperature – see 16.13)
Critical Overtemperature	Critical Error	The value of high temperature setting was exceeded. Please contact Atos service for troubleshooting.



(*) The reaction is software selectable.

7.3.7 Hardware Alarms

Alarm	Reaction	Cause/Troubleshooting
Automatic Reset Error	Fatal Error	The driver resets itself automatically.
Memories Error	Fatal Error	Reading error of the internal EEPROM. Please contact Atos service for troubleshooting.
ADC Hardware Error	Fatal Error	Analog to digital converter internal error. Please contact Atos service for troubleshooting.

7.3.8 Output Alarms

Alarm	Reaction	Cause/Troubleshooting
+5V USB Fault	Message	Internal power supply for USB is not valid. Please contact Atos service for troubleshooting.
Fault Signal Hardware Error	Warning	Short circuit or overload has been detected on fault pin: check wiring connection (see 5.3.5).
Monitor Signal Hardware Error (voltage signal)	Warning (*)	Short circuit or overload has been detected on monitor pin: check wiring connection (see 16.12).
Monitor Signal Hardware Error (current signal)	No Reaction (*)	Monitor not connected: check wiring connection or load resistance - max 500 Ohm (see 16.12). By default this alarm is set to No Reaction. If the monitor is used, it is recommended to activate the alarm in order to detect possible wiring issues.



(*) The reaction is software selectable.

7.3.9 Power Supply Alarms

Alarm	Reaction	Cause/Troubleshooting
+24V Solenoid Too High	Warning	Solenoid power supply is higher than 33 V _{DC} (for 1 sec): check power supply.
+24V Solenoid Too Low	Critical Error	Solenoid power supply is lower than 18 V _{DC} (for 1 sec): check power supply.

7.3.10 Internal Power Supply Alarms

Alarm	Reaction	Cause/Troubleshooting
+3.3V Fault	No Reaction	Internal power supply +3.3V of the MICRO exceeds admissible range. Please contact Atos service for troubleshooting.
+5V Fault	Fatal Error	Internal power supply +5V exceeds admissible range. Please contact Atos service for troubleshooting.
+15V Fault	Fatal Error	Internal power supply +15V exceeds admissible range. Please contact Atos service for troubleshooting.
-15V Fault	Fatal Error	Internal power supply -15V exceeds admissible range. Please contact Atos service for troubleshooting.

8 DRIVER PARAMETERS OPERATION

To operate correctly E-BM-TEB/LEB drivers with the E-SW-SETUP programming software, the user has to consider how the driver and the software parameters are managed.

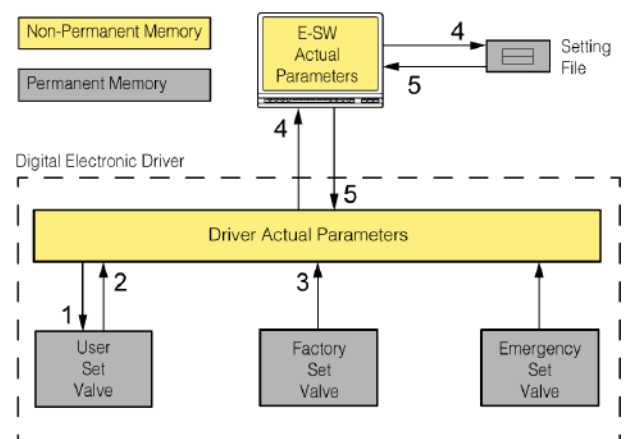
8.1 Driver parameters

Driver parameters can be saved and loaded:

- Save: from 'non-permanent memory' to 'permanent memory'
- Load: from 'permanent memory' to 'non-permanent memory'

8.1.1 Parameters operation scheme

- Driver Save operations (see 8.1.4):
 - 1) Save User Set
- Driver Load operations (see 8.1.5):
 - 2) Load User Set
 - 3) Load Factory Set
- PC Setting File operations (see 21):
 - 4) Save setting file
 - 5) Load setting file



8.1.2 Actual Parameters (non-permanent memory)

The driver functionality and regulation depend by its "Actual Parameters":

- automatically loaded at each power-on from driver's permanent memory
- lost when the driver is turned-off, if not stored to driver's permanent memory
- displayed and modifiable by E-SW-SETUP software


8.1.3 Driver “Factory/User/Emergency Set” (permanent memory)

When the driver is turned-on, one of the following parameter sets is copied from this section to the Actual Parameters (non-permanent memory) to define the driver functionalities:

- “Factory” This parameter set allows to start-up the driver with the factory setting defined by Atos
- “User” This parameter set allows to start-up of the driver with the customized values defined and stored by the user using E-SW-SETUP software (as default “User Set” and “Factory Set” are the same)
- “Emergency” This parameter set allows to start-up the driver when “Factory Set” and “User Set” contain corrupted data

If permanent memory is corrupted, the driver tries to load alternative set:

- “Factory” Loaded automatically in case of invalid “User” set (factory default)
- “Emergency” Loaded automatically in case of invalid “Factory” set (emergency default)

 When invalid parameters are detected at power-on or driver restart (see 13.1.1) the driver goes into “Fault” condition; please contact Atos Technical Sales Support ele-support@atos.com.

8.1.4 Save Driver Set

- “Save User Set” This operation allows to store the driver “Actual Parameters” (non-permanent) into the “User Set” (permanent) set



At power-on the driver will automatically load the “User Set” settings.



During the save operations of the driver permanent memory:

- power supply must be not turned off (driver parameter lose may occur) and the driver must be disabled or in hydraulic null regulation
- the valve enable is set to zero, it's best to operate save with no active valve regulation in the system

8.1.5 Load Driver Set

Two operations are available to select which parameters set has to be loaded into “Actual parameters”:

- “Load Factory” “Factory Set” will be applied at next driver restart or after power off-on sequence!
The current to the solenoid(s) will be temporarily switched to off!
- “Load User” “User Set” will be applied at next driver restart or after power off-on sequence!
The current to the solenoid(s) will be temporarily switched to off!



During load operations the driver must be disabled or in null hydraulic regulation.

8.2 E-SW-SETUP parameters

8.2.1 E-SW-SETUP “Actual Parameters” (non-permanent memory)

The “Actual Parameters” of E-SW-SETUP programming software is the set of parameters displayed in the software graphic interface.

The “Actual Parameters” values, depend on the communication status between the software and the driver:

- ON-LINE
(communication active) “Actual Parameters” of both software and driver are linked (every change in the software is applied in the driver and vice versa)
- OFF-LINE
(communication not active) “Actual Parameters” of the software are not linked to the driver (they can be changed but this is not applied to the driver)

8.2.2 E-SW-SETUP “Setting Files” (permanent memory)

E-SW-SETUP and driver “Actual Parameters” can be saved (upload from driver) or loaded (download to driver) from the PC hard-disk as a “Setting File” (see 21); in any time it will be possible to load these data into the “Actual Parameter” of the driver.



“Setting File” can be used efficiently as a starting point when executing repetitive installation of the same driver.




To perform Download operation the “Setting File” and the driver must be compatible: if ‘Driver Code’ parameter (see 15.2) is not the same a message will display an alarm condition.



During the download operation the driver goes in ‘Init’ state; afterwards the driver checks if the downloaded parameters are valid. If the parameters are not valid the driver goes in ‘Fault Init’ state; ‘Invalid Parameters Downloaded’ alarm is displayed in alarm indicator (see 12.2).

9 SOFTWARE GRAPHIC INTERFACE

E-SW-SETUP software allows to verify, modify and store/restore the drivers parameters. The software can work directly with the parameters of a connected driver (ON-LINE) or with parameters stored in the PC (OFF-LINE). The 'Main window' of the software, displayed at start-up, allows to handle all basic settings and diagnostic operations on the driver, and allow to open the 'Signals - Extended Page' window (see 22) and the 'Oscilloscope' window (see 23), for a more complete analysis of the driver working conditions.

 To open or switch between different windows, press the relevant button, always available in main window.



9.1 Main window

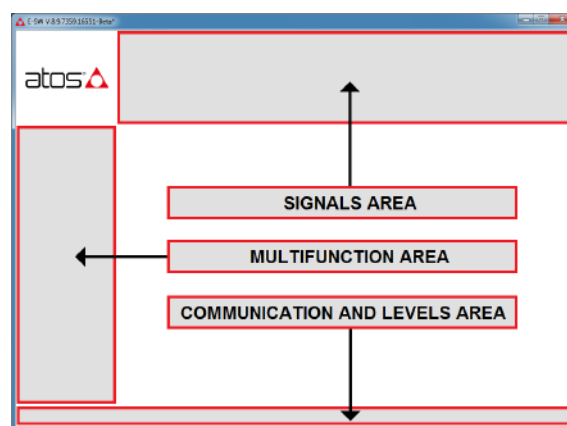
The 'Main window' is divided in three areas:


- Communication and Levels areas (see 10 and 11)
- Signals Area (see 12)
- Multifunction Area (see from 13 to 21)

The 'Main window' allows to completely operate Atos valves/drivers by:

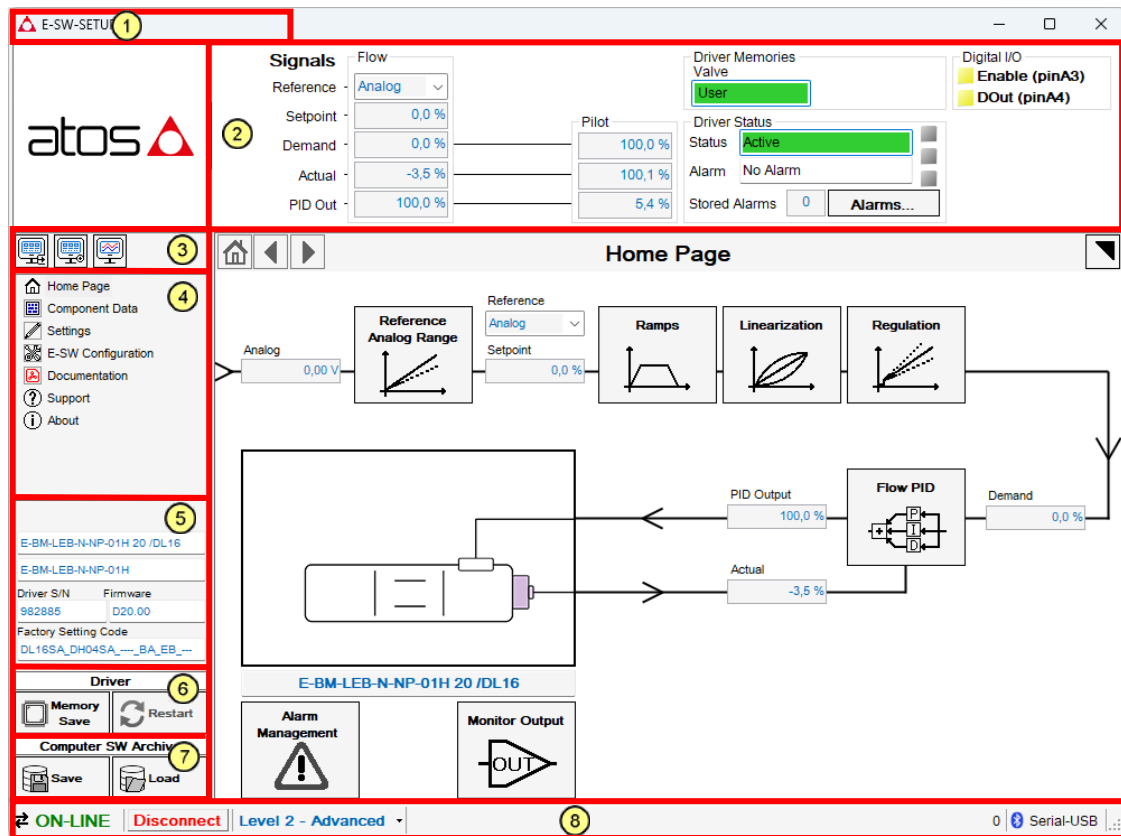
- simply access and numerically set all the functional parameters
- verify the actual working conditions
- identify and quickly solve fault conditions
- adapt the factory parameters to the application requirements
- store the customized setting into the valve
- archive the customized setting into the PC


Main Window Structure



 The window's graphic interface is automatically adapted at start-up of the software according to the connected valve/driver and to the selected access level.

In the 'Main window' are always available the following information and commands:



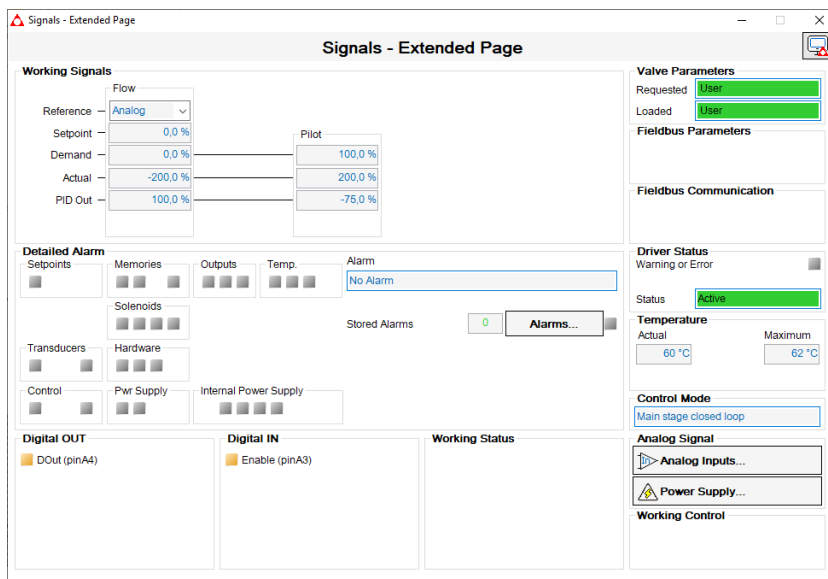
 The image is intended for explanatory purposes only and may show differences in accordance with the connected electronics.

- ① software type and version (see 20)
- ② signals area (see 12)
- ③ commands to open windows of:
'Signals' (see 12), 'Signals – Extended page' (see 22) and 'Oscilloscope' (see 23)
- ④ menu settings (see 16)
- ⑤ valve/driver characteristics connected (see 15)
- ⑥ commands to open 'Driver - Memory Save' window or to restart the driver (see 13)
- ⑦ commands to access to 'Setting Files Archive' software page (see 21)
- ⑧ communication (see 10) and actual level (see 11) area

9.1.1 Signals – Extended Page window

This window allows to verify detailed information on the actual working condition of the driver and to completely operate with the parameters stored into the driver (see 21).

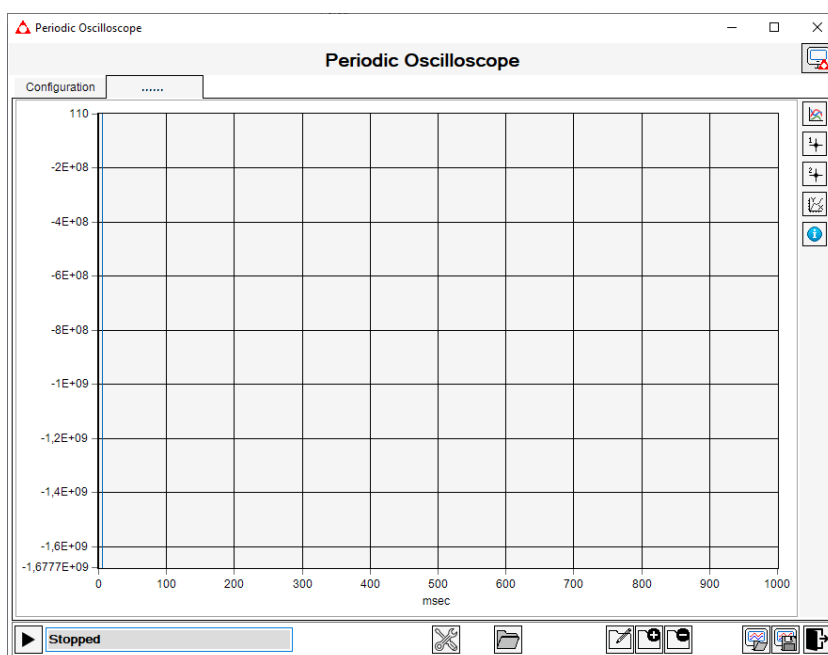
Access button



9.1.2 Oscilloscope window

This window allows to verify the time dependent behaviour of the driver; it is equivalent to a standard oscilloscope (see 23).

Access button



9.2 Parameters issue


The Atos software implements parameters alarm detection system in order to identify missing parameters or eventual communication errors.


9.2.1 Missing parameters (OFF-LINE)

The indicator ① shows specific colour for missing parameter value, if selected settings file is incomplete or corrupted.



 Write the missing value into the indicator ① and save the 'Setting File' on the PC hard disk.

 The symbol ② is displayed aside missing parameters.

 If a 'Setting File' with missing parameter is downloaded into the driver, the missing parameters will overwrite by default values present into the driver.

9.2.2 Communication errors (ON-LINE)

The indicator ③ shows specific colour for communication errors.



 Check the communication parameters (see 10.2).

9.3 Connector/Pin coding

All connectors are identified with a capital letter (see 5.2):

- **A** = power supply, enable and fault
- **B** = solenoids S1 and S2
- **D** = flow reference and flow monitor
- **E** = LVDT_T transducer
- **F** = LVDT_L transducer



Some functions are displayed with the related connection pin (e.g. Enable, Fault, etc.)

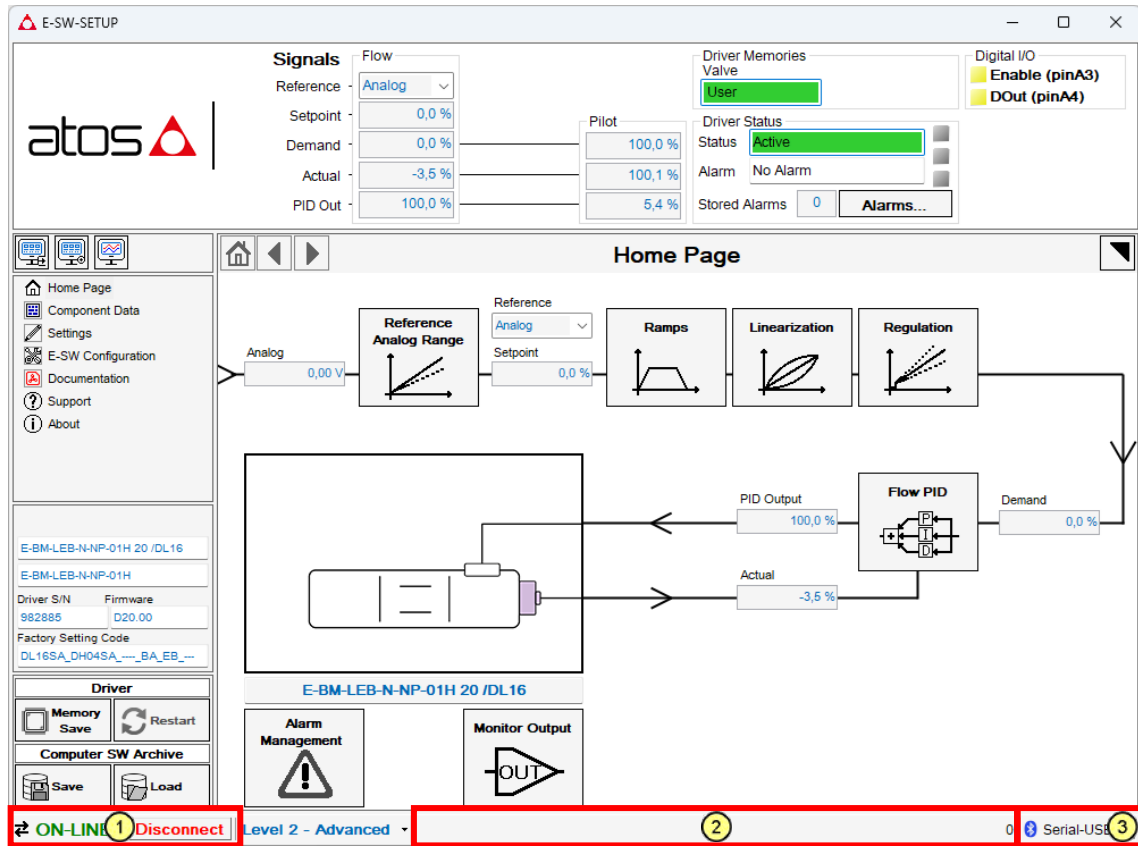
Example: Function (XY)




The "Function" is located on connector "X" and the reference pin is "Y".


10 MAIN WINDOW – COMMUNICATION AREA

In the bottom area of the Main window, it is possible to verify and change the status of communication between the E-SW-SETUP software and the drivers (see 17.2).



 The image is intended for explanatory purposes only and may show differences in accordance with the connected electronics.

10.1 ON-LINE and OFF-LINE status

The indicator  allows the user to verify the actual status of the communication between the E-SW-SETUP software and the connected driver (see 8.1.3).

 To change status between **ON-LINE** and **OFF-LINE** click on Disconnect button.

Disconnect

 **ON-LINE** **Disconnect**

(communication active)

“Actual Parameters” of both software and driver are linked (every change in the software is applied in the driver and vice versa)
Press **Disconnect** button to disconnect the driver from E-SW-SETUP and to pass in **OFF-LINE** status.



At start-up the E-SW-SETUP software always tries to pass in ON-LINE mode if a valve/driver is properly connected.



Always use this communication mode to completely operate and verify the connected driver.

X OFF-LINE **Disconnect**


(communication not active)

“Actual Parameters” of the software are not linked to the driver (they can be changed but are not applied to the driver).



To return to ON-LINE status go to the Communication software page and retry the connection (see 17.2).

10.2 Communication Error

The indicator  allows the user to verify possible error in the communication with the valve/driver.

Displayed Error	Cause/Troubleshooting
Selected communication interface not available!	Verify the correct connection and/or installation of the required USB adapter
Timeout - the driver not respond!	<p>Verify the correct power supply to the driver (see 5.3) and the correct communication wirings</p> <p><u>While switching from OFF-LINE to ON-LINE</u>, verify the correct configuration for the program communication (see 17.2)</p> <p><u>While ON-LINE</u>, specific environment condition may not allow the selected communication speed, try with lower speed (see 17.2)</p>
Parameter value not allowed!	Parameter value is not accepted due to incompatibility with the actual setting of other driver parameters (try different set)
Wrong Data from the driver (CRC)! Wrong Data to the driver (CRC)!	Verify the correct communication wirings and try with lower speed (see 17.2)

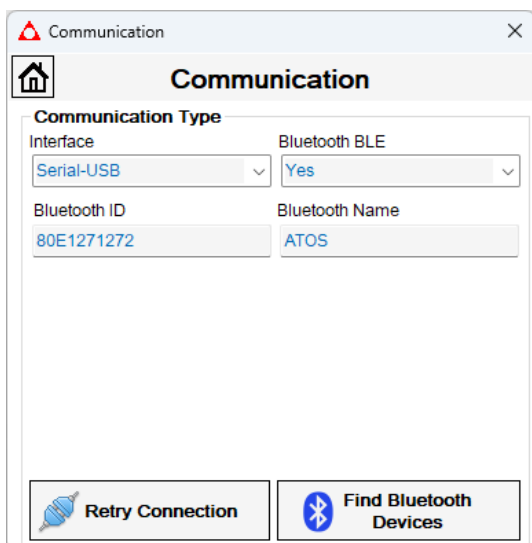


Only the last communication is displayed, double-click on the indicator  to view the list of all occurred messages.

10.3 Communication Settings Window

Double-click on indicator ③ to open the 'Communication' window and set the communication parameters of the E-SW-SETUP programming software (OFF-LINE).

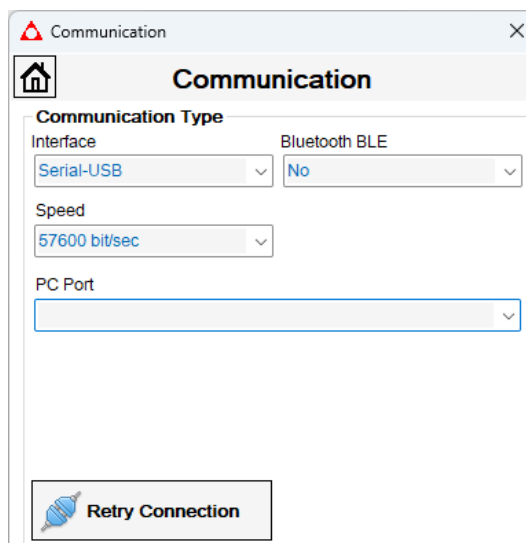
Wireless connection



The 'Communication' window for a wireless connection shows the following settings:

- Interface:** Serial-USB (dropdown)
- Bluetooth BLE:** Yes (dropdown)
- Bluetooth ID:** 80E1271272 (text field)
- Bluetooth Name:** ATOS (text field)
- Buttons:** 'Retry Connection' and 'Find Bluetooth Devices'.

Cable connection



The 'Communication' window for a cable connection shows the following settings:

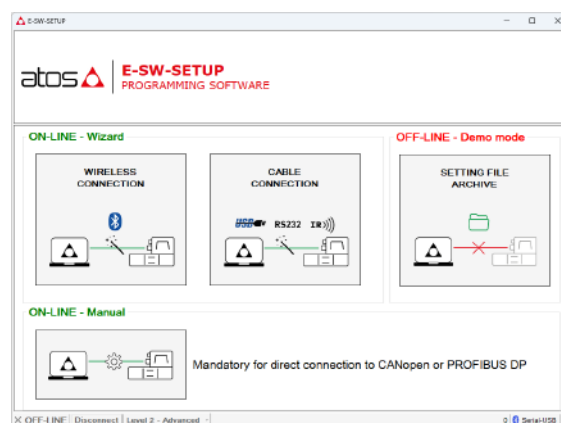
- Interface:** Serial-USB (dropdown)
- Bluetooth BLE:** No (dropdown)
- Speed:** 57600 bit/sec (dropdown)
- PC Port:** (empty dropdown)
- Buttons:** 'Retry Connection'.



The commands not described are the same available for the 'Communication' (see 17.2).

10.4 Driver connection not available

At start-up the E-SW-SETUP software searches automatically for an available interface to communicate with the connected valve/driver. If the connection is not valid, it will display the software page below.



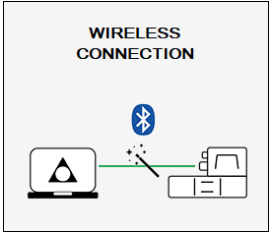
10.4.1 **ON-LINE – Wizard**

If the software does not automatically recognize the connected driver, it is possible to retry the connection through the wizard procedure (verify that all wirings between driver to PC have been performed correctly).

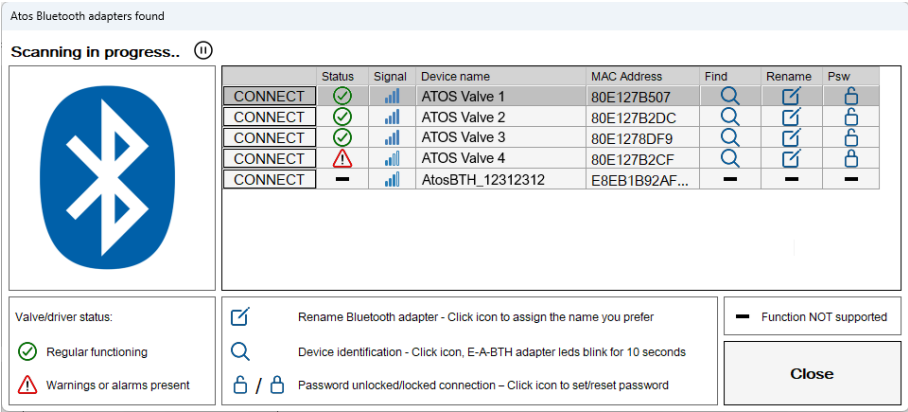
This procedure is highly recommended.

WIRELESS CONNECTION

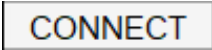
Press button WIRELESS CONNECTION to start wizard for Bluetooth connection via service port between driver and PC.



The window below opens.



Click button CONNECT to connect the desired Atos device.

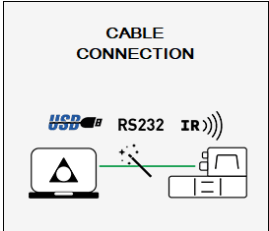


Atos devices already connected (via App or PC software) will not appear in the list of “Atos Bluetooth adapters found”.

For more information about Bluetooth connection, please refer to STARTUP-BLUETOOTH guide.

CABLE CONNECTION

Press button CABLE CONNECTION to start wizard for cable connection via service port between driver and PC.



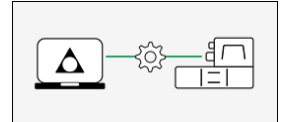
10.4.2 ON-LINE – Manual

If the software does not automatically recognize the connected driver, it is possible to retry the connection through the manual procedure (verify that all wirings between driver to PC have been performed correctly).



This procedure must only be used by expert users.

Press button at side to perform the manual procedure (see 17.2 for detailed description).



E-SW-SETUP communication settings can be modified only in OFF-LINE status.



If the driver connection is still not available, please contact Atos technical support (see 19).

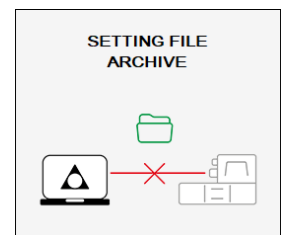


Mandatory for direct connection to CANopen or PROFIBUS DP.

10.4.3 OFF-LINE – Demo mode

If there is no proper connection between valve and laptop or ON-LINE mode cannot be achieved, it is possible to use E-SW-SETUP by opening a setup file in the archive.

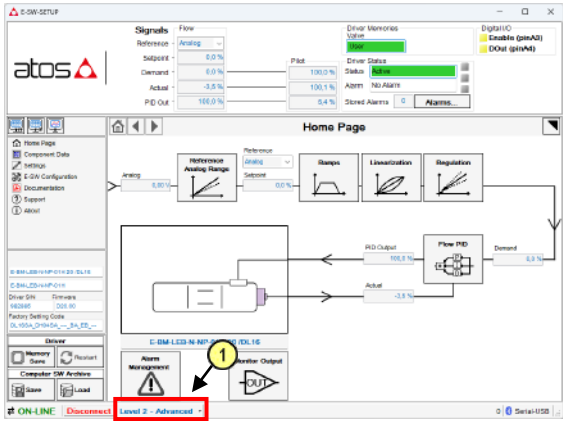
Press button SETTING FILE ARCHIVE and select one of the available factories preset setting files (see 21 for detailed description).



11 MAIN WINDOW - ACTUAL LEVEL

The E-SW-SETUP software graphic interface is organized in multiple pages and levels related to different specific functional groups; use the lowest access level that matches the application requirements to obtain the simplest software interface.

In the bottom area of the Main window, it is possible to verify and change the software level status.



The indicator ① allows the user to verify the actual software level status.

To change software level status click on black arrow and press 'Change Level' button (see image at side).

Level 2 - Advanced

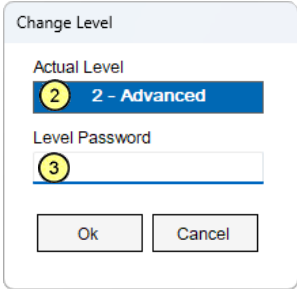
Change Level

Actual Level

The ② indicator displays currently selected access level of the software graphic interface.

Level Password

The control ③ allows the user to input the password for the desired level of the graphic interface; level passwords are available in MyAtos - Download area (see 1.2.2).



Actual Level Configuration

- 0 - Visualization

only visualization - not allowed parameters changes
- 1 - Basic

user with low experience in driver settings can handle basic parameters
- 2 - Advanced

free access to all standard parameters

A further level password is available only upon attending a dedicated training in Atos and upon submitting a detailed description of the application requirements to ele-support@atos.com.

- 3 - Expert

free access to all the driver parameters to specially customize the valve behaviour

12 MAIN WINDOW – SIGNALS

In the upper area of the Main window, it is possible to verify actual working conditions (driver status, alarms, reference and actual signals, etc) thus simplifying tuning and maintenance operations.

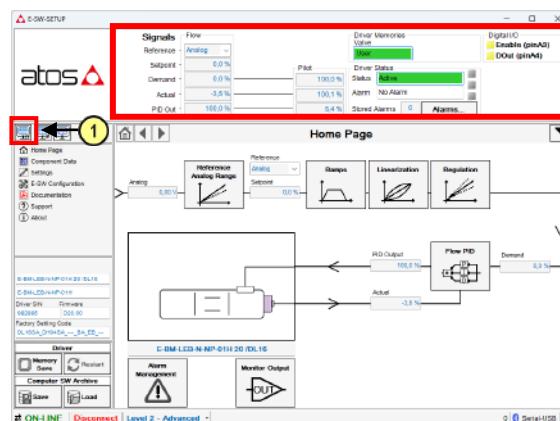
It is always possible to switch on/off the visualization of this area using the dedicated button ① available in the upper-left side of the Main window:



Open Signals area



Close Signals area



In ON-LINE displayed information are updated automatically.

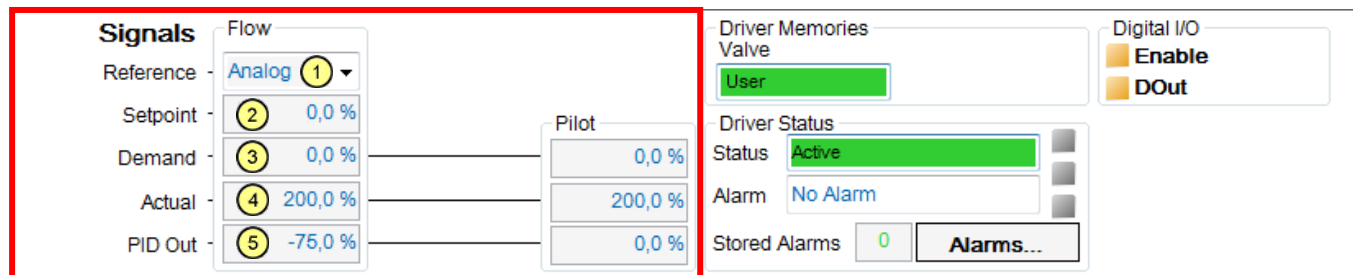
In OFF-LINE displayed information remain frozen to the last status before disconnection.

12.1 Working signals

This part of the Signals area is dedicated to:

- set and/or verify the reference signals used to control the proportional valve
- verify the system response to commands (Actual and PID Out signals)

Parameter Description (Flow)



12.1.1 Reference (Flow)

The control ① allows the user to select the source for the flow reference signal:


Analog

Analog input signal is used as reference position signal; see 16.7 to modify the default input signal range

Internal


Reference signal value is directly set by E-SW-SETUP software (see 12.1.2); use this setting to simplify tuning or maintenance operations

12.1.2 Setpoint (Flow)

The indicator  allows the user to read the numerical value corresponds to the reference signal that is actually selected:


- Analog: the numerical value corresponds to the external analog reference signal as defined by the range setting of the analog input signal (see 16.7)
- Internal: the indicator becomes a control and allows to set the desired % of valve regulation

12.1.3 Demand (Flow)


The indicator  allows the user to verify the % of the demanded valve regulation once the actual reference signal has been elaborated by Bias/Scale (see 16.1, 16.2, and 16.3), Ramps (see 16.4), Linearization (see 16.6) and Dither (see 16.8) functions:

- For '2 position' valve configuration (see 15.4) the demanded flow value is limited between 0 – 100%
- For '3 position' valve configuration (see 15.4) the demanded flow value is limited between $\pm 100\%$

12.1.4 Actual (Flow)

The indicator  allows the user to verify the % of the real valve regulation as readout by the relevant integral position transducer:

- For direct valve the actual value is read through LVDT_T position transducer of the valve (Connector E: see 5.3 and 5.3.6)
- For piloted valve the actual value is read through LVDT_L position transducer of the valve (Connector F: see 5.3 and 5.3.6)

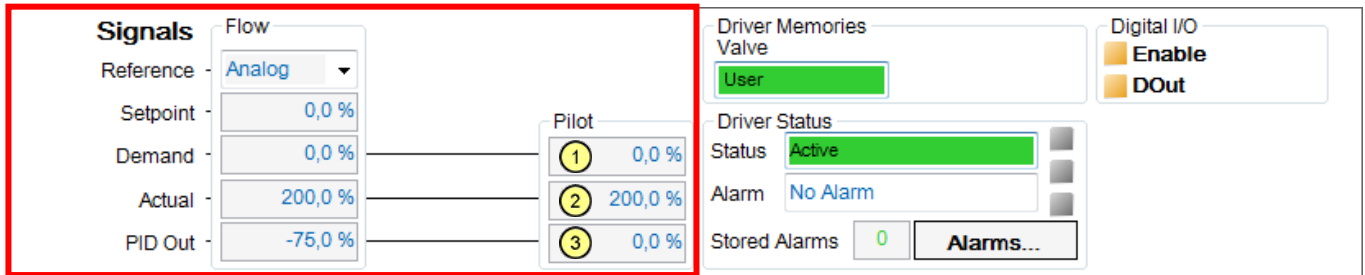
 Actual values exceeding than $\pm 100\%$ can be displayed during dynamic conditions: in static working conditions, reference and actual must correspond.

12.1.5 PID Out (Flow) [level 2]

This indicator  allows the user to verify the % output of the closed loop control action:


- For piloted valves as % of pilot valve regulation
- For direct valves as % of solenoid current command

Parameter Description (Pilot)



12.1.6 Demand (Pilot)


The indicator ① allows the user to verify the demand pilot regulation.

 The value of pilot demand valve regulation is affected by Scale (see 16.3) and Offset (see 16.2) settings.

12.1.7 Actual (Pilot)

The indicator ② allows the user to verify the pilot regulation actual:

- For direct valve the actual value is read through internal position transducer of the driver

 Actual values exceeding than $\pm 100\%$ can be displayed during dynamic conditions: in static working conditions, reference and actual must correspond

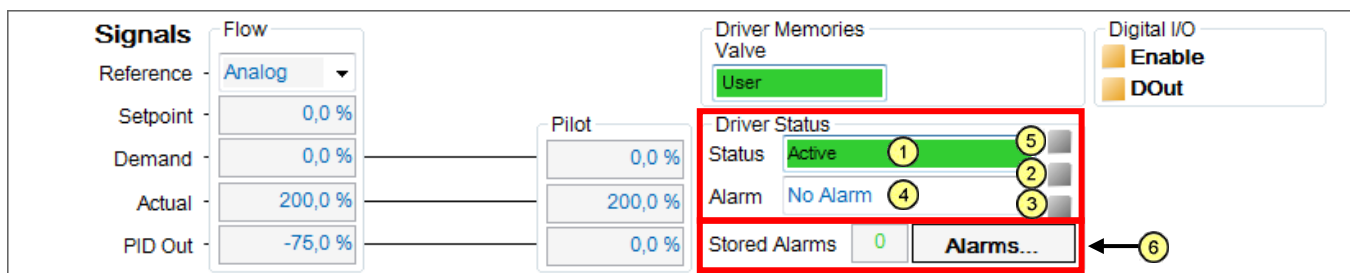
12.1.8 PID Out (Pilot) [level 2]

The indicator ③ allows the user to verify the PID Out pilot regulation:

- For direct valves as % of solenoid current command


12.2 Driver status

This part of the Signals area shows the actual driver status and alarms conditions.





12.2.1 Status


The indicator ① displays which is the actual driver status according to the state machine (see 16.14).


 Use Enable pin (see 5.3.4), fieldbus or software command to change the driver status.

12.2.2 Warning or Error

The warning or error led ② is ON if one or more warnings/errors are active (see 7.1) or the driver is in fault condition (see 16.14).


Priority	Alarm Reaction	Led status
0	No reaction	OFF 
1	Message	
2	Warning	ON 
3	Minor error	
4	Serious error	
5	Critical error	
6	Fatal error	


 Fault conditions always correspond also to the presence of a 0V on the digital output DOut (pin A4) of the connector A (see 5.3.5).

 To identify and solve the fault conditions refer the driver alarms description (see 7) or more detailed information of the Signals – Extended Page window (see 22).

12.2.3 Alarms storage automatically disabled

The led ③ indicates that the storing of the alarms in the driver memory has been automatically disabled in order to preserve driver's memory. Once this condition is raised the user cannot enable again the storing of the alarm.


 This condition does not affect the driver store parameters in the permanent memory (see 8.1.1).

 This condition not compromise the normal working of the driver: it will continue to work correctly, but any new alarms will not to save inside the memory (EEPROM).

12.2.4 Alarm

The indicator ④ shows the most critical active alarm.

The led ⑤ displays if at least one alarm is still present.

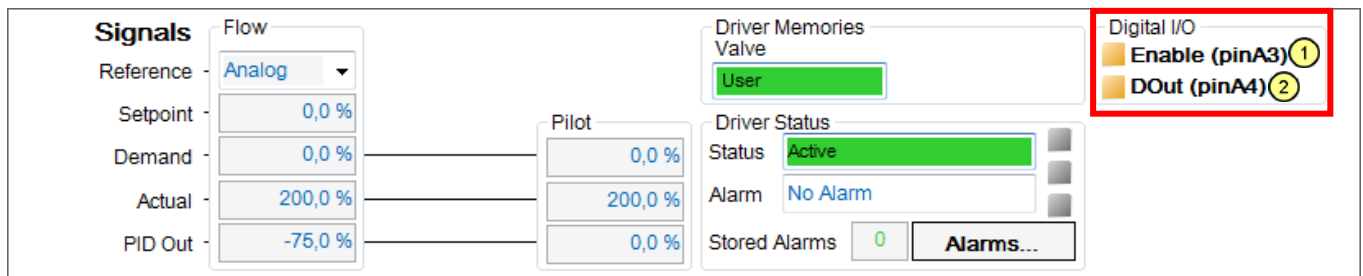
 If more than one alarm is present, this indicator ④ shows the most critical active alarm (see 7.1).

12.2.5 Stored Alarms

The area ⑥ shows several information about the Stored Alarms History; see 22.1.3 for more details.

12.3 Digital I/O

This part of the Signals area is dedicated to view Enable and Fault conditions.





12.3.1 Enable (pin A3)

The led ① displays the pin A3 status.

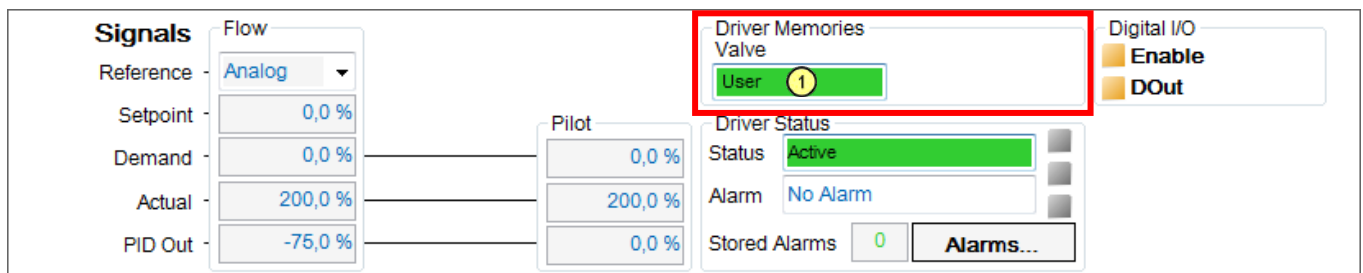
12.3.2 DOut (pin A4)

The led ② displays the pin A4 status.

-  0 V_{DC} on pin A4 = alarm or driver in fault status
-  24 V_{DC} on pin A4 = no alarm and driver in no fault status


12.4 Driver Memories

This part of the Signals area allows the user to verify/set which of the permanent parameter set stored into the driver memory has been loaded at power-on into driver “Actual Parameters” (see 8.1.1).



12.4.1 Valve Parameters (Loaded)

The indicator ① allows the user to verify which valve parameter set has been loaded at last power-on.

 If ‘Requested’ and ‘Loaded’ parameters have different value after power-on, ‘Alarm’ indicator (see 12.2.4) displays “Invalid parameters” message and the driver is disabled:



[Loaded = Factory and Requested = User] Atos factory parameters have been loaded and ‘User’ contains invalid data.



[Loaded = Emergency and Requested = User or ‘Factory’] user and preset valve parameters set contain invalid parameters, please contact Atos service for troubleshooting.

13 MAIN WINDOW - MULTIFUNCTION AREA [DRIVER MEMORY]

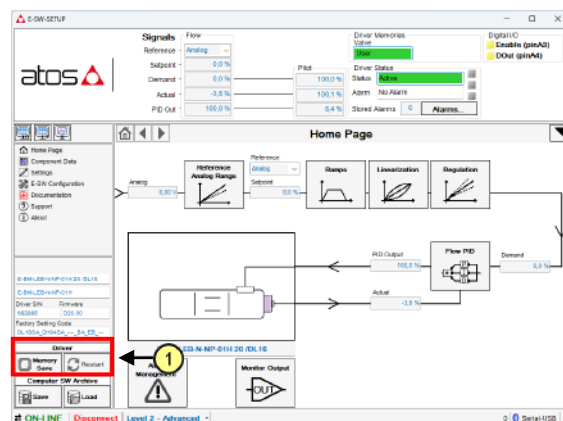
Multifunction area of the Main Window is organized in different sections: in the “Driver” area ① is possible restart the driver (see 13.1.1) or access to driver memory store area (see 13.1.2).



Driver restart



Open ‘Driver - Memory Store’ area



13.1.1 Restart

Restart button ② allows the user to obtain the same effect of switching off/on the driver power supply: digital electronic is restarted and Requested parameter set is loaded.



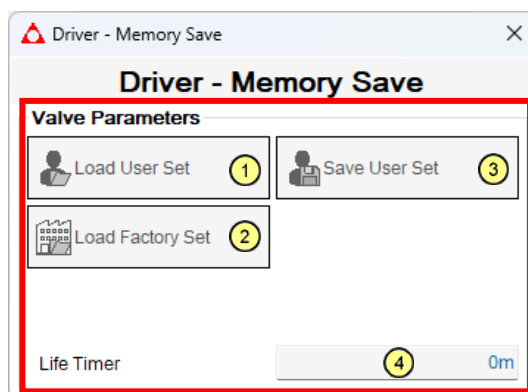
During driver restart operations, power supply to the valve solenoid is switched-off: do not use this function during system normal working.

13.1.2 Memory Store

Memory save button ③ opens the ‘Driver - Memory Save’ area.

13.1.3 Driver - Memory Save

This part of the 'Driver - Memory Save' area allow the user to verify and store the valve parameters.





Load User Set and Load Factory Set


The load buttons (1) and (2) allow to select which of the valve parameters stored into the driver has to be loaded at next power on (see 8.1.1):

Load User Set Last set valve parameters stored by User will be loaded at next power on

Load Factory Set Factory set valve parameters stored by Atos will be loaded at next power on


 These valve parameters will be loaded automatically at the next power-on of the driver; to load immediately the requested valve parameters use driver 'Restart' button (see 13.1.1).


 During valve parameters restoring operations, power supply to the valve solenoid is switched-off: do not use this function during system normal working.

 Never switch-off the driver's power supply during restoring operations: permanent valve parameters stored into the driver may result invalid!

Save User Set

The button (3) allows the user to save the driver "Actual parameters" into the "User parameters" permanent memory (see 8.1.1).

 During valve parameters saving operations, power supply to the valve solenoid is switched-off: do not use this function during system normal working.

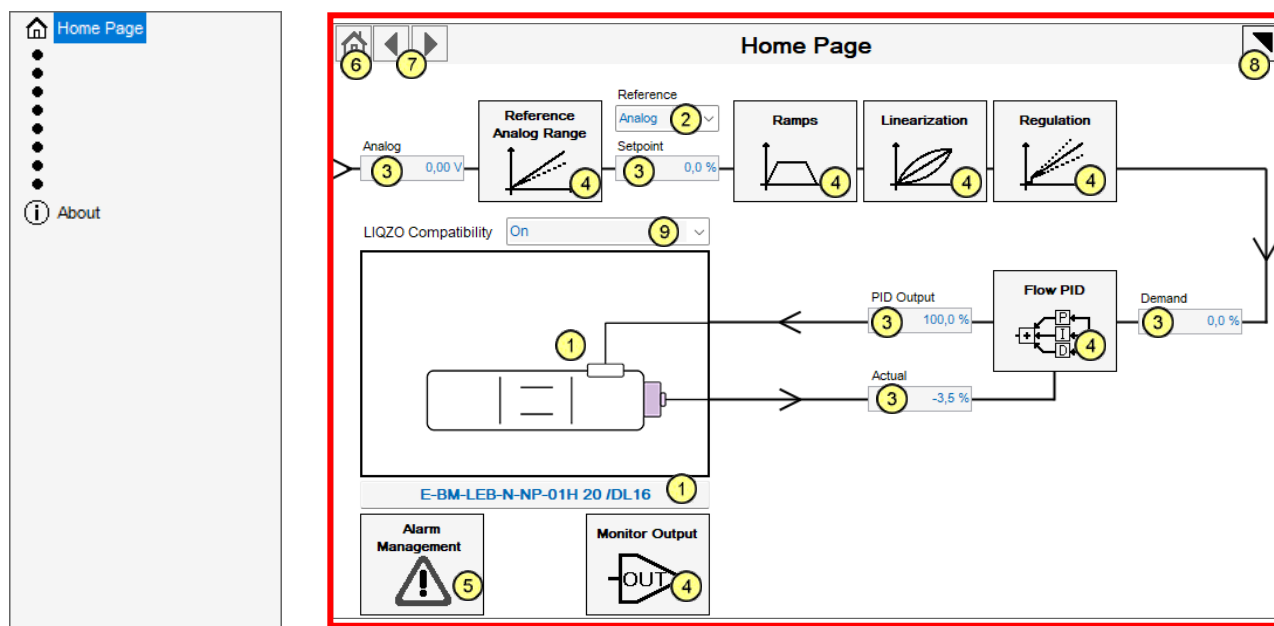
 Never switch-off the driver's power supply during saving operations: permanent parameters stored into the driver may result invalid!


Life Timer

Life Timer (4) displays how long the driver has been powered up (it is the sum of all power-on period).

14 MAIN WINDOW - MULTIFUNCTION AREA [HOME PAGE]

The home page displays the main information of the valve/driver connected and its block diagram; using dedicated buttons, it is possible to directly access the relative software pages.



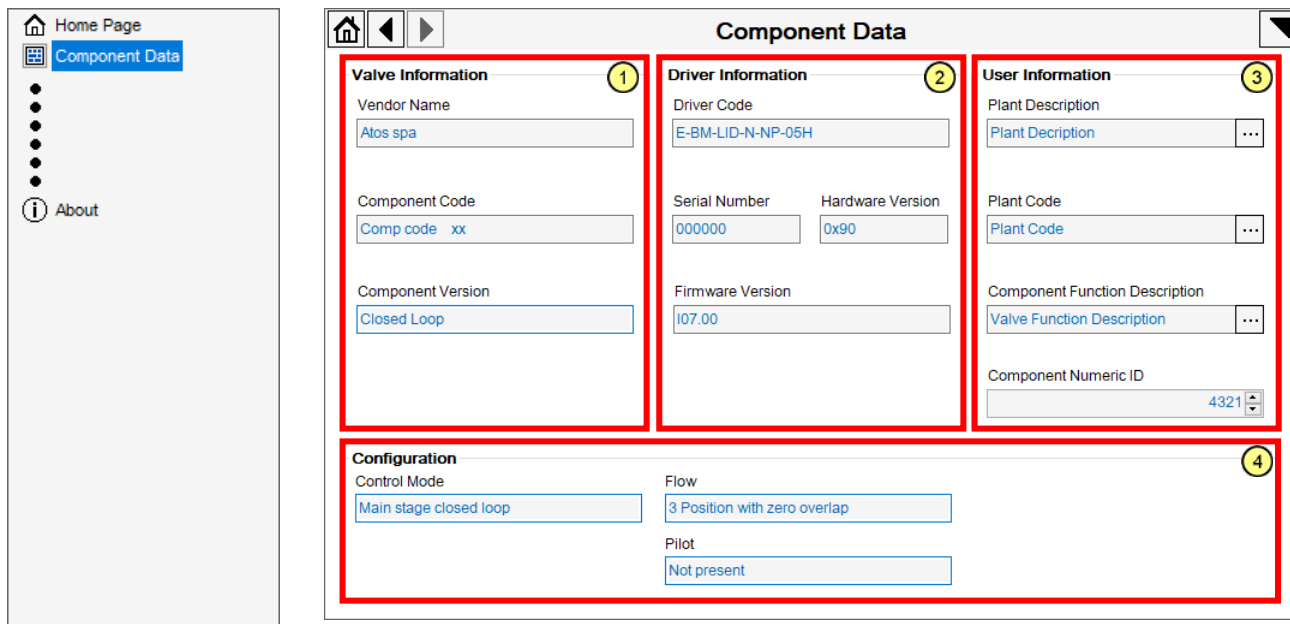
 The image is intended for explanatory purposes only and may show differences in accordance with the connected electronics.

Home page allows to display simultaneously the main information and access the setup parameters:

- ① Hydraulic symbol and component code of the valve connected.
- ② Control allows the user to select the source for the flow reference signal. It is replicated on Signals area (see 12).
- ③ Indicators display the analog, setpoint, demand, actual and PID Out values. They are replicated on Signals area (see 12)
- ④ LEDs display the main alarms conditions of the driver. They are replicated on Signals - Extended Page window (see 22).
- ⑤ Buttons allow to directly access on related software pages.
- ⑥ Button allows to open alarm management window (see 7.2). This button is available only in Home Page.
- ⑦ Return to the home page (available in all software pages).
- ⑧ Chronologic navigation buttons, in order to facilitate the user navigation through the pages of the software in a similar manner to any web browser (available in all software pages).
- ⑨ Undock the page (available in all software pages).
- ⑩ Controls allow the user to select the LIQZO compatibility function (see 16.11)

15 MAIN WINDOW - MULTIFUNCTION AREA [COMPONENT DATA]

Multifunction area of the Main Window is organized in different pages: select the “Component Data” tag on the left side to access the driver general information parameters.



The screenshot shows the 'Component Data' window with a sidebar on the left containing 'Home Page', 'Component Data' (selected), and 'About'. The main area is divided into four sections, each highlighted with a red box and a yellow circle with a number:

- Valve Information (1):** Includes fields for Vendor Name (Atos spa), Component Code (Comp code xx), and Component Version (Closed Loop).
- Driver Information (2):** Includes fields for Driver Code (E-BM-LID-N-NP-05H), Serial Number (000000), Hardware Version (0x90), and Firmware Version (I07.00).
- User Information (3):** Includes fields for Plant Description (Plant Description), Plant Code (Plant Code), Component Function Description (Valve Function Description), and Component Numeric ID (4321).
- Configuration (4):** Includes fields for Control Mode (Main stage closed loop), Flow (3 Position with zero overlap), and Pilot (Not present).

15.1 Valve Information

The group ① indicates relevant information about the driver:

- Component Code** Indicates the valve main characteristics (refer to the valve technical table for further details)
- Component Version** Indicates the valve execution type: “Main stage close loop”

15.2 Driver Information

The group ② indicates relevant information about the electronic driver:

- Driver Code** Indicates the electronic driver main characteristics (refer to the driver technical table for further details)
- Serial Number** Indicates the unique number assigned to the driver that is used for the component production traceability
- Hardware Version** Indicates the hardware version of driver
- Firmware Version** Indicates the firmware version of driver that identifies the available function and parameters



Please always indicate this information when contacting Atos technical support.




Groups ① and ② cannot be changed by the user.


15.3 User Information



The group indicates and allows to modify the relevant information that identifies the component function in the overall system (these information depend only on customer needs):

Plant Description	is intended to indicate a description of the plant/system/machine e.g. "High dynamic injection press"
Plant Code	is intended to indicate the model of the plant/system/machine e.g. "XDS-450/L12"
Component Function Description	is intended to indicate a description of the Atos valve function e.g. "Mould position control"
Component Numeric ID	is intended to indicate a numeric reference of the Atos valve in the overall system

15.4 Configuration

The group  indicates relevant information about the valve/driver hydraulic and control behavior:

Control Mode	Indicates the control function of the electronic driver: "Main stage closed loop"
Flow	Indicates the hydraulic configuration of valve flow regulation (2 position, 3 position with positive overlap or 3 position with zero overlap)  This parameter is factory set by Atos and defines the software graphic interface and the available parameters in 'Setting - Flow' (see 16).
Pilot	Indicates the hydraulic configuration of pilot valve (only for LEB execution)

 Group  cannot be changed by the user.

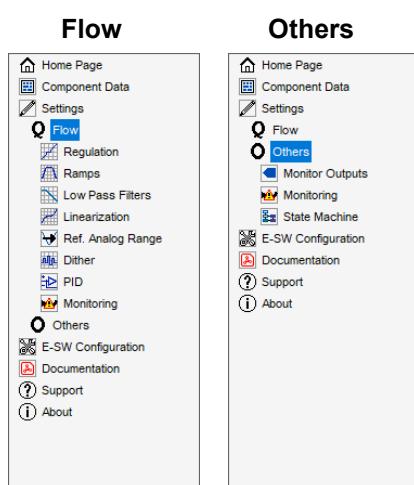
16 MAIN WINDOW – MULTIFUNCTION AREA [MENU SETTINGS]

Multifunction area of the Main Window is organized in different sections; in this section are described the available function to adapt the driver behavior to the specific system requirements:

- Select the “Settings” tag on the left side of this area to access one of the available groups of hydraulic parameters
- Select “Flow” or “Others” tag to access the available functions the selected parameters group
- Select the desired function to access the relevant parameters (the proper interface will be displayed in the right side of the Multifunction area)



Available function and parameters are organized in different access levels: select the lower level that meets user's requirements to reduce and simplify the available options (see 10.3 to change software access level).



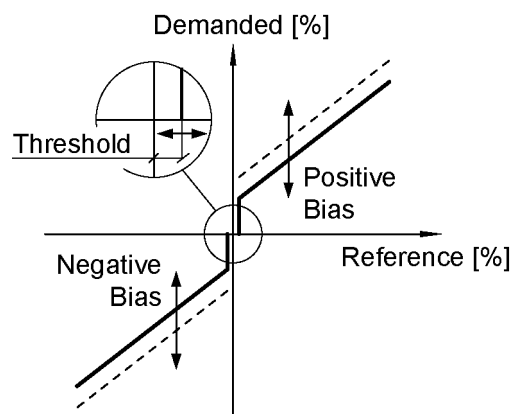
16.1 Flow - Regulation - Bias for 2/3 position valves with positive overlap

Function Description

Bias

Proportional valves with positive overlap are provided with a dead band in the hydraulic regulation to guarantee low flow leaking when switched-off status (no current to the valve solenoid).


This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed 'Bias' preset value to the reference signal (analog or internal generated).



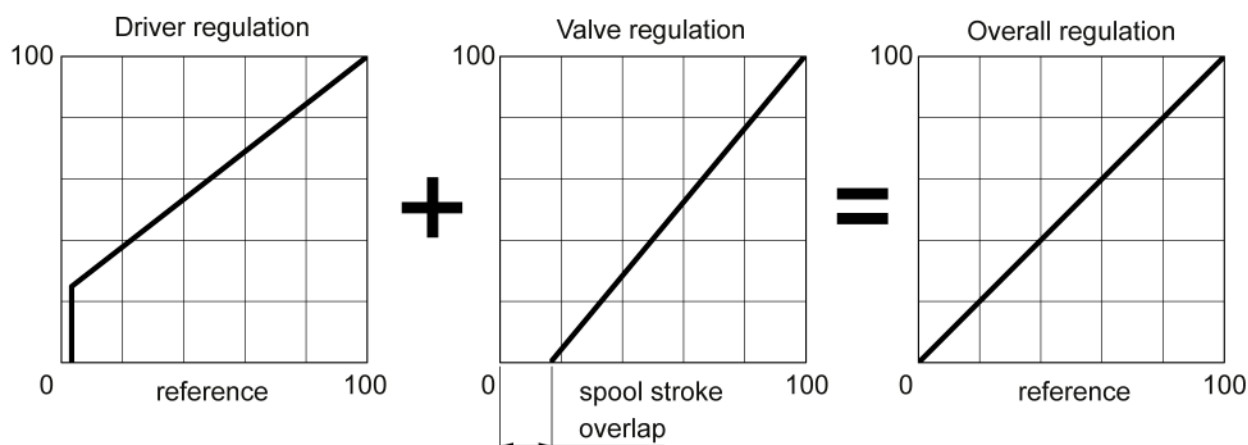
Threshold

The Bias preset value is added only when the reference signal is higher than 'Threshold' value, preset into the driver.

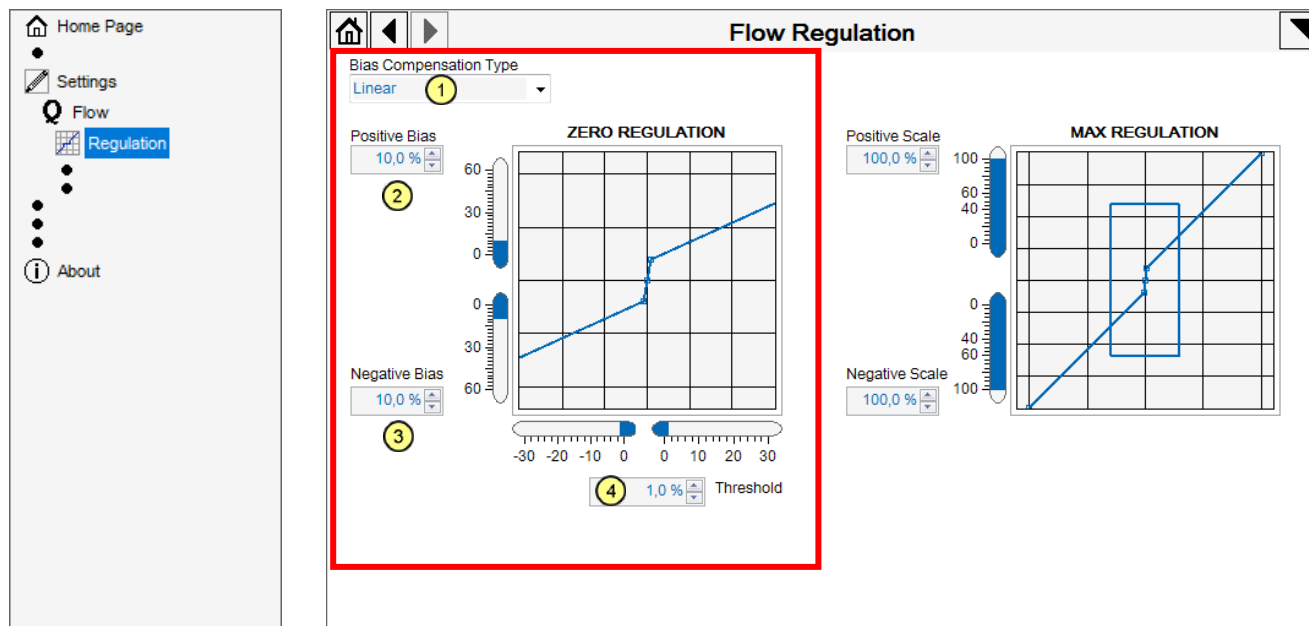
Threshold setting is useful to avoid undesired valve regulation at zero reference signals in presence of electric noise on the analog input signal: low threshold value reduces the reference signal dead band (greater values are less affected by electric noise presence).

 Atos proportional valves with integral driver are factory set during the automated production tests; fine tuning may be required depending on the final system setup.

Example - Bias, Threshold and Scale effect




Parameters Description



Bias Compensation Type

The control ① allows to set different behavior of the Bias function when reference signal goes from zero to Threshold value.

 With 3 position valve the Bias compensation behavior is the same for positive and negative reference signals.

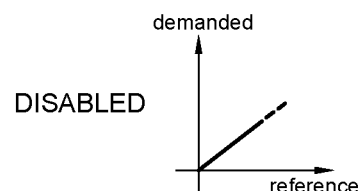
Possible selections are:

No Compensation

Bias is not used: valve spool position linearly increases starting from 0% to max valve regulation (see 16.3) with reference signal from 0% to 100%



Use if dead band compensation is already present in the machine control unit.

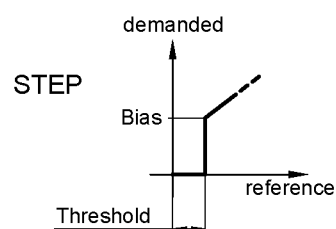


Step Compensation (Default)

Valve spool position is zero for reference signal from 0% to Threshold value and then linearly increases from Bias to max valve regulation (with reference signal from Threshold to 100%).



Use this setting when a stable null hydraulic regulation is required with 0% reference signal (e.g. when the valve is installed in open loop system).



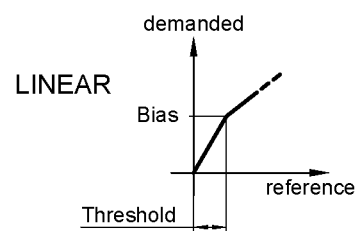
Linear Compensation

Valve spool position linearly increases from zero to Bias with reference signal from 0% to Threshold and then linearly increases from Bias to max valve regulation (with reference signal from Threshold to 100%).



Use this setting with 3 position valves to avoid sudden switches between positive and negative Bias, e.g. when using the valve in closed loop systems, when inverting valve regulation (reference signal switches between positive and negative values).

To maintain a stable null hydraulic regulation use the enable signal (see 5.3.4).

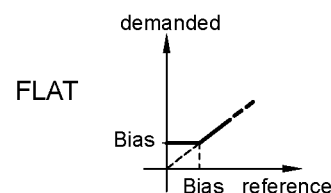


Flat Compensation

Valve spool position is equal to Bias with reference signal from 0% to threshold and then linearly increases from Bias to max valve regulation (with reference signal from Threshold to 100%).



Use this setting with 2 position valves when a minimum regulation greater than zero is required.



Positive/Negative Bias

The controls ② and ③ allow to set the valve spool position values supplied by the driver when the reference input is at the positive/negative Threshold value.

Min	0.0 %
Max	50.0%
Default	valve model dependent



Atos proportional valves with integral driver are factory set during the automated production tests; fine tuning may be required depending on the final system setup.

Threshold

The control ④ allows to set the input reference value (positive and negative) at which the Bias function switch the regulation characteristic (see Bias Compensation Type parameter).

Min	0.0%
Max	30.0%
Default	1.0%

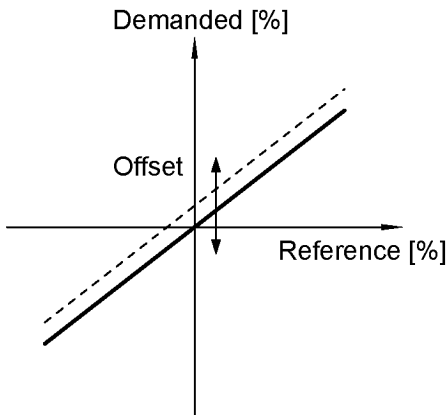
16.2 Flow - Regulation - Offset for 3 position valves with zero overlap

Function Description

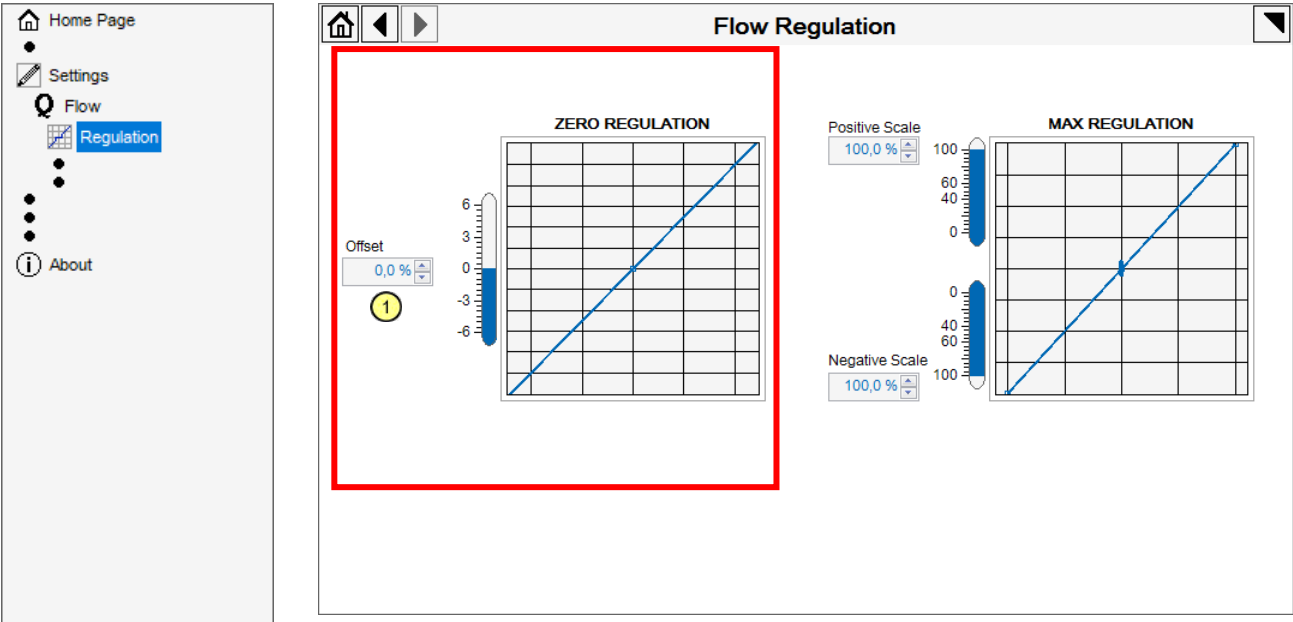
Offset

Proportional valves with zero overlap do not require the Bias compensation function; however they may require a non-zero valve spool position to obtain a null regulation into the system (e.g. to stop a single rod cylinder different pressure levels are required in A and B user ports; this can be obtained using valve's pressure gain with spool positions near to zero – see valve technical table).

Offset function adds a fixed value thus obtaining a non-zero valve spool with zero reference signal.



Parameter Description



Offset

The control ① allows to set the valve spool position value supplied by the driver when the reference input is zero.

Min	-6.0%
Max	6.0%
Default	0.0%

Set driver status to 'Init' (see 16.14) and regulate the Offset to obtain no movements with 0% valve command.

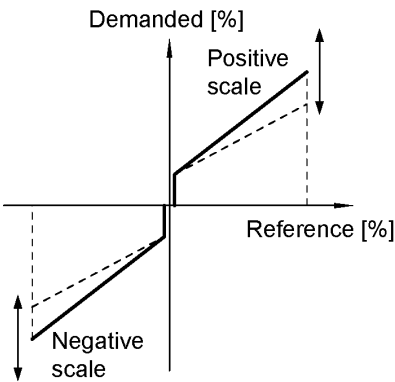
Offset value is added to the reference value: demanded spool position values that overcome $\pm 100\%$ are automatically limited to $\pm 100\%$.

16.3 Flow - Regulation - Scale

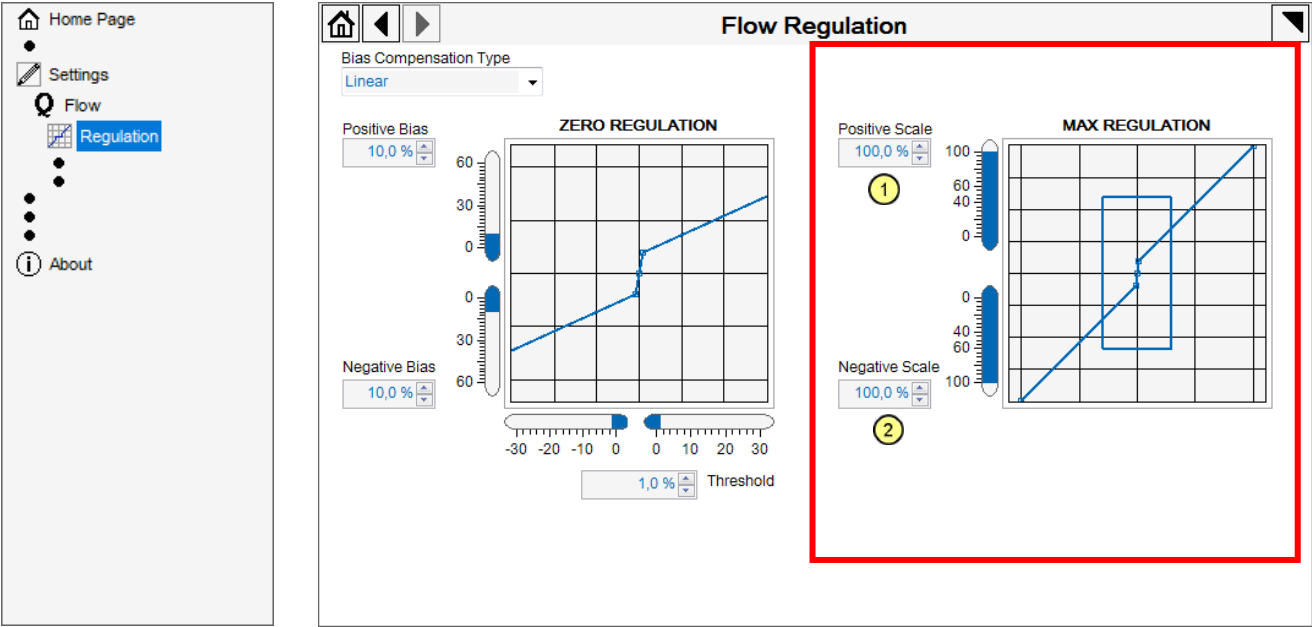
Function Description

The Scale function allows to set the maximum valve regulation at maximum reference signal values; different regulation for positive and negative reference are available with '3 position' flow hydraulic configurations (see 15.4).

These regulations are useful to reduce the maximum valve regulation in front of maximum reference signal to adapt the valve regulation to the system requirements.



Parameters Description



Positive Scale

The control ① allows to set the maximum positive demanded flow at max reference positive value (100%).

Min	0.0%
Max	100.0%
Default	100.0%

Negative Scale

The control ② allows to set the maximum negative demanded flow at max reference negative value (-100%).

Min	0.0%
Max	100.0%
Default	100.0%



Scales values are factory set to 100% and can be regulated according to real working conditions:

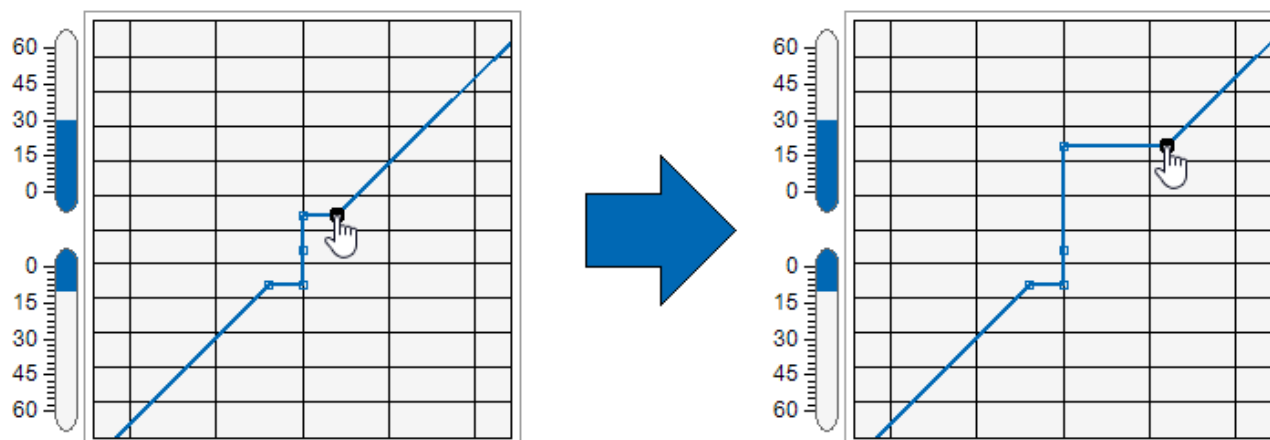
- supply a reference signal corresponding to 100%
- decrease the Scale adjustment until the controlled valve regulation gradually reach the desired maximum regulation



In many applications it is recommended to adjust Scale settings while the system is working; in these applications always remember to start with low Scale values (slow movements)



These regulations can be set by writing a numeric value in the proper controls or by positioning the mouse-arrow on the desired point and by dragging it on the graph:



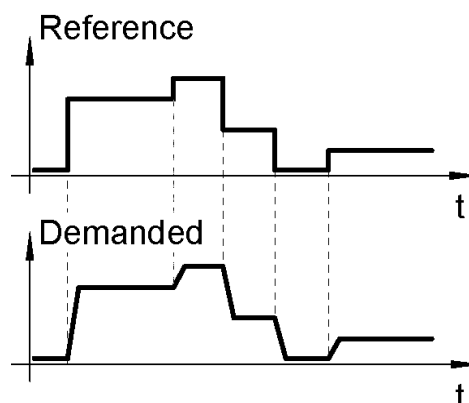
16.4 Flow - Ramps

Function Description

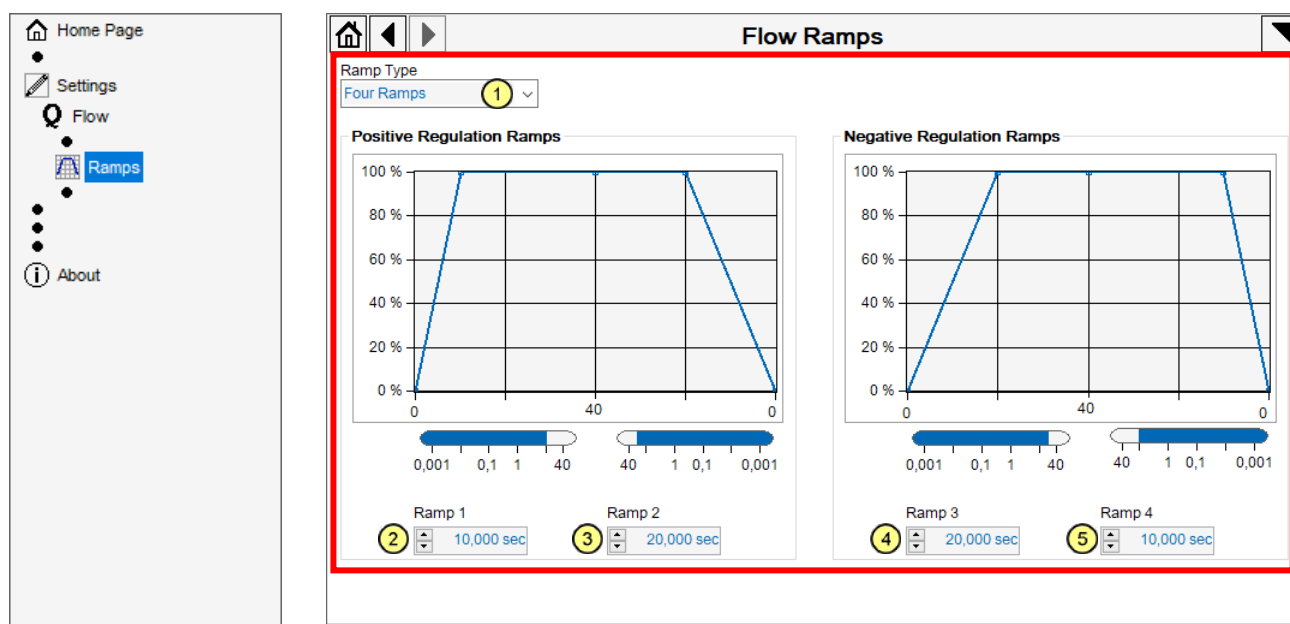
Ramps allow the user to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the valve regulation.

This function 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 driver, the ramps can lead to unstable behavior; for these applications ramp function can be software disabled (default setting).



Parameter Description



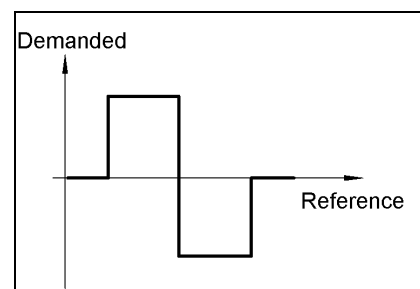
Ramps Type

The control 1 allows to set different behavior of the Ramp function. Possible selections are:

No Ramp (Default)

The step change of the input reference produces a step change of the valve regulation.

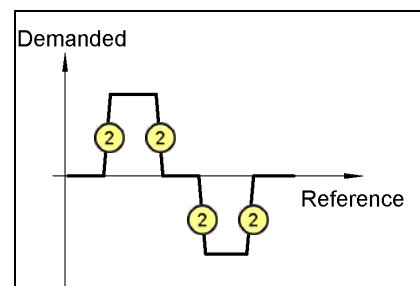
Use this setting when no smoothing function is required or when the driver is driven by a closed loop driver.



Single Ramp

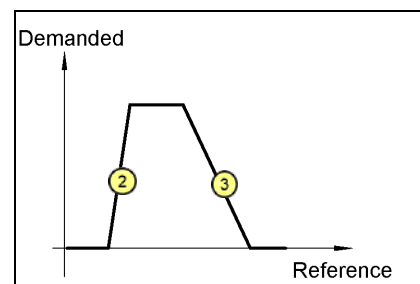
The same ramp time (Ramp Time 1 (2)) is used for increasing (acceleration) and decreasing (deceleration) signals.

Use this setting to simplify tuning operation when the same smoothing function is required.



Double Ramp

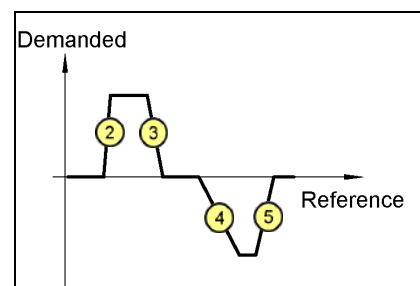
Different ramp times are used for increasing (Ramp Time 1 (2)) and decreasing (Ramp Time 2 (3)) signals.




Four Ramps

Different ramp times are used for:

- positive reference signal increasing (Ramp Time 1 (2)) and decreasing positive reference signal (Ramp Time 2 (3))
- negative reference signal increasing (Ramp Time 3 (4)) and decreasing (Ramp Time 4 (5))



 Ramps duration will depend on specific reference variation and 'Four ramps' is only available with '3 position' flow and 'force push/pull' hydraulic configurations (see 15.4).

Ramp Time 1

The control (2) allows to set the increasing time from 0% to 100% valve regulation with a 0% to 100% reference step variation

Min	0.001 s
Max	40 s
Default	0.001 s

Ramp Time 2

This control (3) allows to set the decreasing time from 100% to 0% valve regulation with a 100% to 0% reference step variation

Min	0.001 s
Max	40 s
Default	0.001 s

Ramp Time 3

This control (4) allows to set the increasing time from 0% to -100% valve regulation with a 0% to 100% reference step variation

Min	0.001 s
Max	40 s
Default	0.001 s

Ramp Time 4

This control (5) allows to set the decreasing time from -100% to 0% valve regulation with a -100% to 0% reference step variation

Min	0.001 s
Max	40 s
Default	0.001 s

16.5 Flow - Low Pass Filters [level 2]

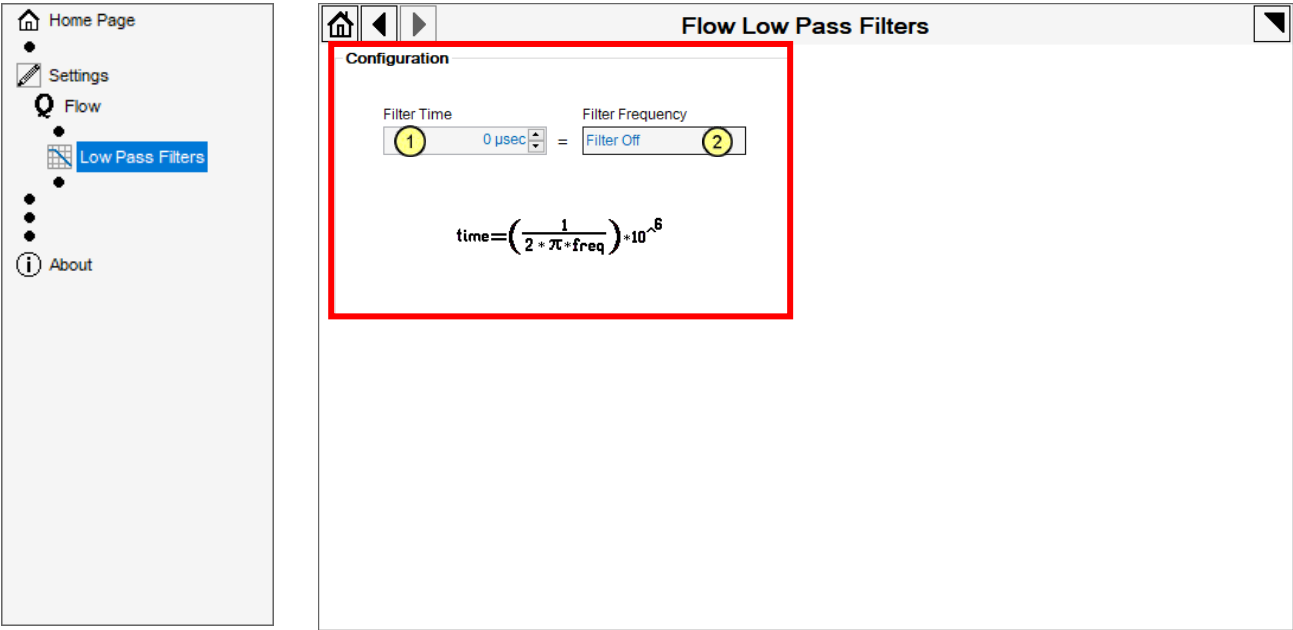
Function Description

Low pass filter allows the user to reduce the band of the valve regulation.

This function is useful for:

- application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks
- reducing noise on reference signal and resulting vibration on hydraulic actuator

Parameters Description




Filter Time


The control ① allows to set the filtering time constant for flow reference.


Increasing filter time value:

- delay on signals
- reduced closed loop bandwidth of the driver

	Time
Min	300 μs
Max	80000 μs
Default	0 μs

 With '0 μs' set, the filter is disable.

 The indicator ② displays the frequency value used to obtain the filter time.

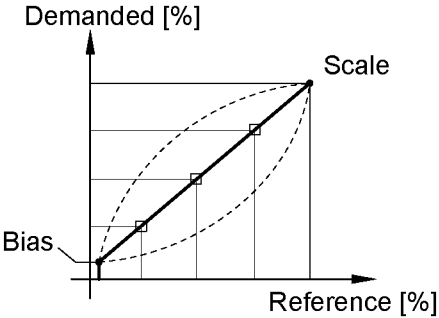
 Passing the mouse arrow on control ① or indicator ② will be display the formula used to obtain the filter time value.

16.6 Flow - Linearization [level 2]

Function Description

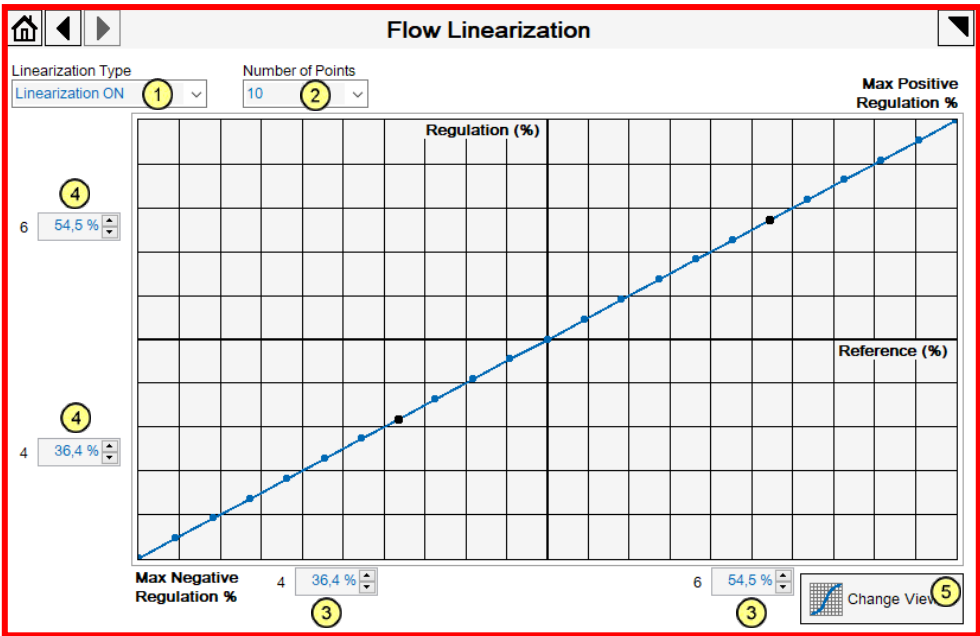
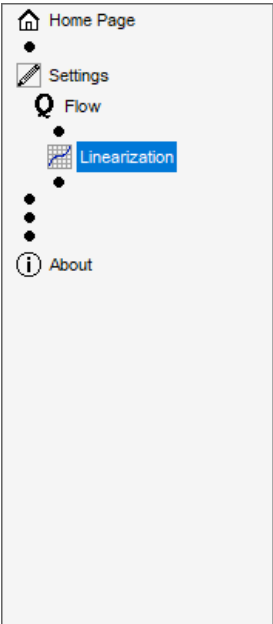
Linearization function allows to modify the relation between the reference input signal and the controlled valve regulation.
Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition.

The hydraulic regulation characteristic of the valve can be linearized by setting points pairs (Reference, Regulation), which respectively corresponds to electronic reference input signal and desired valve regulation.



Linearization for negative reference signal is only available with '3 position' hydraulic configurations (see 15.4).

Parameter Description



Linearization Type

The control ① allows to enable or disable (default setting) the Linearization function.

option1	Linearization ON
option2	Linearization OFF
Default	Linearization OFF

Number of points

The control ② allows to select up to 10 points for linearization.

Positive/Negative Reference

The controls ③ allow to set the reference input values (up to 10 points), where the Regulation settings ④ are applied to obtain the linearization.

Min	0.0%
Max	100.0%

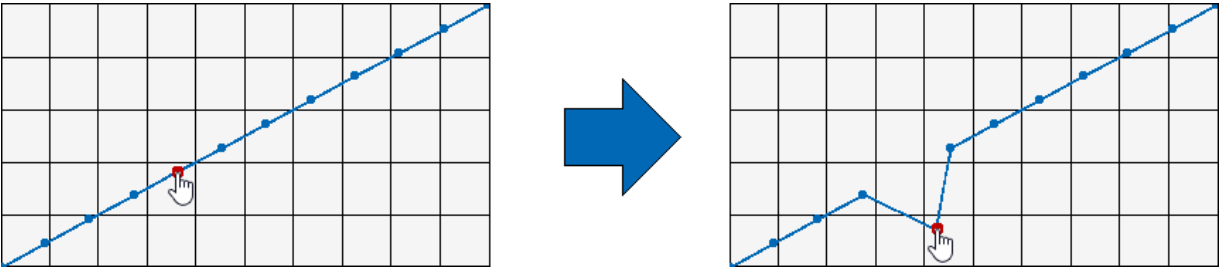
These controls ③ and ④ are available positioning the mouse-arrow on the desired point.

Positive/Negative Regulation

The controls ④ allow to set the current values (up to 10 points) of linearization curve as a percentage of the Max Regulation defined with the scale function (see 16.3).

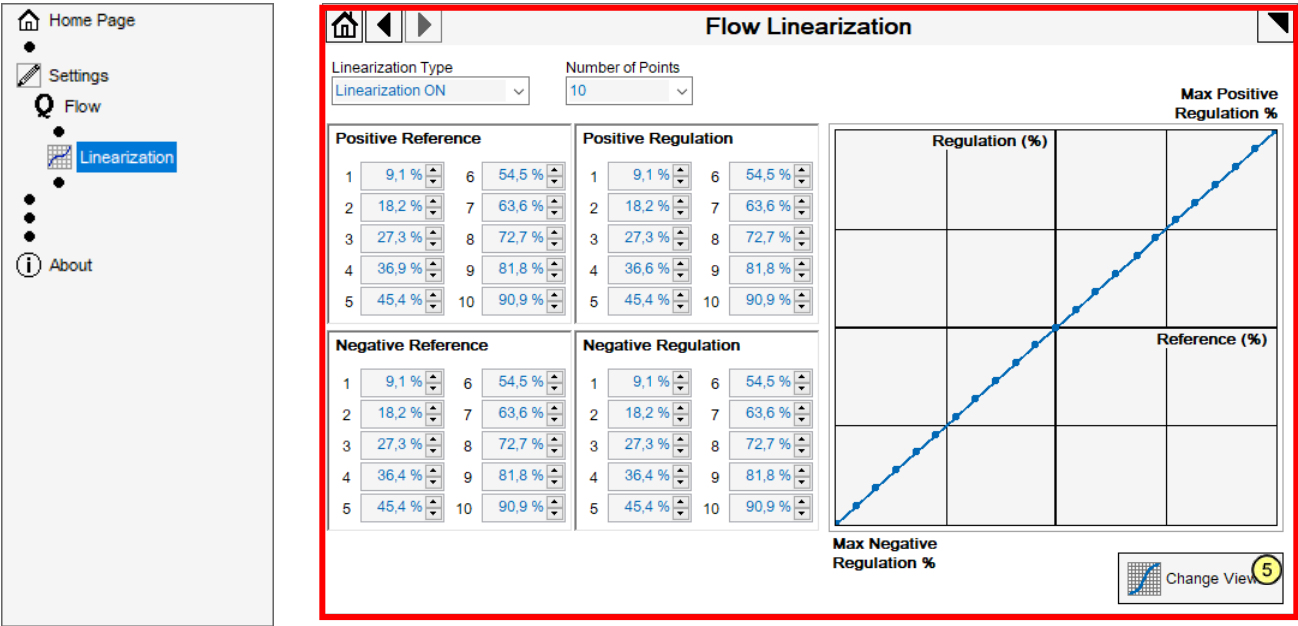
Min	0.0%
Max	100.0%

💡 These adjustments can be set by writing a numeric value or by positioning the mouse-arrow on the desired point and by dragging it on the graph:

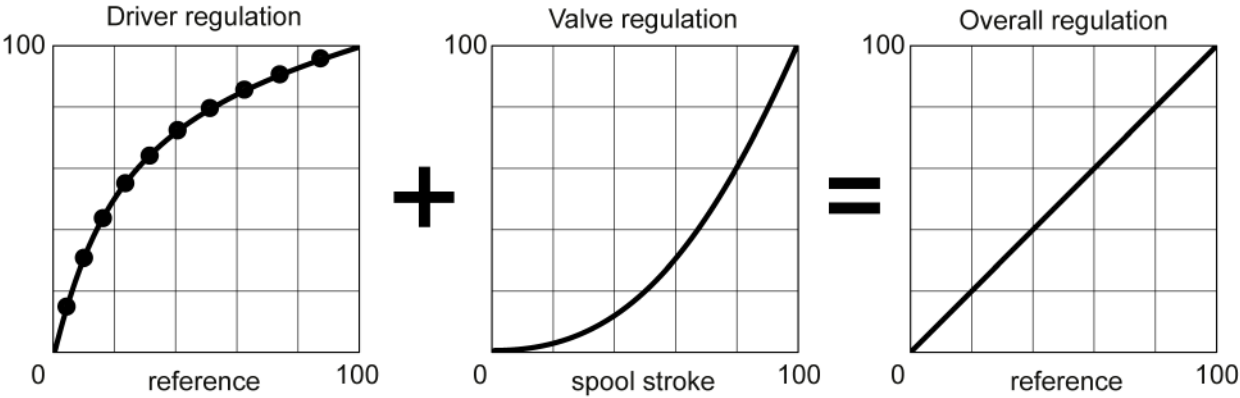


Change View

The button ⑤ allows to display simultaneously all regulation and reference controls (positive/negative) plus the graph (see below).



Example - Linearization effect



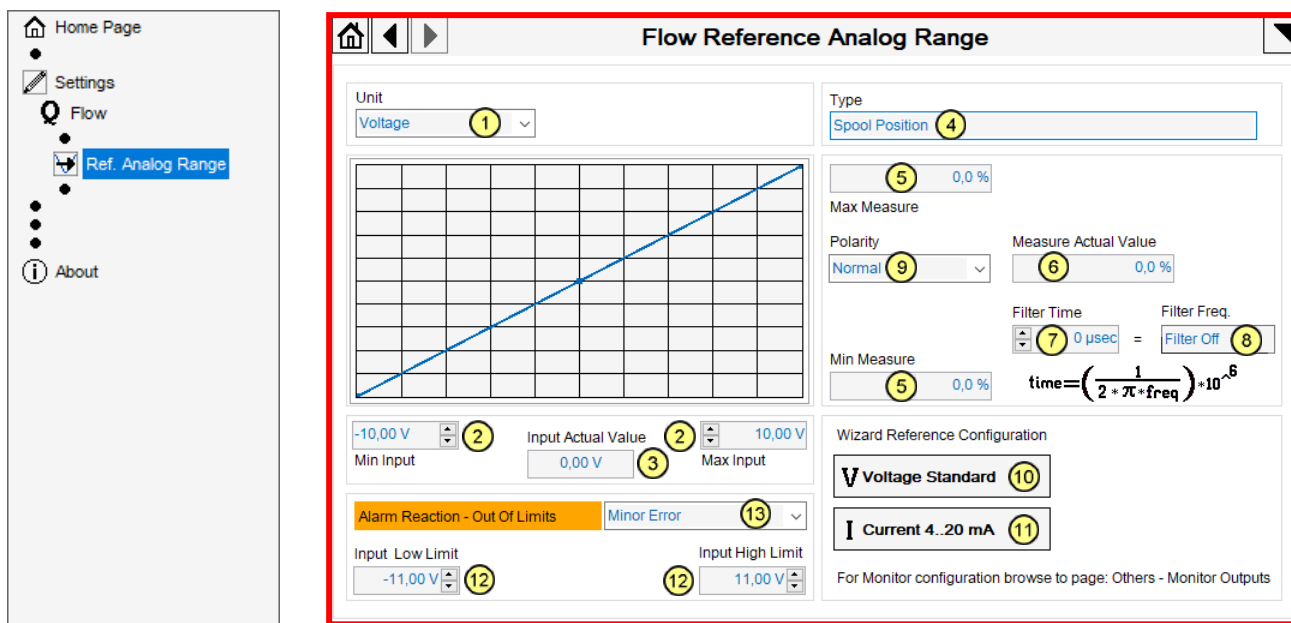
16.7 Flow – Reference Analog Range [level 2]

Function Description

Reference input signals are the typical interface between the driver (positive input Q_INPUT+ pin D1 and negative input INPUT- pin D2 of the connector D- see 5.3.2) and the machine control unit; different functions are available to adapt the standard driver behavior to specific application requirements:

- definition of the relationship between analog input signal (V or mA) and valve regulation reference (%) internally used by the driver
- selection of the admissible range for the analog input signal (high/low limits)
- activation of the low pass filter to reduce high frequency noise

Parameter Description



Unit

The control ① allows to select the unit of measurement (voltage or current) of the valve regulation reference (see 5.3.2).

option1	Voltage
option2	Current
Default	Voltage

Min / Max Input

The controls ② allow to set the range of minimum and maximum input values (voltage or current), referred to the valve regulation reference.

	Voltage	Current
Min	-12.5 V	-25 mA
Max	12.5 V	25 mA
Default Min	-10 V	4 mA
Default Max	10 V	20 mA


Input Actual Value

The indicator ③ allows to verify the actual input value of the valve regulation reference.


Type

The indicator ④ allows to verify the type of unit measure used for the actuator position transducer.


Min / Max Measure

The indicators  allow to verify admissible range for the minimum and maximum input values, referred of valve regulation.

Measure Actual Value

The indicator  allows to verify the measure actual value of the valve regulation.


Filter Time



The control  allows to set the filtering time constant for analog input signal.




Increasing filter time value:

- delay on signals
- reduced closed loop bandwidth of the driver.


	Time
Min	300 μ s
Max	80000 μ s
Default	0 μ s

 With '0 μ s' set, the filter is disable.

 The indicator  displays the frequency value used to obtain the filter time.


 Passing the mouse arrow on control  or indicator  will be display the formula used to obtain the filter time value.


Polarity




The control  allows to reverse the sign of measure actual value.

option1	Normal
option2	Inverted
Default	Normal


Wizard Reference Configuration

The button  allows to automatically set the analog input signal to voltage (default).


The button  allows to automatically set the analog input signal to current.

 Pressing buttons  and  the monitor output signal not change.
Please refer 'Others - Monitor Outputs' to modify the 'Signal Range' configuration (see 16.12).


Input Low / High limit [level 2]


The controls  allow to set the admissible range for the analog input signal of the valve regulation reference: if the input exceeds these values, this will result in a fault condition and react as programmed (see 7.1 for alarm reaction description).

	Voltage	Current
Min	-12.5 V	-25 mA
Max	12.5 V	25 mA
Default Min	-11.0 V	2 mA
Default Max	11.0 V	22 mA

 These settings are used with 4 ÷ 20 mA analog reference to identify cable breakage condition and to disable the driver and the proportional valve.

Alarm Reaction (Flow Analog Setpoint Out of Limits)

The control  allows to set which reaction must be performed when alarm condition is detected (see 7.3.2 and 7.1 for alarm reaction description).

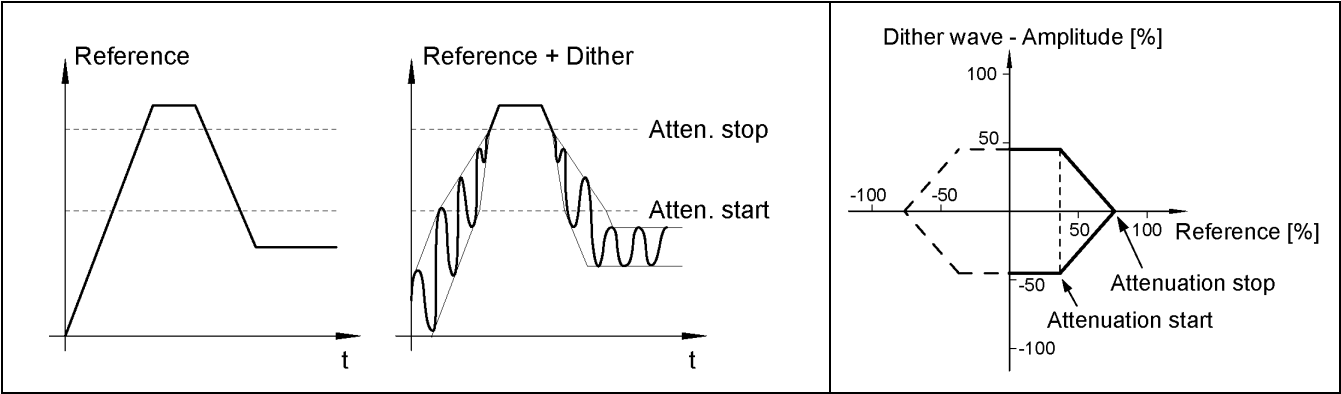
 For voltage signals this alarm is set to 'Message' as default.
For current signals this alarm is set to 'Minor Error' as default.


16.8 **Flow - Dither [Level 2]**

Function Description

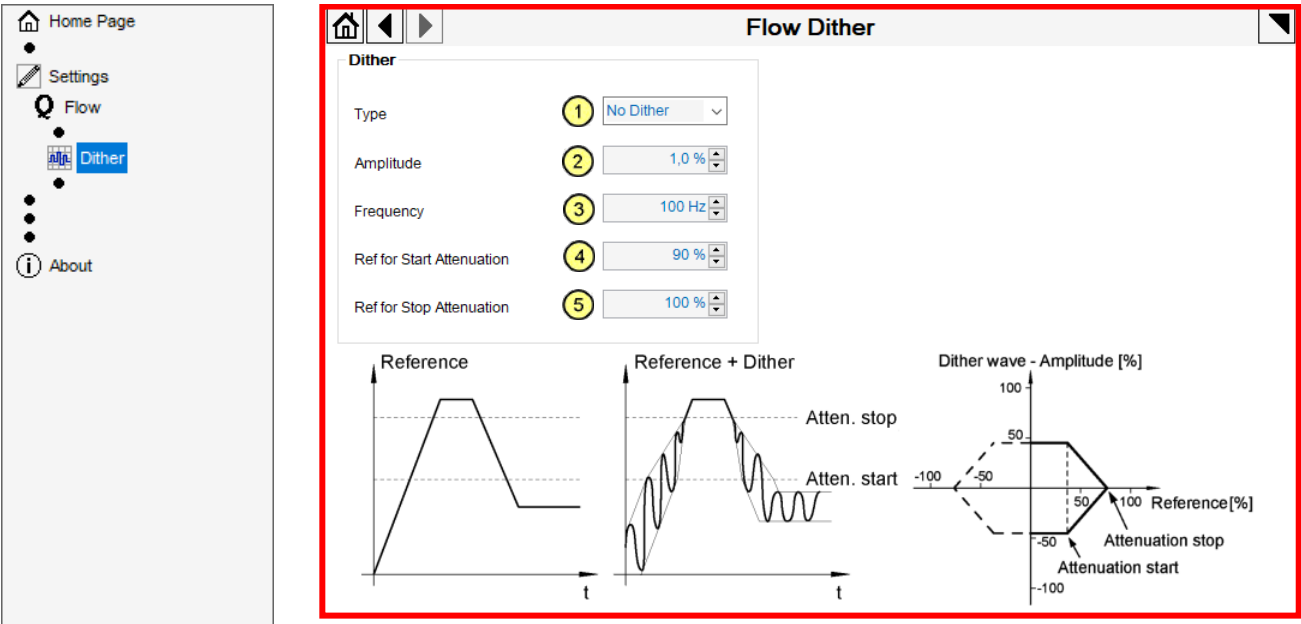
Hysteresis in the desired system response (e.g. motion of hydraulic actuator with relevant static friction effects) can be reduced thanks to a slight vibration in valve regulation that is acting the system: dither function adds a high frequency pulse wave to the valve reference signal thus obtaining the required vibration.

To avoid instability at high valve regulation (e.g. axis speed), it is possible to smooth the dither wave amplitude by setting the reference range in which the dither effect will act.



 With this function basic valve operations can be performed without requiring external/internal reference to simplify tuning or maintenance operations (in these cases the dither function behaves as a signal generator internal to the driver).

Parameter Description




Type

The control **1** allows to set the waveform type of the dither signal added to the reference actual signal thus obtain different effect: rough (square type), medium (triangular type) or smooth (sine type).

The best setting depends on the specific hydraulic system to be controlled.

option1	No Dither
option2	Square
option3	Triangular
option4	Sine
Default	No Dither


Amplitude

The control  allows to set the dither waveform amplitude: greater value produce higher dither effects but may cause undesired system vibrations.


The best setting depends on the specific hydraulic system to be controlled.

Min	0%
Max	100%
Default	2%


Frequency

The control  allows to set the dither waveform frequency: smaller value produce higher dither effects but may cause undesired system vibrations; the best setting depends on the specific hydraulic system to be controlled.

Min	1Hz
Max	180Hz
Default	100Hz


 To avoid instability at high valve regulation (e.g. axis speed), it is possible to smooth the dither wave amplitude: this attenuation start from the selected dither amplitude and reach zero amplitude.

Reference for Start Attenuation


The control  allows to set at which reference signal the dither amplitude attenuation has to start.

Min	0%
Max	99%
Default	90%

Reference for Stop Attenuation

The control  allows to set at which reference signal the dither amplitude attenuation has to stop (Stop value must be always greater than the Start value).

Min	1%
Max	100%
Default	100%



 These settings are symmetrical for positive and negative reference signal: attenuation for negative reference values starts and stops at the same value of positive ones.

16.9 Flow - PID [level 2]

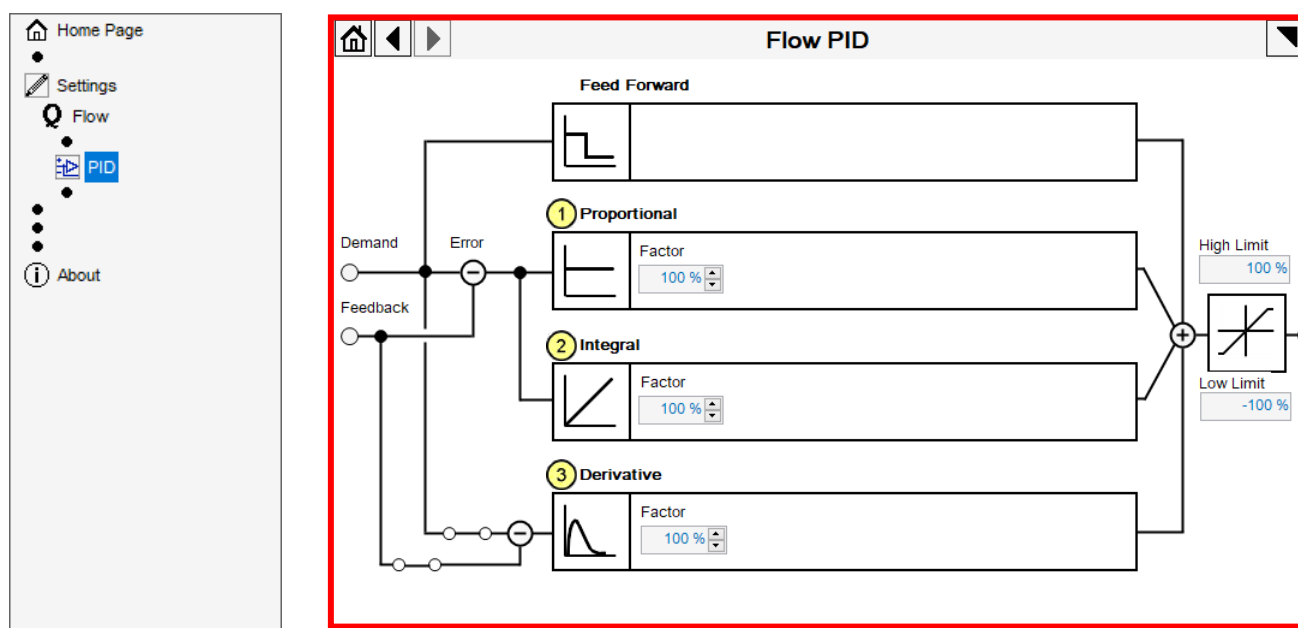
Function Description

Response time, precision and stability of the valve regulations depend on the valve working conditions and on the closed loop control (PID) parameters.

PID parameters are defined by Atos R&D test and are factory set during automated production: default settings can be reduced or increased when specific requirements arise during start-up operations.

-  Flow (valve spool position) control is slightly influenced by the valve working conditions (regulated flow) – do not modify default setting if not strictly required.
-  Depending on Atos default setting some control action may be not available.


Parameter Description



Proportional

The control ① allows to set the proportional part of the closed loop control as percentage of the default setting.


Min	0,0%
Max	200,0%
Default	100,0%

-  PID proportional part is specific for immediate handling of control error (difference between demanded and actual values): greater settings increase valve's reactivity and precision but decrease stability.

Integral

The control ② allows to set integral part of the closed loop control as percentage of the default setting.


Min	0,0%
Max	200,0%
Default	100,0%

-  PID integral part is specific for zeroing the control error with constant reference signal: greater settings increase valve's precision in static conditions but decrease stability.

Derivative

The control ③ allows to set derivative part of the closed loop control as percentage of the default setting.

Min	0,0%
Max	200,0%
Default	100,0%

-  PID derivative part is specific for reducing valve regulation overshoot with fast reference variation: greater settings reduce valve's overshoot in dynamic conditions but decrease stability.

16.10 Flow – Monitoring [level 2]

Function Description

The driver monitors the main spool and pilot spool control functions. These monitoring functions are useful to perform troubleshooting operations.

Direct operated directional valves – TEB execution

- **Main Spool Position Control Monitoring**

Main spool position control monitoring checks solenoid current command and if this command exceeds solenoid operating limits for a time greater than delay time an alarm is generated. This function is useful to detect hardware failures which prevent normal valve operation (e.g.: spool sticking).

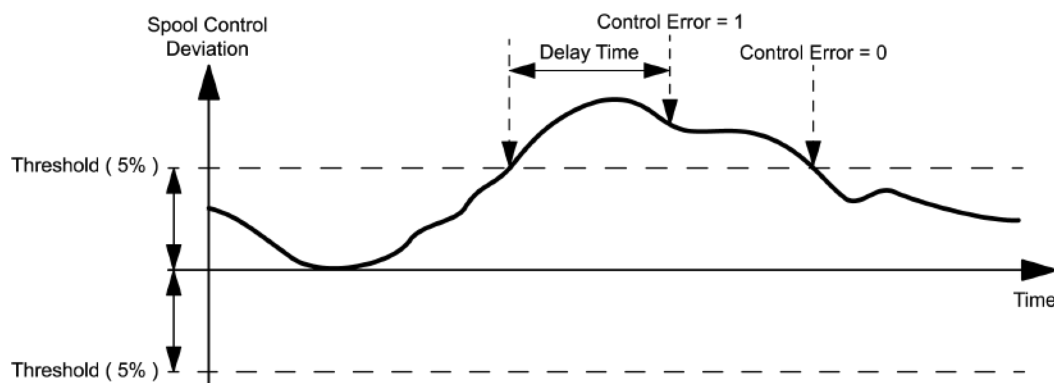
Pilot operated directional valves with one LVDT transducer – TEB execution

- **Main Spool Position Control Monitoring**

Two different types of main spool position control monitoring are available:

Custom Asymmetric - function checks pilot command and if this command is saturated to $\pm 100\%$ for a time greater than delay time an alarm is generated.

Standard Symmetric - function evaluates main stage spool position control deviation error. If main stage spool position control deviation remains out of the admissible bandwidth ($\pm 5\%$) for a time greater than delay time an alarm is generated (see the graph).



Main spool position control monitoring can detect hardware failures which prevent normal valve operation (e.g.: main spool sticking).

Pay attention: the alarm is generated also if piloting pressure is missing and main spool cannot be moved.

- **Pilot Spool Position Control Monitoring**

Pilot spool position control monitoring checks solenoid current command and if this command exceeds solenoid operating limits for a time greater than delay time an alarm is generated. This function is useful to detect hardware failures which prevent normal pilot valve operation (e.g.: spool sticking).

Pay attention: the alarm is generated also if piloting pressure is missing and main spool cannot be moved.

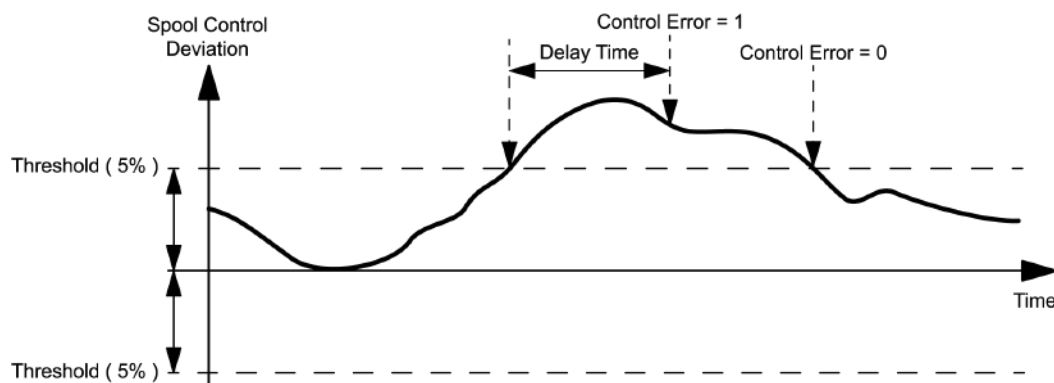
Pilot operated directional valves with two LVDT transducers – LEB execution

- **Main Spool Position Control Monitoring**

Two different types of main spool position control monitoring are available:

Custom Asymmetric - function checks pilot command and if this command is saturated to $\pm 100\%$ for a time greater than delay time an alarm is generated.

Standard Symmetric - function evaluates main stage spool position control deviation error. If main stage spool position control deviation remains out of the admissible bandwidth ($\pm 5\%$) for a time greater than delay time an alarm is generated (see the graph).



Main spool position control monitoring can detect hardware failures which prevent normal valve operation (e.g.: main spool sticking).

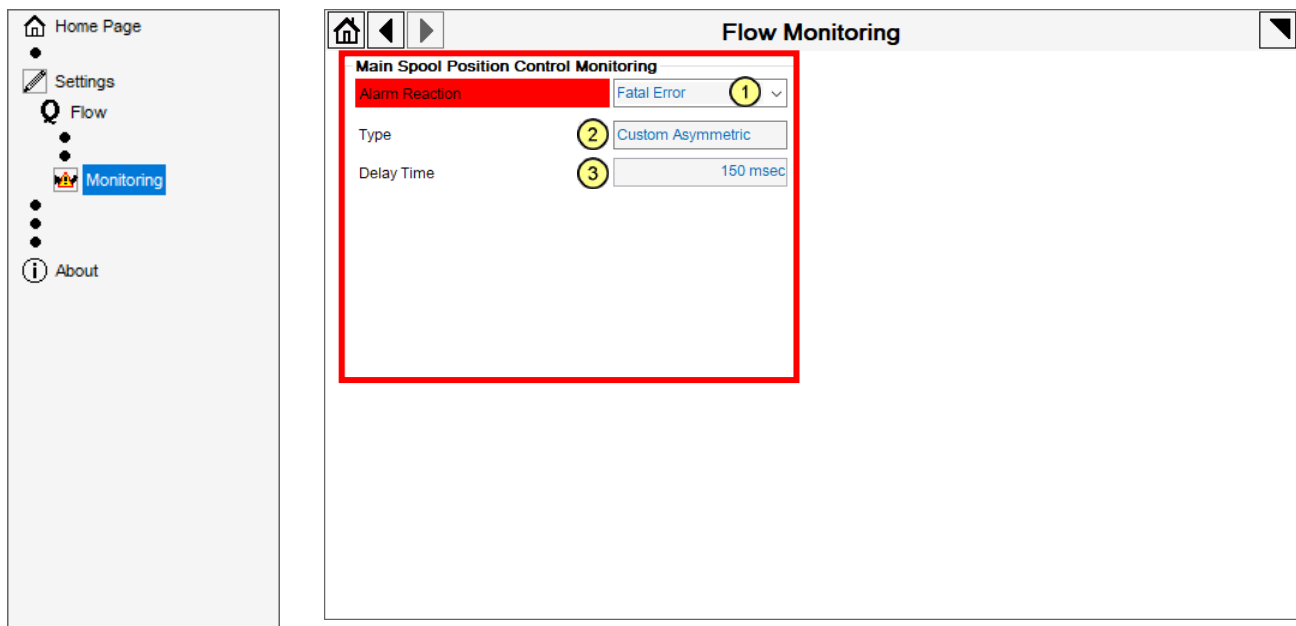
Pay attention: the alarm is generated also if piloting pressure is missing and main spool cannot be moved.

- **Pilot Spool Position Control Monitoring**

Pilot spool position control monitoring checks solenoid current command and if this command exceeds solenoid operating limits for a time greater than delay time an alarm is generated. This function is useful to detect hardware failures which prevent normal pilot valve operation (e.g.: spool sticking).

Parameter Description: Main Spool Position Control Monitoring (Direct operated valves)

- TEB execution - with one LVDT transducer

**Alarm Reaction (Main Spool Position Control Error)**

The control 1 allows to set which reaction must be performed when main spool position control error is detected (see 7.3.4 and 7.1 for alarm reaction description).

Type

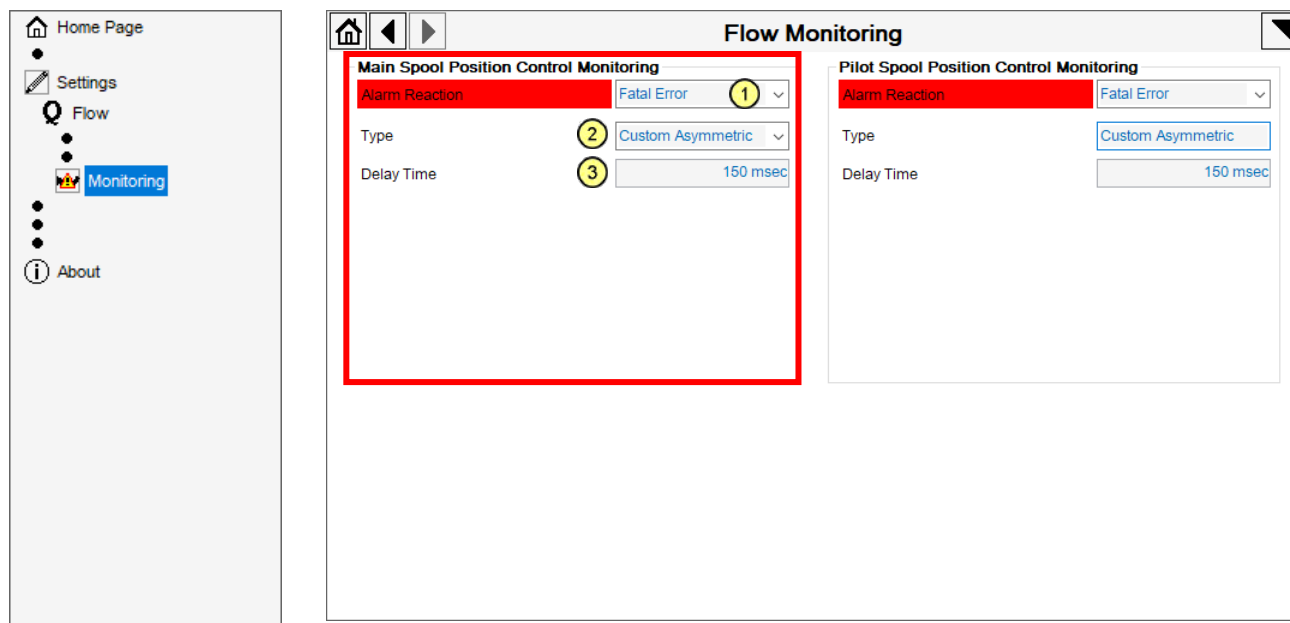
The indicator 2 displays control monitoring type (Custom Asymmetric).

Delay Time

The indicator 3 displays the time that the driver has to wait before switch-on the main spool position control error conditions.

Parameter Description: Main Spool Position Control Monitoring (Pilot operated valves)

- TEB execution - with one LVDT transducer
- LEB execution - with two LVDT transducers



Alarm Reaction (Main Spool Position Control Error)

The control ① allows to set which reaction must be performed when main spool position control error is detected (see 7.3.4 and 7.1 for alarm reaction description).

Type

The control ② allows to set control monitoring type.

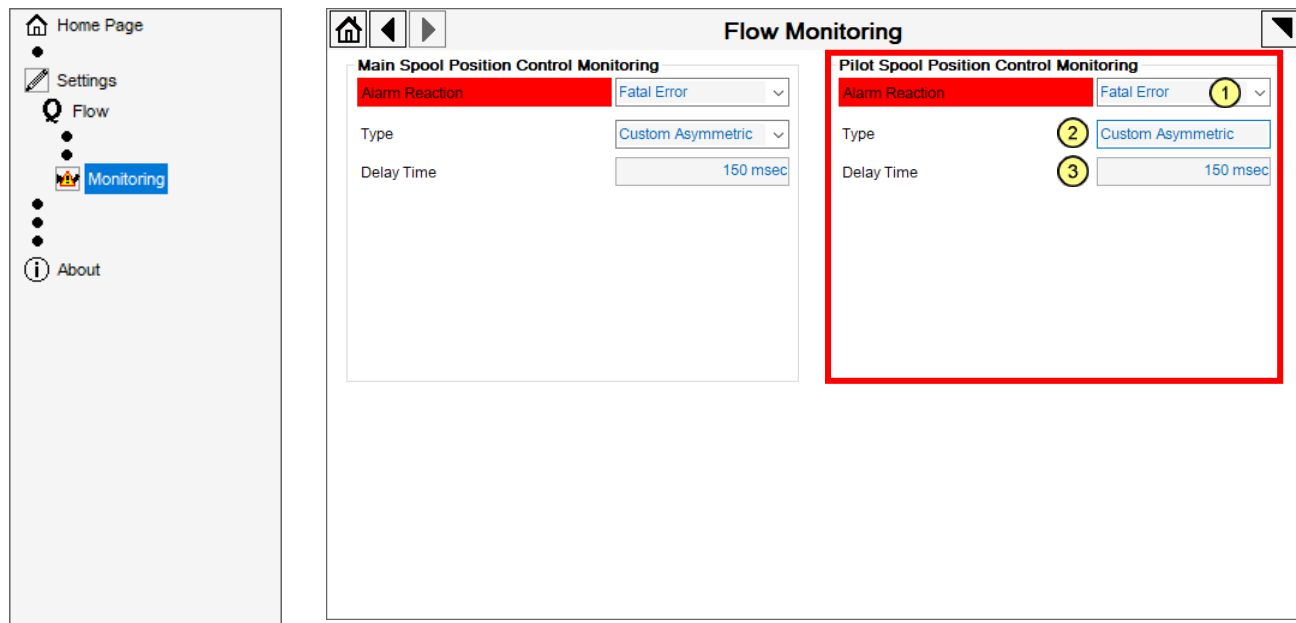
option1	Standard Symmetric
option2	Custom Asymmetric
Default	Standard Symmetric


Delay Time

The indicator ③ displays the time that the driver has to wait before switch-on the main spool control error conditions.


Parameter Description: Pilot Spool Position Control Monitoring (Pilot operated valves)

- TEB execution - with one LVDT transducer
- LEB execution - with two LVDT transducers



 This function area is available only for LEB execution.

Alarm Reaction (Pilot Spool Position Control Error)

The control  allows to set which reaction must be performed when pilot spool position control error is detected (see 7.3.4 and 7.1 for alarm reaction description).

Type

The indicator  displays control monitoring type (Custom Asymmetric).

Delay Time

The indicator  displays the time that the driver has to wait before switch-on the pilot spool control error conditions.

16.11 LIQZO compatibility [level 2]



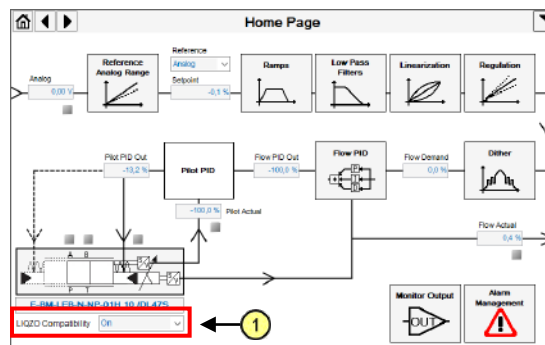
LIQZO compatibility function is available only for LIQZP 2 way cartridges with firmware version D09.00 or higher.



LIQZO compatibility function appears automatically only if present a marked difference in behavior of the flow regulation curve between a LIQZP and a LIQZO.

A new main stage transducer with Pmax 420 bar and rugged design will equip LIQZP proportional cartridges sizes.

The new transducer provides a better linearity then the old one and this reflects on the valve's regulation characteristic of LIQZP. In order to minimize any interchangeability issue with LIQZO, a new firmware/software feature has been created to allow new LIQZP 2 way, where the difference is more evident, to reproduce the flow regulation curve of LIQZO.



In Home Page area **1** is possible select the LIQZO compatibility:

LIQZO Compatibility **Off** ▼

OFF: default setting of the functionality

LIQZO Compatibility **On** ▼

ON: the LIQZP will behave like the LIQZO

16.12 Others – Monitor Outputs [level 2]

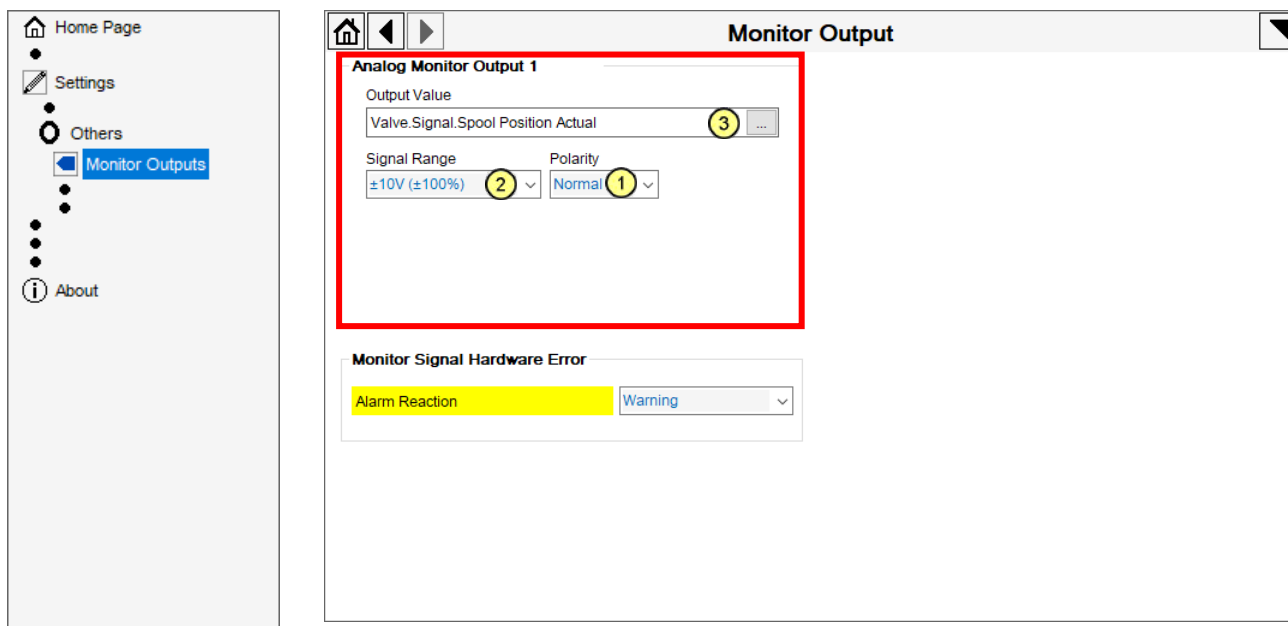
Function Description

The driver generates one analog output signal:

- flow monitor Q_MONITOR pin D3, available on the connector D (see 5.3.3)

As default the analog signal allows to monitor the actual spool position of the valve; monitor output setting allows to select which of the other signals available into the controller should be generated as output.

Parameter Description [Analog Monitor Output 1 (pin D3)]



Polarity

The control ① allows to set the output polarity of the generated analog output.


Min	Normal
Max	Inverted
Default	Normal

Signal Range

The control ② allows to select the unit of measurement (voltage or current), of the generated analog output (pin C1).

option1	±10V (±100%)
option2	±5V (±100%)
option3	4÷20mA (±100%)
option4	4÷20mA (0÷100%)
option5	0÷20mA (±100%)
option6	±20mA (±100%)
option7	±10mA (±100%)
Default	±10V (±100%)

Output Value

The control  allows to set which signals is generated on the analog output (Q_MONITOR) of the driver connector D (see 5.3.3).

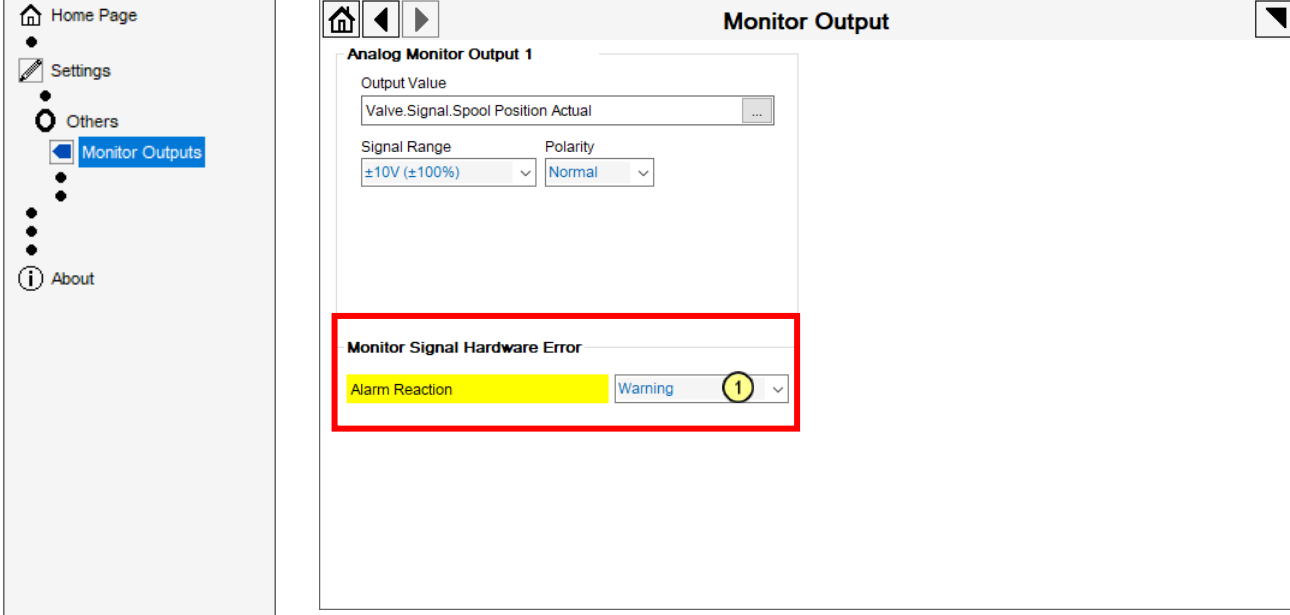
The user can be select the output value through the follow menu:

Valve ▶	Setpoint ▶	Valve. Reference. Analog
	Signals ▶	Valve. Signal. Spool Position Demanded Valve. Signal. Spool Position Actual



Output value default: Valve. Signal. Spool Position Actual.

Parameter Description (Monitor Signal Hardware Error)



The screenshot shows the 'Monitor Output' configuration window. On the left is a sidebar with navigation links: Home Page, Settings, Others, Monitor Outputs (selected), and About. The main window has a title bar with navigation icons and a 'Monitor Output' title. Below the title bar is a section for 'Analog Monitor Output 1' with fields for 'Output Value' (set to 'Valve.Signal.Spool Position Actual'), 'Signal Range' (set to '±10V (±100%)'), and 'Polarity' (set to 'Normal'). Below this is a section titled 'Monitor Signal Hardware Error'. Inside this section, the 'Alarm Reaction' is set to 'Warning', indicated by a yellow background and a circled '1' next to the dropdown arrow.

Alarm Reaction (Monitor Signal Hardware Error)

The control ① allows to set which reaction must be performed when monitor signal hardware error is detected (see 7.3.8 and 7.1 for alarm reaction description).



For voltage signals this alarm is set to 'Warning' as default.

For current signals this alarm is set to 'No Reaction' as default (if the monitor is used in current, it is recommended to activate the alarm in order to detect possible wiring issues).



If 'Signal Range' is modified between voltage and current (or vice versa) the alarm reaction previously set, not change.

16.13 Others – Monitoring [level 2]

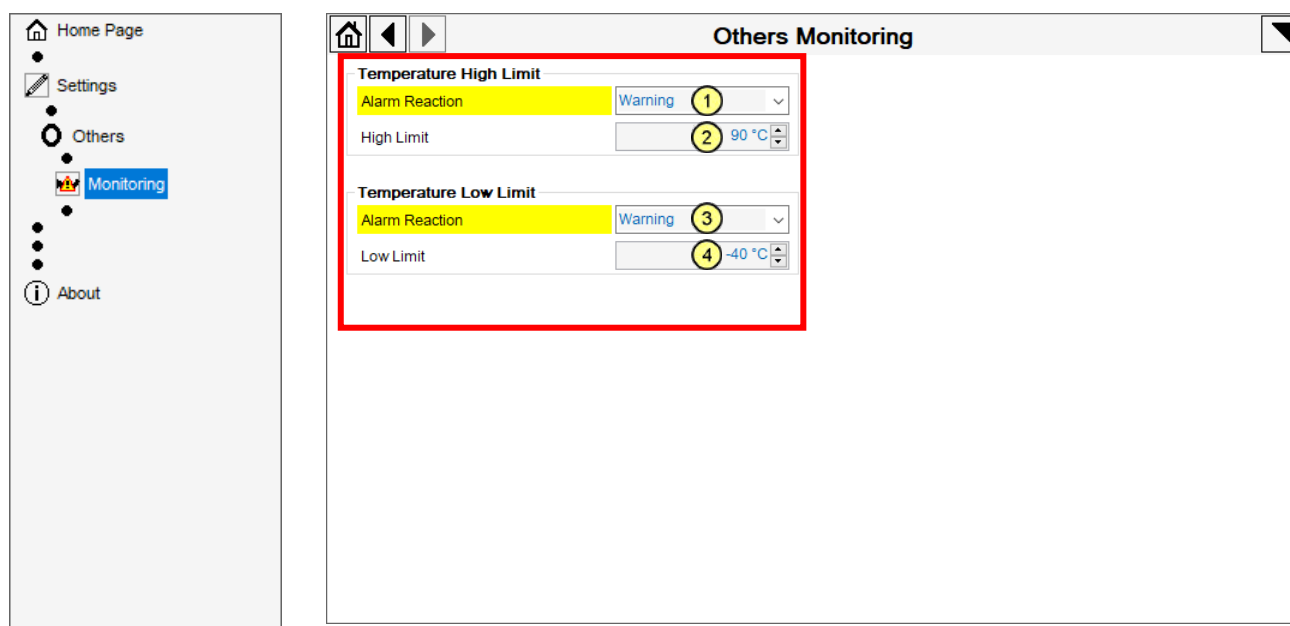
Function Description

The driver monitors the internal temperature. These monitoring functions are useful to perform troubleshooting operations.

Temperature High/Low Limit

These functions continuously verify if internal temperature of the electronic exceeds the normal working conditions. Two different limits are used to detect high/low temperature conditions.

Parameter Description (Temperature High/Low Limit)



Alarm Reaction (High Temperature)

The control ① allows to set which reaction must be performed when temperature exceeds the high limit (see 7.3.6 and 7.1 for alarm reaction description).

High Limit

The control ② allows to set the temperature high limit used for alarm condition detection.

Min	+25°C
Max	+120°C
Default	+90°C



Exceeding temperature limit can damage the electronic driver.

Alarm Reaction (Low Temperature)

The control ③ allows to set which reaction must be performed when temperature exceeds the low limit (see 7.3.6 and 7.1 for alarm reaction description).

Low Limit

The control ④ allows to set the temperature low limit used for alarm condition detection.

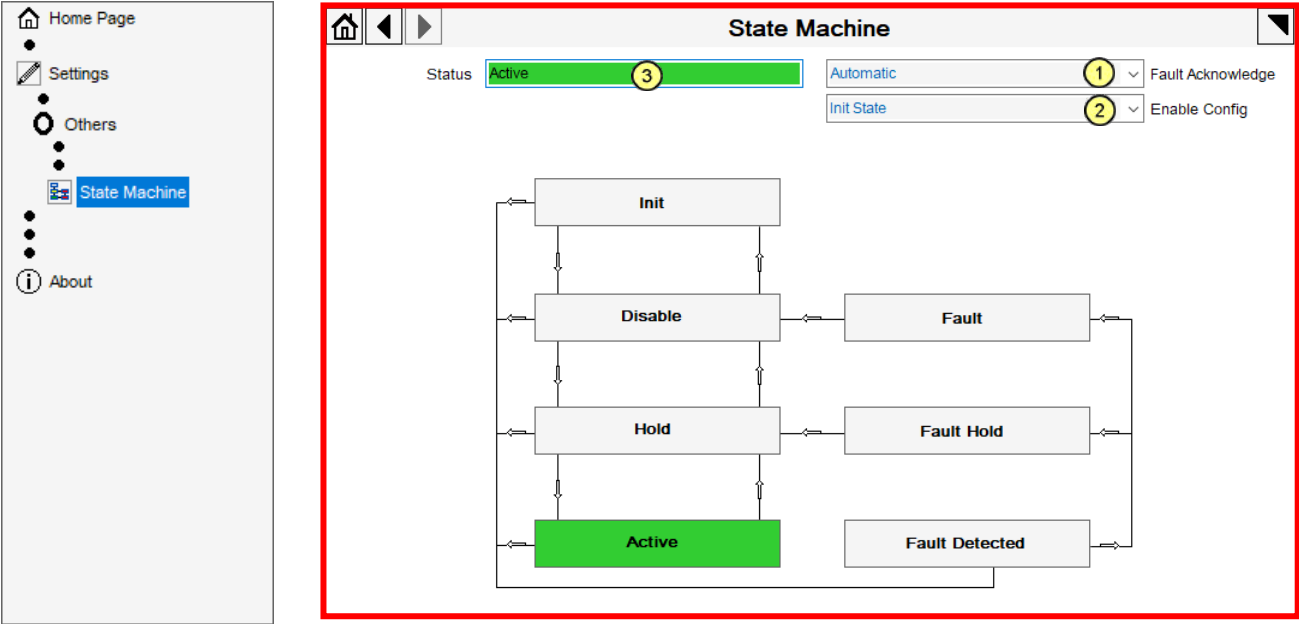
Min	-40°C
Max	+25°C
Default	-40°C

16.14 Others – State Machine

Function Description

The default state of the driver depends only on the on/off input enable and the detected alarm conditions (see 12.2.1).

Parameter Description



Fault Acknowledge [level 2]

The control ① allows the user to select how the driver return to normal working when alarms conditions are solved.

option1	Automatic
option2	Manual
Default	Automatic

Automatic

Without alarm presence, the driver automatically returns to normal working condition and Last Alarm (see 22.1.3) can be used to identify possible valve/driver problems.

Manual – Enable/Restart

Without alarm presence, the driver returns to normal working condition only using driver ‘Restart’ (see 13.1.1), Enable signal (see 5.3.4).


Last Alarm can be used to identify possible valve/driver problems (with Restart the Last Alarm is cleared).








Enable configuration [level 2]

The control ② allows to select the driver status when the enable input pin is switched off (see 5.3.4).

option1	Hold State
option2	Disable State
option3	Init State
Default	Init State

Status

The indicator  displays in which status the driver commands the valve.

State Machine	Control loops configuration		Note
	Valve control:	OFF	No current to solenoid.
	Valve set-point:	Not applicable	
	Valve control:	OFF	No current to solenoid.
	Valve set-point:	Not applicable	
	Valve control:	OFF	No current to solenoid.
	Valve set-point:	Not applicable	
	Valve control:	ON	
	Valve set-point:	According to ref. type (see 12.1.1)	
	Valve control:	OFF	No current to solenoid. To verify and solve fault conditions and to evaluate driver reaction see section 7.1.
	Valve set-point:	Not applicable	
	Valve control:	OFF	No current to solenoid. To verify and solve fault conditions and to evaluate driver reaction see section 7.1.
	Valve set-point:	Not applicable	
	Valve control:	OFF	With fatal error state machine is locked in this state (power off/on is required). This state is assumed when driver detects an error: the final fault state depends on error reaction configuration (see 7.1).
	Valve set-point:	Not applicable	

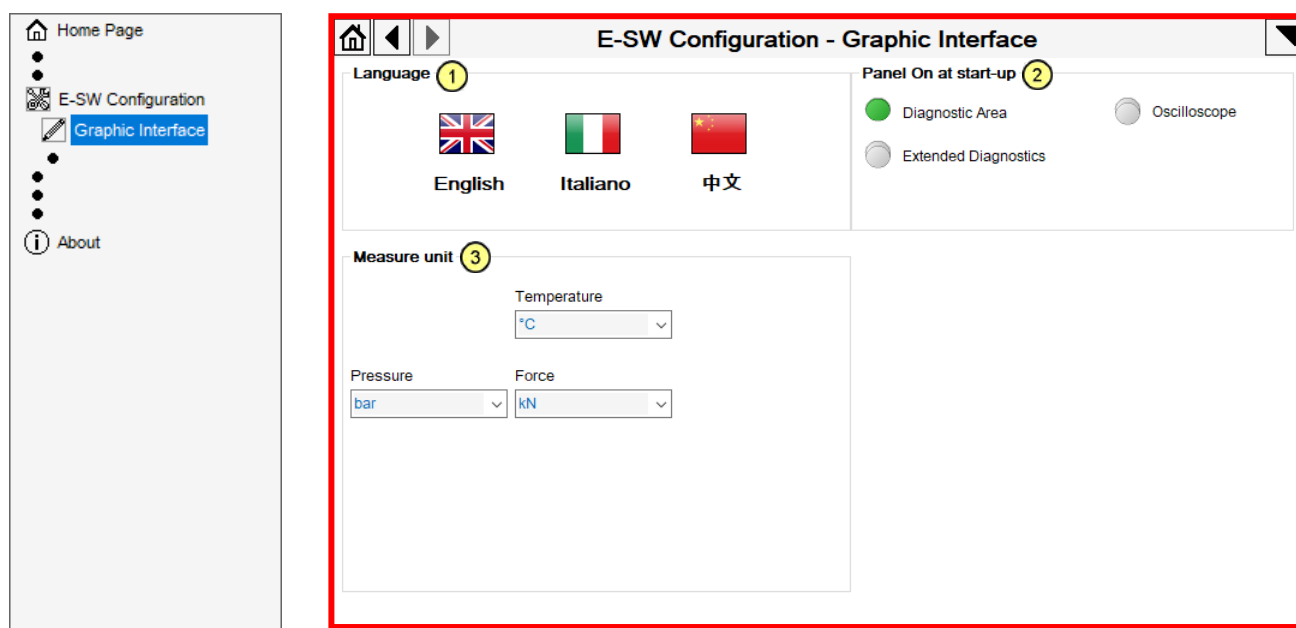
17 MAIN WINDOW - MULTIFUNCTION AREA [E-SW CONFIGURATION]

Multifunction area of the Main Window is organized in different pages: select the “E-SW configuration” tag on the left side to adapt the E-SW-SETUP software behavior to specific requirements.

17.1 Graphic Interface

The E-SW-SETUP software graphic interface is organized in multiple pages and levels related to different specific functional groups; use the lowest access level that matches the application requirements to obtain the simplest software interface.

Parameter Description



17.1.1 Language

In the area ①, the user chooses in which language display the software.

17.1.2 Panel On at start up

The controls in the area ②, if selected, open the relatives windows when the program starts.

17.1.3 Measure unit

In the area ③, the user can select different measures unit to each parameter. The selection effectuated in this section, are valid for each parameter in the software page.

Temperature

This control allows to set the unit of measurement of the temperature.

option1	°C
option2	°F
<i>Default</i>	°C

Pressure

This control allows to set the unit of measurement of the pressure.

option1	bar
option2	psi
<i>Default</i>	<i>bar</i>

Force

This control allows to set the unit of measurement of the force.

option1	kN
option2	N
option3	kg
option4	t
<i>Default</i>	<i>N</i>

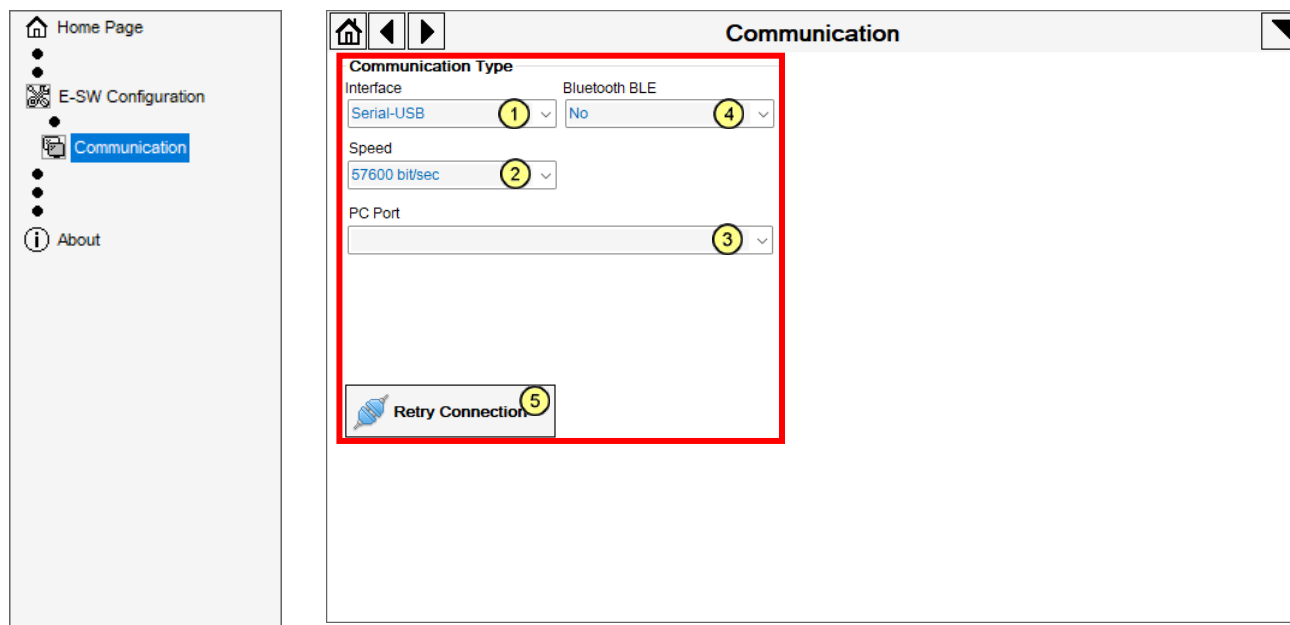
17.2 Communication

The E-SW-SETUP software allow to manage the complete range of Atos electronic driver for proportional valves. Select the appropriate communication according to the connected driver

 E-SW-SETUP communication settings can be modified only in OFF-LINE.

 USB and Bluetooth communication interface are always available.

17.2.1 Communication Type - Connection via USB cable



Interface

The control ① allows to select the communication type as the active interface according to the communication type of the driver connected.

 For E-BM-TEB/LEB drivers only option 1 is available.

option1	Serial-USB
option2	Serial-USB for IO-Link
option3	Serial-USB for CANopen
option4	Serial-USB for Profibus DP
option5	Serial-USB for EtherCAT
option6	Serial-USB for POWERLINK
option7	Serial-USB for EtherNet/IP
option8	Serial-USB for PROFINET
option9	CANopen
option 10	Profibus


Speed

The control ② allows the user to select the speed of the serial communication with the connected driver: high speeds allow a faster update of displayed data but may cause Timeout communication errors (see 10.2).

PC port

The control ③ allows the user to select, which USB port has to be used to communicate with the connected driver among the available USB ports.

 This control displays only the USB ports currently available on the PC.

 Valves connected with USB cable to the PC are recognized as STMicroelectronics Virtual COM Port.

Bluetooth BLE

The control ④ allows the user to choose if the driver must be connected via Bluetooth adapter or not.

option1	No
option2	Yes
Default	No

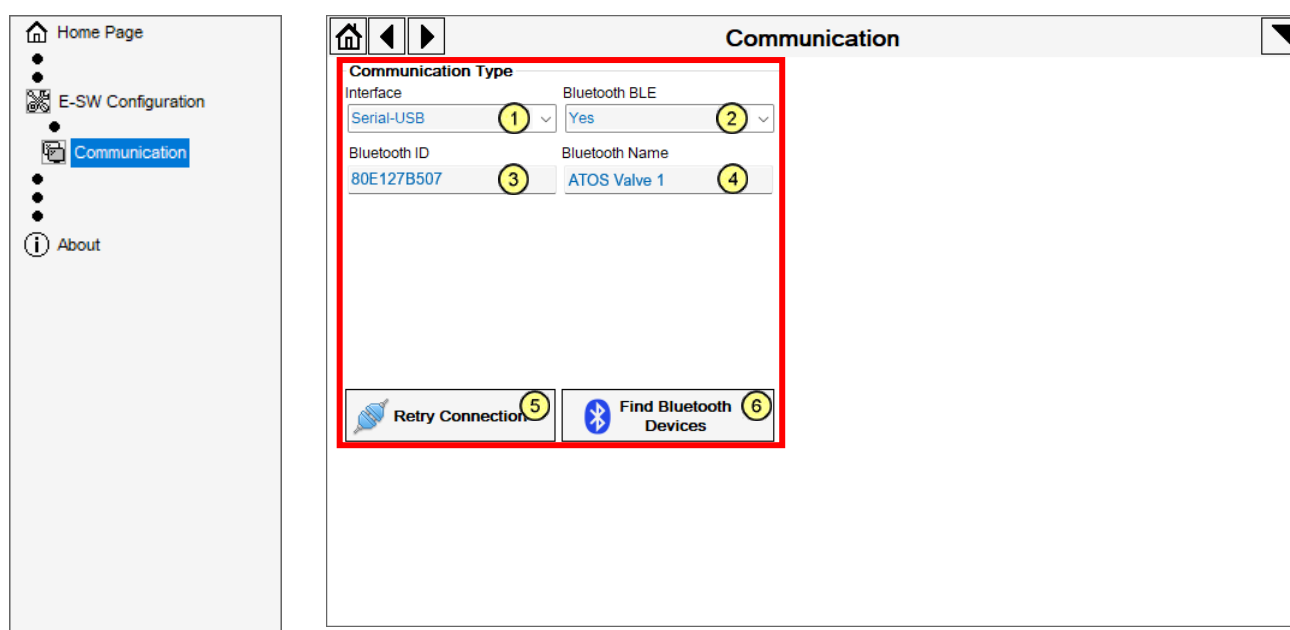


For connection via USB cable select option 1.

Retry connection

Press button ⑤ to retry the connection between driver and software.

17.2.2 Communication Type - Connection via Bluetooth adapter



Interface

The control ① allows to select the communication type as the active interface according to the communication type of the driver connected.



For E-BM-TEB/LEB drivers only option 1 is available.

option1	Serial-USB
option2	Serial-USB for IO-Link
option3	Serial-USB for CANopen
option4	Serial-USB for Profibus DP
option5	Serial-USB for EtherCAT
option6	Serial-USB for POWERLINK
option7	Serial-USB for EtherNet/IP
option8	Serial-USB for PROFINET
option9	CANopen
option 10	Profibus

Bluetooth BLE


The control ② allows the user to choose if the driver must be connected via Bluetooth adapter or not.

option1	No
option2	Yes
Default	No



For connection via Bluetooth adapter select option 2.

Bluetooth ID

The indicator  displays Atos device name through the MAC address (unique identifier).




Bluetooth Name

The indicator  displays Atos device name assigned by the user.




Atos device name will always have ATOS prefix

Retry connection

By pressing button  the software will attempt to connect to the Bluetooth adapter which will have the “Bluetooth ID” and “Bluetooth Name” displayed in indicators  and .

Find Bluetooth Devices

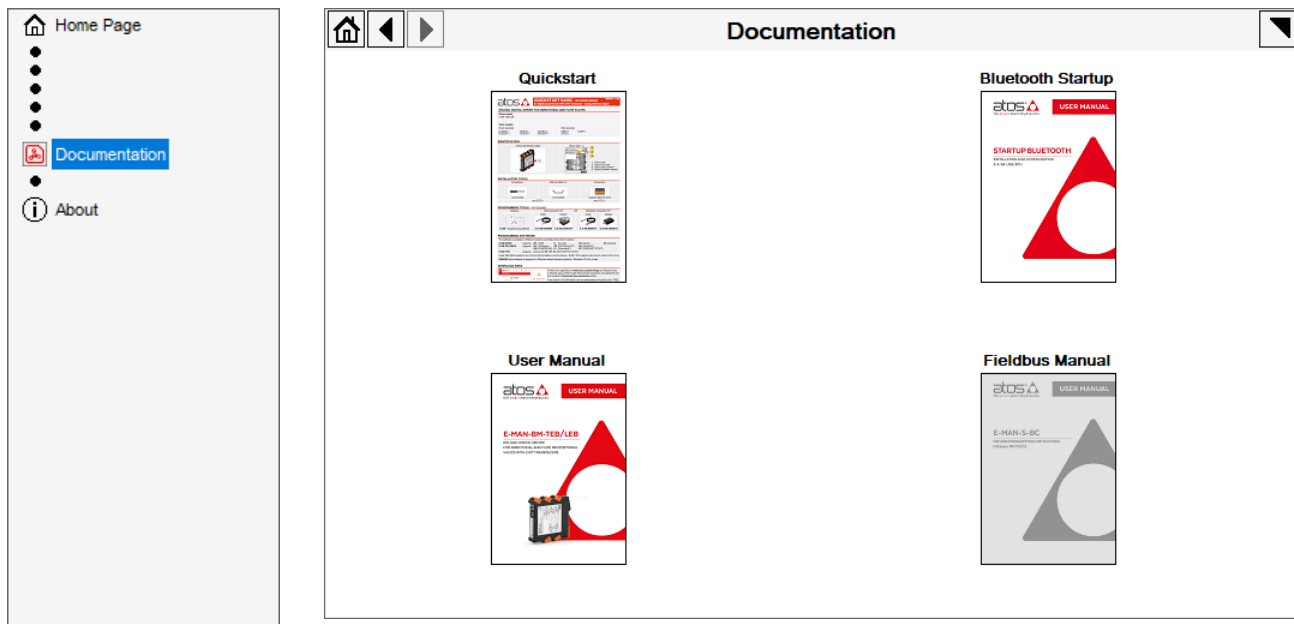
Press button  to start searching for other Bluetooth devices (see)



WARNING: see tech table GS500 for the list of countries where the Bluetooth adapter has been approved. For more information about E-A-BTH Bluetooth adapter please refer to STARTUP-BLUETOOTH guide.

18 **MAIN WINDOW - MULTIFUNCTION AREA [DOCUMENTATION]**

Multifunction area of the Main Window is organized in different section: select the “Documentation” tag on the left side to access to main documents.

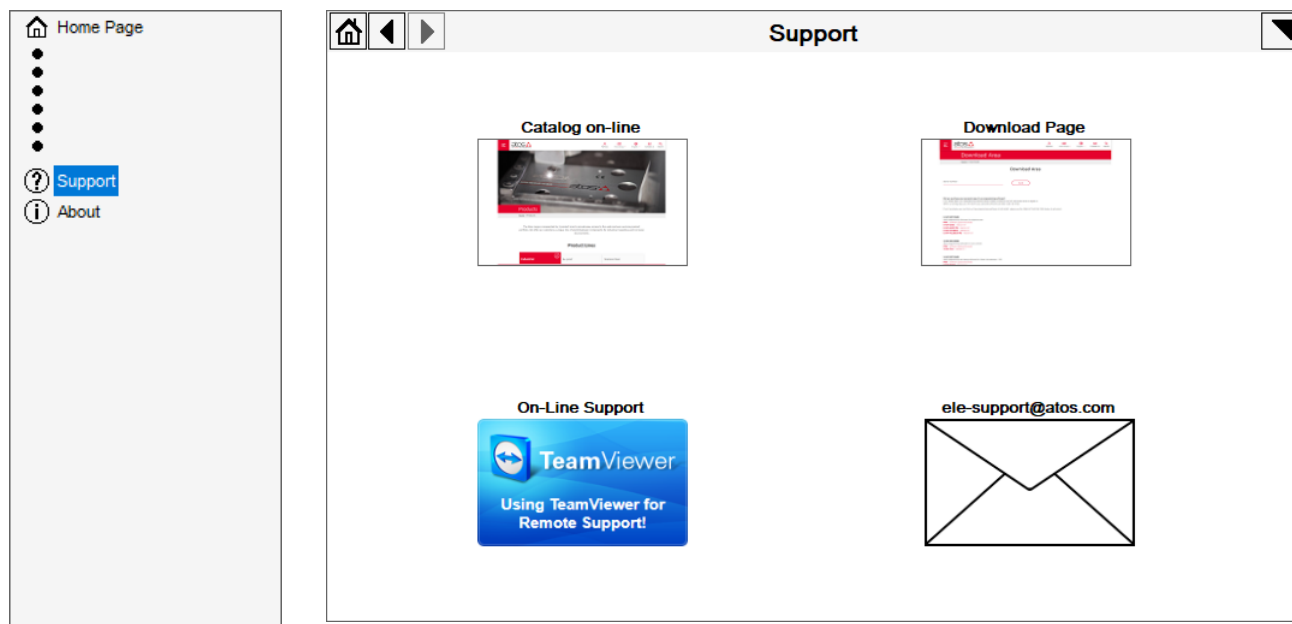


Documentation

- Quickstart: driver installation and valve programming quick procedure of the valve connected (click on to download)
- Bluetooth manual: Bluetooth adapter startup guide (click on to download)
- User Manual: driver programming manual of the valve connected (click on to download)

19 MAIN WINDOW - MULTIFUNCTION AREA [SUPPORT]

Multifunction area of the Main Window is organized in different section: select the "Support" tag on the left side to access to support.



Support

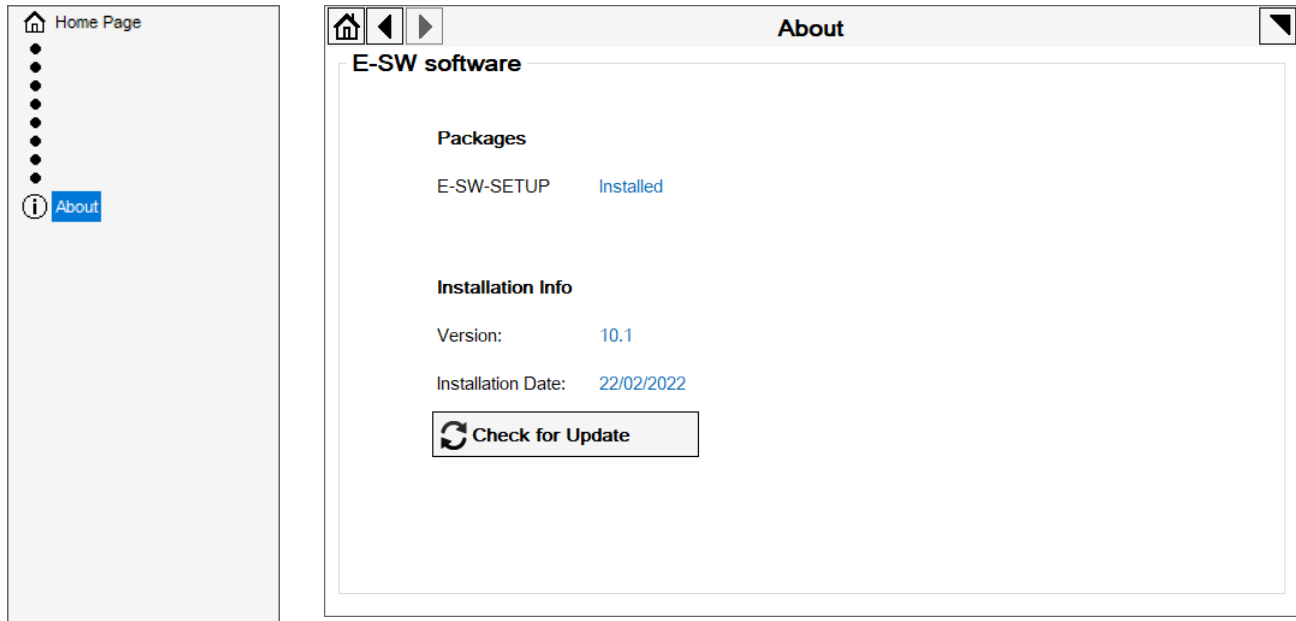
- Catalog on-line: technical tables, advertising and technical articles
- Download Page: SWK smart software for assisted selection of Atos components code (free download), SWC smart software for assisted cylinder's sizing and code selection (free download), E-SW-SETUP software (free download) and access to download area
- On-line support: use TeamViewer for remote support with on-line Atos support service
e.g. by selecting TeamViewer, a support request will be sent to Atos It is recommend send a detailed e-mail first (ele-support@atos.com) containing all the necessary information about the requested support.
- ele-support@atos.com: technical support service of Atos Electronic Division
e.g. by selecting ele-support@atos.com, will be send to Atos all the information to provide efficient technical support. Is possible also attach the software setting file (see 21.2).



Active internet connection is required to access Atos support services.

20 MAIN WINDOW - MULTIFUNCTION AREA [ABOUT]

Multifunction area of the Main Window is organized in different section: relevant information about E-SW-SETUP software are displayed in this section.



Packages

Software type actually installed on PC.

Installation info

- Version shows the software version
- Installation date shows the software installation date

Check for Update

Press this button to verify if a new version of software is available.



In case of a new software version available, follow the wizard to perform the update.

21 MAIN WINDOW - MULTIFUNCTION AREA [SETTING FILES ARCHIVE]

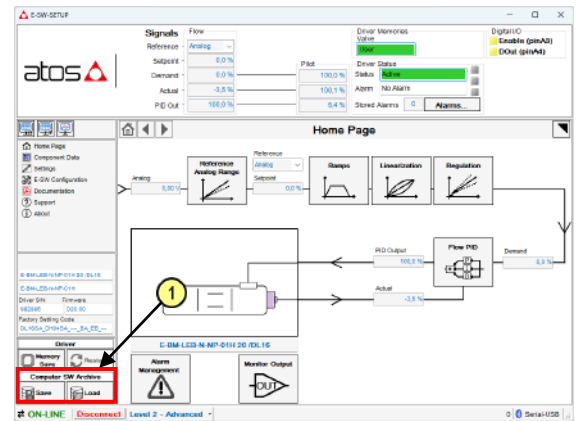
Multifunction area of the Main Window is organized in different section: press the “Save” or “Load” button in area ① to operate with the parameters ‘Setting Files’ saved into the PC hard-disk (see 8).



Save actual parameters (see 21.1)



Load setting file (see 21.2)



In ‘Computer SW Archive – Setting Files’ software page three different database are available:

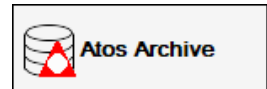
User Archive

Press button to open the user setting database: this archive is used to save the setting files customized by the user.



Atos Archive

Press button to open the standard product archive: this archive is used to load the factory setting files included in the software installation, for standard series products.



Atos Old Series Archive

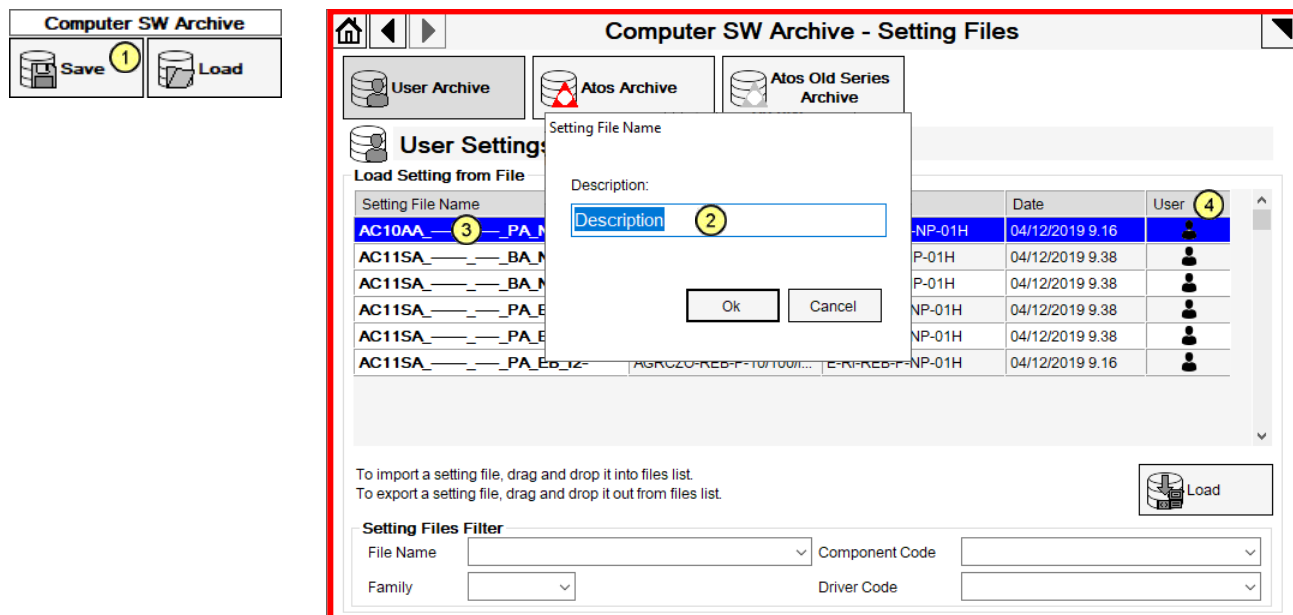
Press button to open the old series product archive: this archive is used to load the factory setting files included in the software installation, for old series product.



The setting file can be used efficiently as a starting point for executing repetitive installations of the same driver. For specific ‘Setting Files’ please contact the Technical Sales Support of Atos Electronic Division – ele-support@atos.com.

21.1 Save (store into pc)

This operation allows to save the “Actual Parameters” of the programming software into PC hard-disk as a ‘Setting File’.



- Click-on **Save** button (1) in multifunction area
- Insert a description (2) that will identify the new saved 'Setting File' and click-on **Ok** button

💡 'Setting Files' are only saved in 'User Archive'.

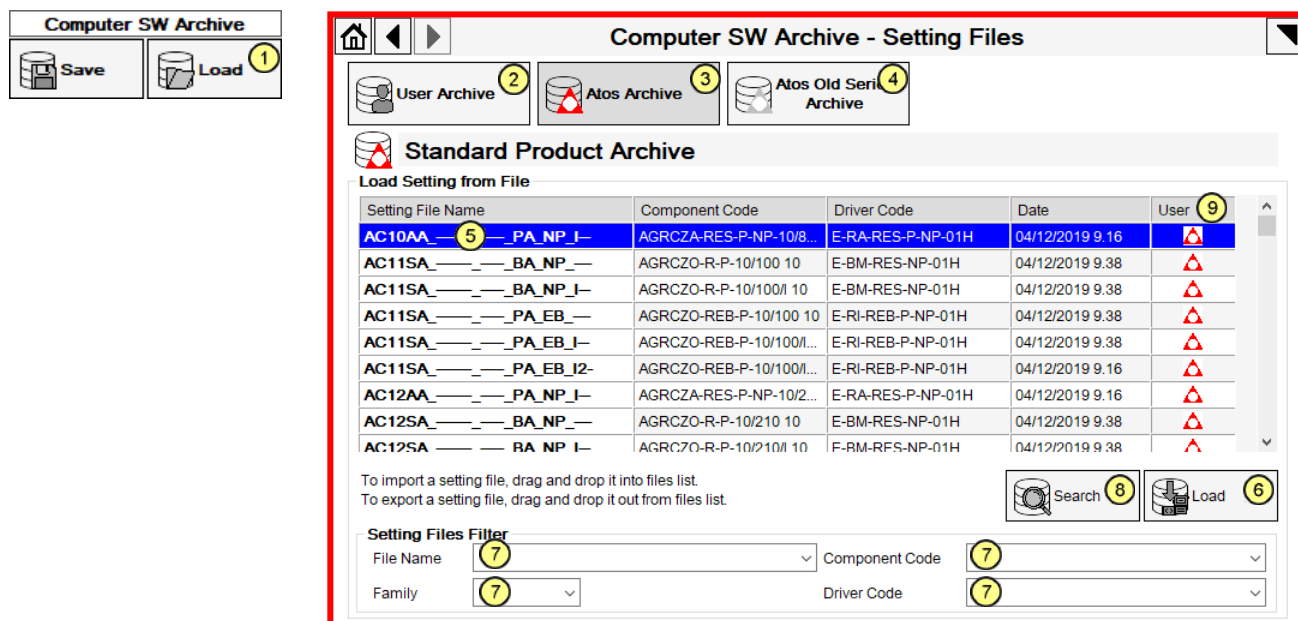
💡 The new 'Setting File' will be displayed in (3) into the available settings list for load operations.

💡 When in ON-LINE status (see 10.1), this operation allows to directly save “Actual Parameters” of the connected driver.

💡 User indication (4) allows to identify setting files delivered by Atos  or by the user .

21.2 Load (restore from pc)


This operation allows to load a 'Setting Files' from the PC hard-disk into the programming software.



- Click-on **Load** button ① in multifunction area
- Select the archive: User ②, Atos ③ (default) or Atos Old Series ④
- Select one of the available 'Setting Files' ⑤
- Click-on **Load** button ⑥

💡 If Load operation is performed while in ON-LINE status (see 10.1), the software will ask for downloading immediately the new parameters into the connected driver.

💡 Filters can be used to search the required setting files using some relevant informations ⑦: it is possible to input the complete requested information or a only part (automated search will be performed).

💡 Quick search of the setting file name:
press button ⑧, enter the valve component code and then press 
If the part number is correct, press the **Ok** button.

Search

Setting File Name

Component Code

Ok

Cancel

💡 User indication ⑨ allows to identify setting files delivered by Atos  or by the user .

💡 To delete a setting file, select it and press 'Del' on your keyboard.
To import a setting file, select and drag it from Window's desktop to E-SW-SETUP software.
To export a setting file, select and drag it from E-SW-SETUP software to Window's desktop.
e.g. the setting file exported on Window's desktop is possible send to ele-support@atos.com (see 19).


⚠ The E-SW-SETUP software allow the user to delete custom 'Setting File'; Atos preset 'Setting File' can't be deleted by user.


22 SIGNALS - EXTENDED PAGE WINDOW

The 'Signals – Extended Page Window' allows to verify detailed information about the actual valve/driver working conditions and to perform a complete troubleshooting of possible alarm/fault conditions.

Access button



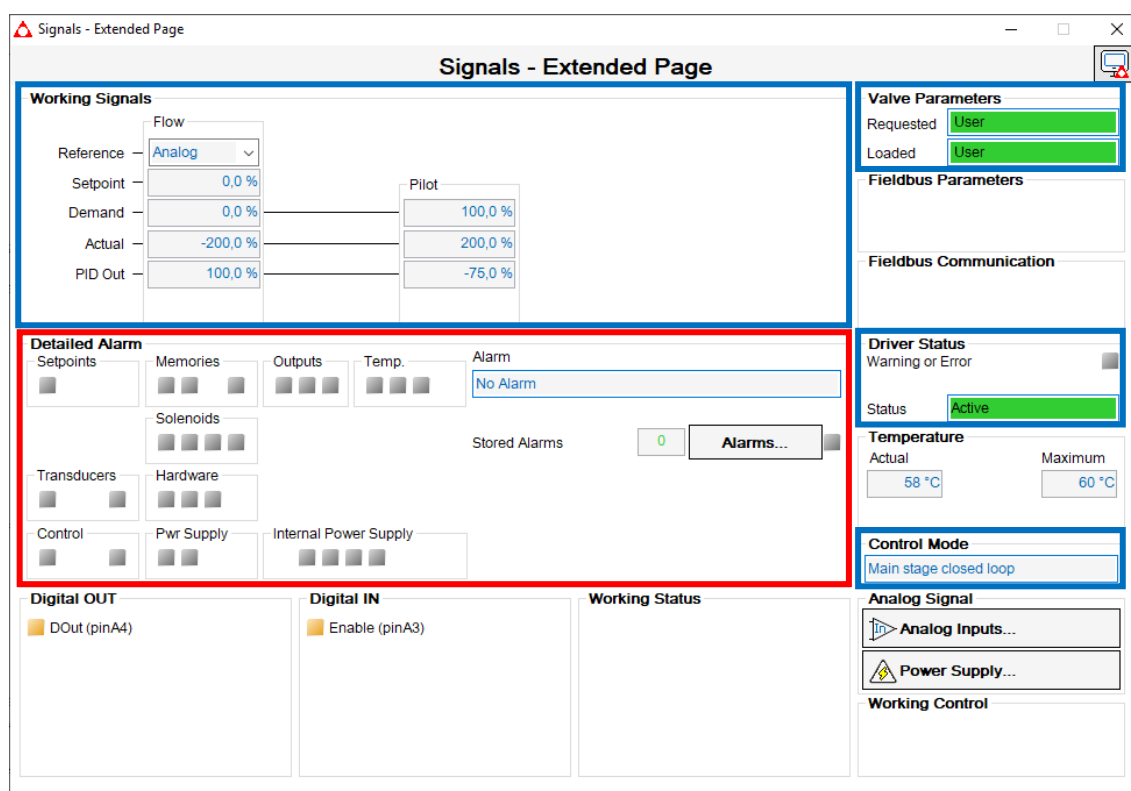
 This window is an extension of Signals area (see 12) for the description of the common elements (the contents inside the blue boxes, have been described in previous paragraphs).

 To return on 'Main Window' press the button shown at side (the 'Signals – Extended Page Window' will not be closed).

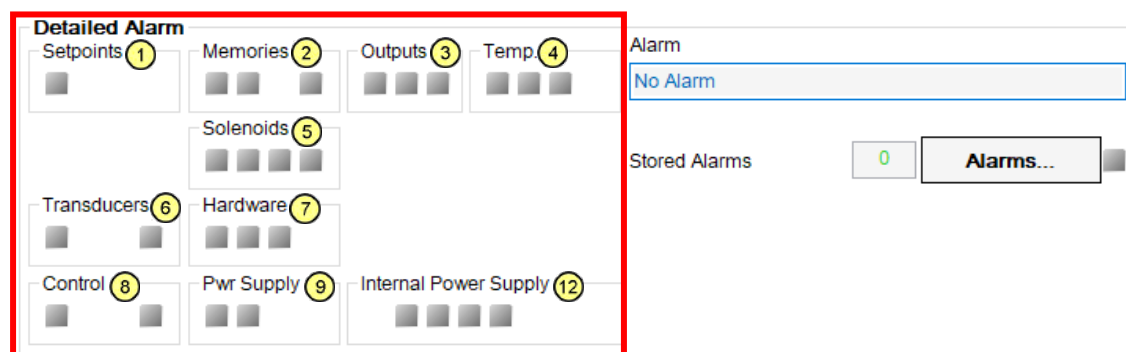


22.1 Detailed Alarm

This part contains the relevant information to verify and solve alarm and fault conditions. When driver detects an alarm condition, it is displayed with proper led (see 22.1.1) and store alarm (see 22.1.3), alarm/fault pin is set and driver state can change according to alarm reaction.



22.1.1 Led alarms indicators



Setpoints

The group ① indicates when analog reference inputs exceed their range (see 7.3.2).

Memories

The group ② indicates when the driver or the communication parameters are not valid (see 7.3.1).

Outputs

The group ③ indicates when a load value too high is applied on the output (see 7.3.8).

Temperature

The group ④ indicates when driver internal temperature exceeds the allowed working limits (see 7.3.6).

Solenoids

The group ⑤ indicates when solenoid current cannot be controlled to the demanded value due to wrong solenoid connections or short-circuit conditions (see 7.3.5).

Transducers

The group ⑥ indicates when analog actual inputs exceed the allowed maximum range (see 7.3.3).

Hardware

The group ⑦ indicates when driver detects hardware alarm condition (see 7.3.7).

Control Monitoring

The group ⑧ indicates when control alarms exceed the allowed working limits (see 7.3.4).

Power Supply

The group ⑨ indicates when the power supply exceeds the allowed maximum range (see 7.3.9).

Internal Power Supply

The group ⑫ indicates when the power supply that are generated internally by the driver exceed the allowed maximum range (see 7.3.10).

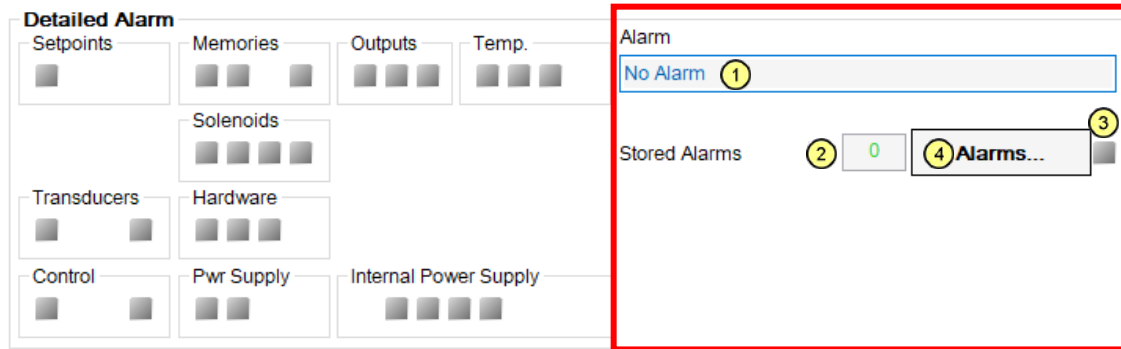


For relevant information to verify and solve fault conditions and to evaluate driver reaction, see 7.1.



The led displayed may change depending on communication interface (see 17.2) and driver configuration (see 15.4).

22.1.2 Alarms



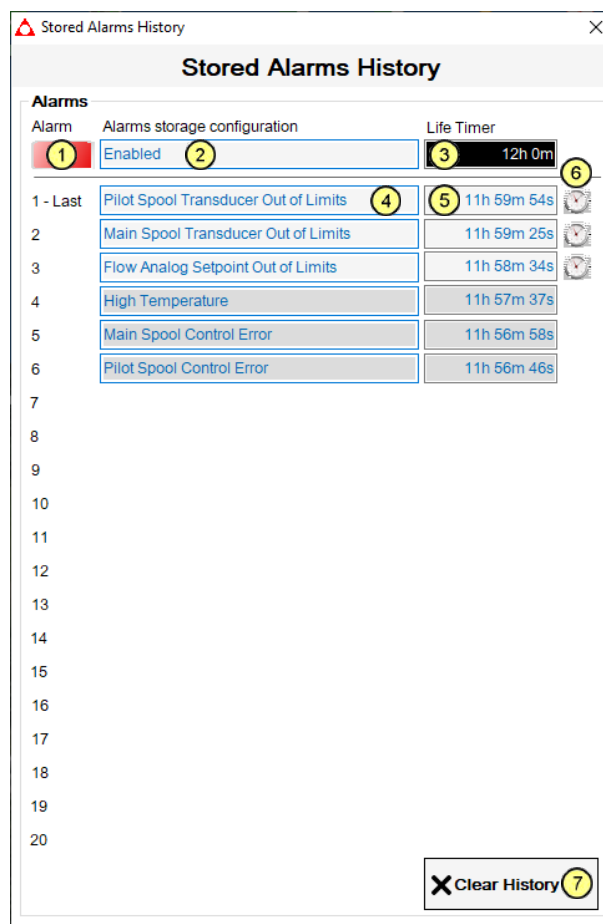
The indicator ① shows the last or the most critical present alarm (this indicator is also present in the 'Signals' area - see 12.2.4)

The indicator ② displays number of the stored alarms.

The led ③ indicates that the storing of the alarms in the driver memory has been automatically disabled (this indicator is also present in the 'Signals' area - see 12.2.3).

The button ④ allows to open a window with all stored alarms history details (see 22.1.3).

22.1.3 Stored Alarms History



Alarm

The led (1) displays if at least one alarm is still present (see 12.2.4).



no alarm



alarm present

Alarms storage configuration

The indicator (2) displays the alarms storage configuration status:

Enable: alarms are stored in the driver's memory (default)

Automatically disabled: the storing of the alarms in the driver memory has been automatically disabled in order to preserve driver's memory. Once this condition is raised the user cannot enable again the storing of the alarm.



This condition does not affect the driver store parameters in the permanent memory (see 8.1.1).




This condition not compromise the normal working of the driver: it will continue to work correctly, but any new alarms will not to save inside the memory (EEPROM).


Life Timer

The indicator (3) displays how long the driver has been powered up (it is the sum of all power-on period).


Alarm description

The indicator  displays the alarm description: in the "1 - last" position the last alarm occurred is showed Up to 20 alarm messages can be stored; if the list is full and a new alarm will be occur, this new alarm will be stored as "1 - last" while the list will be shifted down (the 20th alarm is removed).




The indicator  is light grey, when the alarms are stored after of the last driver power up.





The indicator  is dark gray, when the alarms are stored before of the last driver power up.




The indicator  displays the time when the alarm has occurred referred to the life timer.



The indicator  displays after how long the alarm occurred since the last power up (only when the indicator  is white).


Clear history

The button  allows to delete the list of stored alarms history.



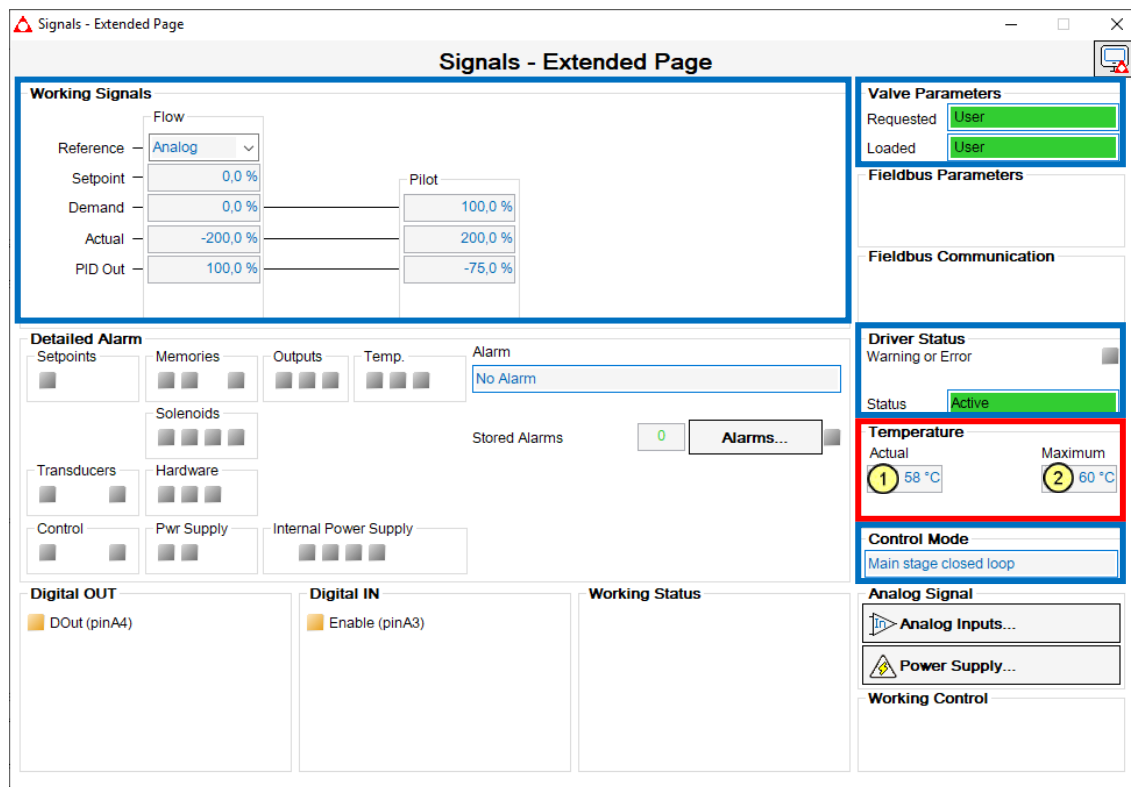
During the storing alarms history delete operation, power supply to the valve solenoid is switched-off: do not use this function during system normal working.



The button  is available only in ON-LINE (see 10.1).

22.2 Temperature

This part contains information about internal temperature of the driver connected.



22.2.1 Temperature - Actual

The indicator ① allows to verify the actual internal temperature of the driver.



Each time the driver is restarted, 10 seconds are needed to stabilize the internal temperature reading.

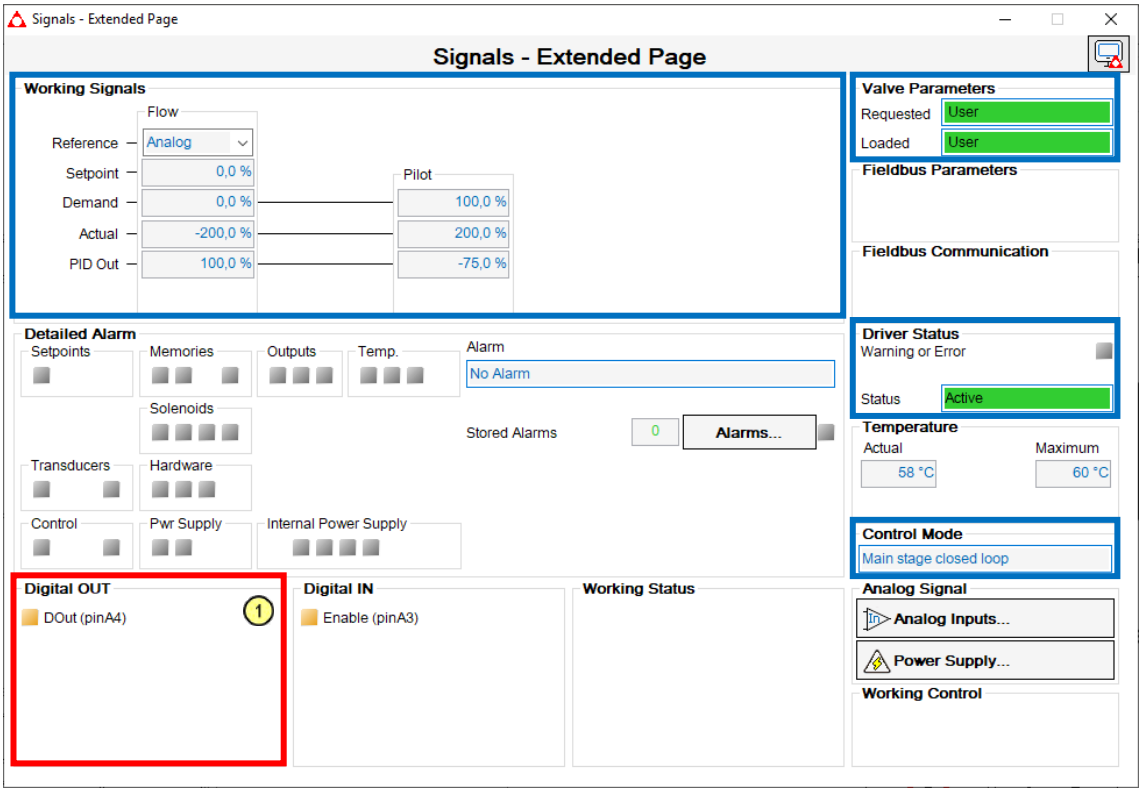
22.2.2 Temperature - Maximum

The indicator ② allows to verify the maximum internal temperature of the driver since its first power on.

22.3 **Digital OUT**

The area ① shows relevant information about the driver digital output.

The Digital OUT displayed may change depending on driver configuration (see 15.4).



DOut (pin A4)

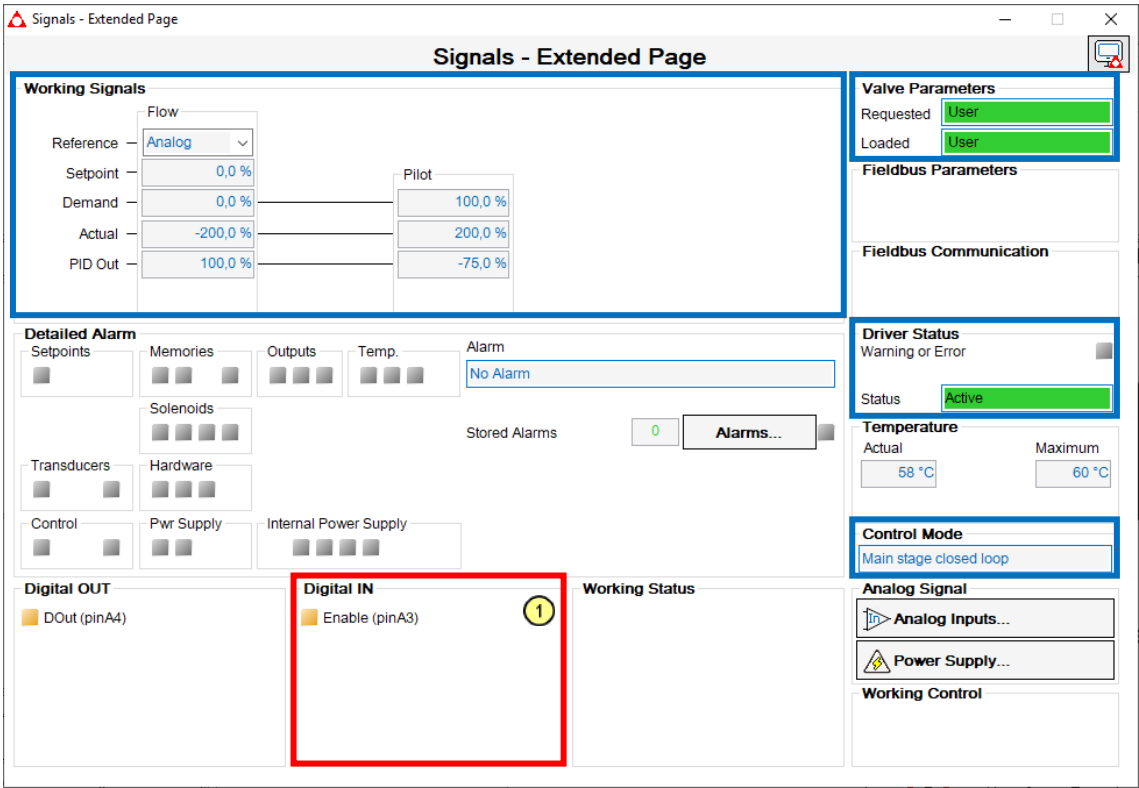
The led indicates the status of the output signal (pin A4 on the driver connector A - see 5.3.5 and 12.3.2).

led on	pin = 0V
led off	pin = 24V

22.4 **Digital IN**

The area ① shows relevant information about the driver digital input.

The Digital IN displayed may change depending on driver configuration (see 15.4).

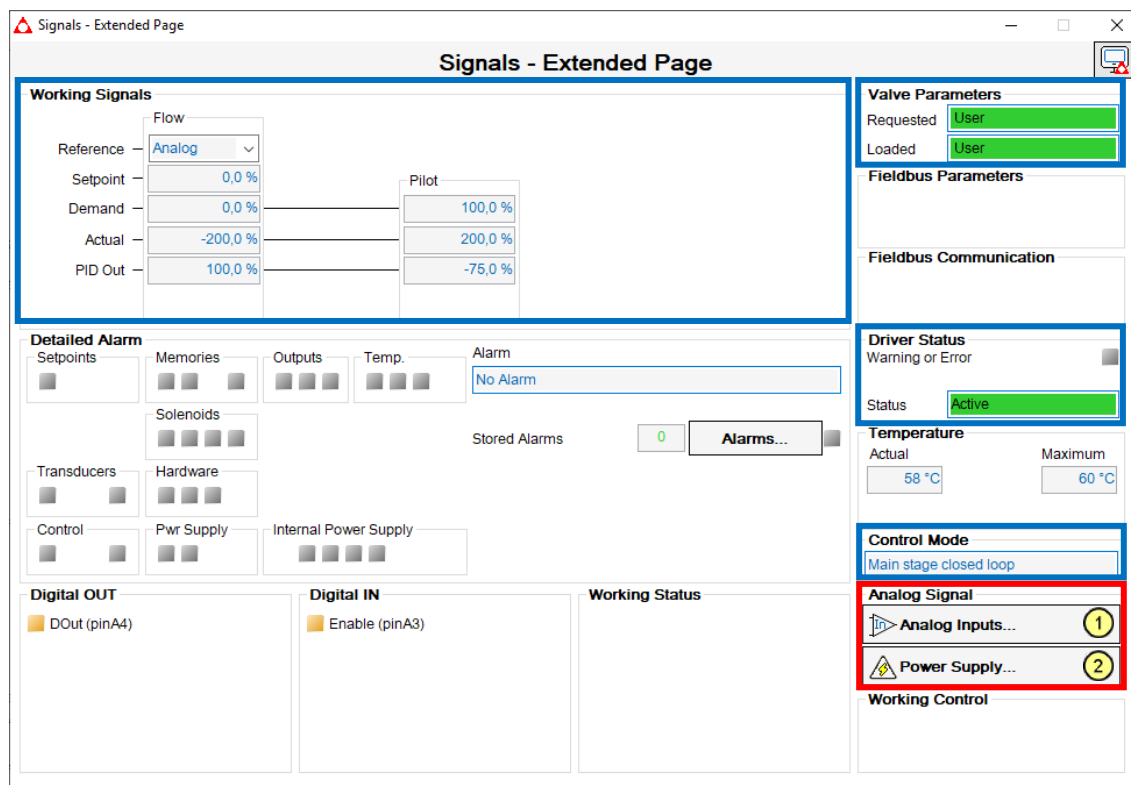


Enable (pin A3)

The led indicates the status of the input enable signal (pin A3 on the driver connector A - see 5.3.4 and 12.3.1).

led on	pin > 9V
led off	pin < 5V

22.5 Analog Signal

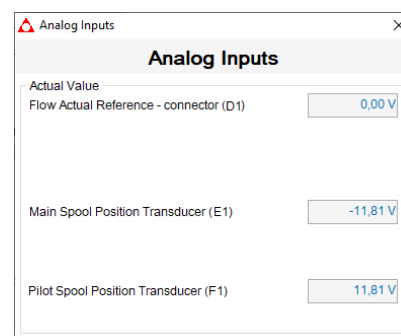


22.5.1 Analog Inputs

The button ① opens window with information about all driver analog input actual values.

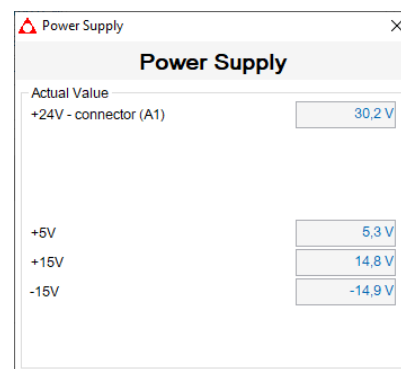


The analog inputs displayed may change depending on driver configuration (see 15.4).



22.5.2 Power Supply

The button ② opens window with information about all driver internal supply actual values.




23 OSCILLOSCOPE WINDOW

The 'Oscilloscope Window' allows to verify the dynamic response of the valve.

While 'Driver Signals – Extended Page Window' is intended to verify the valve static working conditions or the presence of alarms and fault, 'Oscilloscope Window' must be used to analyze the time trends of the selected signals.

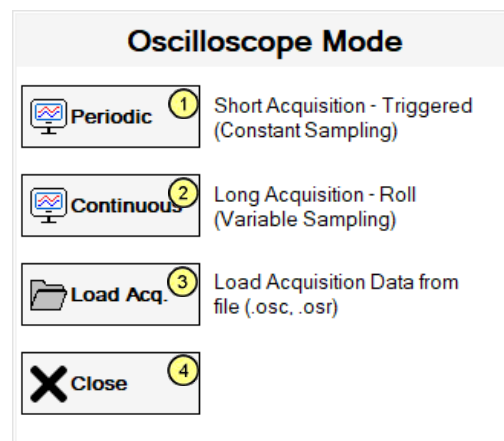
Access button




 To return on 'Main Window' press the button shown at side (the 'Oscilloscope Window' will not be closed).





Pressing the relevant 'Access button' the user can choose two different oscilloscope function between periodic and continuous, load acquisition data or close the 'Oscilloscope Mode' window.




Periodic


Press button  to open periodic oscilloscope (see 23.3). This oscilloscope allows to analyze with periodic acquisition specific a time window in detail mode (constant sampling). Trigger function (see 23.3.2) can be used to detect defined events.

 Data transfer is not real time refreshed.

 Fixed and configurable sample time.


Continuous

Press button  to open continuous oscilloscope (see 23.2). This oscilloscope allows to analyze with continuous acquisition the complete cycle machine (variable sampling).


 Data transfer is real time refreshed.

 Trigger function is not available for continuous oscilloscope.

Load Acq.

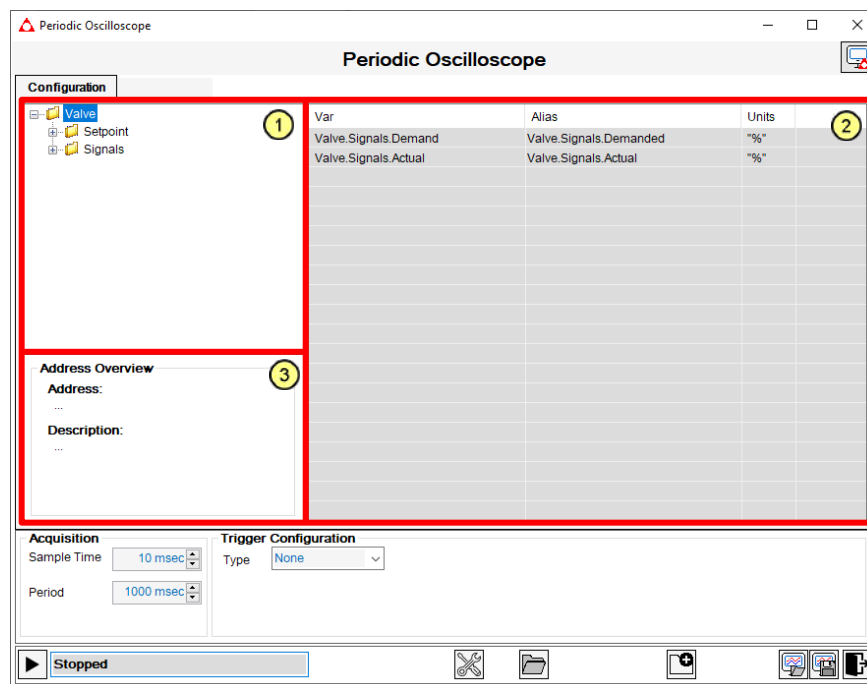
Press button  to load acquisition data from PC, previously saved (see 23.3 or 23.2). File with extension ".osc" opens a new continuous oscilloscope window while the file with extension ".osr" opens a new periodic oscilloscope window.


Close

Press button  to exit the oscilloscope function.


23.1 Configuration [level 2]

Through configuration function the user can chose which signals acquire and display on the oscilloscope.




 Configuration function is available for Periodic and Continuous oscilloscope.

In the area ① are available the signals that can be acquired and displayed on oscilloscope panels.

 Double-click with left button of the mouse to select the signal.

In the area ② are displayed the signals previously selected.

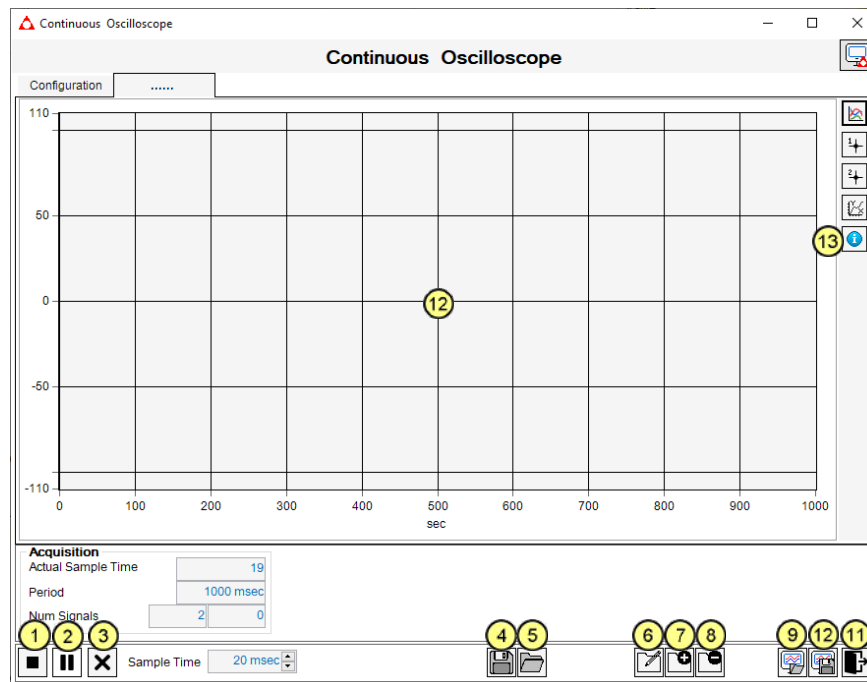
In the column 'Alias' the signal name can be customized and it is displayed in the plot legend of the oscilloscope panel (see 23.3.4).

 Double-click with left button of the mouse to change the name signal.

The area ③ allows to display the signal information when it is selected in the area ① :

- Address: decimal value of the signal (Channel Code)
- Description: more detailed description of the signal selected

23.2 Continuous Oscilloscope – Long Acquisition



Trigger Configuration function is not available (see 23.3.2).



Press button ① to start the acquisition (the acquisitions will be displayed on graph ⑫).



Press button ① to stop the automatic restart of the acquisition process.



Pressing the stop button ①, data are not acquired. To restart still the acquisition process, press again the start button ①.



Press button ② to pause acquisition process.



Pressing the pause button ② the acquisition process is fixed on the graphic ⑫. Press the button ② again to return to the display of real time data.



Press button ③ to delete all acquisition data.



Press button ④ to save acquisition data on PC. This command generates two type of files: the file with extension “.osr” and a file with extension “.lvm” (“.lvm” file allows to import data in Excel format).



Press button ⑤ to load acquisition data from PC, previously saved with button ④. File with extension “.osr” opens a new oscilloscope window used for display only (Plot Visualization).



Press button ⑥ to open the Panel Config (see 23.3.6).



Press button ⑦ to add new oscilloscope panels.



Press button ⑧ to delete oscilloscope panels.



Press button ⑨ to load oscilloscope configuration from PC, previously saved with button ⑩. File with extension “.tra” opens a new oscilloscope configuration window.



Press button ⑩ to save oscilloscope configuration on PC.

This command generates one type of files with extension “.tra”.

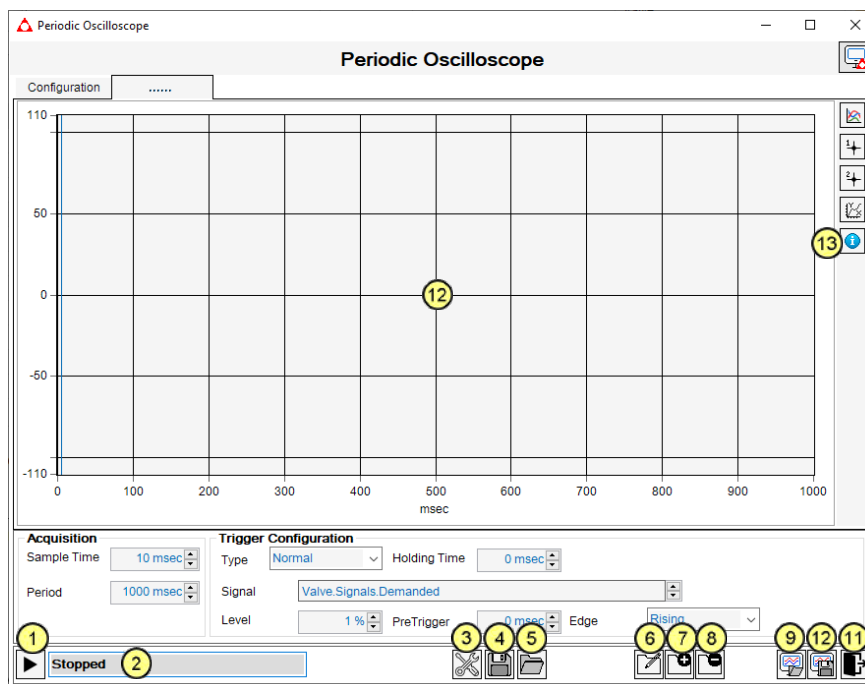


Press button ⑪ to exit the Oscilloscope.



Press button ⑬ to open graph keyboard help (see 23.3.7).

23.3 Periodic Oscilloscope –Short Acquisition



Press button ① to start the acquisition (the acquisitions will be displayed on graph ⑫).



Press button ① to stop the automatic restart of the acquisition process.



The indicator ② will display the actual step of the acquisition process (see 23.3.1).



Press button ③ to access acquisition (see 23.3.1) and trigger settings (see 23.3.2).



Acquisition and trigger advanced settings are available to adapt the acquisition behavior to specific requirements.



Press button ④ to save acquisition data on PC. This command generates two type of files: the file with extension “.osc” and a file with extension “.lvm” (“.lvm” file allows to import data in Excel format).



Press button ⑤ to load acquisition data from PC, previously saved with button ④. File with extension “.osc” opens a new oscilloscope window used for display only (Plot Visualization).



Press button ⑥ to open the Panel Config (see 23.3.6).



Press button ⑦ to add new oscilloscope panels.



Press button ⑧ to delete oscilloscope panels.



Press button ⑨ to save oscilloscope configuration on PC. This command generates one type of files with extension “.tra”.



Press button ⑫ to load oscilloscope configuration from PC, previously saved with button ⑨. File with extension “.tra” opens a new oscilloscope configuration window.

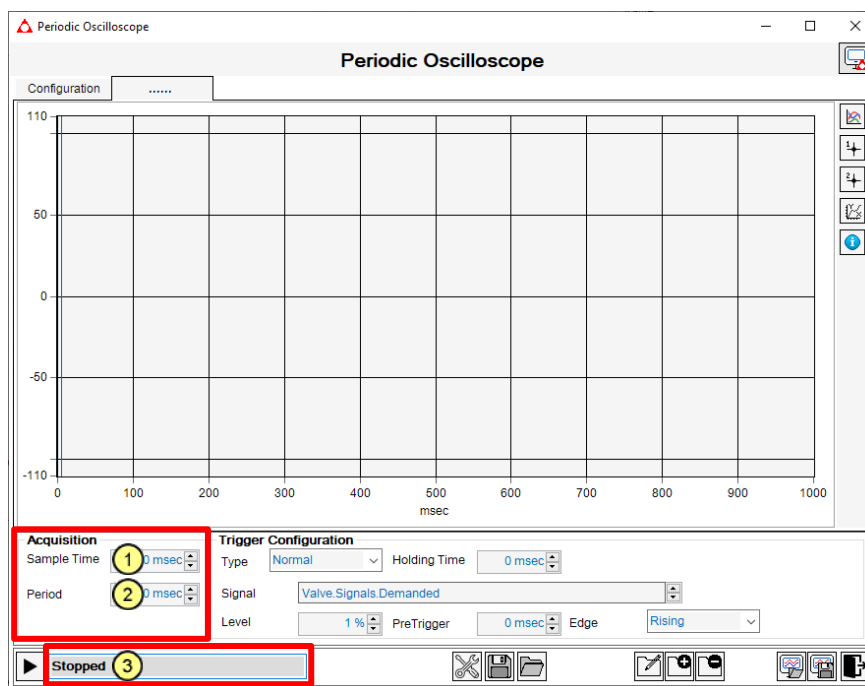


Press button ⑪ to exit the Oscilloscope.



Press button ⑬ to open graph keyboard help (see 23.3.7).

23.3.1 Acquisition





Sample Time

The control ① allows to set the range time between the acquisition points: to analyzing fast response dynamic, set a low time.

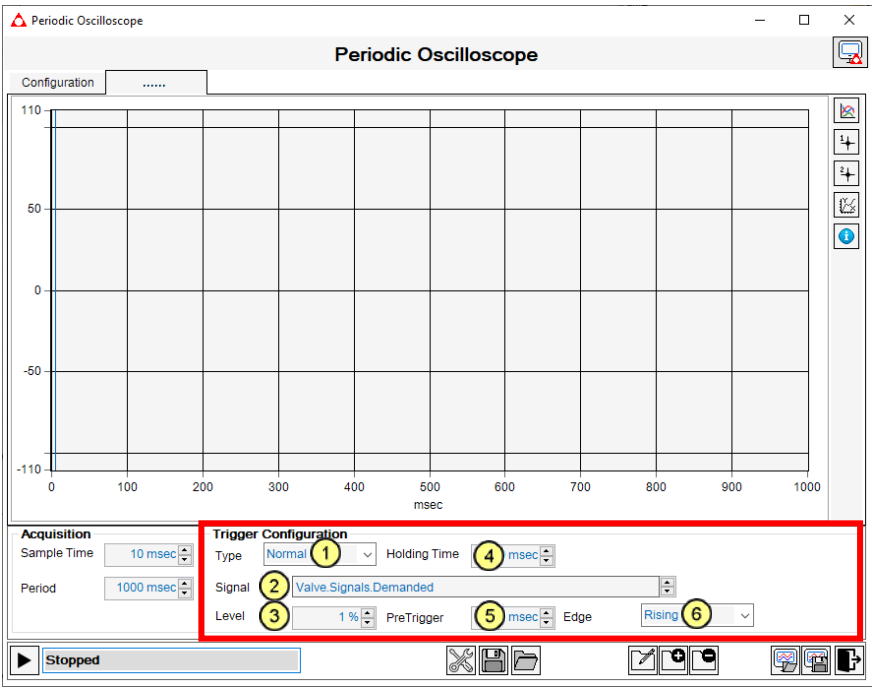
Period

The control ② allows to set how long the signals must be acquired: use higher setting to obtain a more complete acquisition of the machine working cycle.

 Driver internal memory to acquisitions storing is limited. Low sample time and high period settings increase the data amount to be stored and require longer time to complete acquisition process (more data must be transferred from the driver to E-SW-SETUP software).

 If a setting of 'Sample Time' and 'Period' requires more data than the available driver internal memory, the indicator ③ will display the following alarm message: 'Wrong Setting (too much acquisition data)'. Increase 'Sample Time' or reduce 'Period' to solve this problem.

23.3.2 **Trigger Configuration**



This function is not available for Continuous Oscilloscope (see 23.2).

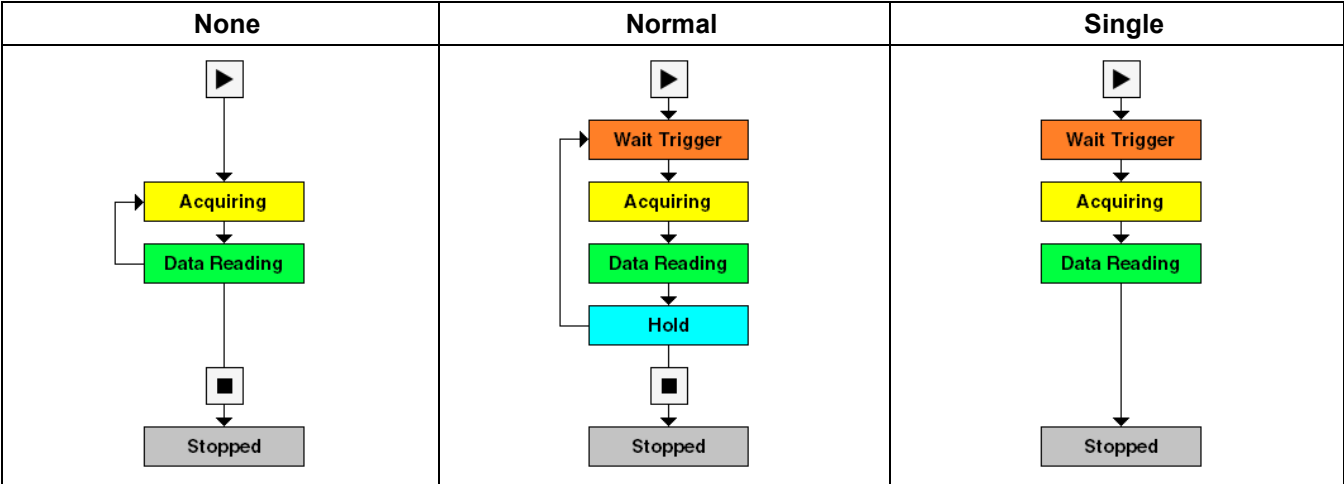
Type

The control allows the user to activate trigger function and define a starting condition for the acquisition process: trigger can be used to identify which part of the machine working cycle must be acquired and to obtain a signals visualization repetitive.


option1	None
option2	Normal
option3	Single
Default	None

- None trigger is not used and the acquisition process start automatically; the acquisition process restart automatically once acquired signals have been displayed.
- Normal trigger is active and can be configured using Level, Edge, Holding Time, Pre-Trigger; the acquisition process restart automatically once acquired signals have been displayed.
- Single trigger is active and can be configured using Level, Edge, Holding Time, Pre-Trigger; the acquisition process stop automatically once acquired signals have been displayed.


Acquisition process data: oscilloscope status will display the acquisition process as following diagrams.



Signal

The indicator  allows the user to display which of the acquired signals will be used to detect trigger condition.


Level

The control  allows the user to set the value at which the trigger condition is detected (when the selected signal receives the set value, the acquisition starts).

Holding Time

The control  allows the user to set the length of the pause time, between the Acquisitions.


Pre-trigger

The control  allows the user to set the time period that must be acquired and displayed before trigger.



Pre-trigger time is added to Acquisition Period and can cause a wrong setting condition (see 23.3.1).

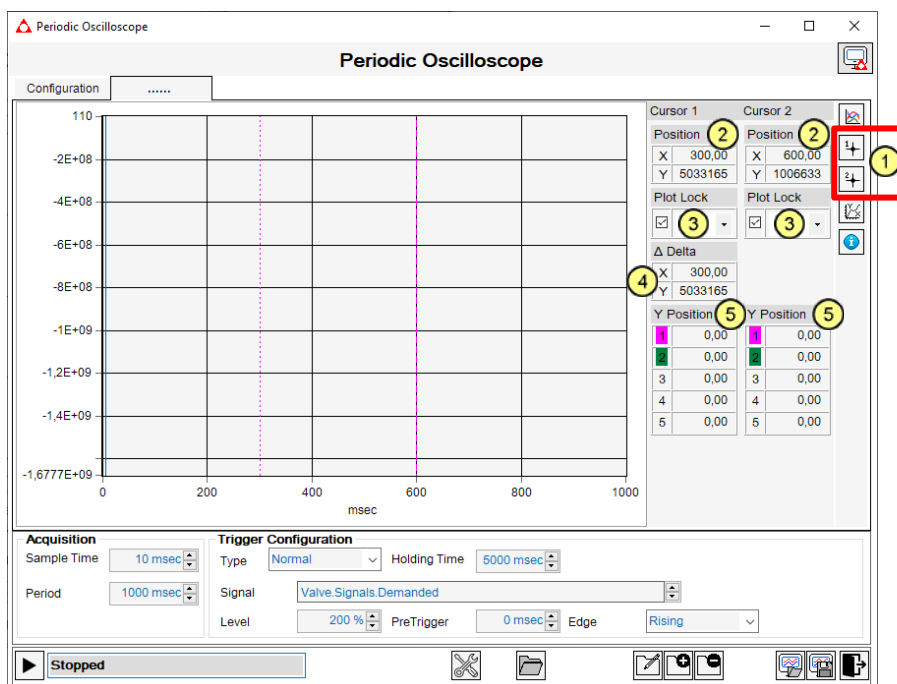
Edge

The control  allows the user to select if the trigger condition must be detected with rising and/or falling signals.

option1	Rising
option2	Falling
option3	Both
<i>Default</i>	<i>Rising</i>

23.3.3 Cursors

Cursors tools are available to perform a more detailed analysis of the acquired data.



Cursors



The buttons ① allow to switch on/off one or both available cursors.

Position

The indicators ② display the cursors position in the graph (X: time value always in 'msec', Y: plot value). Y coordinate will display the cursor position using the same scaling of the selected trace.

Plot Lock

The controls ③ allow to bind movement cursor only on coordinates that belong to the selected trace.

Δ Delta

The indicator ④ displays the coordinates values difference, between cursors.



Δ Delta indicator is displayed only with both cursors active.

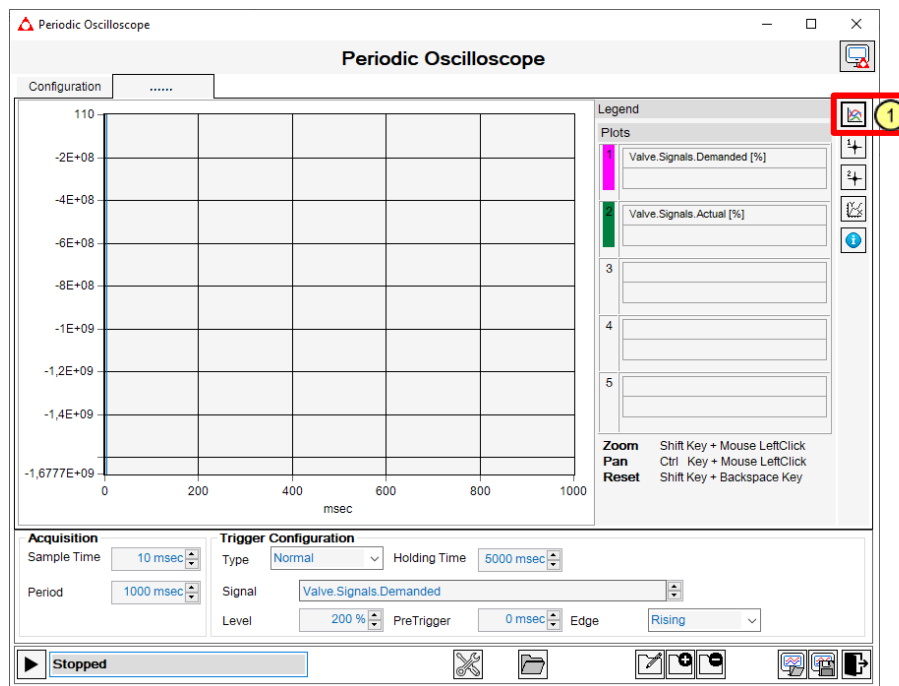
Y Position

The indicators ⑤ display the Y values of all traces in relationship to the time selected with X position cursor.



Y Position indicators are displayed only with 'Plot Lock' active.

23.3.4 Legend



Legend

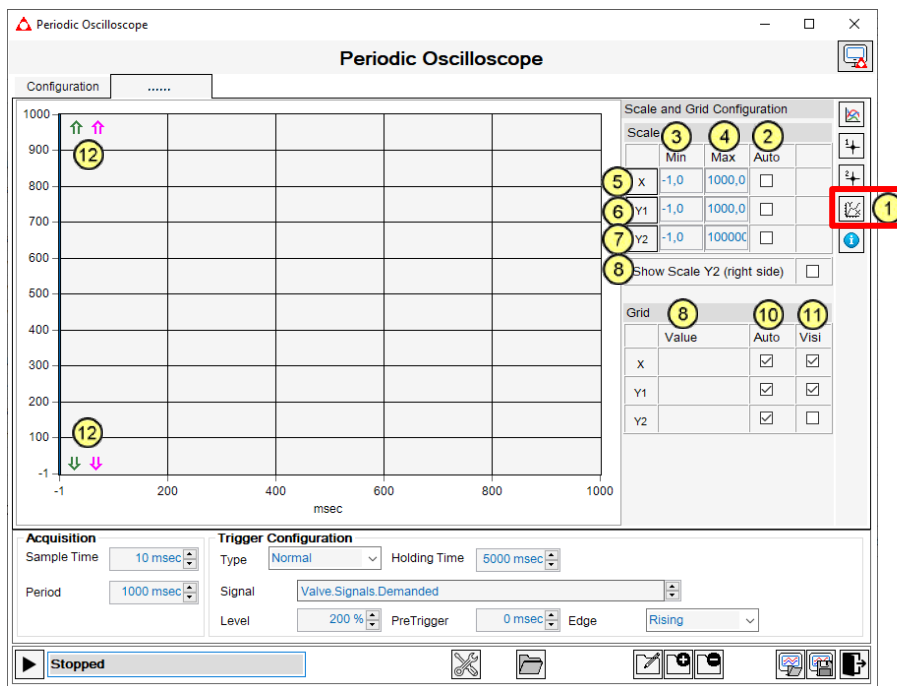


The button ① allows to switch on/off the viewing of the oscilloscope plots legend.




Different colors can be associated for each plots through panel configuration (see 23.3.6).

23.3.5 Scale and Grid



Scale and Grid Configuration

 The button **1** allows to switch on/off the scale and grid configurations (through these configurations the user can modify the default setting of the oscilloscope visualization).

- **SCALE (Auto)**

Switch on control **2**: the scales are set at each acquisition.



- **SCALE (Manual)**

Switch off control **2**: the scales are set to the optimal value at the first acquisition.

The controls **3** and **4**, allow to set manually the scales value.

The buttons **5**, **6** and **7**, allow to set automatically the optimal value scales.

The control **8** allows to show Y2 scale on the window right side.

 If the signal exceeds the scales value set, it will exit of the oscilloscope screen. In this case the arrows  indicate where are located the signals (with too low signals values, the arrows appear in high to the screen; with too high signals values, the arrows appear in low to the screen). The arrow color shows the plot color corresponding (see 23.3.6).

- **GRID**

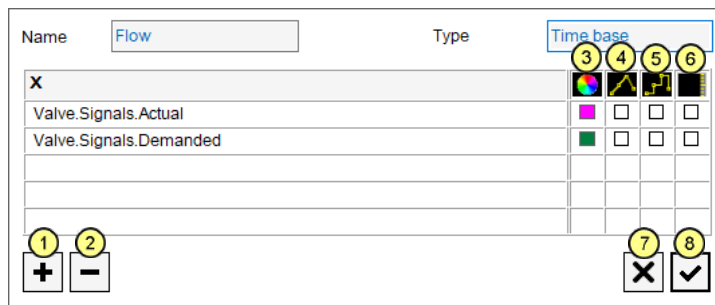
Disable control **11** to switch off the plot grid visualization.

Disable control **12** to set manually the grid spacing value **9**.

23.3.6 Panel Config [level 2]



In the Oscilloscope window, press button “Panel Config” (see 23.3) to customize the oscilloscope visualization.




Press button ① to add a plot (see procedure below).



Press button ② to delete a plot (see procedure below).



The column ③ shows the color of the corresponding plot (click on the correspondent color to change it).



The column ④ allows to set a graphic analog trend to the plots.



The column ⑤ allows to set a graphic digital trend to the plots.



The column ⑥ allows to associate a second scale to the plot (to screen right).



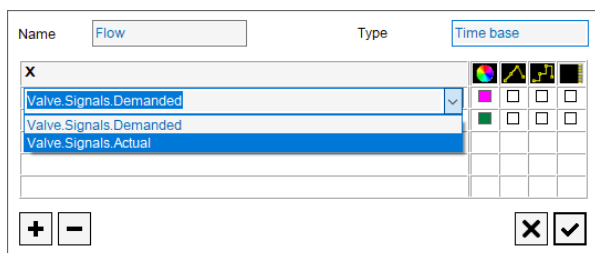
Press button ⑦ to exit the panel configuration (the changes are not saved).



Press button ⑧ to confirm the changes.

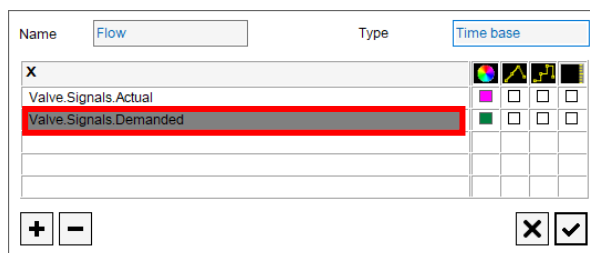
Add plot procedure

- Press button ① (signal list previously set is opens – see 23.1)
- Select a signal (plot)



Delete plot procedure

- Select a signal (plot)
- Press button ② to delete the plot selected




Oscilloscope panel manages up to five plots; to display more plots add new oscilloscope panel through relevant button (see 23.3).



The plots can be changed:

- select a plot
- click on right button of the mouse to open the signals list (see 23.1)
- select a new plot

23.3.7 Graph Keyboard Help

Zoom and Pan commands can be replicated using key combination.



Press this button to open the Graph Keyboard Help window (see below).

Graph Keyboard Help	
Key Combination	Action
Zoom	
Shift+LeftMouseDown	Zoom into Selection.
Shift+LeftMouseDown	Zoom into proportional selection.
Shift+LeftClick	Zoom in around point.
Shift+UpArrow	Zoom in around middle of plot area.
Shift+DownArrow	Zoom out around middle of plot area.
Shift+MouseWheel	Zoom in/Zoom out.
Shift+RightClick	Undo.
Shift+Backspace	Reset.
Pan	
Ctrl+LeftMouseDown	Pan.
Ctrl+LeftArrow	Pan left.
Ctrl+RightArrow	Pan right.
Ctrl+UpArrow	Pan up.
Ctrl+DownArrow	Pan down.
Ctrl+RightClick	Undo.
Ctrl+Backspace	Reset.

24 FIRMWARE VERSION – AVAILABLE PARAMETERS

Atos programming software recognises automatically the firmware version of connected driver (see 15.2) and adapts the graphic interface to display the available functions and parameters.

Available starting from driver firmware D20.00

This image shows a full page of blank, lined paper. It features approximately 28 horizontal ruling lines spaced evenly down the page. The lines are thin and light gray or blue. There are no margins, text, or other markings on the page.

This image shows a full page of blank, lined paper. It features approximately 28 horizontal grey lines spaced evenly apart, typical of standard notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings present.



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