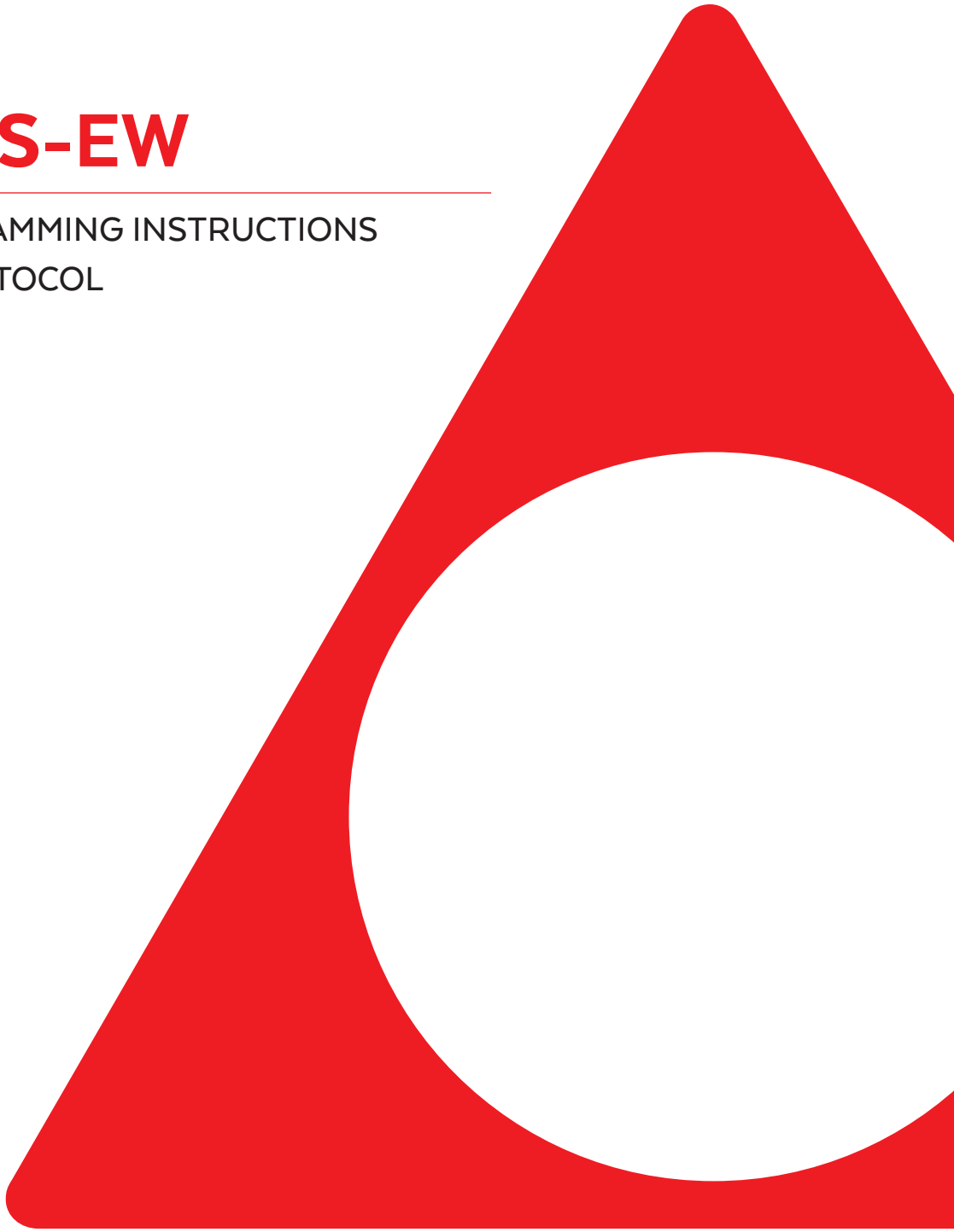
atos
the smart electrohydraulics

USER MANUAL

E-MAN-S-EW

DRIVERS PROGRAMMING INSTRUCTIONS
POWERLINK PROTOCOL



INDEX

1 GENERAL

1.1 About this user manual

This manual describes the required information to operate Atos proportional control valves using POWERLINK fieldbus 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 fieldbus startup operations it is always recommended to use the Atos E-SW-SETUP programming software for PC (see 1.4) before connecting Atos valves to the fieldbus: E-SW-SETUP software allows a fast identification of the valve functions and parameters that would be included in the POWERLINK 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 POWERLINK fieldbus 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).

The manual contains important safety instructions (see 1.6), 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
- AS170 Proportional controls for axial piston pumps
- GS240 Digital electronic E-BM-TES/LES drivers
- GS500 Programming tools for digital electronics
- GS510 Fieldbus - technical table
- E-MAN-RI-LES On-board driver for directional and flow proportional valves with LVDT transducers
- E-MAN-RI-LES-S On-board driver with P/Q control for directional proportional valves with LVDT transducers
- E-MAN-RI-PES On-board driver with P/Q control for axial piston pumps
- E-MAN-BM-LES DIN-Rail driver for proportional with one or two LVDT transducers
- E-MAN-RA-AES On-board driver for ex-proof proportional valves without transducer
- E-MAN-RA-RES On-board driver for ex-proof proportional valves with pressure transducer
- E-MAN-RA-LES On-board driver for ex-proof directional and flow proportional valves with LVDT transducers
- E-MAN-RA-LES-S On-board driver with P/Q control for ex-proof directional proportional valves with LVDT transducers

Standard References:

- IEC 61158-300 Data link layer service definition
- IEC 61158-400 Data link layer protocol specification
- IEC 61158-500 Application layer service definition
- IEC 61158-600 Application layer protocol specification
- Profile Fluid 1.5 VDMA - Proportional Valves and Hydrostatic Transmissions
- Profile Fluid 1.6 VDMA - Proportional Valves and Hydrostatic Transmissions
- EPSG DS 301 v1.2 Ethernet POWERLINK Communication Profile Specification
- IEC 61076-2-101 Connectors for electronic equipment – Product Requirements
- CiA DS 408 v1.5.1 CANopen – Device Profile for Proportional Hydraulic Valves

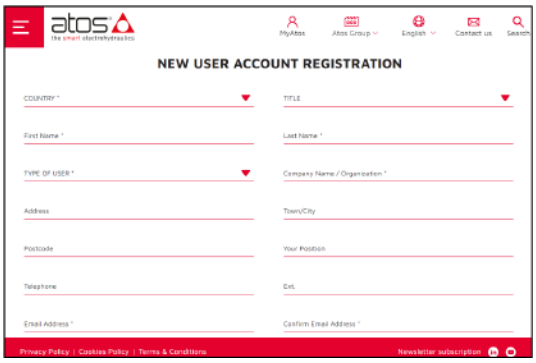
1.2.2 MyAtos area – Download area electronics

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**

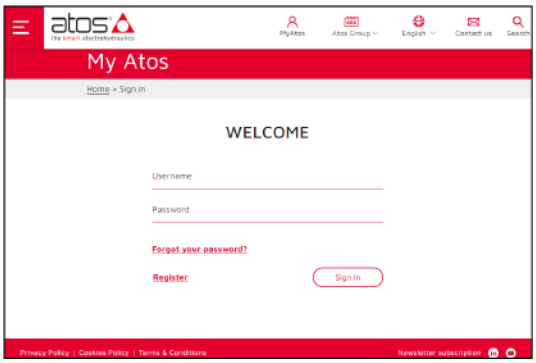
In order to have the access in MyAtos, perform the registration at https://www.atos.com/en-it/register by filling the form.



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

1.2.4 Abbreviations

Abbreviation	Description
ACL	Access Control List
ARP	Address Resolution Protocol
ASnd	Asynchronous Send (POWERLINK frame type)
CAN	Controller Area Network
CiA	CAN in Automation
CN	POWERLINK Controlled Node
DCF	Device Configuration File
EA	Exception Acknowledge (flag in POWERLINK frame)
EIA	Electronic Industries Association
EMC	Electro Magnetic Compatibility
EN	Exception New (flag in POWERLINK frame)
EPL	Ethernet POWERLINK
EPSG	Ethernet POWERLINK Standardisation Group
ICMP	Internet Control Message Protocol
ID	Identifier
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IP	Internet Protocol
MAC	Media Access Control
MIB	Management Information Base
MN	POWERLINK Managing Node
MS	Multiplexed Slot (flag in POWERLINK frame)
MSS	Maximum Segment Size
MTU	Maximum Transmission Unit
NAT	Network Address Translation
NIL	Not in List (Basic Data Type)
NMT	Network Management
PDO	Process Data Object
PR	Priority (bit field in POWERLINK frame)
PReq	PollRequest (POWERLINK frame type)
PRes	PollResponse (POWERLINK frame type)
PS	Prescaled Slot (flag in POWERLINK frame)
PTP	Precision Time Protocol
RD	Ready (flag in POWERLINK frame)
RFC	Requests for Comments
RPDO	Receive Process Data Object
RS	Request to Send (flag in POWERLINK frame)
SCNM	Slot Communication Network Management
SDO	Service Data Object
SNMP	Simple Network Management Protocol
SoA	Start of Asynchronous (POWERLINK frame type)
SoC	Start of Cyclic (POWERLINK frame type)
TCP	Transmission Control Protocol
TIA	Telecommunications Industry Association
TPDO	Transmit Process Data Object
UDP	User Datagram Protocol
VPN	Virtual Private Network
XDC	XML device configuration file
XDD	XML device description file

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}).

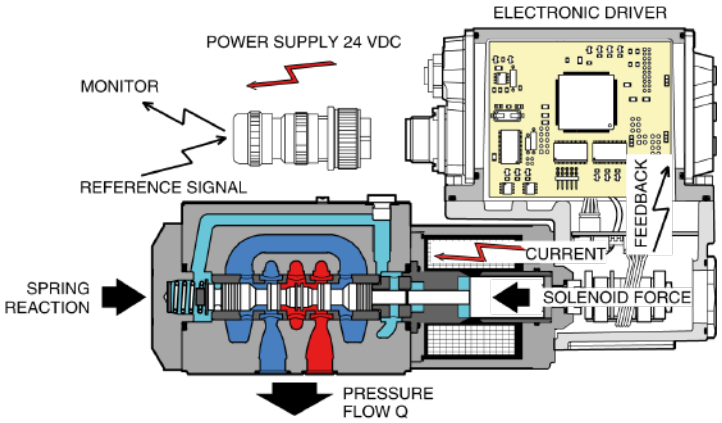
The force of the solenoid is proportional to the reference signal, thus properly moving the spool against a return spring to modulate hydraulic parameters.

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.

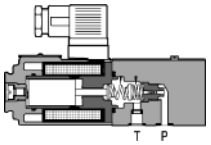
1.3.3 Digital proportional controls

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:

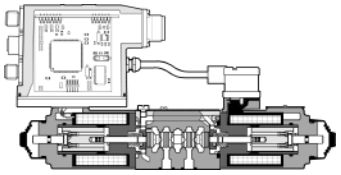
ZO-A

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.

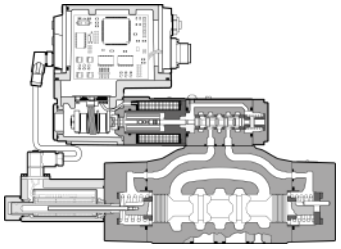


ZO-TES; ZO-LES

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.

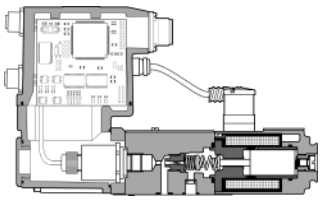
SP/SF/SL options add alternated pressure/force control to the valve standard spool-flow control.



ZO-RES

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

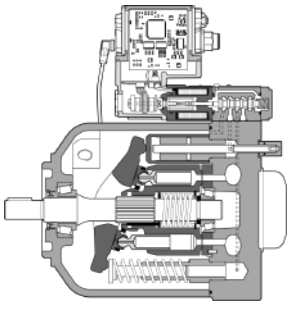
Digital integral electronic driver (factory preset) and integral pressure transducer assure valve-to-valve interchangeability, easier set-up and high response dynamics.



ZO-PES

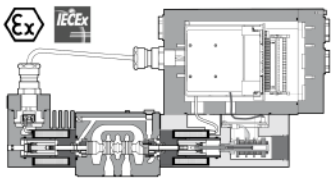
Variable displacement pumps with digital integral electronic driver, control in closed loop flow and pressure; a dedicated algorithm selects which control (flow/pressure) is active time by time.

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



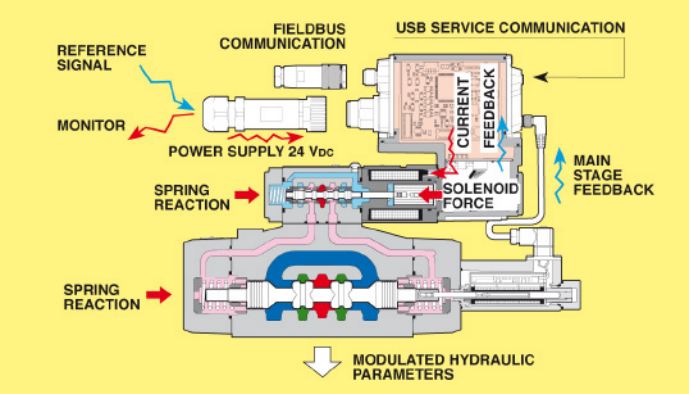
1.3.4 Digital electronic drivers

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 variable plus to proportional electrohydraulics:

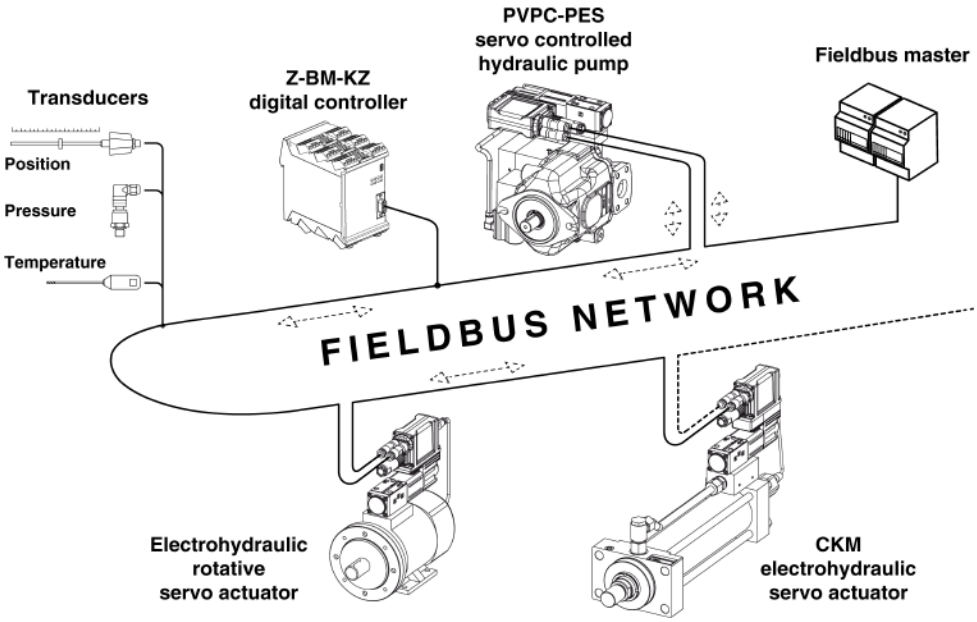
- better performances: hysteresis, response time, linearity
- software setting of hydraulic parameters: scale, bias, ramp, non-linearity
- diagnostics and computer assisted maintenance
- high immunity to electromagnetic noise easy interfacing to fieldbus systems



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:

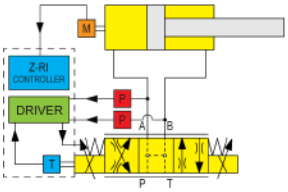
- option BC allows integration into CANopen fieldbus systems
- option BP allows integration into PROFIBUS DP fieldbus systems
- option EH allows integration into EtherCAT fieldbus systems
- option EW allows integration into POWERLINK fieldbus systems
- option EI allows integration into EtherNet/IP fieldbus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



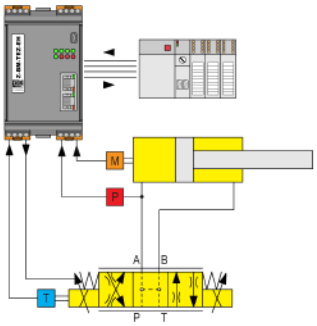
1.3.6 Axis controls

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 performances, simplify the automation architecture and may be integrated in the fieldbus network.

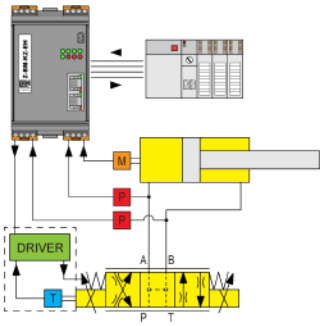
TYPE		ON BOARD AXIS CARD AND DRIVER	AXIS CARD WITH DRIVER FUNCTION	AXIS CARD
FORMAT / MAIN FUNCTION			 DIN-rail format	 DIN-rail format
Technical table		**FS610 FS620 FS630**	**GS330**	**GS340**
Valve's driver function		●	●	n.a.
Nr. of controlled Axis		1	1	1
Internal programmable cycles		simple	simple	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



P pressure transducer



T valve's spool transducer



M actuator's position transducer

= 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 E-SW-SETUP with fieldbus systems

E-SW-SETUP programming software is also an excellent tool for develop and start-up fieldbus systems: it allows to experience the different functional settings and to plan efficiently which parameters and functions insert in overall machine fieldbus 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 allow to access useful information for fieldbus communication development (see 1.4.4).

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 and E-C-SB-USB/BM cables, 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:

<table>
<tr><th rowspan="2">Driver</th><th colspan="2">Bluetooth</th><th colspan="3">USB, Serial, Infrared</th></tr>
<tr><th>Adapter</th><th>Cable</th><th>Adapter</th><th>Cable</th><th>Terminator</th></tr>
<tr><td>E-BM-TEB/LEB</td><td rowspan="5">E-A-BTH</td><td rowspan="2">E-C-BTH</td><td rowspan="5">E-A-SB-USB/OPT</td><td rowspan="2">E-C-SB-USB/BM</td><td rowspan="5">-</td></tr>
<tr><td>E-BM-TES/LES</td></tr>
<tr><td>E-RI-TES/LES</td><td rowspan="3">-</td><td rowspan="3">E-C-SB-USB/M12</td></tr>
<tr><td>E-RA-TES/LES</td></tr>
<tr><td>E-RI-PES</td></tr>
</table>

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

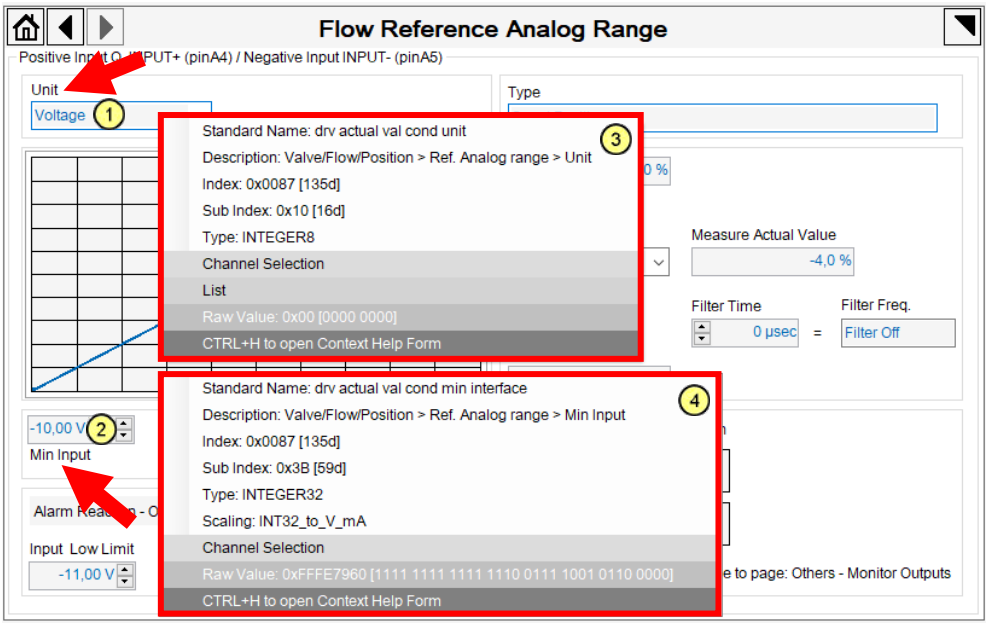
The previous versions of the Bluetooth adapter and cables are still compatible.

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 fieldbus 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 **Unit** control (1) or **Min Input** control (2) to open the related fieldbus communication windows ((3) and (4)).

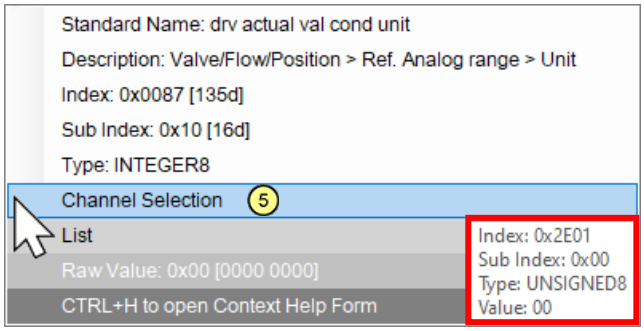


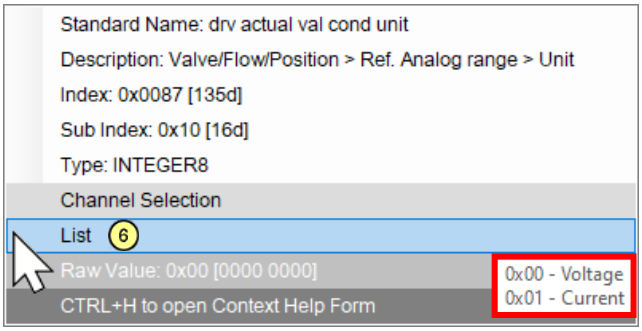
Windows (3) and (4) shown all fieldbus information of selected parameter:

Standard Name:	Parameter name description
Description:	E-SW-SETUP software fast reference parameters
Index:	Parameter address
Sub Index:	
Type:	Parameter dimension and data type
Scaling:	Parameter scaling value (see 5.7)
Channel Selection:	PreParameter info (Index, Sub Index, Type, Value) **(1)**
List:	Parameter list value **(2)**
Raw Values	Numeric parameter
CTRL+H	Press CRTL+H to open Context Help Form (see **CRTL+H - example**)

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

(2) Pass mouse arrow on **List** (6) 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".

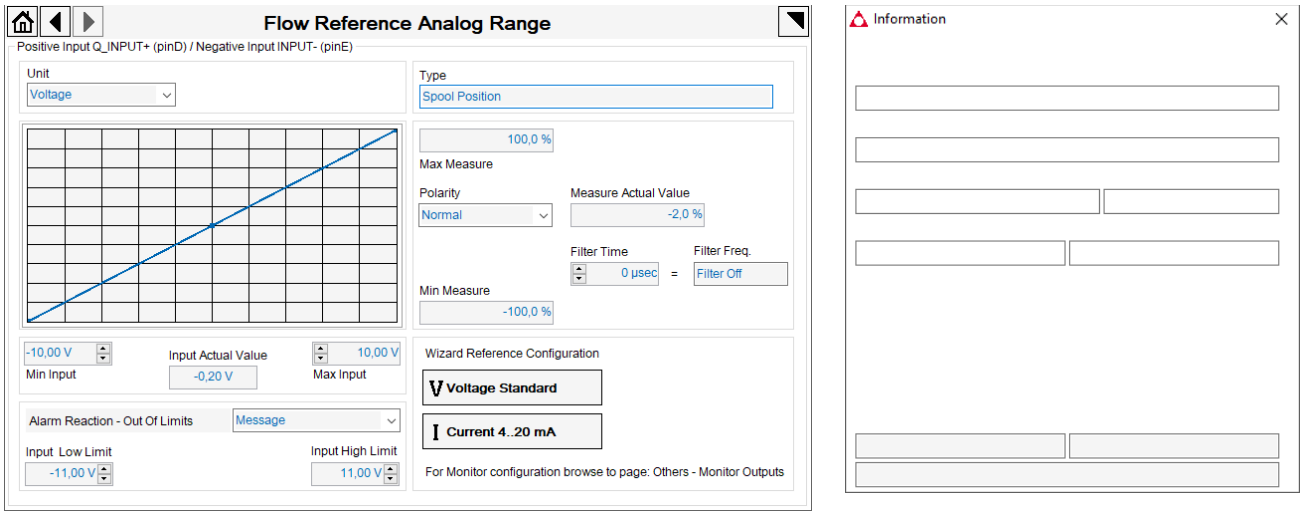
By pressing CRTL+H on PC keyboard the Context Help Form windows opens.

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 fieldbus information of each single parameter present on the software page, simply by positioning the mouse over it.

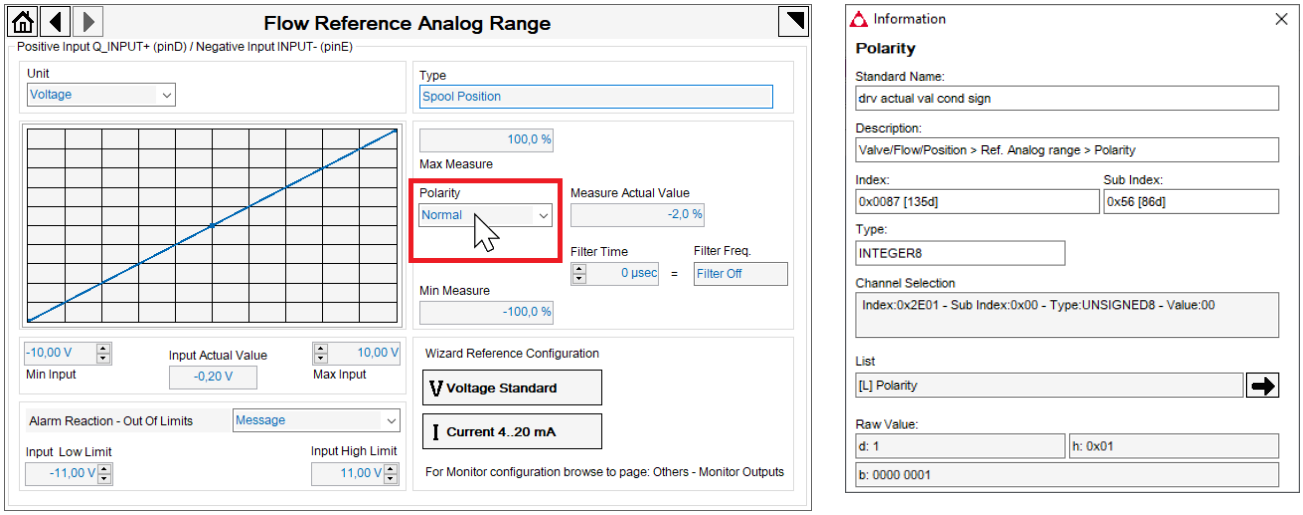
If no parameter is selected the fields of the window will be appears empty.

Example: no parameter selected



Pass the mouse on a parameter to display all fieldbus communication information related to it.

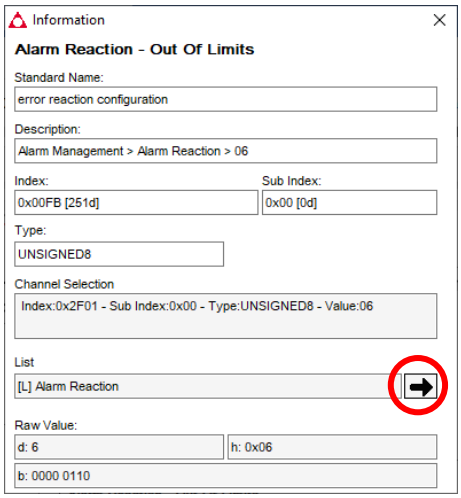
Example: “Polarity” parameter selected



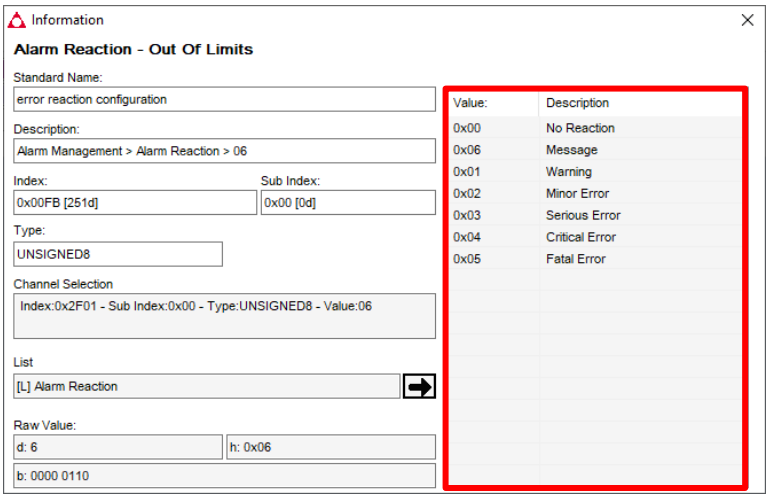
When in a parameter is present a “List” [L] press the black arrow to display the related information of the list (Value and Description).

Example: [L] Alarm Reaction

Press the black arrow



List information is displayed



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 (see 5.8.5) 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 drivers 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 driver is valid only if wirings are realized according to the recommended electric connections (refer also to sections 4).

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 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 POWERLINK 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 Analog external reference

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

- Supply electrical power to the valve
- Regulate the analog input reference to operate the driver

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

3 ABOUT POWERLINK - ETHERNET FIELDBUS

Ethernet Powerlink is a deterministic real-time protocol for standard Ethernet. It is an open protocol managed by the Ethernet POWERLINK Standardization Group (EPSG) and it was introduced by automation company B&R. The EPSG cooperates with the standardization bodies and associations, like the CAN in Automation (CiA) Group and the IEC.

3.1 Atos POWERLINK device features

Following the main features of Atos Powerlink device:

- Multiplexing and PollResponse Chaining supported
- 1 TPDO and 1 RPDO supports dynamic process data remapping from the network; 16 Byte Max allowed in each direction (see 5.5)
- The module is capable of participating as an isochronous Controlled Node (CN) in EPL networks (sync signal on SoC)
- Cycle times down to 200 µs

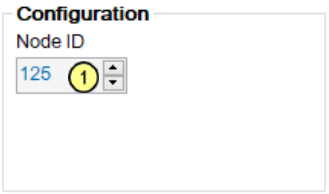
3.2 Assigning node ID to Atos CN device

Make sure you have assigned the drive node ID before making the EPL connection. Verify that no two drives on the network have the same node ID.

The default valve node is factory set at 125. The fieldbus node can be assigned by E-SW-SETUP software or by SDO service.

3.3 Node ID setting

In ‘Network Management > Configuration’ software window is possible set the Node ID using E-SW-SETUP software



Default address is node 125. When new driver is connected to the network first time, its node 125 address should be changed from a value between 1 and 239. Add one driver at time to the network, because two devices cannot coexist over the network using same node address.

Node ID

The control (1) allows to set the unique driver identification into the fieldbus.

Node 0: reserved for generic purposes - it can not be used
Node 240: reserved to manager EPL node
Nodes from 241 to 255: reserved for generic purposes - they can not be used

4 ETHERNET PHYSICAL LAYER

Ethernet physical layer defines all the relevant aspects data signals transmission between devices connected to the network.

4.1 Ethernet POWERLINK Network

A member of an Ethernet POWERLINK (EPL) network is called a node.

An EPL network comprises one Managing Node (MN) and one or more Controlled Nodes (CN). In this case, the controller is the MN and the device is the CN.

The MN starts and stops the network and initiates all communication. The CN responds to requests from the MN.

An EPL network is a private class C network with Net ID 192.168.100.0.

The first 3 octets are always 192.168.100 for all EPL nodes.

The node ID of an individual node is the last octet of the EPL IP address of that node.

The EPL IP address is not related in any way to the standard IP address given with the IP command.

e.g. if an EPL drive has the address of 110, its IP address is 192.168.100.110. The correlation of node ID with network IP is required, because EPL uses TCP/IP as part of the protocol.

4.2 Topology

Atos CN devices are supplied with two communication connections (see 4.4) to manage two EPL ports. An integrated Ethernet hub is implemented in the Atos CN device: this feature allows to use the two ports on the device interchangeably. Connect one EPL port of the Atos CN device to a port on the MN device (e.g. PLC).

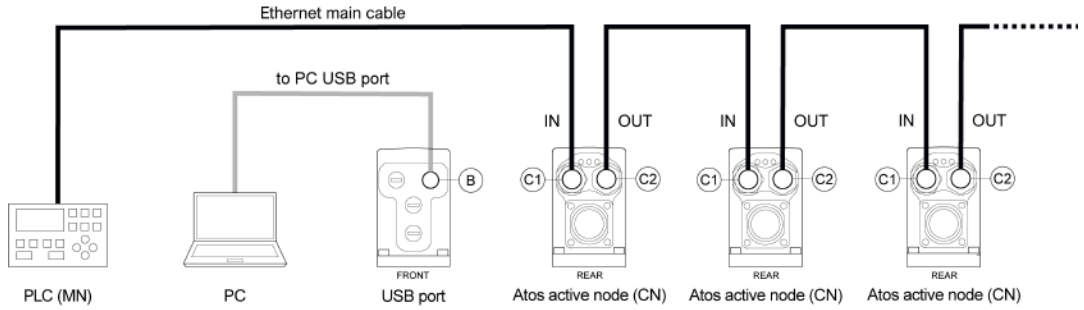
EPL network configuration is for the most part performed automatically by the MN (PLC). Please refer the PLC user guide for complete information on network configuration.

For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

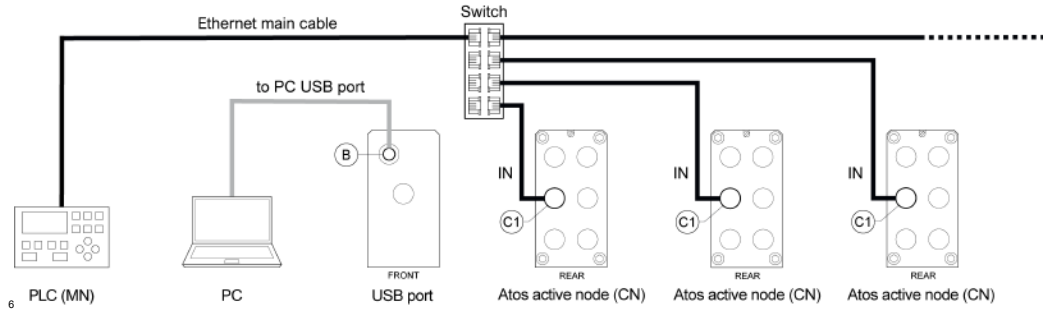
Max Nodes up to 255 slaves.

Network wiring connection examples:

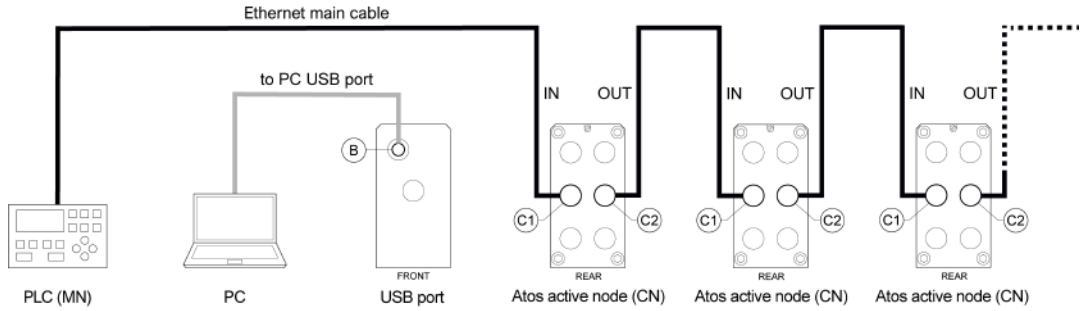
E-RI-TES/LES



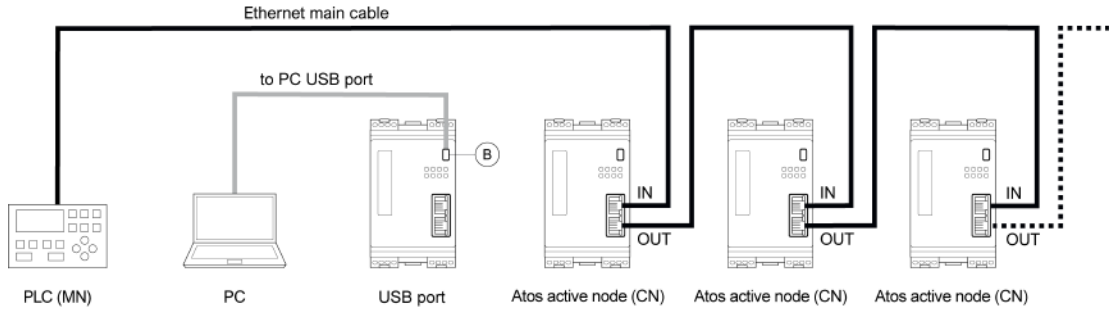
E-RA-TES/LES (via stub connection)



E-RA-TES/LES (daisy chain connection)



E-BM-TES/LES



4.3 Cables

To connect the EtherCAT devices only use cables that meet the Ethernet specifications.

Type	Signal	Distance between 2 nodes	Category
Ethernet on	100 BASE-TX Transformer Coupling	0,2 - 100 m	CAT5 or greater
	100 BASE-FX Fibre Optics	0,2 - 2 km	

4.4 Communication connections

The communication connections are different depending on the connected driver.

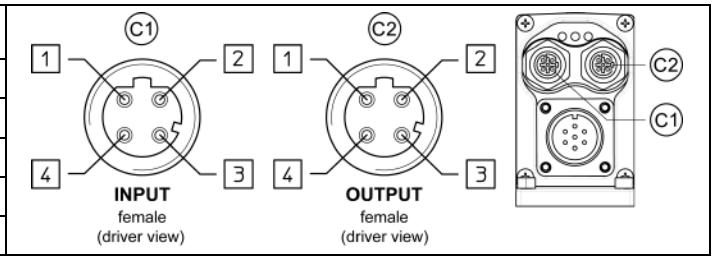
The external terminators are not required (internally terminated).

4.4.1 E-RI-TES/LES, E-RI-PES connectors

Two fieldbus communication connectors are always available.

To connect the driver into the POWERLINK network use dedicated M12 – 5 pin (coding D) connector standard IEC 61076-2-101.

PIN	SIGNAL	TECHNICAL SPECIFICATIONS
1	**TX+**	Transmitter+
2	**RX+**	Receiver+
3	**TX-**	Transmitter-
4	**RX-**	Receiver-
Housing	**SHIELD**	

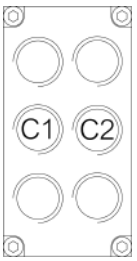


4.4.2 E-RA-TES/LES cable entrance

Two fieldbus communication cable entrance are always available.

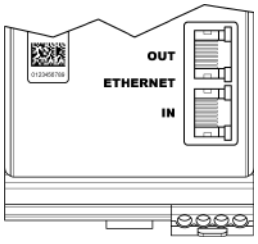
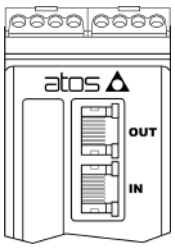
To connect the driver into the POWERLINK network use dedicated pin on terminal board.

CABLE ENTRANCE		SIGNAL	TECHNICAL SPECIFICATIONS
C1 (pin)	C2 (pin)		
14	13	**NC**	do not connect
16	15	**TX-**	Transmitter
18	17	**TX+**	Transmitter
20	21	**RX-**	Receiver
22	19	**RX+**	Receiver



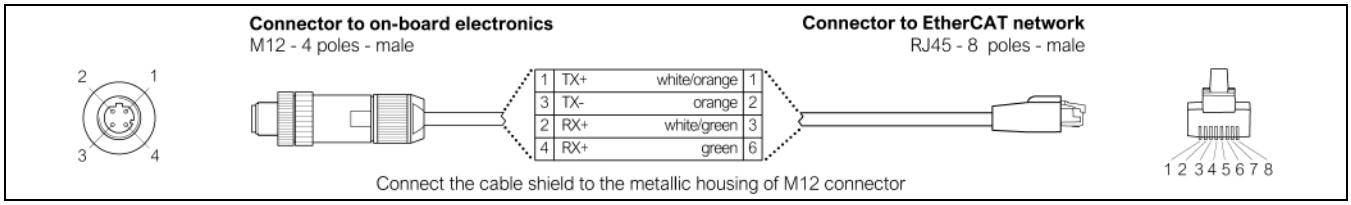
4.4.3 E-BM-TES/LES, E-BM-AES, E-BM-RES connector

One fieldbus communication connector is always available. To connect the driver into the POWERLINK network use dedicated DB9 - pin 9 connector.

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	E-BM-TES/LES	E-BM-AES E-BM-RES
1	**TX+**	Transmitter		
2	**RX+**	Receiver		
3	**TX-**	Transmitter		
6	**RX-**	Receiver		

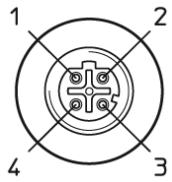
4.4.4 Ethernet cable wiring diagram example

Ethernet cable wiring diagram:



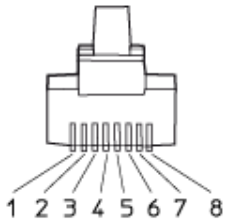
Connector to driver side (M12 d-code – 4 poles - male):

PIN	SIGNAL	COLOR (may change depending on cable)		TECHNICAL SPECIFICATIONS
1	**TX+**	white/orange	(or yellow)	Transmitter+
2	**RX+**	white/green	(or white)	Receiver+
3	**TX-**	orange	(or orange)	Transmitter-
4	**RX-**	green	(or blue)	Receiver-
Housing	**Shield**			Positioned on control cabinet side



Connector to ethernet network (RJ45 – 8 poles - male):

PIN	SIGNAL	COLOR (may change depending on cable)		TECHNICAL SPECIFICATIONS
1	**TX+**	white/orange	(or yellow)	Transmitter+
2	**TX-**	orange	(orange)	Transmitter-
3	**RX+**	white/green	(or white)	Receiver+
4		blue		(do not connect)
5		white/blue		(do not connect)
6	**RX-**	green	(or blue)	Receiver-
7		white/brown		(do not connect)
8		brown		(do not connect)

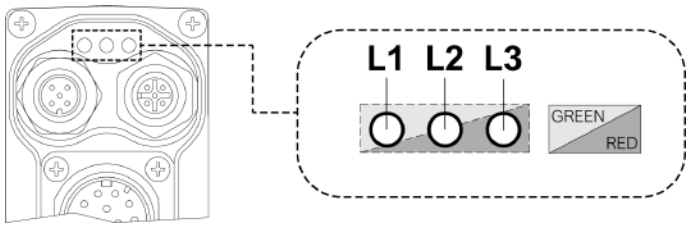


4.5 Led Diagnostic

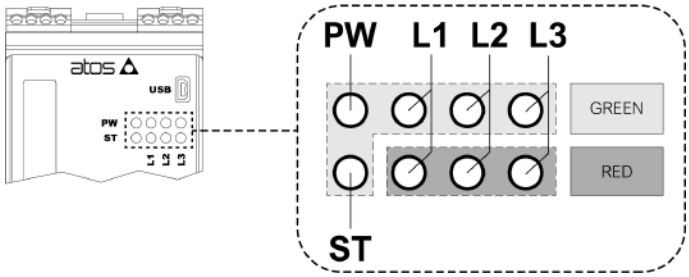
Driver operative conditions are shown by several leds for an immediate basic diagnostics of valve, network and solenoid.

Leds are not available for E-RA ex-proof drivers.

E-RI-TES/LES – E-RI-PES	
L1	LINK/ACT - VALVE STATUS
L2	NETWORK STATUS
L3	LINK/ACT - SOLENOID STATUS

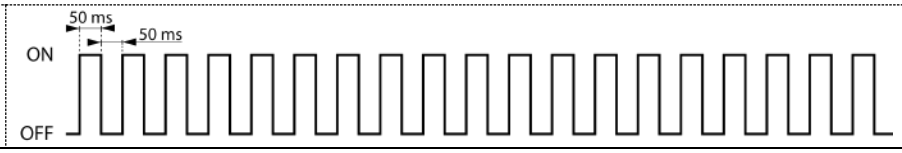
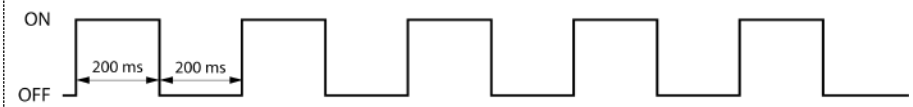
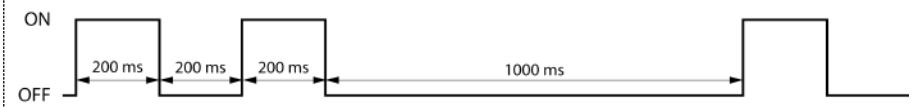
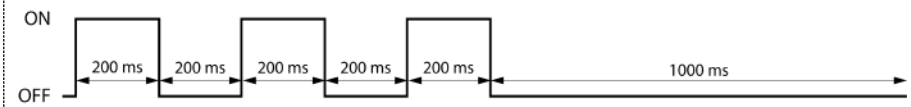


E-BM-TES/LES	
L1	LINK/ACT - VALVE STATUS
L2	NETWORK STATUS
L3	LINK/ACT - SOLENOID STATUS
PW	OFF = Power supply OFF ON = Power supply ON
ST	OFF = Fault present ON = No fault



Flash rate

Leds flash rate is used to define different driver operative conditions.

Flash Rate	Description	
ON	LED steady ON	
OFF	LED steady OFF	
Fast Flash	ON and OFF phase:	
	ON: 50ms OFF: 50ms	
Slow Flash	ON and OFF phase:	
	ON: 200 ms OFF: 200 ms	
Single Flash	One short flash ON followed by a long OFF phase:	
	ON: 200 ms OFF: 1000 ms	
Double Flash	Two short flash ON separated by a short OFF, followed by a long OFF phase:	
	ON: 200 ms OFF: 200 ms ON: 200 ms OFF: 1000 ms	
Triple Flash	Three short flash ON separated by two short OFF, followed by a long OFF phase:	
	ON: 200 ms OFF: 200 ms ON: 200 ms OFF: 200 ms ON: 200 ms OFF: 1000 ms	

Led flash rate timing are defined according to relevant specification.

L1 : LINK/ACT – VALVE STATUS

This led allows to display two different conditions:

- LINK/ACT (GREEN): state and activity of the physical link
- VALVE STATUS (RED): valve fault/warning conditions

LED	Function	Color	Flash rate	Status	Note
L1	VALVE STATUS	RED	OFF	No error / No warning	For more info about driver error reaction and conditions see relevant user manual (see 1.2.1)
			Slow Flash	Warning	
			ON	Fault	
	LINK/ACT	GREEN	OFF	Port closed LINK: no ACTIVITY: no	Input communication connector (see 4.4)
			Fast Flash	Port open LINK: yes ACTIVITY: yes	
			ON	Port open LINK: yes ACTIVITY: no	

Led flash rate between LINK/ACT and VALVE STATUS is not synchronized.

L2 : NETWORK STATUS

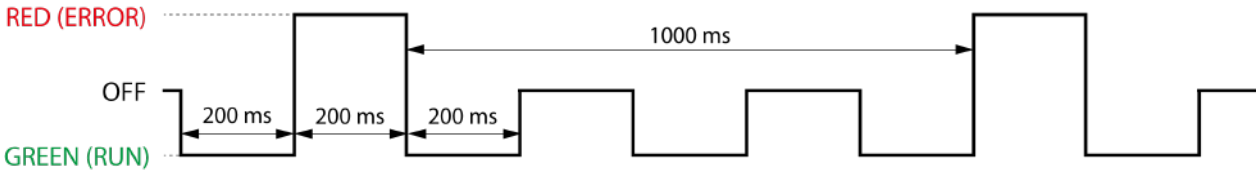
This led allows to display the network status condition:

- NETWORK STATUS (RED): state changes not required and SM Watchdog timeouts are displayed
- NETWORK STATUS (GREEN): the ESM status is displayed

LED	Function	Color	Flash rate	Status	Note
L2	NETWORK STATUS	RED	OFF	No error	
			ON	Fatal event	
		GREEN	OFF	Valve is OFF	Communication initializing or not active
			Fast Flash	NMT_CS_ BASIC_ETHERNET	Basic Ethernet state: no POWERLINK traffic has been detected
			Triple Flash	NMT_CS_ READY_TO_OPERATE	Ready to operate Asynchronous and synchronous data; No PDO data
			Double Flash	NMT_CS_ PRE_OPERATIONAL_2	Asynchronous and synchronous data; No PDO data
			Single Flash	NMT_CS_ PRE_OPERATIONAL_1	Only asynchronous data
			Slow Flash	NMT_CS_ STOPPED	Module stopped (for controlled shutdown, for example) Asynchronous and synchronous data; No PDO data
			ON	NMT_CS_ OPERATIONAL	Fully operational; Asynchronous and synchronous data PDO data is sent and received

In presence of multiple errors, the error that occurred first is indicated.

The following diagram displays the STATUS indicator behavior: the GREEN (RUN) status is 180 degree phase shift to the RED (ERROR) states.



In case of a conflict between turning the led on green versus red, the led is turned on RED.

L3 : LINK/ACT – SOLENOID STATUS

This led allows to display two different conditions:

- LINK/ACT (GREEN): state and activity of the physical link
- SOLENOID STATUS (RED): solenoid fault condition

LED	Function	Color	Flash rate	Status	Note
L3	SOLENOID STATUS	**RED**	OFF	No error	Solenoid current ON (*)
			Single Flash	Fault Hold	Only for state machine type **VDMA 1.6**: Solenoid current ON (*)
			Slow Flash	Fault Disabled	Only for state machine type **VDMA 1.6**: Solenoid current ON (*)
			Fast Flash	Fault	Only for state machine type **VDMA 1.5**: Solenoid current OFF (*)
				Fault Init	Only for state machine type **VDMA 1.6**: Solenoid current OFF (*)
			ON	Fault Fatal	Solenoid current OFF (*)
	LINK/ACT	**GREEN**	OFF	Port closed LINK: no ACTIVITY: no	Output communication connector (see 4.4)
			Fast Flash	Port open LINK: yes ACTIVITY: yes	
			ON	Port open LINK: yes ACTIVITY: no	

(*) For valve state machine description, refer relevant user manual (see 1.2.1).

Led flash rate between LINK/ACT and SOLENOID STATUS is not synchronized.

5 POWERLINK – DEVICE PROFILE

XDD (XML Device Description) – configuration file

An electronic description of Atos drivers POWERLINK characteristics is available through XDD configuration file. These files, available in MyAtos – Download Area (see 1.2.2), list the communication features and the accessible parameters thus allowing to speed up configuration process of fieldbus master devices.

5.1 Object Dictionary

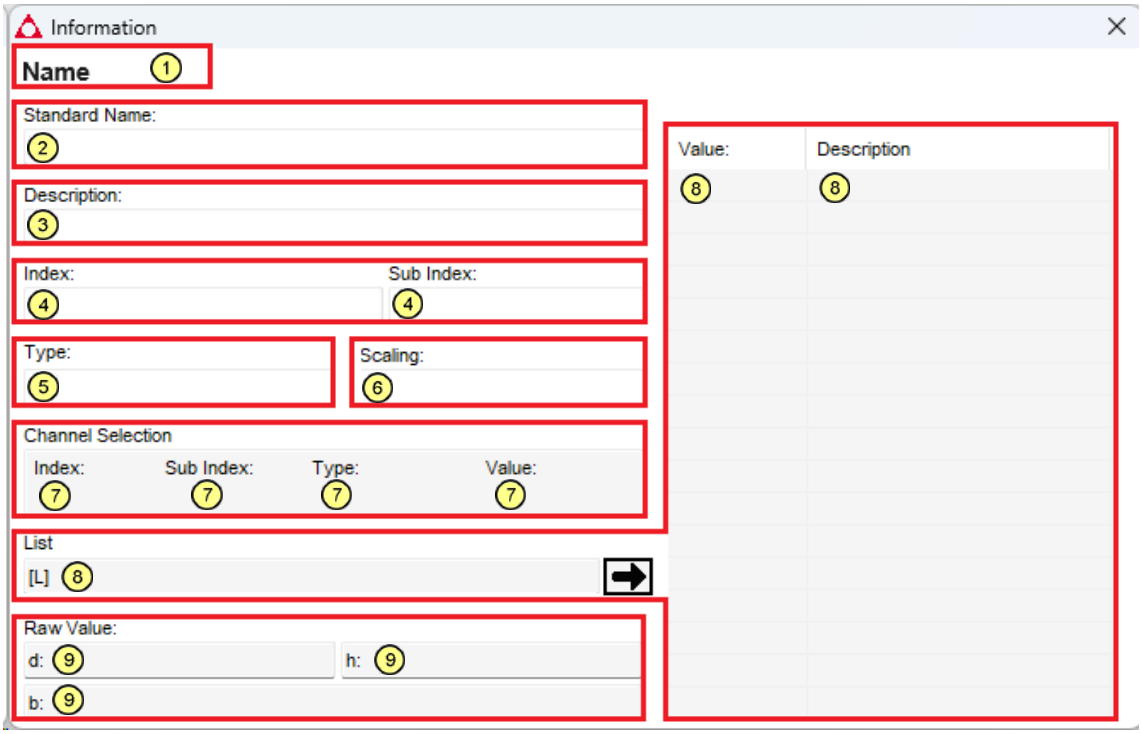
Object Dictionary is a collection of the available parameters that allow configuring driver's communication and functional behavior.

All parameters defined in object dictionary are accessible through SDO service and are identified by a unique index value.

Index groups as defined by DS301

<table>
<tr><th>Index (Hex)</th><th>Object Group (Profile Area)</th></tr>
<tr><td>1000-1FFF</td><td>Communication Profile Area (DS301)
contains the compatibility object with dedicated CoE object</td></tr>
<tr><td>2000-5FFF</td><td>Manufacturer Specific Profile Area (Application specific)
contains all parameters defined by Atos for the specific functions not included in standardized area</td></tr>
<tr><td>6000-9FFF</td><td>Standardized Device Profile Area (DS408 for Hydraulic Devices)
contains all parameters common to a class of standard devices functions:
<table>
<tr><td>6000-60FF</td><td>Device control and identification</td></tr>
<tr><td>6100-62FF</td><td>Valve, driver and controller actual value conditioning</td></tr>
<tr><td>6300-637F</td><td>Spool position control (open loop and closed loop)</td></tr>
<tr><td>6380-63FF</td><td>Pressure control (open loop and closed loop)</td></tr>
<tr><td>6400-647F</td><td>Additional parameters for closed loop and P/Q control</td></tr>
</table></td></tr>
<tr><td>A000-FFFF</td><td>Reserved for further use</td></tr>
</table>

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:



4 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 for SDO operations.

5 Type

Parameter dimension and data type:

Type	Dimension	SDO messages (command)
BYTE	8 bit	Expedited (4Fh/2Fh)
UNSIGNED8	8 bit	
INTEGER8	8 bit	
UNSIGNED16	16 bit	Expedited (4Bh/2Bh)
INTEGER16	16 bit	
INTEGER32	32 bit	Expedited (43h/23h)
UNSIGNED32	32 bit	
V_STRING16	8 bit x 16	Segmented
V_STRING64	8 bit x 64	

⑥ Scaling

Parameter scaling value.

Scaling function is required to transform the raw value transmitted via SDO 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 5.7)

⑦ Channel Selection

PreParameter info.

Some parameters are multiplexed on the same Index and SubIndex.
Write 'PreParameter' selector parameter before any other operation:
required 'PreParameter' Index, SubIndex, Type and Value are indicated.

Address		**Channel Selection**			
Index	*SubIndex*	*'PreParameter' Index*	*'PreParameter' SubIndex*	*'PreParameter' Type*	*'PreParameter' Value*

⑧ List

Parameter List information: Value and Description.

⑨ Raw Value

Numeric parameter (for more information see 5.7.1)

The raw value is displayed in three different formats:

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

5.2 EMCY configuration

Atos proportionals manage different EMCY messages depending on the specific driver code:

Error Meaning		Code [hex]	Register [hex]	Manufacturer [hex]	RI/RA/BM - TES/LES-N	RI/RA/BM - TES/LES-S	RI - PES
No Error		0000	01		x	x	x
Solenoid S1 Short Circuit		2211	23	00	x	x	x
Solenoid S2 Short Circuit		2212	23	00	x	x	
+5V Fault		3200	05	02	x	x	x
+15V Fault		3200	05	03	x	x	x
-15V Fault		3200	05	04	x	x	x
+24VF Fault		3200	05	05		x	x
+7,5VP Fault		3200	05	07			
+5V USB Fault		3300	05	01	x	x	x
Fault Signal Hardware Error		3300	05	11	x	x	x
Monitor Signal Hardware Error		3300	05	21	x	x	x
+24V Solenoid Too High		3411	25	00	x	x	x
+24V Solenoid Too Low		3412	25	00	x	x	x
+24VL Logic Too High		3421	25	00	x	x	x
+24VL Logic Too Low		3422	25	00	x	x	x
Low Temperature		4212	29	00	x	x	x
High Temperature		4211	29	00	x	x	x
Critical Overtemperature		4211	29	01	x	x	x
Temperature Sensor Error		5000	01	01	x	x	x
Fieldbus Hardware Error		5000	01	02	x	x	x
ADC Hardware Error		5000	01	03	x	x	x
Flow Setpoint Out of Limits		5231	21	00	x	x	x
Pressure / Force Setpoint Out of Limits		5232	21	00		x	x
Pressure 1 / Force Transducer Out of Limits		5234	21	00		x	x
Pressure 2 Transducer Out of Limits	(1)	5235	21	00		x	
Main Spool Transducer Out of Limits		5236	21	00	x	x	x
Solenoids Current Fault		5239	21	00	x	x	x
Pilot Spool Transducer Out of Limits	(1)	523A	21	00	x	x	x
Memories Error		5530	21	00	x	x	x
Automatic Reset Error		6010	21	00	x	x	x
Emergency Parameters Loaded		6300	01	00	x	x	x
Invalid Valve Parameters		6310	21	00	x	x	x
Invalid Fieldbus Parameters		6310	21	01	x	x	x
Invalid Parameters Downloaded		6320	21	00	x	x	x
Generic Fieldbus Communication Error		8100	11	00	x	x	x
RPDO Timeout		8250	11	00	x	x	x
Out of Operational		FF31	81	00	x	x	x
Solenoids Current Control Error		8300	21	01	x	x	x
Pilot Spool Control Error	(2)	8300	21	02	x	x	x
Main Spool Control Error		8300	21	03	x	x	x
Pressure / Force Control Error		8302	21	00		x	x
Pressure / Force Setpoint Limits Touched		F090	01	02		x	x

(1) Not available for TES-N and TES-S drivers

(2) Available only for TES/LES-S drivers with SF pressure/force control selected

Error register byte is a bitwise field where:

Bit 7	Manufacturer specific error
Bit 6	Reserved
Bit 5	Device profile error
Bit 4	Communication error
Bit 3	Temperature error
Bit 2	Voltage error
Bit 1	Current error
Bit 0	General error

Refer to relevant user manual for a complete errors description (see 1.2.1).

5.3 Errors reaction configuration

The driver has different selectable reaction for each error.

Refer to relevant user manual for a complete errors reaction description (see 1.2.1).

Index	2F00h	**SubIndex**	00h	**Data Type**	UNSIGNED8

Selection	**Value (hex)**	**Description**
No reaction	00h	
Message	06h	
Warning	01h	
Minor error	02h	
Serious error	03h	
Critical error	04h	
Fatal error	05h	

5.4 State machine selection – VDMA 1.5 vs VDMA 1.6

The driver can be operated using two different state machine type.

Index	220Dh	**SubIndex**	00h	**Data Type**	UNSIGNED8

Selection	**Value**	**Notes**
State Machine – VDMA 1.5	0	
State Machine – VDMA 1.6	1	

State Machine – VDMA 1.5

Driver automatically selects 16 bit 'Flow' and 'Pressure/Force' reference:

- Flow reference = "%" (16383 = 100%)
- Pressure/Force reference = "%" (16383 = 100%)

 e.g. : the 100% value is given by Pressure/Force>Configuration>Full Scale

State Machine – VDMA 1.6

Driver automatically selects 32 bit 'Flow' and 'Pressure/Force' reference:

- Flow reference = "%" (100000 = 100%)
- Pressure reference = "mbar"
- Force reference = "N"

5.5 PDO configuration

1 TPDO and 1 RPDO supports dynamic process data remapping from the network; 16 Byte Max allowed in each direction.

5.5.1 TPDO Mapping

Object	Index	SubIndex	Type	Valve Type	
				SN	SP,SF,SL
Status Word - 16bit	0x6041	0x00	UNSIGNED16	X	X
Status Word 2 - 16bit	0x2541	0x00	UNSIGNED16	X	X
Status Word - 32bit	0x6045	0x00	UNSIGNED32	X	X
Flow Actual Value - 16bit	0x6301	0x01	INTEGER16	X	X
Flow Actual Value - 32bit	0x6309	0x01	INTEGER32	X	X
Pressure/Force Actual Value - 16bit	0x6381	0x01	INTEGER16		X
Pressure/Force Actual Value - 32bit	0x6389	0x01	INTEGER32		X
Output Working Counter - 16bit	0x2B01	0x00	UNSIGNED16	X	X
Output Working Counter - 32bit	0x2B03	0x00	UNSIGNED32	X	X
Output 1 16bit	0x2F50	0x00	INTEGER16	X	X
Output 2 16bit	0x2F51	0x00	INTEGER16	X	X
Output 3 16bit	0x2F52	0x00	INTEGER16	X	X
Output 4 16bit	0x2F53	0x00	INTEGER16	X	X
Output 1 32bit	0x2F56	0x00	INTEGER32	X	X
Output 2 32bit	0x2F57	0x00	INTEGER32	X	X
Output 3 32bit	0x2F58	0x00	INTEGER32	X	X
Output 4 32bit	0x2F59	0x00	INTEGER32	X	X
Output 5 32bit	0x2F5A	0x00	INTEGER32	X	X
Output 6 32bit	0x2F5B	0x00	INTEGER32	X	X
Output 7 32bit	0x2F5C	0x00	INTEGER32	X	X
Pilot Actual Value - 16bit	0x20D1	0x01	INTEGER16	X	X
Pressure/Force Error	0x63D0	0x01	INTEGER16		X

5.5.2 RPDO Mapping

Object	Index	SubIndex	Type	Valve Type	
				SN	SP,SF,SL
Control Word - 16bit	0x6040	0x00	UNSIGNED16	X	X
Control Word 2 - 16bit	0x2040	0x00	UNSIGNED16	X	X
Control Word - 32bit	0x6044	0x00	UNSIGNED32	X	X
Flow Reference - 16bit	0x6300	0x01	INTEGER16	X	X
Flow Reference - 32bit	0x6308	0x01	INTEGER32	X	X
Pressure/Force Reference - 16bit	0x6380	0x01	INTEGER16		X
Pressure/Force Reference - 32bit	0x6388	0x01	INTEGER32		X
Input Working Counter - 16bit	0x2B00	0x00	UNSIGNED16	X	X
Input Working Counter - 32bit	0x2B02	0x00	UNSIGNED32	X	X
Input 1 16bit	0x2F30	0x00	INTEGER16	X	X
Input 2 16bit	0x2F31	0x00	INTEGER16	X	X
Input 3 16bit	0x2F32	0x00	INTEGER16	X	X
Input 4 16bit	0x2F33	0x00	INTEGER16	X	X
Input 1 32bit	0x2F36	0x00	INTEGER32	X	X
Input 2 32bit	0x2F37	0x00	INTEGER32	X	X
Input 3 32bit	0x2F38	0x00	INTEGER32	X	X
Input 4 32bit	0x2F39	0x00	INTEGER32	X	X
Input 5 32bit	0x2F3A	0x00	INTEGER32	X	X
Input 6 32bit	0x2F3B	0x00	INTEGER32	X	X
Input 7 32bit	0x2F3C	0x00	INTEGER32	X	X

5.6 Fieldbus parameters

Fieldbus Parameters are used to move equal size values of other parameters present in object dictionary (see 1.4.4 and see 5.1) avoiding the elaborate CoE PDO mapping procedure.

Two Fieldbus parameters types are available:

- Fieldbus Input: received data from Driver Atos
- Fieldbus Output: transmitted data from Driver Atos

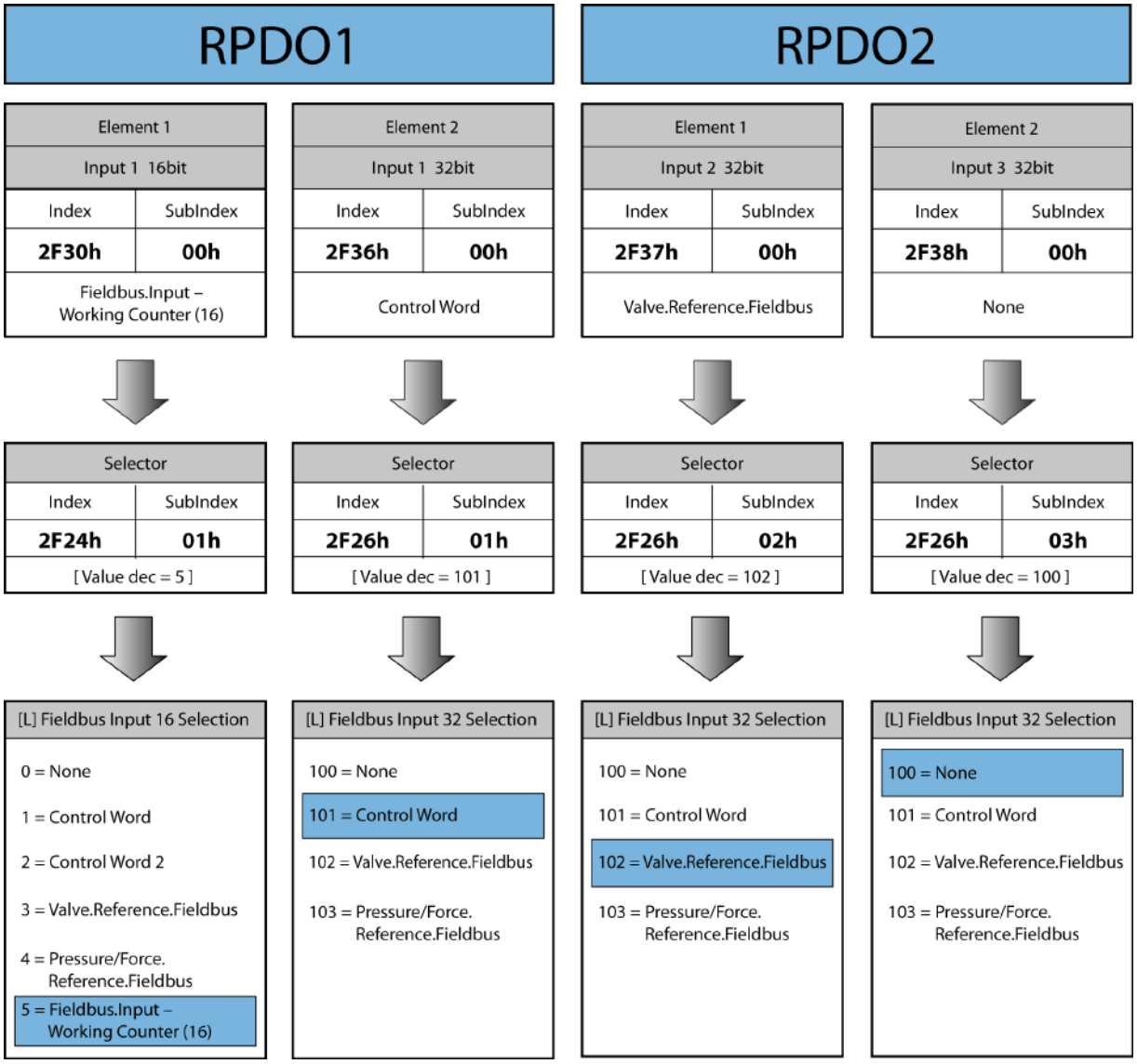
Each Fieldbus Parameter is associated to Selection Parameter which is used to map the objects:

Fieldbus Parameters				**Selection Parameter**		
Fieldbus In / Out	**Bit**	**Mapping Index**	**Mapping SubIndex**	**Selector Index**	**Selector SubIndex**	**Data Type**
Input 1	16	2F30h	00h	2F24h	01h	INTEGER16
Input 2		2F31h			02h	
Input 3		2F32h			03h	
Input 4		2F33h			04h	
Input 1	32	2F36h	00h	2F26h	01h	INTEGER32
Input 2		2F37h			02h	
Input 3		2F38h			03h	
Input 4		2F39h			04h	
Input 5		2F3Ah			05h	
Input 6		2F3Bh			06h	
Input 7		2F3Ch			07h	
Output 1	16	2F50h	00h	2F25h	01h	INTEGER16
Output 2		2F51h			02h	
Output 3		2F52h			03h	
Output 4		2F54h			04h	
Output 1	32	2F56h	00h	2F27h	01h	INTEGER32
Output 2		2F57h			02h	
Output 3		2F58h			03h	
Output 4		2F59h			04h	
Output 5		2F5Ah			05h	
Output 6		2F5Bh			06h	
Output 7		2F5Ch			07h	

Example:

RPDO1 / RPDO2 mapping:

- RPDO1: 'Fieldbus.Input – Working Counter (16)' + 'Control Word'
- RPDO2: 'Valve.Reference.Fieldbus' + 'None'



5.7 Scaling Descriptions

For POWERLINK communication (PDO/SDO services) 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.

5.7.1 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
decmsec_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	%

Real_Value [Real Unit] = Gain_Raw_to_Real ∗ Raw_Value

Raw_Value = Gain_Real _to_Raw ∗ Real_Value [Real Unit]

Example, write:

To set the regulation of a TES-N closed loop valve at 50%:

Parameter	Index	SubIndex	PreAccess			Scale
Valve/Driver Signals > Valve/Flow > Demand	6310	01				INT16_to_Perc200

The Raw_Value for SDO or PDO service corresponds to 8192:

- Gain_Real_to_Raw ∗ 50[%] → (32767/200) ∗ 50 = 8192

Example, read:

To read the input actual value to flow analog reference, e.g. 2[V]:

Parameter	Index	SubIndex	PreAccess			Scale
Valve/Flow/Position > Ref. Analog Range > Input Actual Value	2E05	01	2E01	00	00	INT32_to_V_mA

The Raw_Value for SDO service is equal to 20000. The Real_Value is given by:

- Gain_Raw_to_Real ∗ 2000 → 0,0001 ∗ 20000 = 2[V]

5.7.2 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	**A_raw**: (Most Significant Word)	**B_raw**: (Less Significant Word)

where for Gain function:

*Real_Gain = (A_raw / B_raw) * Real_Fullscale*

5.7.3 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

5.7.4 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 µs with scaling defined as 'RAW_µs':

Parameter	Index	SubIndex	PreAccess			Scale
Valve/Flow/Position > Ref. Analog Range > Filter Time	2E32h	01h	2E01	00	00	RAW_µs

Raw_µs = Physical value

1000 (Raw_µs) = 1000 µs (Physical value)

Example 2

Set parameter value 'Full Scale' at 100 mbar/N with scaling defined as 'RAW_ mbar/RAW_N':

Parameter	Index	SubIndex	PreAccess			Scale
Pressure/Force > Configuration > Pressure Full Scale	2E22h	01h	2E01	00	00	RAW_mbar/RAW_N

Raw value = Physical value

100 (RAW_ mbar/RAW_N) = 100 mbar/N (Physical value)

5.7.5 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
Pressure	2	RAW_mbar	mbar
Pressure for Force	-2	RAW_mN	mN
Force	-1	RAW_mN	mN
Spool Position	1	INT32_to_Perc200	%
Differential Pressure	3	RAW_mbar/RAW_N	mbar/N
Flow	4	RAW_mL/min	mL/min

Example:

Parameter	Index	SubIndex	PreAccess			Scale
Pressure/Force > Ref. Analog Range > Type	2E02h	00h	2E01h	00h	01h (*)	[L] List Interface Type
Pressure/Force > Ref. Analog Range > Measure Actual Value	2E04h	01h	2E01h	00h	01h (*)	VALUE_to_Physical

(*) 00h corresponds to 'Valve/Flow/Position > Ref. Analog Range'
01h corresponds to 'Pressure/Force > Ref. Analog Range'
03h corresponds to 'Pressure/Force > Transducer 1'
04h corresponds to 'Pressure/Force > Transducer 2'
05h corresponds to 'Valve/Flow > Main Spool Position Transducer'
08h corresponds to 'Valve/Flow - Pilot > Pilot Spool Position Transducer'

Pressure/Force > Ref. Analog Range

- Read parameter 'Pressure/Force > Ref. Analog Range > Type'
- Parameter 'Pressure/Force > Ref. Analog Range > Type' is equal to 2
- Value type 2 correspond to scaling 'RAW_mbar/ RAW_N'
- Any read/write operation to 'Pressure/Force > Ref. Analog Range > Max Measure' uses measure unit equal to 'mbar/N'

5.8 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.

5.8.1 Status Word – 16bit

Index	6041h

SubIndex	00h

Conditions:

MSB *LSB*

Bit	**15**	**14-13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3-0**
Content	**Res**	**Pressure/Force PID Selection**	**Pressure/Force Target Reached**	**Control Error**	**Limit Touched**	**Res**	**P/Q**	**Power Limitation Active**	**Res**	**Warning**	**Local**	**Status**


Bit 7 is valid only for PES.


Bits 8, 10, 11, 12, 13, 14 are valid only for PES and TES/LES-S.

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 fieldbus (see 5.8.3 – control word) or not:

Local (bit 4)	
Local (internal) control	1
Remote (fieldbus) 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’.

Power Limitation Active

Bit 7 indicates if the control (Power Limitation Active) is active or is not active:

Power Limitation Status (bit 7)	
No active	0
Active	1

 This indication is valid only for PES.

P/Q

Bit 8 indicates which control is active (Flow or Pressure/Force) when using alternated control logic:

P/Q (bit 8)	
Flow active	0
Pressure/Force active	1

 For full description refer to the specific driver manual section: ‘Valve Signals – Extended Page’.

 This indication is valid only for PES and TES/LES-S.

Limit Touched

Bit 10 indicates when the demanded pressure/force value is out of limit:

Limit Touched (bit 10)	
Limit not touched	0
Limit touched	1

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

 This indication is valid only for PES and TES/LES-S.

Control Error

Bit 11 indicates when a pressure/force error is present:

Control Error (bit 11)	
Normal working	0
Control error present	1

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

 This indication is valid only for PES and TES/LES-S.

Pressure/Force Target Reached

Bit 12 indicates when the actual regulated pressure/force has reached the demanded value:

Pressure/Force target reached (bit 12)	
Not reached	0
Reached	1

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

 This indication is valid only for PES and TES/LES-S.

Pressure/Force PID Selection

Bits 14-13 indicate which pressure/force PID is active:

Pressure/Force PID selection (bits 14-13)	
PID1	00
PID2	01
PID3	10
PID4	11

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

 This indication is valid only for PES and TES/LES-S.

5.8.2 Status Word - 32bit

Index	6045h	**SubIndex**	00h

Conditions:

MSB *LSB*

Bit	31-15	14-13	12	11	10	9	8	7	6	5	4	3-0
Content	Res	Pressure/Force PID Selection	Pressure/Force Target Reached	Control Error	Limit Touched	Res	P/Q	Power Limitation Active	Res	Warning	Local	Status

Bit 7 is valid only for PES.

Bits 8, 10, 11, 12, 13, 14 are valid only for PES and TES/LES-S.

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 fieldbus (see 5.8.4 – control word) or not:

Local (bit 4)	
Local (internal) control	1
Remote (fieldbus) 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’.

Power Limitation Active

Bit 7 indicates if the control (Power Limitation Active) is active or is not active:

Power Limitation Status (bit 7)	
No active	0
Active	1

This indication is valid only for PES.

P/Q

Bit 8 indicates which control is active (Flow or Pressure/Force) when using alternated control logic:

P/Q (bit 8)	
Flow active	0
Pressure/Force active	1

For full description refer to the specific driver manual section: ‘Valve Signals – Extended Page’.

This indication is valid only for PES and TES/LES-S.

Limit Touched

Bit 10 indicates when the demanded pressure/force value is out of limit:

Limit Touched (bit 10)	
Limit not touched	0
Limit touched	1

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

 This indication is valid only for PES and TES/LES-S.

Control Error

Bit 11 indicates when a pressure/force error is present:

Control Error (bit 11)	
Normal working	0
Control error present	1

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

 This indication is valid only for PES and TES/LES-S.

Pressure/Force Target Reached

Bit 12 indicates when the actual regulated pressure/force has reached the demanded value:

Pressure/Force target reached (bit 12)	
Not reached	0
Reached	1

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

 This indication is valid only for PES and TES/LES-S.

Pressure/Force PID Selection

Bits 14-13 indicate which pressure/force PID is active:

Pressure/Force PID selection (bits 14-13)	
PID1	00
PID2	01
PID3	10
PID4	11

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

 This indication is valid only for PES and TES/LES-S.

5.8.3 Control Word - 16bit

Index	6040h	SubIndex	00h

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

MSB						*LSB*
Bit	**15**	**14-13**	**12-9**	**8**	**7-4**	**3-0**
Content	**Res**	**Pressure/Force PID Selection**	**Res**	**Pressure/Force Control Enable**	**Res**	**Control**

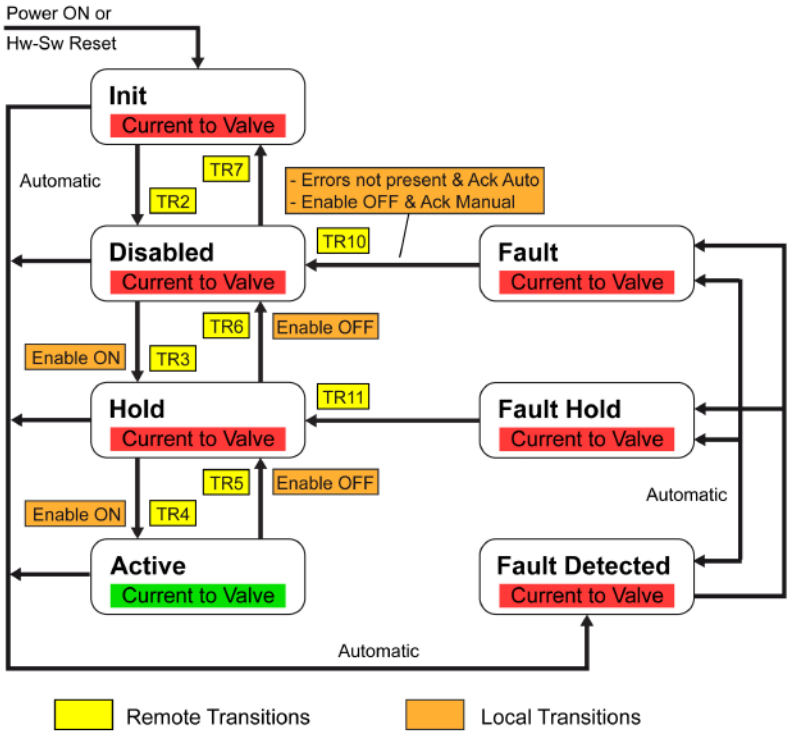
The modifications of the control word bits have effect only if the remote (fieldbus) control is active (see 5.8.1).

Bits 8, 13, 14 are valid only for PES and TES/LES-S.

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	xxx**1**
TR3	up to Hold	xx**11**
TR3	up to Active	x**111**
TR5	down to Hold	x**0**xx
TR6	down to Disable	x**00**x
TR7	down to Init	x**000**
TR10	exit Fault	**0**x**0**x -> **1**x**0**x
TR11	exit Fault Hold	**0**x**1**x -> **1**x**1**x

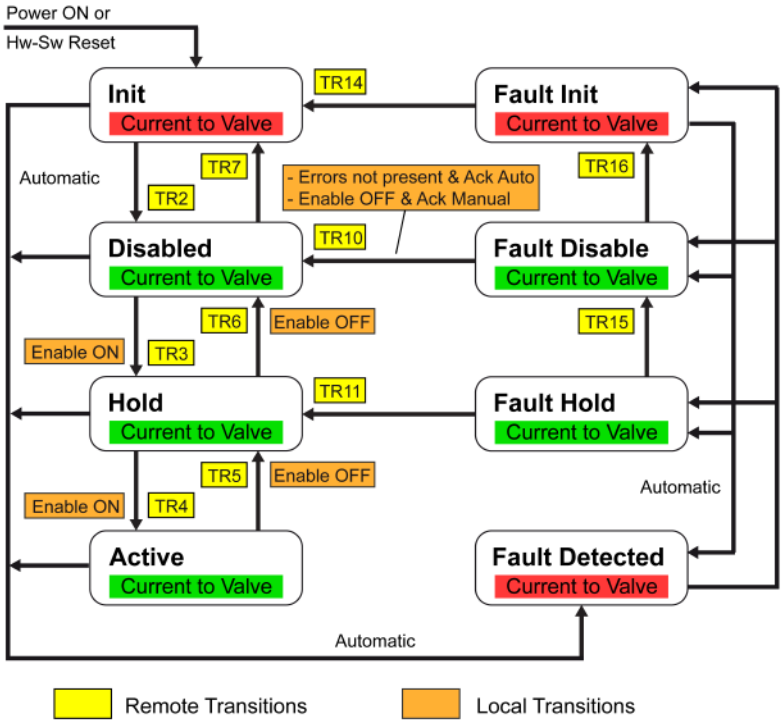


Thanks to 'x' not care conditions it is possible to repeat the same control word to reach a defined drive state (up or down); example - to reach Active from Init, simply repeat 'x111' control word command.

Control (state machine – VDMA 1.6)

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	xxx**1**
TR3	up to Hold	xx**11**
TR4	up to Active	x**111**
TR5	down to Hold	x**0**xx
TR6	down to Disable	x**00**x
TR7	down to Init	x**000**
TR10	exit Fault Disable	**0001 -> 1001**
TR11	exit Fault Hold	**0011 -> 1011**
TR14	exit Fault Init	**0000 -> 1000**
TR15	down to Fault Disable	x**001**
TR16	down to Fault Init	x**000**



Thanks to 'x' not care conditions it is possible to repeat the same control word to reach a defined drive 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
TR2	up to Disable	xxx**1**	000**1** 001**1** 010**1** 011**1** 100**1** 101**1** 110**1** 111**1**

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

Remote transition		Control value (bits 3-0)	Allowed combinations
TR3	up to Hold	xx**11**	00**11** 01**11** 10**11** 11**11**

Pressure/Force Control Enable

Bit 8 allows to select Enable when the alternated control is active:

Pressure/Force Control Enable (bit 8)	
Flow control active	0
Alternated control active	1

This control is valid only for PES and TES/LES-S.

Valid only for active control selection equal "Alternated Controls or Flow Control".

Pressure/Force PID Selection

Bits 14-13 indicate which pressure/force PID is active:

Pressure/Force PID selection (bits 14-13)	
PID1	00
PID2	01
PID3	10
PID4	11

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

This indication is valid only for PES and TES/LES-S.

5.8.4 Control Word - 32bit

Index	6044h	SubIndex	00h

Conditions:

MSB *LSB*

Bit	31-15	14-13	12-9	8	7-4	3-0
Content	Res	Pressure/Force PID Selection	Res	Pressure/Force Control Enable	Res	Control

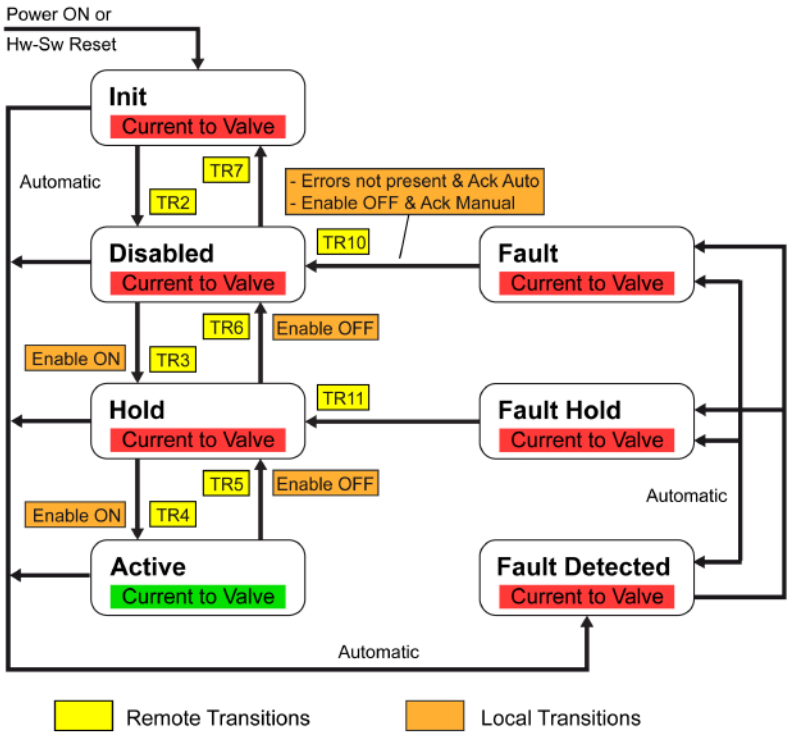
The modifications of the control word bits have effect only if the remote (fieldbus) control is active (see 5.8.1).

Bits 8, 13, 14 are valid only for PES and TES/LES-S.

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	xxx**1**
TR3	up to Hold	xx**11**
TR3	up to Active	x**111**
TR5	down to Hold	x**0**xx
TR6	down to Disable	x**00**x
TR7	down to Init	x**001**
TR10	exit Fault	**0**x**0**x -> **1**x**0**x
TR11	exit Fault Hold	**0**x**1**x -> **1**x**1**x

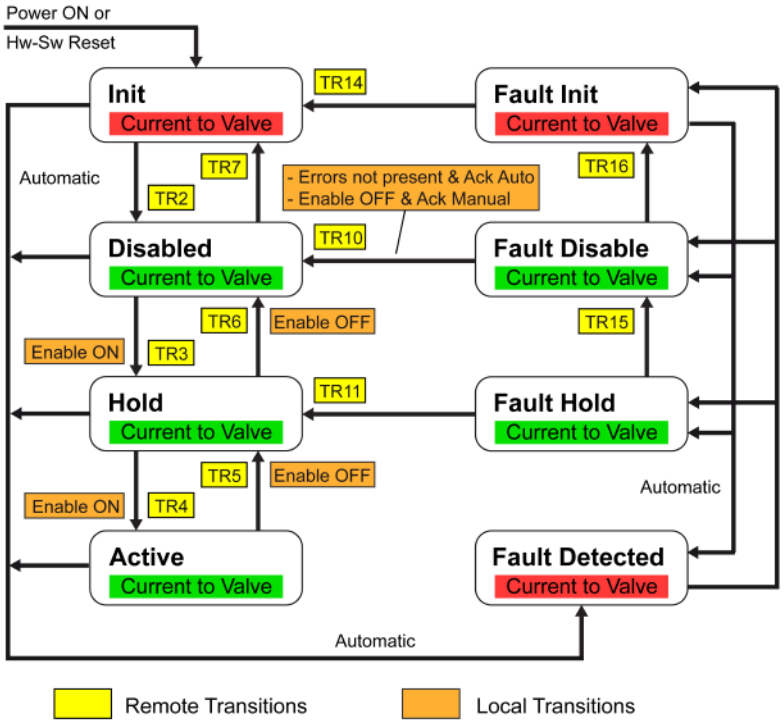


Thanks to 'x' not care conditions it is possible to repeat the same control word to reach a defined drive state (up or down); example - to reach Active from Init, simply repeat 'x111' control word command.

Control (state machine – VDMA 1.6)

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	xxx**1**
TR3	up to Hold	xx**11**
TR4	up to Active	x**111**
TR5	down to Hold	x**0**xx
TR6	down to Disable	x**00**x
TR7	down to Init	x**000**
TR10	exit Fault Disable	**0001 -> 1001**
TR11	exit Fault Hold	**0011 -> 1011**
TR14	exit Fault Init	**0000 -> 1000**
TR15	down to Fault Disable	x**000**
TR16	down to Fault Init	x**000**



Thanks to ‘x’ not care conditions it is possible to repeat the same control word to reach a defined drive 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
TR2	up to Disable	xxx**1**	000**1** 001**1** 010**1** 011**1** 100**1** 101**1** 110**1** 111**1**

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

Remote transition		Control value (bits 3-0)	Allowed combinations
TR3	up to Hold	xx**11**	00**11** 01**11** 10**11** 11**11**

Pressure/Force Control Enable

Bit 8 allows to select Enable when the alternated control is active:

Pressure/Force Control Enable (bit 8)	
Flow control active	0
Alternated control active	1

This control is valid only for PES and TES/LES-S.

Valid only for active control selection equal "Alternated Controls or Flow Control".

Pressure/Force PID Selection

Bits 14-13 indicate which pressure/force PID is active:

Pressure/Force PID selection (bits 14-13)	
PID1	00
PID2	01
PID3	10
PID4	11

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

This indication is valid only for PES and TES/LES-S.

5.8.5 Save and Load parameters

Two types of driver parameters can be separately saved and loaded, valve parameters and fieldbus parameters:

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

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

Driver “User/Factory/Emergency Parameters” (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 allow 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 the driver goes into “Fault” condition (see 5.8.3); please contact Atos Technical Sales Support ele-support@atos.com.

Save operations

This operation allows to save the driver “Actual Parameters” (non-permanent) into the “User Set” (permanent).

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

Both save and load operations can be operated separately for the valve functional parameters and for the fieldbus communication parameters.

During the save/load 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
- current to valve solenoid is switched off, is best to operate save/load with no active valve regulation in the system

A single SDO write operation is required to perform save operation; use proper SubIndex value to select which part of driver parameters to be saved:

Index	1010h

SubIndex	
01h	Save Functional & Communication parameters
02h	Save Communication parameter
03h	Save Functional parameter

The SDO write operation must be performed with the parameter data part set to “save” (byte 5..8 set to 65766173 hex value).

Load operations

Two operations are available to select which parameters set has to be loaded into “Actual parameters” at the next driver power-on:

- “Load Factory” “Factory Set” will be load at next driver power-on
- “Load User” “User Set” will be load at next driver power-on

During the loading 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 null hydraulic regulation.

A single SDO write operation is required to perform load operation; use proper SubIndex value to select which part of driver parameters to be loaded:

Index	1011h

SubIndex	
01h	Load Functional & Communication ‘Factory’
02h	Load Communication parameter ‘Factory’
03h	Load Functional parameter ‘Factory’
05h	Load Functional parameter ‘User’
06h	Load Communication parameter ‘User’
07h	Load Functional & Communication ‘User’

The SDO write operation must be performed with the parameter data part set to “load” (byte 5..8 set to 64616F6C hex value)

5.8.6 Driver restart parameter

Driver restart procedure can be performed in two different modalities according to the firmware version.

Index	2FFFh	**SubIndex**	00h	**Data Type**	UNSIGNED8

Selection	**Value**	**Notes**
No Restart	0	
Slow Restart	1	for firmware versions T13/S13 or lower
Fast Restart	2	for firmware versions T14/S14 or greater

5.8.7 Valve Signals – Extended Page > Digital Input > DI 0...7

Index	2421h	**SubIndex**	01h

This parameter indicates the presence of Enable or digital inputs on the driver connector:

Enable (bit 0)	
Enable ON (24V)	0
Enable OFF (0V)	1

Enable is available for TES/LES-N with /Q or /Z option, TES/LES-S and PES with /X or /SX option.

5.8.8 Valve Signals – Extended Page > Digital Output > DO 0...7

Index	2451h	**SubIndex**	01h

This parameter indicates the presence of Fault or digital outputs on the driver connector:

Fault (bit 0)	
Fault present (0V)	1
Fault not present (24V)	0

Fault is available TES/LES-N with /F or /Z option, TES/LES-S and PES.

Fault signal available on connector uses inverted logics in order to intercept as a fault also the cable breakage.

5.8.9 Valve Signals – Extended Page > Detailed Errors > Err 0-31

Index	2F15h	SubIndex	01h

This parameter indicates which alarms/errors are actually present into the driver; this is a more detailed indication of the standard error indication (see 5.2):

Bit	Error	RI/RA/BM - TES/LES-N	RI/RA/BM - TES/LES-S	RI - PES
0	Solenoids Current Control Error	x	x	x
1	High Temperature	x	x	x
2	Low Temperature	x	x	x
3	Main Spool Transducer Out of Limits	x	x	x
4	Pressure 1 / Force Transducer Out of Limits (1)		x	x
5	Pilot Spool Transducer Out of Limits (1)	x	x	x
6	Flow Setpoint Out of Limits	x	x	x
7	Main Spool Control Error	x	x	x
8	Pressure / Force Control Error		x	x
9	*- reserved*			
10	Pilot Spool Control Error (2)	x	x	x
11	Pressure / Force Setpoint Out of Limits		x	x
12	*- reserved*			
13	*- reserved*			
14	*- reserved*			
15	*- reserved*			
16	*- reserved*			
17	*- reserved*			
18	*- reserved*			
19	Pressure / Force Setpoint Limits Touched		x	x
20	*- reserved*			
21	*- reserved*			
22	Invalid Valve Parameters	x	x	x
23	Invalid Parameters Downloaded	x	x	x
24	Emergency Parameters Loaded	x	x	x
25	Generic Fieldbus Communication Error	x	x	x
26	*- reserved*			
27	Invalid Fieldbus Parameters	x	x	x
28	Pressure 2 Transducer Out of Limits (2)		x	
29	Solenoids Current Fault	x	x	x
30	*- reserved*			
31	Solenoid S1 Short Circuit	x	x	x

(1) Not available for TES-N and TES-S drivers

(2) Available only for TES/LES-S drivers with SF pressure/force control selected

5.8.10 Valve Signals – Extended Page > Detailed Errors > Err 32-63

Index	2F15h	**SubIndex**	02h

This parameter indicates which alarms/errors are actually present into the driver; this is a more detailed indication of the standard error indication (see 5.2):

Bit	**Error**	**RI/RA/BM - TES/LES-N**	**RI/RA/BM - TES/LES-S**	**RI - PES**
0	Solenoid S2 Short Circuit	x	x	x
1	*- reserved*			
2	+5V Fault	x	x	x
3	+15V Fault	x	x	x
4	-15V Fault	x	x	x
5	+24VF Fault		x	x
6	*- reserved*			
7	*- reserved*			
8	*- reserved*			
9	+24V Solenoid Too High	x	x	x
10	+24V Solenoid Too Low	x	x	x
11	+24VL Logic Too High	x	x	x
12	+24VL Logic Too Low	x	x	x
13	Critical Overtemperature	x	x	x
14	Temperature Sensor Error	x	x	x
15	Memories Error	x	x	x
16	Automatic Reset Error	x	x	x
17	*- reserved*			
18	*- reserved*			
19	*- reserved*			
20	*- reserved*			
21	Fieldbus Hardware Error	x	x	x
22	ADC Hardware Error	x	x	x
23	+5V USB Fault	x	x	x
24	Fault Signal Hardware Error	x	x	x
25	Monitor Signal Hardware Error	x	x	x
26	*- reserved*			
27	RPDO Timeout	x	x	x
28	Out of Operational	x	x	x
29	*- reserved*			
30	*- reserved*			
31	*- reserved*			

5.8.11 Valve Signals – Extended Page > Detailed Errors > Err Present (Leds)

Index	2022h

SubIndex	00h

This parameter indicates the presence of one or more errors:

Err Present (bit 0)	
One or more errors	0
No error present	1

5.8.12 Valve/Flow (Pressure/Force and Spool)> PID > Configuration Word

Index	2240h
Index	2270h
Index	2800h

SubIndex	00h	for Flow PID
SubIndex	00h	for Pressure/Force PID1
SubIndex	00h	for Spool PID

Index 2270h subindex 00h require pre-access sequence, see drivers object dictionary.

This parameter is a collection of all relevant setting to enable/disable/modify the different actions of PID closed loop control:

Bit	15-6	5-4	3	2	1	0
Content	Res	Dcfg	D	I	P	FF

Bits 3..0 allow to enable (bit set to 1) or disable (bit set to 0) the PID actions:

Bits (3..0)	Description
0 = FF	Enable Feed Forward action
1 = P	Enable Proportional action
2 = I	Enable Integral action
3 = D	Enable Derivative action

Bits 5..4 allow to select the input signal of PID derivative action:

Bits (5..4)	Derivative Input
01	Demanded signal
10	Feedback signal
11	Error = Demanded - Feedback

Pay attention to avoid any changes to drivers default value of "Reserved bits" field, before any write operation read the content and leave unchanged bits 15 to 6.

5.8.13 Valve/Flow (Pressure/Force) > PID > AntiWindUp Config

Index	2980h
Index	2982h

SubIndex	00h	for Flow PID
SubIndex	00h	for Pressure/Force PID1

Index 2982h subindex 00h require pre-access sequence, see drivers object dictionary.

This parameter is a collection of all relevant setting to enable/disable/modify the different actions of PID closed loop control:

Bit	15	14-13	12	11	10	9	8	7	6	5	4	3	2	1	0
Content	**Δ P Comp.**	**Res**	**Out Lim High**	**Out Lim Low**	**Error High Thr.**	**Error Low Thr.**	**Out Lim High**	**Out Lim Low**	**Error High Thr.**	**Error Low Thr.**	**Out Lim High**	**Out Lim Low**	**Error High Thr.**	**Error Low Thr.**	**Limit Active**

Bit 0 allow to enable (bit set to 1) or disable (bit set to 0) the Limit Active:

Bit 0	Description
0	Disabled
1	Enabled

Bits 4..1 allow to enable (bit set to 1) or disable (bit set to 0) the PID actions (Flow):

Bits (4..1)	Description
1	Error Low Threshold
2	Error High Threshold
3	Out Limit Low
4	Out Limit High

Bits 8..5 allow to select the input signal of PID derivative action (Pressure/Force):

Bits (8..5)	Description
5	Error Low Threshold
6	Error High Threshold
7	Out Limit Low
8	Out Limit High

Bits 12..9 allow to select the input signal of PID derivative action (Pilot):

Bits (12..9)	Description
9	Error Low Threshold
10	Error High Threshold
11	Out Limit Low
12	Out Limit High

Bits 12 to 9 are not available for index 2982h.

Bit 15 allow to enable (bit set to 1) or disable (bit set to 0) the Δ P Compensation:

Bit 15	Description
0	Disabled
1	Enabled

Bit 15 is not available for index 2980h.

Pay attention to avoid any changes to drivers default value of "Reserved bits" field, before any write operation read the content and leave unchanged bits 14 to 13.

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