

# **E-MAN-S-IL**

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DRIVERS PROGRAMMING INSTRUCTIONS  
IO-Link PROTOCOL



**INDEX**

<b>1</b>	<b>GENERAL</b>	<b>4</b>
1.1	About this user manual.....	4
1.2	Documentation .....	4
1.3	About proportional electrohydraulics .....	8
1.4	About E-SW-SETUP programming software .....	12
1.5	About Atos CONNECT mobile App .....	17
1.6	Safety prescriptions .....	18
<b>2</b>	<b>GETTING STARTED</b>	<b>20</b>
2.1	Digital Reference .....	20
<b>3</b>	<b>ABOUT IO LINK INTERFACE – POINT TO POINT CONNECTION</b>	<b>21</b>
3.1	Generic system features .....	21
3.2	Communication Feature .....	21
3.3	System design .....	22
3.3	Operating principle .....	23
3.4	Functions and operating modes .....	23
3.5	IO-Link mode .....	23
3.6	Response times.....	24
3.7	Combining IO-Link devices with different specifications .....	24
<b>4</b>	<b>ATOS IO-LINK FEATURES</b>	<b>25</b>
4.1	IO-Link specific diagnostic support.....	26
4.2	IODD (IO Device Description) – configuration file.....	26
4.3	Communication connections .....	27
4.4	Acyclic communication .....	28
4.5	Object Dictionary .....	29
4.6	Scaling Descriptions .....	31
4.7	State machine.....	33
4.8	Bits parameters descriptions .....	34
<b>5</b>	<b>DRIVER ALARMS</b>	<b>37</b>
5.1	Alarm Reaction .....	37
5.2	Alarm Management .....	39
5.3	Alarms Conditions .....	40
5.4	Alarm management via IO-Link.....	43
<b>6</b>	<b>COMMISSIONING - QUICK SETUP EXAMPLE</b>	<b>48</b>



# 1 GENERAL

## 1.1 About this user manual

This manual describes the required information to operate Atos proportional control valves using IO-Link communication: always refer to the specific driver manual (see 1.2.1) for a complete description of the available function and of the parameters settings.

To speed up the startup operations it is always recommended to use the Atos E-SW-SETUP programming software for PC before connecting Atos valves to the network: E-SW-SETUP software allows a fast identification of the valve functions and parameters that would be included in the IO-Link communication.

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 IO-Link and Atos drivers/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](mailto:ele-support@atos.com)).

The manual contains important safety instructions (see 1.4), 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 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)
- QUICKSTART Installation and commissioning for proportional valves
- FS\*\*\* Proportional valves - technical tables
- GS500 Programming tools for digital electronics - technical table
- GS520 IO-Link features - technical table
- E-MAN-RI-AEB On-board driver for proportional valves without transducer
- E-MAN-RI-REB On-board driver for pressure proportional valves with pressure transducer
- E-MAN-RI-LEB On-board driver for directional and flow proportional valves with LVDT transducers

## 1.2.2 MyAtos area – Download area electronics

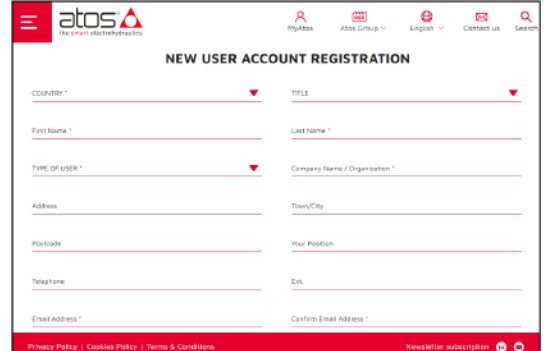
Latest releases of the programming software, manuals, USB drivers, configuration files and level passwords are available on MyAtos at [www.atos.com](http://www.atos.com).

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

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

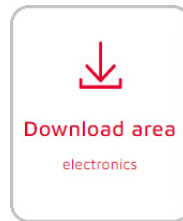
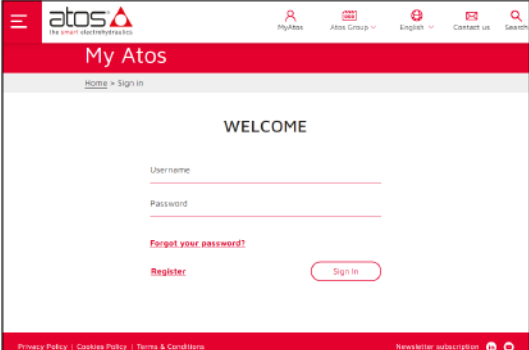
In order to have the access in MyAtos, perform the registration at <https://www.atos.com/en-it/register> by filling the form.

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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**1.2.4 Abbreviations**

Abbreviation	Description
AL	application layer
C/Q	connection for communication (C) or switching (Q) signal (SIO)
DI	digital input
DL	data link layer
DO	digital output
EDS	Electronic Data Sheet
EMC	ElectroMagnetic Compatibility
ESD	ElectroStatic Discharge
FTP	File Transfer Protocol
GSD	General Station Description
GSDML	GSD Markup Language
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
I/O	input / output
IODD	IO Device Description
ISO	International Standard Organization
IP	Internet Protocol
LAN	Local Area Network
LED	light emitting diode
L-	power supply (-)
L+	power supply (+)
N24	24 V extra power supply (-)
MAC	Medium Access Control
NMT	Network Management
OD	On-request Data
P24	24 V extra power supply (+)
PD	Process Data
PDCT	port and Device configuration tool
PL	physical layer
PLC	programmable logic controller
PROFINET	Process Field Network
RT	Real Time
SDCI	single-drop digital communication interface
SIO	standard input output (digital switching mode) [IEC 61131-2]
SM	system management
SNMP	Simple Network Management Protocol
TBIT	bit time (measured in s)
TCYC	cycle time on M-sequence level (measured in s)
TCP	Transmission Control Protocol
UART	universal asynchronous receiver transmitter
UDP	User Datagram Protocol
USB	Universal Serial Bus
V+	voltage at L+
V0	voltage at L-
WURQ	wake-up request pulse

### 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  $\pm 10$  V<sub>DC</sub>).

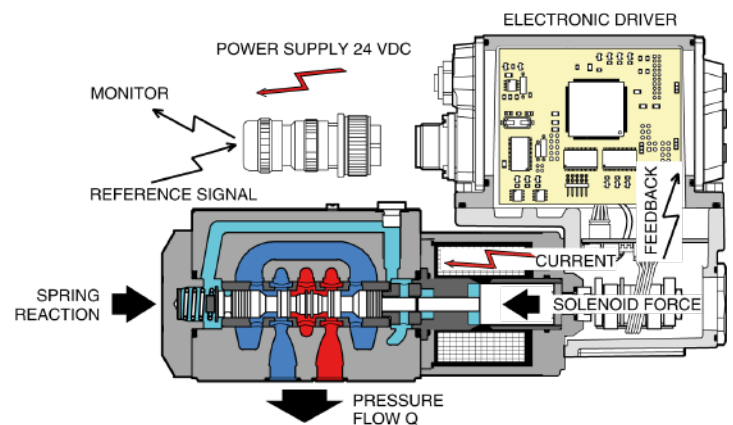
The force of the solenoid is proportional to the reference signal, thus properly moving the spool against a return spring to modulate hydraulic parameters.

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.

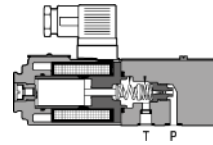
### 1.3.3 Digital proportional controls

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:

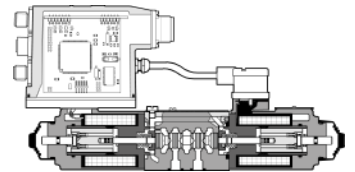
#### ZO-A

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.

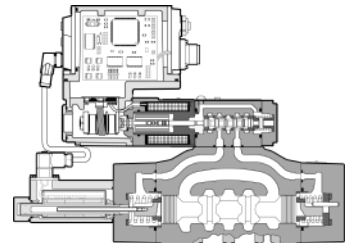


#### ZO-TES; ZO-LES

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.

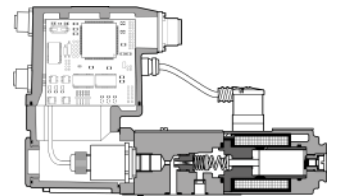
SP/SF/SL options add alternated pressure/force control to the valve standard spool-flow control.



#### ZO-RES

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

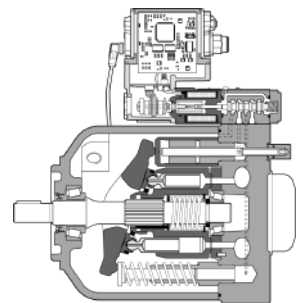
Digital integral electronic driver (factory preset) and integral pressure transducer assure valve-to-valve interchangeability, easier set-up and high response dynamics.



#### ZO-PES

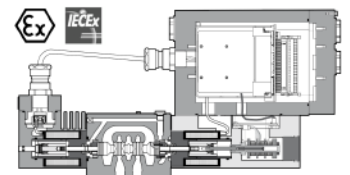
Variable displacement pumps with digital integral electronic driver, control in closed loop flow and pressure; a dedicated algorithm selects which control (flow/pressure) is active time by time.

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, available with and without integral ex-proof driver and transducer.



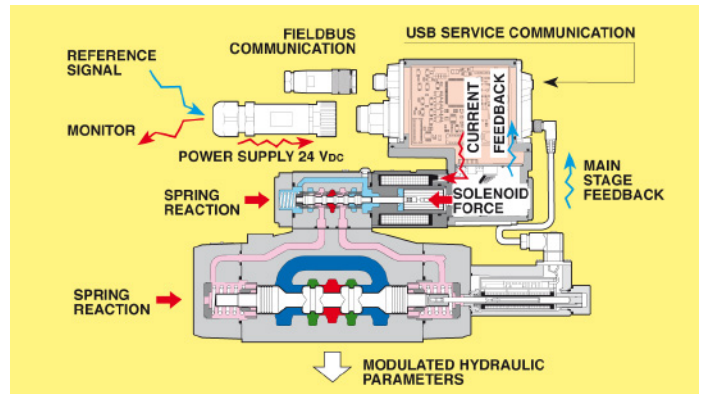
### 1.3.4 Digital electronic drivers

Atos electronics include analog or digital drivers both in separate or integral-to-valve 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:

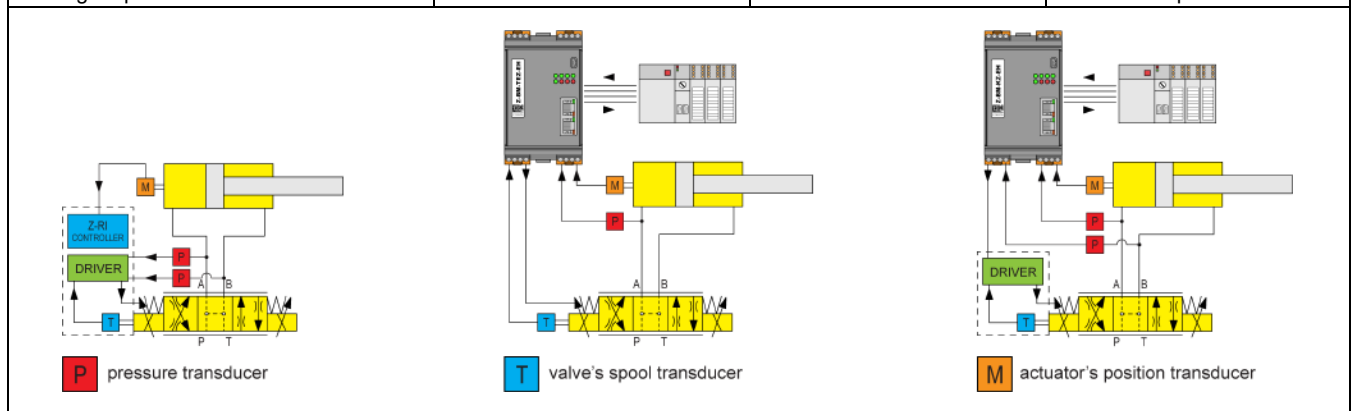
- better performances: hysteresis, response time, linearity
- software setting of hydraulic parameters: scale, bias, ramp, non-linearity
- diagnostics and computer assisted maintenance
- high immunity to electromagnetic noise
- easy interfacing to fieldbus systems



### 1.3.5 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
 FORMAT MAIN FUNCTION				 DIN-rail format
		 DIN-rail format		
Technical table		<b>FS610</b> <b>FS620</b> <b>FS630</b>	<b>GS330</b>	<b>GS340</b>
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 supported communication interface:

<b>NP</b>	USB
<b>IR</b>	Infrared
<b>PS</b>	Serial RS232
<b>IL</b>	IO-Link via USB
<b>BC</b>	CANopen
<b>BP</b>	PROFIBUS DP
<b>EH</b>	EtherCAT
<b>EW</b>	POWERLINK via USB
<b>EI</b>	Ethernet/IP via USB
<b>EP</b>	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 E-SW-SETUP with IO-Link systems

E-SW-SETUP programming software is also an excellent tool for develop and start-up IO-Link systems: it allows to experience the different functional settings and to plan efficiently which parameters and functions insert in overall machine IO-Link communication.

E-SW-SETUP software can be also used for machine start-up and configuration for all parameters that do not require to be modified during machine operation thus avoiding to insert them into the overall machine communication.

 Mouse right-click on E-SW-SETUP graphic interface allows to access useful information for IO-Link communication development (see 1.4.4).


### 1.4.3 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.

#### 1.4.4 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/M12 cable, the use of USB isolator adapter is highly recommended for PC protection.

 **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-RI-AEB	E-A-BTH	-	E-A-SB-USB/OPT	E-C-SB-USB/M12	-
E-RI-REB					
E-RI-TEB/LEB					

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

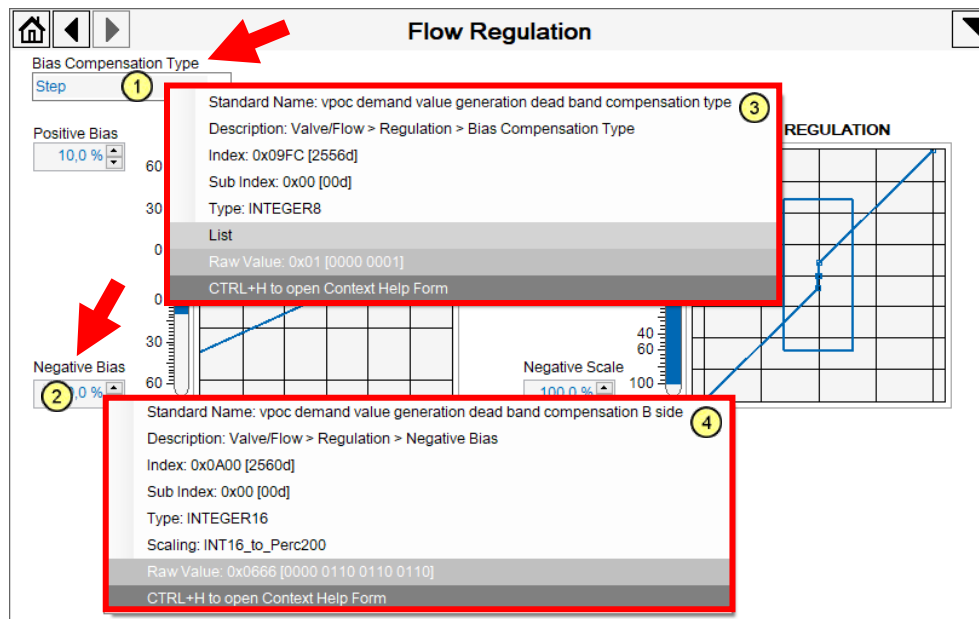
 The previous versions of the Bluetooth adapter and cables are still compatible.

### 1.4.5 Software wizard for Object Dictionary

Directly from the graphical interface of the E-SW-SETUP software, it is possible to access information useful for the development of IO-Link communication by simply clicking with the mouse on a selected parameter or pressing CTRL+H on the PC keyboard.

#### Mouse click- example:

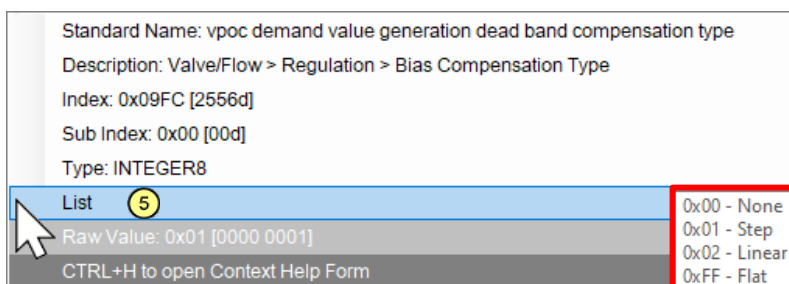
Click right button of the mouse on **Bias Compensation Type** control (1) or **Negative Bias** control (2) to open the related IO-Link communication windows (3) and (4).



Windows (3) and (4) shown all IO-Link information of selected parameter:

Standard Name:	Parameter name description
Description:	E-SW-SETUP software fast reference parameters
Index	Parameter address for Acyclic operations
Subindex	
Type:	Parameter dimension and data type
Scaling:	Parameter scaling value (see 4.6)
List:	Parameter list value (1)
Raw Values	Numeric parameter
CTRL+H	Press CTRL+H to open Context Help Form (see <b>CTRL+H - example</b> )

(1) Pass mouse arrow on **List** (5) to display the information



**CRTL+H - example:**

The information in Context Help Form window are the same as described above for the "mouse click - example".

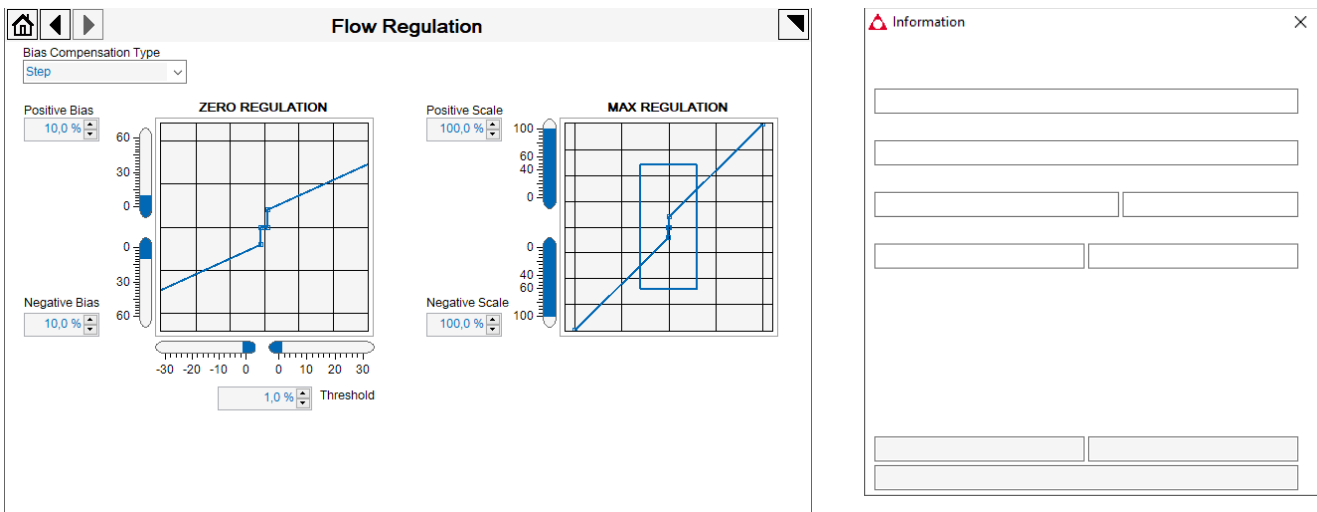
By pressing CTRL+H on PC keyboard the Context Help Form windows opens.

Once the window has been opened with CTRL + H, it always remains active until it is closed by the user.

In this way it is possible to view the IO-Link information of each single parameter present on the software page, simply by positioning the mouse over it.

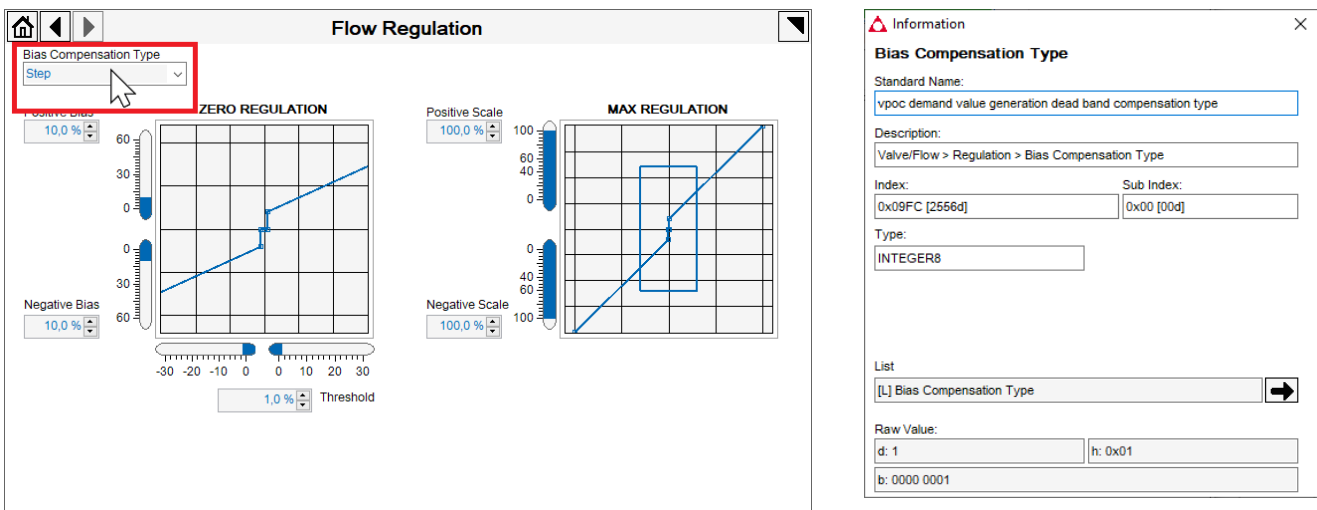
If no parameter is selected the fields of the window will be appears empty.

Example: no parameter selected



Pass the mouse on a parameter to display all IO-Link communication information related to it.

Example: "Bias Compensation Type" parameter selected





## 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**.



## 1.6 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 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: 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.

 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](mailto:ele-support@atos.com)) communicating complete electronics code plus driver serial number and valve code printed on driver's label.

## 2 GETTING STARTED

This section contains a brief review of the main operations required to start-up Atos drivers with IO-Link communication; to install and configure the drivers and the proportional valve/pump, refer to the user manual of specific driver.

Atos proportional digital drivers can be operated with reference signal options; each one gets different performances and requires different steps to start-up.

Choose one of the available driver operations depending on the specific application requirements (high/low performance, periodic parameters tuning, etc), or on the actual machine development phase (R&D, start-up, normal operation, maintenance, etc).

### 2.1 Digital Reference

All IO-Link digital drivers are factory preset to operate via IO-Link Digital reference: standard start-up driver procedures are required (see user manual for details):

- Connect Master IO-Link to the Valve
- Set-up the network configuration, using IODD device description file.
- Supply electrical power P24 and L+ to the valve.
- Set Digital Reference value to operate the driver



Atos IO-Link devices are not equipped with analog inputs/outputs.



E-SW-SETUP software can be used to perform diagnostic and setting operations.

### 3 ABOUT IO LINK INTERFACE – POINT TO POINT CONNECTION

IO-Link is a fieldbus independent communication interface for sensors and actuators. Signals and energy can be exchanged between any networks, fieldbuses and backplane buses via a digital, serial point-to-point connection.

Each IO-Link system consists of an IO-Link master (e.g. I/O hub) and an IO-Link devices (e.g. valves, transducers). An IO-Link master is provided with at least one IO-Link port (channel). One IO-Link device can be connected to each port. The system components are interconnected according to the port specification via unshielded 3-wire or 5-wire standard cables.

The IO-Link technology is described in the “IO-Link Interface and System Specification” and IEC 61131-9.

IO-Link-capable devices comply either with specification V1.0 or specification V1.1.

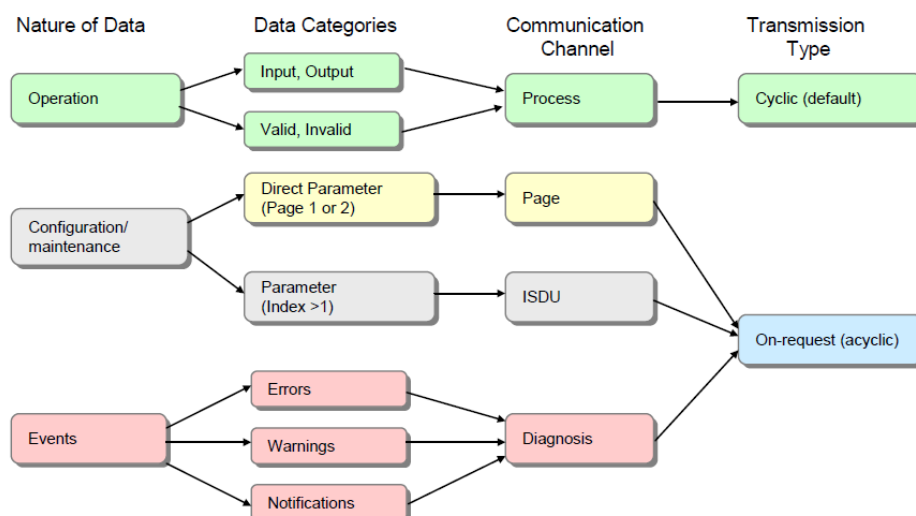
#### 3.1 Generic system features

- Point-to-point connection (max. cable length: 20 m)
- Unshielded 5-wire standard cables
- Cyclical process data transmission
- Acyclical data transmission, e.g. device data and events
- Communication between IO-Link master and IO-Link device possible in 2 baud rates
- Parallel exchange of device data without influencing the process data
- Communication via 24 V pulse modulation, standard UART protocol

#### 3.2 Communication Feature

Communication between a Master and a Device is point-to-point and is based on the principle of a Master first sending a request message and then a Device sending a response message. Both messages together are called an M-sequence. Several M-sequence types are defined to support user requirements for data transmission

Data of various categories are transmitted through separate communication channels within the data link layer, as shown:



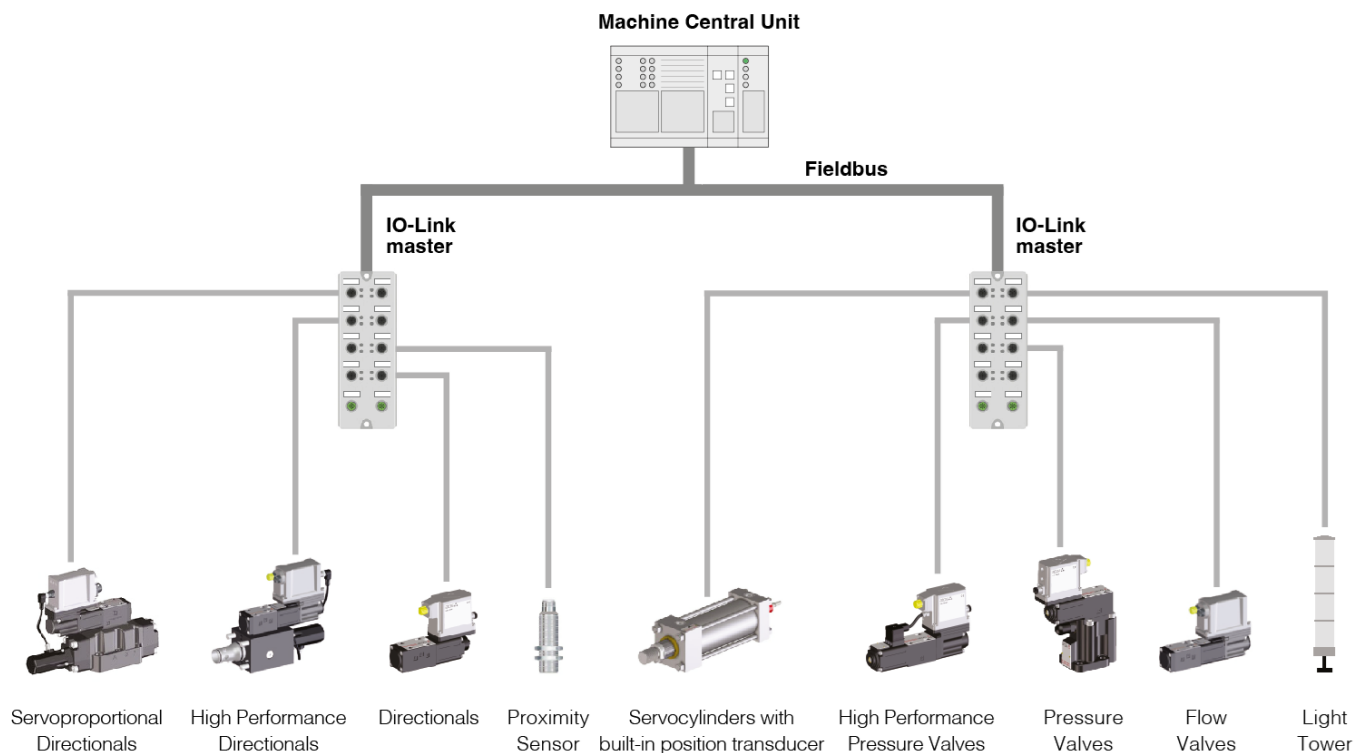
### 3.3 System design

At least one IO-Link master and one IO-Link device (e.g. sensors or actuators) are required for IO-Link communication. IO-Link master and IO-Link device are interconnected via an unshielded 3-wire or 5-wire standard cable. The setting can be carried out with a configuration tool or via the fieldbus level.

The IO-Link master establishes the connection between IO-Link device and the higher-level control system. An IO-Link master can have several IO-Link ports. Only one IO-Link device can be connected to each port.

IO-Link hubs also make it possible to integrate devices without an IO-Link output in automation systems via IO-Link.

Standard tools and functions are provided for the integration, commissioning and configuration of the IO-Link communication.



### 3.4 Operating principle

IO-Link is a digital point-to-point connection between an IO-Link master and an IO-Link device. Process data and other information such as parameters and diagnostic messages are transferred with a 24 V pulse modulation via a combined switching status and data channel (C/Q).

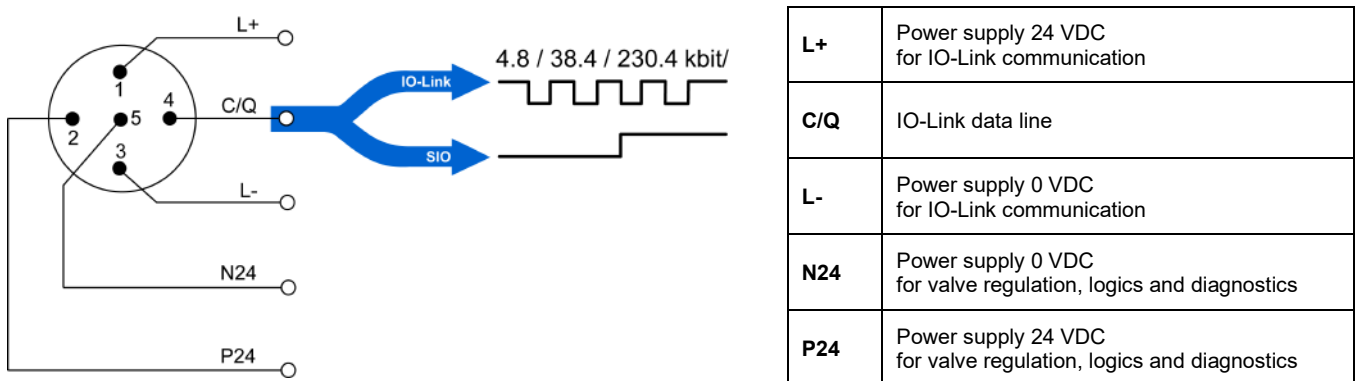
**IO-Link communication is independent of the fieldbus used.**

### 3.5 Functions and operating modes

The operating mode can be set separately at any port of the IO-Link master. Two operating modes are available for the IO-Link master:

- IO-Link mode: IO-Link communication possible
- Standard I/O mode (SIO): digital I/O communication

IO-Link communication is implemented via the switching and communication cable (C/Q).



During initialization the ports of the IO-Link master behave like a normal digital input. The IO-Link devices are operated in IO-Link mode. A command of the higher-level IO-Link master establishes IO-Link communication in IO-Link mode. This command is called the “Wake-up request”.

### 3.5 IO-Link mode

In IO-Link mode communication takes place between an IO-Link master and an IO-Link device. Communication always starts from the IO-Link master.

Transmission speed between IO-Link master and IO-Link device

Three transmission rates are defined in the IO-Link specification:

- 4.8 kBaud
- 38.4 kBaud
- 230.4 kBaud

**Each device supports only one baud rate, an IO-Link master supports all transmission rates.**

The transfer time of the cyclical process data is determined by the telegram length as well as the delay times in the device and the master. With a transmission rate of 38.4 kBaud and a telegram length of 2 byte the transmission time is typically 2.3 ms.

### 3.6 Response times

The response time of the IO-Link system provides information on the frequency and speed of the data transmission between IO-Link master and IO-Link device. This response time depends on the following factors:

- Minimum cycle time: Intervals defined in the IODD in which the IO-Link master addresses the IO-Link device. Different minimum cycle times can be defined for different devices.
- Internal processing time of the IO-Link master and the IO-Link device

#### **Cyclical and acyclical communication**

The data exchanged between IO-Link master and the IO-Link device can be divided into cyclical process data and acyclical data. Process data and value states are transferred cyclically. Acyclical data is transferred separately to cyclic process data. Acyclical data includes device data, parameter functions and events such as diagnostic information, which is only transferred on request. The two communication types are independent of each other and do not interact.

### 3.7 Combining IO-Link devices with different specifications

Only devices of specification V1.0 can be operated on IO-Link masters of specification V1.0. Devices of specification V1.0 and V1.1 can be operated on IO-Link masters of specification V1.1.

	IO-Link device V1.0	IO-Link device V1.1
IO-Link master V1.0	✓	
IO-Link master V1.1	✓	✓

## 4 ATOS IO-LINK FEATURES

Following the main features of Atos IO-Link Devices

### Physical

- Serial input format: **24 V pulse modulation**
- Transmission rate: **230.4 kbit/s (COM3)**
- Port Class: **Class B**
- Cable type: **5 wires, unshielded**
- Cable length: **Up to 20 m**

### Communication Protocol

- Data Link Layer - M sequence type:
  - In PREOPERATE MODE = **TYPE\_0**
  - In OPERATE MODE = **TYPE\_2\_V**
- Device type - Device - Supported features:
  - Cyclic transmission of process data
  - Acyclic transmission of parameters
  - Acyclic transmission of identification data
  - Acyclic transmission of diagnostic events

### Configuration and Commissioning

- - setting via Atos PC software
- - setting via IO-Link / USB adapter and configuration tool
- - setting via IO-Link Master and configuration tool
- - setting via Machine Central Unit

### Cyclic transmission of process data

Cycle time: **Min 2 ms**

Number input data: **2 Word** (ControlWord, Setpoint )

Number output data: **2 Word** (Status Word, Main Spool Postion)

### Diagnostic Events:

Update time **2 msec**

Event Category Type **Error, Warning, Notification**

Status Code **Type 2 with details**

Nr of Events **max 6 concurrent errors.**

## 4.1 IO-Link specific diagnostic support

IO-Link includes diagnostic alarms. A diagnostic alarm is transmitted to the controller in the case of device problem (short circuit, Valve control monitoring, etc ).

For a rapid analysis, the cause of the problem is stated in plain text in the IO-Link controller. These alarm descriptions are included into IODD file of the device.

Device events are transmitted using acyclic transfers through a diagnostic channel. Device events are reported using 3 severity levels, error, warning, and notification

Error and warning events are managed with appear and disappear messages, while Notification events have only single appear message.

Atos IO Device sends diagnosis with detailed information about the event (Type 2 with detail) .

A full list of error codes and their management are described in “Driver Alarms” Chapter ( see 6 )

## 4.2 IODD (IO Device Description) – configuration file

The properties, functions and parameters of the IO-Link device are represented in an electronic device description (IODD). The IODDs of all devices have the same structure and contain the following information for system integration:

- Communication properties
- Device parameters with value range and default value
- Identification, process and diagnostic data
- Device data
- Text description
- Picture of the device
- Logo of the manufacturer

The structure of the IODD is defined by the IO-Link specification and is the same for all IO-Link devices. The IODD is based on indexes. The communication properties, device parameters, identification, process, diagnostic and device data are assigned to fixed indexes in the IODD, via which the parameters can be controlled. Some indexes are further divided by subindexes.

For I/O data, the IODD file describes the structure of the cyclic input and output data transferred between the Programmable Controller and the IO-Link Device. Any mismatch between the size or structure of the input and output data and the actual internal device structure generates an alarm to the controller.

### 4.3 Communication connections

For IL executions (IO-Link) one communication connector is always available for digital driver.

#### 4.3.1 E-RI-AEB, E-RI-REB connector

To connect the driver into the IO-Link network use dedicated M12 – 5 pin (coding A) connector.

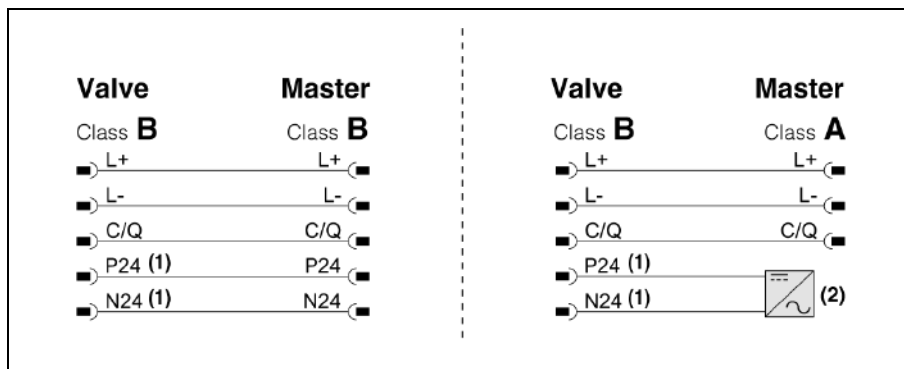
PIN	SIGNAL	TECHNICAL SPECIFICATIONS
1	<b>L+</b>	Power supply 24 VDC for IO-Link communication
2	<b>P24</b>	Power supply 24 VDC for valve regulation, logics and diagnostics
3	<b>L-</b>	Power supply 0 VDC for IO-Link communication
4	<b>C/Q</b>	IO-Link data line
5	<b>N24</b>	Power supply 0 VDC for valve regulation, logics and diagnostics

#### 4.3.2 E-RI-TEB/LEB connector

To connect the driver into the IO-Link network use dedicated M12 – 5 pin (coding A) connector.

PIN	SIGNAL	TECHNICAL SPECIFICATIONS
1	<b>L+</b>	Power supply 24 VDC for IO-Link communication
2	<b>P24</b>	Power supply 24 VDC for valve regulation, logics and diagnostics
3	<b>L-</b>	Power supply 0 VDC for IO-Link communication
4	<b>C/Q</b>	IO-Link data line
5	<b>N24</b>	Power supply 0 VDC for valve regulation, logics and diagnostics

#### 4.3.3 Valve to Master connection examples



(1) Maximum power consumption: 50 W

(2) For Master ports Class A connect P24 and N24 to an external power supply

## 4.4 Acyclic communication

Configuration and maintenance parameters are transmitted using acyclic transfers.

An ISDU channel is used for accessing additional parameters and commands.

The parameter address of the data object to be transmitted using the ISDU is specified in the “Index” element. “Index” has a range of values from 0 to 65535d . Atos Parameters starts from index 256d.

The data element address of a structured parameter of the data object to be transmitted using the ISDU is specified in the “Subindex” element. “Subindex” has a range of values from 0 to 255, whereby a value of “0” is used to reference the entire data object.

ISDU Communication is possible in Preoperate and Operational state, using dedicated software Master function blocks.

Another simple way to access the parameters is to use the IODD interpreter present in various development tools.

This functionality take advantage of the parameter menus created by Atos in its IODD files.

Common Process Data Identification Observation Parameter Diagnosis Scope Generic IODD				
Name	R/W	Value	State	Unit
[-] Control Word				
Control Word Mode	rw	Local Control	d	
[-] Flow Regulation				
Bias Compensation Type	rw	Step	d	
Offset	rw	0,0	d	%
Positive Bias	rw	10,0	d	%
Negative Bias	rw	10,0	d	%
Bias Compensation Threshold	rw	1,0	d	%
Positive Scale	rw	100,0	d	%
Negative Scale	rw	100,0	d	%
[-] Flow Ramps				
Ramp_Type	rw	No Ramp	d	
Ramp 1 Time	rw	0,001	d	"
Ramp 2 Time	rw	0,001	d	"
Ramp 3 Time	rw	0,001	d	"
Ramp 4 Time	rw	0,001	d	"
[+] Flow Linearization				
[-] Flow_Dither				
Dither Type	rw	No Dither	d	
Dither Amplitude	rw	1,0	d	%
Dither Frequency	rw	100	d	Hz
Ref for Start Attenuation	rw	90,0	d	%
Ref for Stop Attenuation	rw	100,0	d	%
[-] Flow Smart Tuning				
Smart Tuning	rw	PID1 Dynamic	d	
[-] Flow Low Pass Filter				
Low Pass Filter Time [1]	rw	0	d	µs
Low Pass Filter Time [2]	rw	0	d	µs
Low Pass Filter Time [3]	rw	0	d	µs
[-] Memory Store				
Store_Valve_Parameters	wo	Store User Parameters		
Loaded Parameter Set	ro	User	d	
[-] Monitoring				
Low Temperature Limit Set	rw	-40,0	d	°C
High Temperature Limit Set	rw	90,0	d	°C
[-] System				
Driver Restart	wo	RESTART		

## 4.5 Object Dictionary

Object Dictionary is a collection of the available parameters that allow configuring driver's communication and functional behaviour.

From the E-SW-SETUP software it is possible to view all the information of the fieldbus parameters (see 1.4.4). Select a parameter and press CTRL+H on the PC keyboard to open the "Information" window:

### ① Name

Software parameter name

### ② Standard Name

Parameter name description

### ③ Description

E-SW-SETUP software parameter fast reference (Area > Function > Parameter)

### ④ Index and Sub Index

Parameter address.

### ⑤ Type

Parameter dimension and data type:

Type	Dimension
BYTE	8 bit
UNSIGNED8	8 bit
INTEGER8	8 bit
UNSIGNED16	16 bit
INTEGER16	16 bit
INTEGER32	32 bit
UNSIGNED32	32 bit

## ② Scaling

Parameter scaling value.

Scaling function is required to transform the raw value into the real (meaning) value as displayed also in the E-SW-SETUP Atos software.



Scaling function indicate that parameter must be operated with a selection of defined dictate values (see 4.6)

## ⑦ List

Parameter List information: Value and Description.

## ⑥ Raw Value

Numeric parameter (for more information see 4.6.1)




The raw value is displayed in three different formats:

- **d** : decimal
- **h** : hexadecimal
- **b** : binary

## 4.6 Scaling Descriptions

Numeric parameters are always formatted as 'Raw' values (integer data types of 8/16/32 bits): to read these parameters with a 'Real' physical meaning a scaling function must be applied.

 'Real' values obtained using scaling functions are the same displayed with E-SW-SETUP programming software.

### 4.6.1 Internal resolution scaling

These scaling convert 'Raw' value with internal resolution formats in 'Real' value [Real Unit]:

Scale	Gain Raw to Real	Gain Real to Raw	Real Unit
decmsc_to_μsec	100	0,01	μsec
INT16_dec°C_to_°C°F	0,1	10	°C
INT16_to_Perc100	100 / 32767	32767 / 100	%
INT16_to_Perc200	200 / 32767	32767 / 200	%
INT16_to_Perc200n	-200 / 32767	32767 / -200	%
INT32_to_Perc200	0,001	1000	%
INT32_to_V	0,0001	10000	V
INT32_to_V_mA	0,0001	10000	V
	0,0002	5000	mA
INT32min_to_gg_hh_mm	1	1	min
POWERSUPPLY	0,01	100	V
UINT16_msec_to_sec	0,001	1000	sec
UINT16_to_400Perc	400/65535	65535/400	%

$$\text{Real\_Value [Real Unit]} = \text{Gain\_Raw\_to\_Real} * \text{Raw\_Value}$$

$$\text{Raw\_Value} = \text{Gain\_Real\_to\_Raw} * \text{Real\_Value [Real Unit]}$$

#### Example, write (set command):

To set the regulation of a TEB/LEB driver at 50%:

Parameter	Index	Subindex	Scale
Valve/Driver Signals > Valve/Flow > Demand	0x0938	0x00	INT16_to_Perc200

The Raw\_Value for Acyclic or Cyclic Data corresponds to 8192:

- $\text{Gain\_Real\_to\_Raw} * 50[\%] \rightarrow (32767/200) * 50 = 8192$

#### Example, read (read command):

To read the input actual value to flow analog feedback, e.g. 50[%]:

Parameter	Index	Subindex	Scale
Valve/Driver Signals > Valve/Flow > Actual	0x0939	0x00	INT16_to_Perc200

The Raw\_Value for Acyclic service is equal to 8192. The Real\_Value is given by:

- $\text{Gain\_Raw\_to\_Real} * 8192 \rightarrow (200/32767) * 8192 = 50[\%]$

#### 4.6.2 Gain scaling

These scalings convert 32bits 'raw' values into a Gain factor with unit indication if required:

Scale	Real Full Scale	Real Unit
INT32_to_Gain	1	none

The function use the two words of value to calculate the gain real value:

Raw Value 

<b>A_raw:</b> (Most Significant Word)	<b>B_raw:</b> (Less Significant Word)
---------------------------------------	---------------------------------------

where for Gain function:

$$Real\_Gain = (A\_raw / B\_raw) * Real\_Fullscale$$

#### 4.6.3 Data scaling

These scale converts a structured 32bits 'raw' value into a standard data format where day/month/year corresponds to:

Year		Month	Day
byte4	byte3	byte2	byte1

**Example:**

21/10/2010 (day/month/year)

Year		Month	Day
byte4	byte3	byte2	byte1
07h	DAh	0Ah	15h

#### 4.6.4 RAW \* scaling

These scaling state the 'Raw' value in 'Physical' value as one to one value.

**Example 1**

Set parameter value 'Filter Time' at 1000  $\mu$ s with scaling defined as 'RAW\_ $\mu$ s':

Parameter	Index	Subindex	Scale
Valve/Flow > Low Pass Filter > Filter Time	0x0A05	0x00	RAW_ $\mu$ s

Raw\_ $\mu$ s = Physical value

1000 (Raw\_ $\mu$ s) = 1000  $\mu$ s (Physical value)

#### 4.6.5 VALUE to Physical scaling

These scaling depend by the input interface. In the below table are described the input interface types:

Input interface	Type	Scaling	Measure Unit
Spool Position	1	INT32_to_Perc200	%
Flow	4	RAW_mL/min	mL/min

## 4.7 State machine

### State Machine – VDMA 1.5

Driver automatically selects 16 bit 'Flow reference':

- Flow reference = "%" (16383 = 100%)

## 4.8 Bits parameters descriptions

Single bit or group of bits must be decoded to correctly evaluate the following parameters: refer to the specific driver manual (see 1.2.1) for a full description bit(s) meaning and behaviour.

### 4.8.1 Status Word - 16bit

Index	Subindex
0x01C8	0x00

Conditions:

<i>MSB</i>				<i>LSB</i>
<i>Bit</i>	<b>15-6</b>	<b>5</b>	<b>4</b>	<b>3-0</b>
<i>Content</i>	<b>Res</b>	<b>Warning</b>	<b>Local</b>	<b>Status</b>

### Status

The first four bits 3-0 indicate the functional status of the electronic driver:

Status value (bits 3-0) – State Machine VDMA 1.5	
Init	1000 (8h)
Disabled	1001 (9h)
Hold	1011 (Bh)
Active	1111 (Fh)
Fault Hold	0011 (3h)
Fault	0001 (1h)
Fault Fatal	0111 (7h)

Status value (bits 3-0) – State Machine VDMA 1.6	
Init	1000 (8h)
Disabled	1001 (9h)
Hold	1011 (Bh)
Active	1111 (Fh)
Fault Hold	0011 (3h)
Fault Disable	0001 (1h)
Fault Init	0000 (0h)
Fault Fatal	0111 (7h)



For full description refer to the specific driver manual sections: 'Driver Status' and 'State Machine'.

### Local

Bit 4 indicates if the driver status is actually controlled by IO-Link (see 4.8.2 – control word) or not:

Local (bit 4)	
Local (internal) control	1
Remote (IO-Link) control	0



For full description refer to the specific driver manual sections: 'State Machine'.

### Warning

Bit 5 indicates the presence of alarm or error conditions:

Warning (bit 5)	
Normal working	0
Error/Alarm present	1



For full description refer to the specific driver manual sections: 'Valve Signals – Extended Page'.

### 4.8.2 Control Word - 16bit

Index	Subindex
0x01CB	0x00

This parameter is a collection of all relevant command that can be send by IO-Link to control the driver working condition:

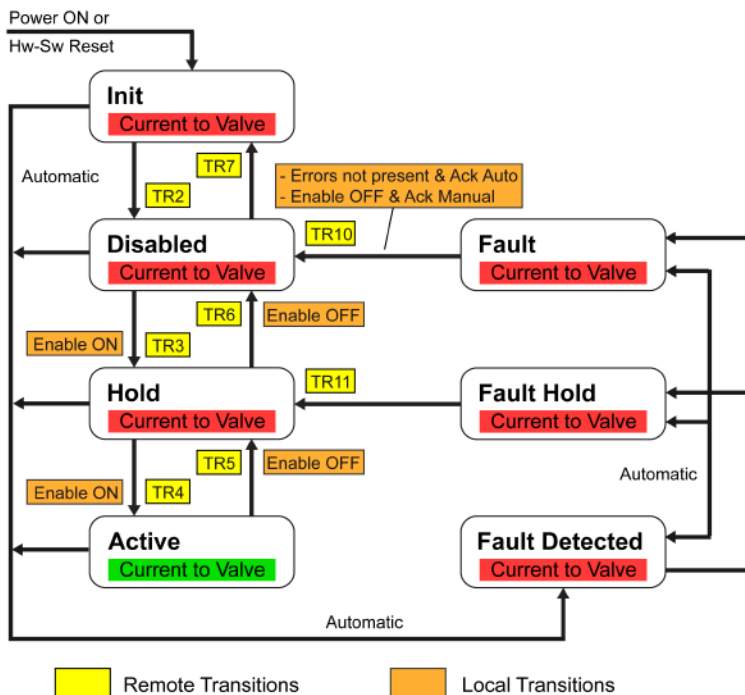
MSB	LSB	
Bit	15-4	3-0
Content	Res	Control

The modifications of the control word bits have effect only if the remote (IO-Link) control is active (see 4.8.1).

#### Control (state machine – VDMA 1.5)

The first four bits 3-0 allow to request the transition of the driver status to a defined condition:

Remote transition		Control value (bits 3-0)
TR2	up to Disable	xxx1
TR3	up to Hold	xx11
TR4	up to Active	x111
TR5	down to Hold	x0xx
TR6	down to Disable	x00x
TR7	down to Init	x000
TR10	exit Fault	0x0x -> 1x0x
TR11	exit Fault Hold	0x1x -> 1x1x



With 'Reference Type' parameter set to IO-Link, the driver requires cyclic data exchange to be active: Operational communication state is required to reach Hold or Active driver state.

Thanks to 'x' not care conditions it is possible to repeat the same control word to reach a defined driver state (up or down); example - to reach Active from Init, simply repeat 'x111' control word command.

**Example of state machine allowed bits combination:**

The 'x' bits, indicated in the column "**Control value (bits 3-0)**", it could assume any value and doesn't affect the state transition.

State transition from **TR2** to **TR3**

Remote transition		Control value (bits 3-0)	Allowed combinations
<b>TR2</b>	up to Disable	xxx1	000 <b>1</b> 001 <b>1</b> 010 <b>1</b> 011 <b>1</b> 100 <b>1</b> 101 <b>1</b> 110 <b>1</b> 111 <b>1</b>

State transition from **TR3** to **TR4**

Remote transition		Control value (bits 3-0)	Allowed combinations
<b>TR3</b>	up to Hold	xx11	00 <b>11</b> 01 <b>11</b> 10 <b>11</b> 11 <b>11</b>

## 5 DRIVER ALARMS

When driver detects an alarm condition (see 5.2), it is displayed with proper led, and driver state can change according to alarm reaction (see 5.1).



The messages error are sent also via IO-Link (see 5.4).

### 5.1 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. Fault status: it is identified in 'Valve Signals' through 'Alarm' indicator and 'Alarm Present' led (see 5.1.1) and in 'Valve Signals – Extended Page' through 'Alarm History' indicator and dedicated led (see 5.1.2).



The reaction of the driver depending on the state machine selected (see 4.7).

#### State Machine – VDMA 1.5 (Control mode: Main Stage Closed loop)

Priority	Class	IO-Link Class	Active control mode	Active reference	Fault acknowledge	State machine	Fault
0	No reaction	No Event	Spool closed loop	(*)	None	(**)	OFF
1	Message	Notification	Spool closed loop	(*)	None	(**)	OFF
2	Warning	Warning	Spool closed loop	(*)	None	(**)	ON
3	Minor error	Error	No mode	Solenoid switched off	Enable transition	Fault	ON
4	Serious error	Error	No mode	Solenoid switched off	Enable transition	Fault	ON
5	Critical error	Error	No mode	Solenoid switched off	Enable transition	Fault	ON
6	Fatal error	Error	No mode	Solenoid switched off	Power supply off	Fault Fatal	ON

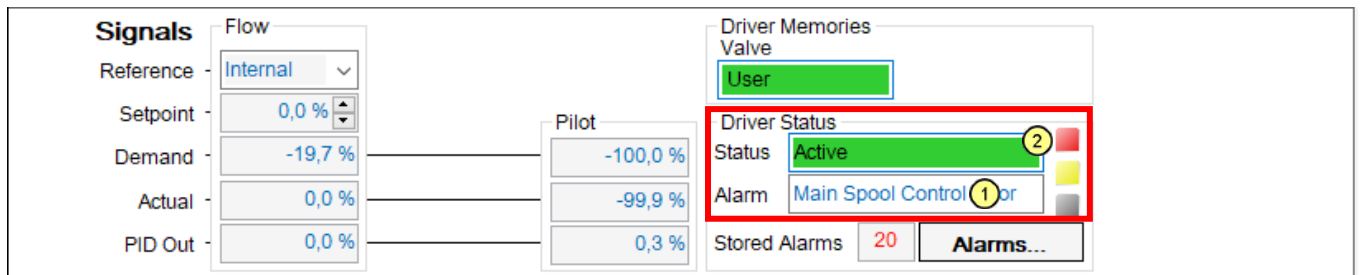
(\*) The driver maintains the reference type selected by the user; refer to 'Working Signals' on software.

(\*\*) The driver maintains the state selected by the user; refer to 'State Machine – VDMA 1.5' (see 4.7).




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

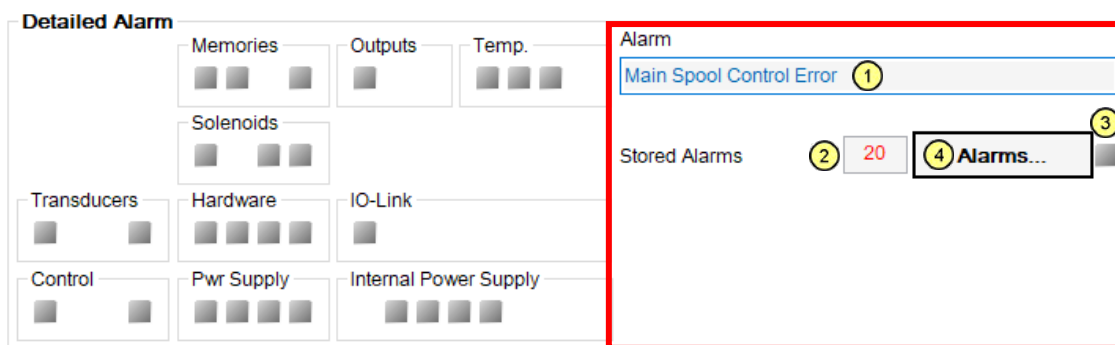
### 5.1.1 Driver Status – Alarm (Valve Signals)



The indicator ① allows the user to identify which is the last fault/alarm condition that has occurred and led ② to verify if the alarm is still present.

 In case of multiple fault/alarm conditions, the worst condition is displayed first; when driver is restarted or power off/on, 'Alarm' is set to 'No Alarm' (see 5.2 for the complete Alarms description).

### 5.1.2 Alarm History (Valve Signals – Extended Page)



The indicator ① shows the last or the most critical present alarm.

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.

The button ④ allows to open a window with all stored alarms history details.

## 5.2 Alarm Management

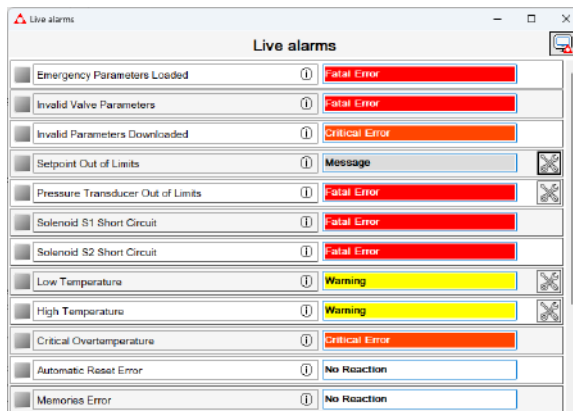
A complete diagnostic of driver alarm conditions is available through a dedicated software window page. To access at this page click on related button located on software Home Page.



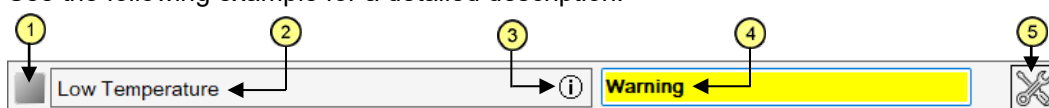
Alarm Management Access button



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 5.3)
- ③: Pass mouse on (i) : a pop up opens with cause/troubleshooting description of the alarm (see 5.3)
- ④: In this area are displayed the seriousness of alarms through different colours and descriptions (see 5.1)
- 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

### 5.3 Alarms Conditions

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

#### 5.3.1 Memories Alarms

Alarms	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: 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.


 (\*) The reaction is software selectable.

#### 5.3.2 Transducer Alarms

Alarms	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 LEB driver]	Fatal Error	Pilot spool position analog actual input signal exceeds admissible range. Please contact Atos service for troubleshooting.

#### 5.3.3 Control Monitoring Alarms

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


 (\*) The reaction is software selectable.

### 5.3.4 Solenoids Alarms

Alarms	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.

### 5.3.5 Temperature Alarms

Alarms	Reaction	Cause/Troubleshooting
Low Temperature	Warning (*)	Internal low temperature, verify correct installation and working conditions (ambient temperature)
High Temperature	Warning (*)	Internal high temperature, verify correct installation and working conditions (ambient and fluid temperature)
Critical Overtemperature	Critical Error	The value of high temperature setting was exceeded. Please contact Atos service for troubleshooting.
Temperature Sensor Error	Fatal Error	The internal temperature sensor of the driver is fault. Please contact Atos service for troubleshooting.

 (\*) The reaction is software selectable.

### 5.3.6 Hardware Alarms

Alarms	Reaction	Cause/Troubleshooting
Automatic Reset Error	Fatal Error	The driver is reset by itself (see software to display the last command that has generated the driver reset).
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.
IO-Link Hardware Error	Fatal Error	The driver has detected an hardware error on communication. Switch off/on the driver power supply. If error is still present, please contact Atos service for troubleshooting.

### 5.3.7 Output Alarms

Alarms	Reaction	Cause/Troubleshooting
+5V USB Fault	Message	Internal power supply for USB is not valid. Please contact Atos service for troubleshooting.

### 5.3.8 Power Supply Alarms

Alarms	Reaction	Cause/Troubleshooting
P24 Too High	Warning	Power supply for valve regulation, logics and diagnostics is higher than 33 V <sub>DC</sub> (for 1 sec): check power supply.
P24 Too Low	Critical Error	Power supply for valve regulation, logics and diagnostics is lower than 18 V <sub>DC</sub> (for 1 sec): check power supply.
L+ Too High	Warning	Power supply for IO-Link communication is higher than 33 V <sub>DC</sub> (for 1 sec): check power supply.
L+ Too Low	Warning	Power supply for IO-Link communication is lower than 18 V <sub>DC</sub> (for 1 sec): check power supply.

### 5.3.9 Internal Power Supply Alarms

Alarms	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.

### 5.3.10 IO Link

Alarms	Reaction	Cause/Troubleshooting
Out of Operate [only for IL execution]	Warning	The driver has lost the connection with the master: check IO-Link connection.

## 5.4 Alarm management via IO-Link

Alarms status can be read through Cyclic and Acyclic parameters.

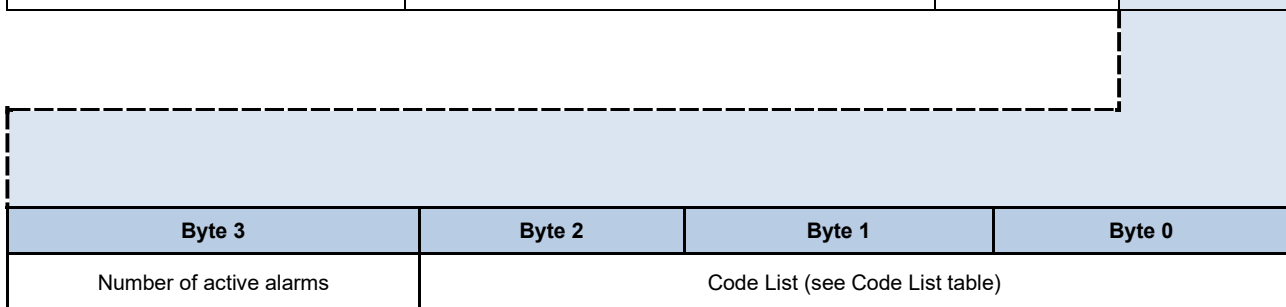
### Cyclic:

- Bit Warning on Status Word (see 4.8.1).

### Acyclic:

- Running alarm parameter (see 5.4.1)
- Alarm History (see 5.4.2)
- Alarms status – Detailed Alarms - binary coding (see 5.4.4 and see 5.4.5)
- Bit Warning on Status Word (see 4.8.1)
- Diagnostic Service (see 4.1)

### 5.4.1 Running Alarm parameter

Parameter	Index	Subindex	Type
Running Alarm	0x019C	0x00	UINT32
			
Byte 3	Byte 2	Byte 1	Byte 0
Number of active alarms	Code List (see Code List table)		



If more than 1 alarm is present, this parameter contains the most critical active alarm (see 5.1).

**Code List**

<b>Selection</b>	<b>Value dec</b>	<b>Value hex</b>
No Alarm	0	0x000000
Solenoid S1 Short Circuit	8721	0x002211
Solenoid S2 Short Circuit	8722	0x002212
P24 Too High	13329	0x003411
P24 Too Low	13330	0x003412
L+ Too High	13345	0x003421
L+ Too Low	13346	0x003422
High Temperature	16913	0x004211
Low Temperature	16914	0x004212
Main Spool Transducer Out of Limits	21046	0x005236
Solenoids Current Fault	21049	0x005239
Pilot Spool Transducer Out of Limits	21050	0x00523A
Memories Error	21808	0x005530
Automatic Reset Error	24592	0x006010
Emergency Parameters Loaded	25344	0x006300
Invalid Valve Parameters	25360	0x006310
Invalid Parameters Downloaded	25376	0x006320
Generic IO-Link Communication Error	33024	0x008100
Out Of Operational	65329	0x00FF31
+3.3V Fault	78336	0x013200
+5V USB Fault	78592	0x013300
Critical Overtemperature	82449	0x014211
Temperature Sensor Error	86016	0x015000
Solenoids Current Control Error	99072	0x018300
+5V Fault	143872	0x023200
IO-Link Hardware Error	151552	0x025000
Pilot Spool Control Error	164608	0x028300
+15V Fault	209408	0x033200
ADC Hardware Error	217088	0x035000
Main Spool Control Error	230144	0x038300
-15V Fault	274944	0x043200
+10VP Fault	471552	0x073200
-10VP Fault	537088	0x083200

### 5.4.2 Alarm History parameter

This parameter is an history buffer of the last 15 errors occurred into the driver; each parameter can contain the code shown the 'Alarm History List'.

Parameter	Index	Subindex	Type
Alarm History	0x029A	(*)	Array of UINT32

(\*): Nr of Subindex = 15 (0x01 ÷ 0x0F)

#### Alarm History list

Selection	Value dec	Value hex
No Alarm	0	0x000000
Solenoid S1 Short Circuit	8721	0x002211
Solenoid S2 Short Circuit	8722	0x002212
P24 Too High	13329	0x003411
P24 Too Low	13330	0x003412
L+ Too High	13345	0x003421
L+ Too Low	13346	0x003422
High Temperature	16913	0x004211
Low Temperature	16914	0x004212
Main Spool Transducer Out of Limits	21046	0x005236
Solenoids Current Fault	21049	0x005239
Pilot Spool Transducer Out of Limits	21050	0x00523A
Memories Error	21808	0x005530
Automatic Reset Error	24592	0x006010
Emergency Parameters Loaded	25344	0x006300
Invalid Valve Parameters	25360	0x006310
Invalid Parameters Downloaded	25376	0x006320
Generic IO-Link Communication Error	33024	0x008100
Out Of Operational	65329	0x00FF31
+3.3V Fault	78336	0x013200
+5V USB Fault	78592	0x013300
Critical Overtemperature	82449	0x014211
Temperature Sensor Error	86016	0x015000
Solenoids Current Control Error	99072	0x018300
+5V Fault	143872	0x023200
IO-Link Hardware Error	151552	0x025000
Pilot Spool Control Error	164608	0x028300
+15V Fault	209408	0x033200
ADC Hardware Error	217088	0x035000
Main Spool Control Error	230144	0x038300
-15V Fault	274944	0x043200
+10VP Fault	471552	0x073200
-10VP Fault	537088	0x083200

### 5.4.3 Number of errors

This parameter contains the number of actual errors present in the Alarm History List (see 5.4.2).

Parameter	Index	Subindex	Type
Number of errors	0x2D31	0x00	UINT8

**5.4.4 Detailed Errors > Err 0-31**

Parameter	Index	Subindex	Type
Detailed Error	0x0293	0x00	UINT32

This parameter indicates which alarms/errors are actually present into the driver; this is a more detailed indication of the standard error indication:

Bit	Error
0	Solenoids Current Control Error
1	High Temperature
2	Low Temperature
3	Main Spool Transducer Out of Limits
4	- reserved
5	Pilot Spool Transducer Out of Limits (1)
6	Flow Setpoint Out of Limits
7	Main Spool Control Error
8	- reserved
9	- reserved
10	- reserved
11	- reserved
12	- reserved
13	- reserved
14	- reserved
15	- reserved
16	- reserved
17	- reserved
18	- reserved
19	- reserved
20	- reserved
21	- reserved
22	Invalid Valve Parameters
23	Invalid Parameters Downloaded
24	Emergency Parameters Loaded
25	Generic IO-Link Communication Error
26	- reserved
27	- reserved
28	- reserved
29	Solenoids Current Fault
30	- reserved
31	Solenoid S1 Short Circuit

(1) Available only for LEB drivers

**5.4.5 Detailed Errors > Err 32-63**

Bit	Error
0	Solenoid S2 Short Circuit
1	- reserved
2	+5V Fault
3	+15V Fault
4	-15V Fault
5	+24VF Fault
6	- reserved
7	- reserved
8	- reserved
9	P24 Too High
10	P24 Too Low
11	L+ Too High
12	L+ Too Low
13	Critical Overtemperature
14	Temperature Sensor Error
15	Memories Error
16	Automatic Reset Error
17	- reserved
18	- reserved
19	- reserved
20	- reserved
21	IO-Link Hardware Error
22	ADC Hardware Error
23	+5V USB Fault
24	- reserved
25	- reserved
26	- reserved
27	
28	
29	- reserved
30	- reserved
31	- reserved

## 6 COMMISSIONING - QUICK SETUP EXAMPLE

The following examples describe the configuration of Atos IO-Link devices at the PROFINET fieldbus level.


IO-Link devices can be set and configured via a Phoenix-IO-Link master on a Siemens S7-1200/1500 PLC and STEP7 V15 TIA Portal.

### Software used

- Siemens STEP 7 V15.1 Professional (TIA Portal)
- GSDML file of the Phoenix IO-Link master

### Hardware used

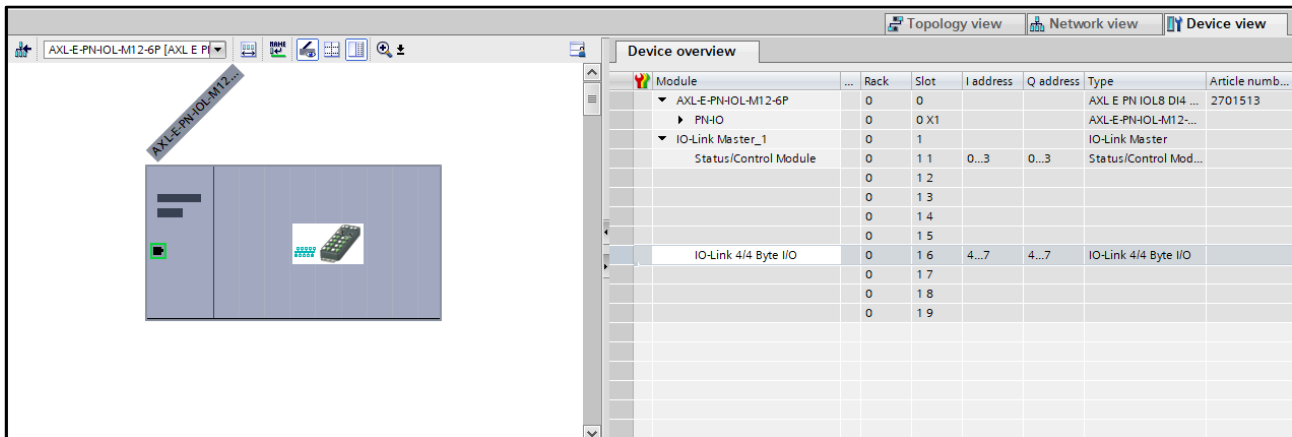
- Siemens S7 controller, e.g. with CPU 1511-1PN
- Phoenix master AXL-E-PN-IOL-M12-6P
- Atos E-RI-TEB-N-IL-xx (connected to port 5 of the IO-Link master)

 If there is the need to exchange acyclic data ( e.g configuration Parameters ), a special function block has to be called in the program section of the PLC, in order to access the data of the slave device. In siemens PLC "IO-LINK-DEVICE" function is used to read and write of acyclic data records on devices with IO-Link.

1. Import GSDML of AXL-E-PN-IOL into TIA Catalog
2. Create a Project with connection between PLC and AXL-E-PN-IOL



3. In Device View, select the module 4/4 byte IO and drag and drop it into slot nr 1.6 (port 5)  
Atos (TEB/LEB device use 2 Word In 2 Word out)



4. Transfer the configuration project to PLC
5. Go Online and check I address 4..7 and Q address 4..7

IW 4 = StatusWord from Valve

IW 6 = Actual Main Spool Position from valve

QW 4 = ControlWord to Valve

QW 6 = Setpoint to valve

