MURR ELEKTRONIK

stay connected

ENGLISH MANUAL

for devices of the IMPACT67 Pro EtherCAT series
Art.-No. 54632

This document is valid for the following products:

Product designation	Art.-No.
IMPACT67 Pro EC DIO8 IOL8 M12L 5P	54632

Document status:

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NOTE
Translation of the original instructions

Table of Contents

1 Introduction

Purpose of this document

This document instructs the technical staff of the machine manufacturer or machine operator on the safe use of the described devices.

It does not include instructions on the safe use of the machine in which the devices are integrated. For such information, please refer to the operating instructions of the machine.

➔ Read this chapter carefully before you start working with the documentation or the device.

➔ Read the documentation carefully before starting up the device.

➔ Store the manual in a place that is accessible to all users at all times for the entire service life of the device.

You will need general knowledge about automation engineering in order to understand this manual. In addition, planning and using automation systems requires technical knowledge which is not contained in this manual.

1.1 Service and support

Sales and distribution

Our sales employees in the indoor and outdoor service and our technicians will support you at any time.

Customer Service Center (CSC)

Our staff of the Customer Service Center will help you with all questions concerning installation and start-up. They support you, for example, if you have problems with combining hardware and software products from different manufacturers with Murrelektronik products.

A number of support tools and measurement facilities are available for field bus systems and EMC interferences.

Please do not hesitate to call us at +49 (0) 7191 47-2050 or send an e-mail to support@murrelektronik.com

Service addresses

Murrelektronik GmbH has a policy of customer proximity, both at national and international level. Please visit our website to find your contact person: www.murrelektronik.com

1.2 Scope of delivery

The scope of delivery includes:

1x IMPACT67 device
1x Operating instructions – multilingual
15x Designation label

1.3 Applicable documents

Document	Art.-No.
Operating instructions	54632
Product data	54632

The other applicable documents are included in the scope of delivery or can be downloaded
from shop.murrelektronik.com

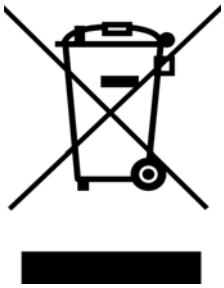
1.4 Environmentally friendly disposal

Comply with country-specific waste disposal regulations!

- ➔ Always dispose of scrap devices in compliance with the applicable country-specific regulations on waste disposal (e.g., the European Waste Code 16 02 14).

Only qualified persons may sort scrap materials.

- ➔ Proceed with caution when dismantling the device since you could injure yourself.
- ➔ Sort the separated components into the correct recycling line.



Disposal

The product can be returned to Murrelektronik GmbH free of charge for disposal. The same is true for the original packaging and any batteries or power packs. Any units that have been contaminated with hazardous substances will not be accepted for repair or disposal.

Returns

- ➔ Label the product and the packaging with ***"For disposal"***.
- ➔ Package the product.
- ➔ Send the package to:

  Murrelektronik GmbH

  Falkenstraße 3

  71570 Oppenweiler | GERMANY

We will make sure that the items are disposed of in accordance with German legislation. The most recent owner is responsible for transport to the return point until items arrive at their destination.

1.5 About this manual

1.5.1 Symbols

This document includes information and notes that must be observed for your own safety and to avoid injuries and equipment damage. They are marked as follows:

DANGER!

Immediate danger.

➔ Failure to observe this warning involves an imminent risk of death or serious injuries.

WARNING!

Possible danger.

➔ Failure to observe this warning can lead to death or serious injuries.

CAUTION!

Low-risk danger.

➔ Failure to observe this warning can lead to mild or moderate injuries.

NOTICE

Possible material damage.

➔ Failure to observe the warning may cause damage to the device and/or the system.

NOTE
Other technical information and notes of Murrelektronik GmbH.

RECOMMENDATION
Notes with this symbol are recommendations of Murrelektronik GmbH.

PRODUCTS AND ACCESSORIES
This symbol indicates accessories or product recommendations.

Instruction for use

➔ An arrow marks instructions.

➔ Read and observe the instructions.

1 | If they are numbered, it is absolutely necessary to follow them in the correct order.

2 | Read and observe the instructions.

1.5.2 Trademarks

Trademarks of the following companies and institutions are used in this documentation:

EtherCAT® and TwinCAT®	Registered trademarks of the Beckhoff Automation GmbH
IO-Link	c/o PROFIBUS Nutzerorganisation e.V. (PNO)

1.5.3 Specifications

Specification	Link
TwinCAT Version 3.1	www.beckoff.com
IO-Link Version 1.1.2 dated 2013-07	www.io-link.com

NOTE
The features of IO-Link specification version 1.1.3 are also supported.

1.5.4 Murrelektronik software tools

Software tool	Link
Murrelektronik IO-Link Device Tool Version V40 and higher	shop.murrelektronik.com
AutoUpdateX V3	shop.murrelektronik.com

2 For your safety

➔ Read this chapter carefully.

➔ Only after that you may work with the fieldbus device.

2.1 General safety instructions

DANGER!

High electrical voltage in the machine/system.

Death or severe injuries resulting from electric shock

➔ When working on the machine/devices, comply with the five safety rules of electrical engineering.

Protection of persons and material assets

➔ According to DIN VDE 0105-100 - Operation of electrical systems - Part 100: General definitions

The five safety rules

Protect against high electrical voltage

1 | Switch off.

2 | Secure against switching on again.

3 | Make sure that there is no voltage on any pole.

4 | Ground and short-circuit.

5 | Cover or block off adjacent parts that are live or energized.

Qualified personnel

Only qualified and safety-trained personnel may assemble, commission and operate the device.

They are qualified if they meet the following requirements:

- they have undergone suitable electrical engineering training,
- they were trained by the machine operator to operate the machine and instructed on the related safety regulations,
- they have access to the Operating Instructions and this manual,
- they are familiar with the safety standards which are common practice in automation engineering,
- they are familiar with the basic and technical standards related to the specific application.

Using the unit

➔ Comply with all safety and accident prevention regulations when conducting project engineering, installation, commissioning, operation, and testing of the device.

➔ Check material resistance if aggressive media are used.

NOTE

Work on the hardware and software may only be performed by qualified personnel of Murrelektronik GmbH, with the exception of firmware updates.

NOTE

Use only a power supply unit that allows max. 60 V DC or 25 V AC under single-fault conditions. The power supply must comply with SELV or PELV.

Protective measures by the machine operator

➔ Follow the instructions in this manual.

➔ Pay attention to the specifications and the operating instructions of all connected components.

2.2 Intended purpose

IMPACT67 is a decentralized device. It can be used in harsh industrial environments up to degree of protection IP67.

Operation of the device in accordance with its designated use and the degree of protection IP67 are only guaranteed if open male and female connectors are closed using screw plugs.

Designated use also includes EMC-compliant electrical installation. The device is designated for use in industrial environments. Radio interference may occur if used in domestic or mixed environments.

➔ If the device is used in domestic or mixed environments, the applicable standards must be observed.

Warnings

➔ Do **not** alter the design, engineering, or electrical features of the device.

➔ Do **not** use the device outside the applications described in this manual, the Technical Data or in the operating instructions.

➔ Do **not** use the device as a safety-related device. It does not meet the relevant standards. Safety functions of the system are not ensured!

➔ Do **not** use the Off state of the device outputs for safety-related requirements of the system/machine!

➔ Do **not** use the device outdoors or for continuous operation in liquids.

➔ Do **not** clean the device with a high-pressure cleaner.

➔ Do **not** use the device as a climbing aid.

Warranty and liability claims become void if:

- the device is not used according to its designated use,
- damage is caused because the manual and the operating instructions have not been observed,
- the personnel was/is not qualified.

3 Description

3.1 Device

The IMPACT67 EC is a compact EtherCat device in a plastic housing with IP67 protection.

Connection

2xM12 ports (D-coded) are available for connection to the EtherCAT.

Power supply

The supply is fed in via M12 Power (L-coded) and looped through.

IO-Link

The device also has 8xM12 IO-Link master ports (A-coded). The IO-Link masters (Pin4 C/Q) can be parameterized independently of each other and used either in IO-Link or in SIO mode (DI, DO).

Additional digital inputs and outputs, as well as a permanent 24 V supply, are available for each port (Pin2 I/Q).

Properties

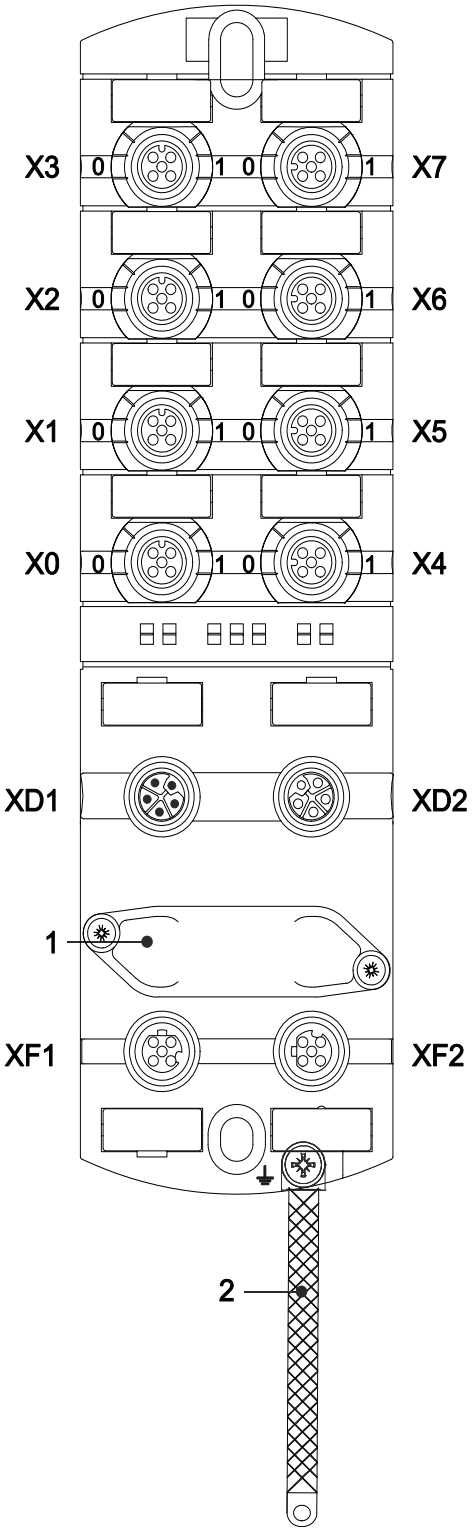
- EtherCAT: AoE, EoE, FoE
- Degree of protection IP67
- Swing shock checked

3.1.1 Structure of the device designation

The designation is based on a scheme that indicates the product's function.

IMPACT67	Product family
EC	Industrial Ethernet protocol ■ EtherCAT
DIO8	Digital inputs and outputs ■ D = Digital ■ I = Input ■ O = Output Number of channels ■ 8 = 8 channels (pin 2)
IOL8	IOL = IO-Link master Number of channels ■ 8 = 8 channels (pin 4)
M12L 5P	POWER connection (power supply) ■ M12 = Size ■ L = Coded ■ 5P = 5-pin version with FE (Functional ground)

3.1.2 Device structure



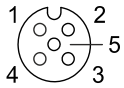
Slots overview

X0 ... X7	Digital inputs and outputs or IO-Link, M12, A-coded
0	Channel corresponds to pin 4
1	Channel corresponds to pin 2
	Examples:
	Channel **0**2 = **Pin 4** Female connector X2
	Channel **1**6 = **Pin 2** Female connector X6
XD1	Power supply POWER IN, M12, L-coded, **5-pin**
XD2	Power supply POWER OUT, M12, L-coded, **5-pin**
1	Rotary switch
XF1	EtherCAT IN, Port 1, M12 D-coded
XF2	EtherCAT OUT, Port 2, M12 D-coded
2	Ground strap for functional ground

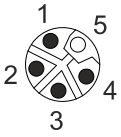
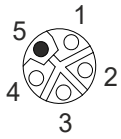
Fig. 3-1: Device design

3.1.3 Pin assignment

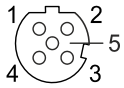
M12 female connector A-coded

X0 ... X7		
	Pin 1	24 V ⎓
	Pin 2	DI/DO
	Pin 3	0 V
	Pin 4	DI/DO/IO-Link
	Pin 5	0 V

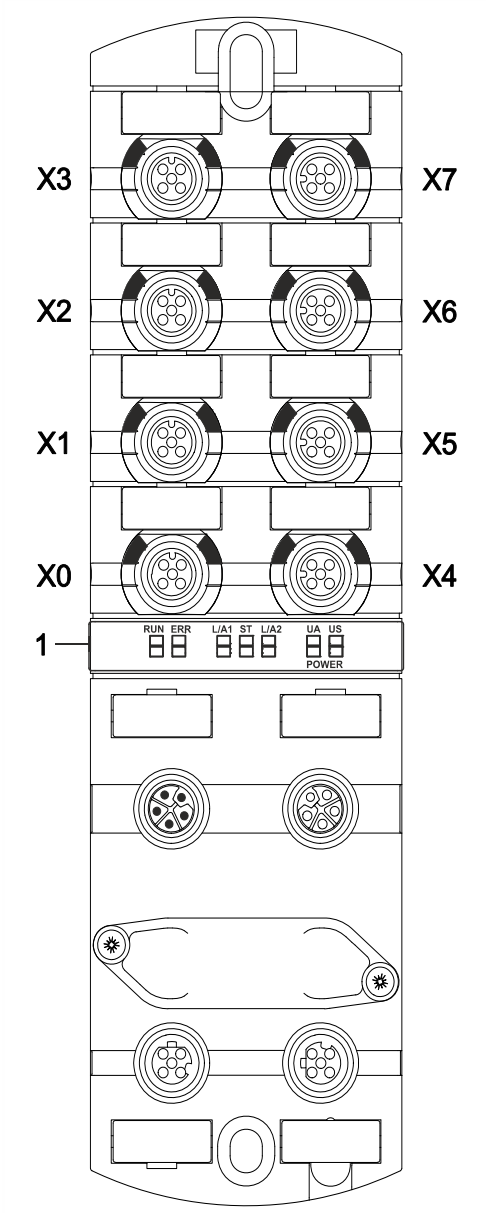
M12 male/female connector L-coded POWER IN/OUT

XD1			XD2
	Pin 1	24 V ⎓ US	
	Pin 2	0 V	
	Pin 3	0 V	
	Pin 4	24 V ⎓ UA	
	Pin 5	⏚	

M12 female connector D-coded Port 1 / Port 2

XF1 / XF2		
	Pin 1	TD +
	Pin 2	RD +
	Pin 3	TD -
	Pin 4	RD -
	Pin 5	n.c.

3.1.4 Display elements



X0 ... X7	LED digital inputs and digital outputs or IO-Link
1	LED RUN
	LED ERR
	LED L/A1
	LED L/A 2
	LED Status (ST)
	LED POWER UA
	LED POWER US

Fig. 3-2: Indicators

For further information on the behavior of the LEDs, please refer to chap. 9.1 "LED indication".

3.2 EtherCAT

3.2.1 EtherCAT communication

Fieldbuses have been well established in the automation technology for many years. Due to the demand for higher speeds on the one hand and the fact that the technical limits in this technology have already been reached on the other, new solutions needed to be found.

Ethernet, known from the office world, is very fast with 100 Mbit/s nowadays available everywhere. Due to the type of cabling and the rules for access rights, however, Ethernet is not realtime-capable. This was corrected with EtherCAT.

EtherCAT®

The following applies for EtherCAT®:

- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- EtherCAT means Ethernet for Controller and Automation Technology. It was originally developed by Beckhoff Automation GmbH and is now supported and further developed by ETG (EtherCAT Technology Group). The ETG is the worldwide largest international user and manufacturer association for Industrial Ethernet.
- EtherCAT is an open Ethernet-based fieldbus system standardized acc. to IEC. It fulfills the user profile used in industrial realtime systems.
- Contrary to the traditional Ethernet communication, EtherCAT exchanges I/O data at 100 Mbit/s in full-duplex mode while the telegram runs through the EtherCAT slaves. This way, a telegram in sending and receiving direction reaches the data of many users, EtherCAT has a payload rate of over 90%.
- The EtherCAT protocol optimized for process data is transported directly in the Ethernet telegram. It consists of several sub-telegrams that serve each a memory range of the process image.

Transmission medium

EtherCAT uses Ethernet as the transmission medium. Standard CAT5 cables are used. Line lengths of up to 100 m between 2 users are possible.

You may use EtherCAT components only in an EtherCAT network. To create topologies other than line topology, you need EtherCAT components supporting this.

The use of network hubs is not possible.

3.3 IO-Link

IO-Link is a standardized protocol that enables connection of intelligent devices (sensors and actuators) to an automation system.

Communication takes place between an IO-Link master and one or more IO-Link devices. A master module has one or more ports and one device can be connected to each port. IO-Link is a point-to-point communication system and is not a fieldbus.

The IO-Link master module is the interface between the controller and the IO-Link system.

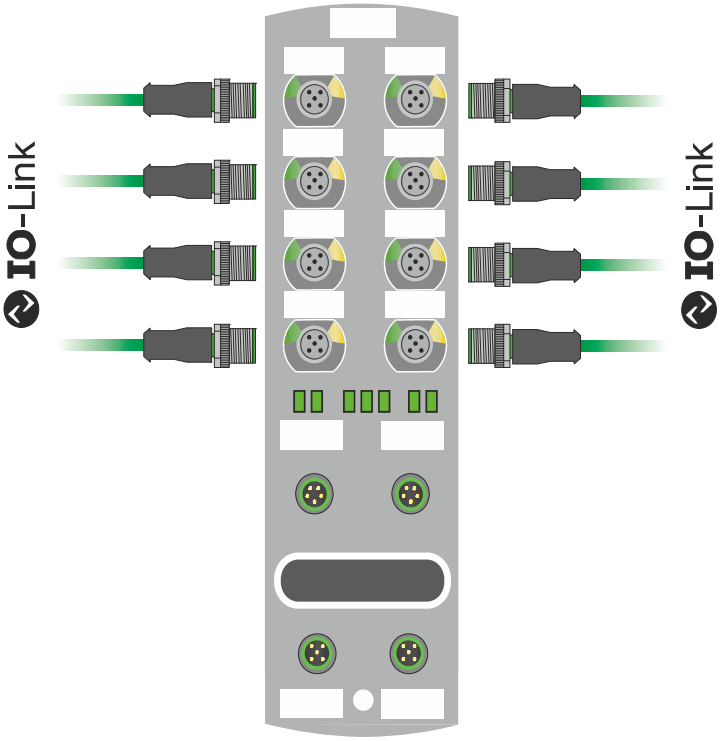


Fig. 3-3: IO-Link

For further information, refer to chap. 8 "Configuration/setting".

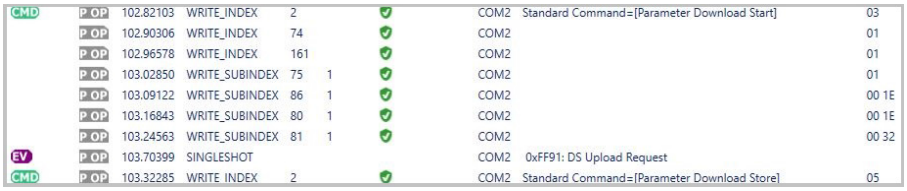
3.3.1 Data storage

NOTE
Data storage is only available for IO-Link devices that comply with IO-Link version V1.1 and higher.

- Data storage offers scope for replacing IO-Link devices without reconfiguration.
- The IO-Link master and the IO-Link device save the set device parameters of the previous parameterization.
- In data storage, the parameter data storage facilities of the IO-Link master and IO-Link device are synchronized.
- Following the replacement of a device, the master writes the saved device parameters to the new device whenever data storage is enabled in the IO-Link master.
  The application can be restarted without reparameterization.
- After having replaced the IO-Link master, the master reads the IO-Link device parameters and stores them. For this, the data storage option “Save and restore” must be active.
  The application can be restarted without reparameterization.
- To use data storage, the vendor ID and the device ID of the connected IO-Link device must be entered additionally for each IO-Link master port in the validation settings.
  The IO-Link port mode must be set to “Manual”.
- To store the modified IO-Link device parameters again in the master, device parameterization must be done via block parameterization.

  After this, the device sends an upload request to the master.
  Block parameterization can be carried out via the IO-Link device tool in the “Parameter” window and with the “Block Write Mode”.

  Optionally, block parameterization can also be done via the web server or a PLC block,
  e.g. Siemens IOL_Call.
  In this case, block parameterization must always be completed with the command “Parameter Download Store” ISDU index 0x02 subindex 0 value 05.



- In the validation/backup mode “no Device check”, the saved device parameter content in the IO-Link master is deleted.

3.4 Industrial Internet of Things (IIoT)

The device supports the following IIoT functions for industrial communication: JSON, MQTT, and OPC UA.

For further information, refer to chap. 8.6 "Industrial Internet of Things (IIoT)".

NOTE
Functions are only available after having activated EoE Ethernet via EtherCat.

4 Technical Data

4.1 Electrical data

Bus data		
Fieldbus protocol		EtherCAT
Connection		M12, 4-pin, D-coded
Transfer rate		100 Mbit/s
Addressing		AutomaticallyID via rotary switchID via mailbox (station alias)
Specification		ETG.5001.6220 S
Supported protocol	ADS over EtherCAT	AoE
	CANopen over EtherCAT	CoE
	Ethernet over EtherCAT	EoE
	File access over EtherCAT	FoE
Diagnostic function	EtherCAT state machine	ESM
	Emergency messaging	EMCY
SYNC manager		4
FMMU		8

OPC UA-Server		
OPC UA Server	According to "IO-Link Companion Specification" and Murrelektronik IO-Link Diagnosis www.murrelektronik.com	Yes
Transport		UA TCP, UA Secure Conversation, UA Binary Encoding
Server profile		Micro Embedded Device
Protocol		OPC UA TCP
User access	Read access only Read and write access	Anonymous User name/password
Number of sessions		2
Number Subskriptions per Session		2
Number „Monitored Items“ per Session		20
Minimum release interval		100 ms
Maximum number of sessions/clients		5
Data coding		UA binary
Energy monitoring	Current and voltage	Yes
Temperature monitoring		Yes

MQTT-Client		
MQTT		Client
Client services		Publish
Protocols	Over TCP	MQTT
Topic size	Individually per MQTT publication and common topic prefix of the associated MQTT connection	≤256 bytes ≤256 bytes

MQTT-Client		
Topics		■ Printable UTF-8 string ■ NUL-terminated ■ Multibyte encoding (MBCS) ■ Payload: JSON
Will Topic		≤256 Bytes
Quality of Service		QoS 0, QoS 1 and QoS 2
IP standard		IPv4
Port	1883 (default)	MQTT unencrypted
MQTT standard		V3.1.1
JSON, MQTT	JSON integration for IO-Link V1.0.0	Yes, via REST API and MQTT
Energy monitoring	Current and voltage	Yes
Temperature monitoring		Yes
Restriction		The Subscribe service is not supported.

Web server		
HTTP		HTTP/1.1
Port		80
Connections	Over TCP	≤8 simultaneous connections. One connection is being processed.
JavaScript		Required
HTTPS		Not supported

REST API		
Standard	According to “JSON Integration for IO-Link,Version 1.0.0, Mar 2020” https://io-link.com/share/Downloads/IO-Link_Integration/JSON_Integration_10222_V100-_Mar20.zip	Yes
Protocol		HTTP
User access	Read access only Read and write access	Anonymous User name/password
Authentication	According to RFC 7617	HTTP Basic Authentication
Supported endpoints		See product manual

IO-Link		
IO-Link devices operating voltage		24 V ⎓
IO-Link devices voltage range		20 ... 30 V ⎓
Transfer rate		COM1 / COM2 / COM3
Standardized Master Interface (SMI)		According to IO-Link specification V1.1
Transfer rate recognition		Automatic

Supply		
Operating voltage US		24 V⎓
Voltage range US		18 ... 30 V⎓
	When using IO-Link	20.3 ... 30 V⎓
Operating voltage UA		24 V⎓

Supply		
Voltage range UA		18 ... 30 V⎓
Sensor current US	≤40 °C (see Derating)	≤16 A
Actuator current UA	≤40 °C (see Derating)	≤16 A
Current consumption	At idle	≤0.18 A
Protection against reverse polarization for US and UA		Yes
Reverse polarity protection		Yes
Connection		M12, 5-pin, L-coded
Cable cross-section	Current per supply ≤12 A	≥1,5 mm^2
	Current per supply >12 A	≥2,5 mm^2

Input (DI)		
Sensor power supply	Per port, ≤40 °C (see Derating)	≤2 A load Automatic start
Total current sensor supply	≤40 °C (see Derating)	≤10 A
Filter time		0 ... 15 ms + tcycle, adjustable
Delay time for signal change		2 ... 5 ms
Input characteristic	EN 61131-2	Type 1 + Type 3
Short-circuit protection, sensor supply		MOSFET with current measurement
Connection		M12, 5-pin, A-coded
Cable cross-section		≤0.75 mm^2
Cable length		≤30 m
Total current	Per port	≤4 A

Output (DO)		
Output current DO (UA)	Per pin, ≤40 °C (see Derating)	≤2 A
Total current outputs	≤40 °C (see Derating)	≤16 A
Frequency		≤50 Hz
Short-circuit protection actuator		MOSFET with current measurement
Connection		M12, 5-pin, A-coded
Cable cross-section		≤0.75 mm^2
Cable length		≤30 m
Total current	Per port	≤4 A

Derating sensor current US/ actuator current UA

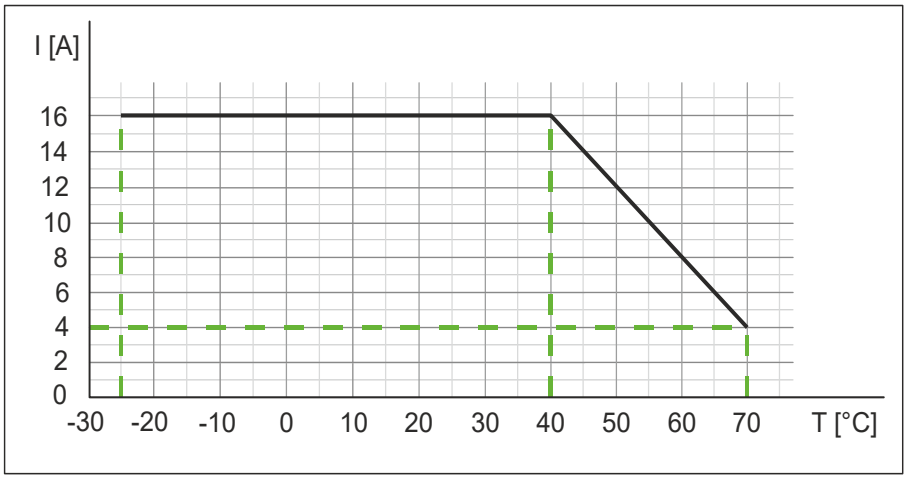


Fig. 4-1: Derating sensor current US and actuator current UA

Derating total current, sensor power supplies/ total current, outputs

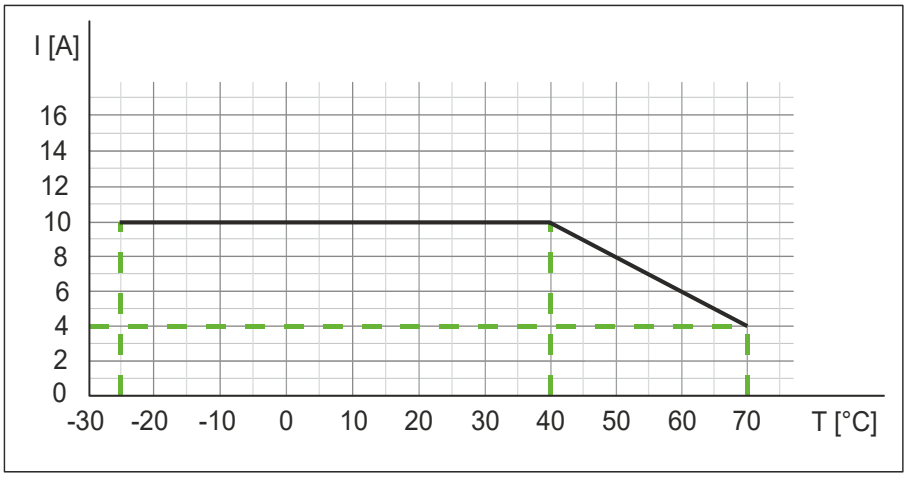


Fig. 4-2: Derating total current, sensor power supplies and total current, outputs

Derating current per sensor power supply/ output

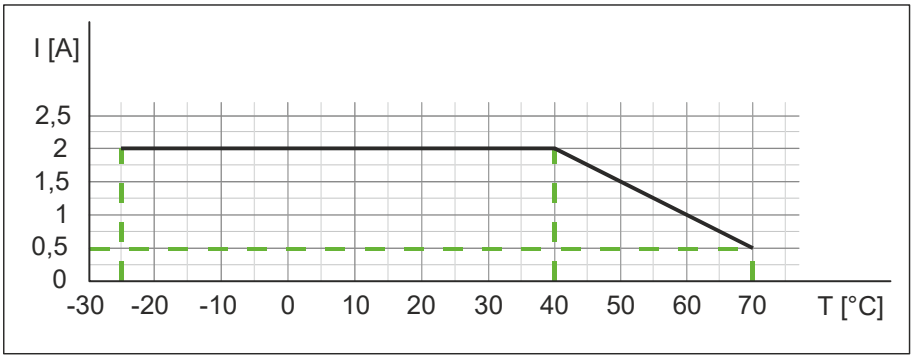


Fig. 4-3: Derating current per sensor power supply and output

4.2 Environmental characteristics

Climatic		
Ambient temperature Until HW 1.02 and SW 1.06		-25 °C ... +70 °C
Ambient temperature From HW 1.03 and SW 1.07		-40 °C ... +70 °C
Storage temperature Until HW 1.02 and SW 1.06	Provide acclimatization for commissioning	-25 °C ... +85 °C
Storage temperature From HW 1.03 and SW 1.07	Provide acclimatization for commissioning	-40 °C ... +85 °C
Transport temperature Until HW 1.02 and SW 1.06	Provide acclimatization for commissioning	-25 °C ... +85 °C
Transport temperature From HW 1.03 and SW 1.07	Provide acclimatization for commissioning	-40 °C ... +85 °C
Relative humidity		≤95 %
Installation hight	Above sea level	≤3000 m

Mechanical		
Oscillation test	EN 60068 Part 2-6	10 ... 58 Hz, Oscillation angle 0,35 mm, 58 ... 150 Hz; 20 g
Shock test	EN 60068 Part 2-27	50 g, duration 11 ms

Electrical safety		
Protection degree	EN 60529	IP67
Protection class	Using a SELV- or PELV- power supply	III
Pollution degree		2

EMC-inteference		
Radiated inteference E-field enclosure	EN 55016-2-3	Conform

EMC-immunity		
Electrostatic discharge (ESD)	EN 61000-4-2	Conform
Electromagnetic RF-fields	EN 61000-4-3	Conform
Fast transient burst	EN 61000-4-4	Conform
Surge AC	EN 61000-4-5	Conform
Conducted RF-fields	EN 61000-4-6	Conform
Voltage dips	EN 61000-4-11	Conform

4.3 Protection

Device protection		
Overvoltage protection		Yes
Overload protection device supply	To be ensured through load circuit monitoring	Yes
Inverse-polarity protection device supply		Yes
Short-circuit protection sensor supply		Electronically
Short-circuit protection output		Electronically
Protective circuit input	Internal	Suppressor diode

4.4 Mechanical data

Material data		
Housing material		Plastic

Assembly data		
Weight	Net	470 g
Dimensions	L x W x H	225.4 x 63 x 36 mm

4.5 Conformity, Approvals

Conformity, Approvals		
Product standard	EN 61131-2 Programmable logic controllers, Part 2	Compliant
CE	2014/30/EU 2011/65/EU	Compliant
UKCA		Compliant
EMC	2014/30/EU	Compliant
REACH	No. 1907/2006	SVHC List
WEEE	2012/19/EU	Compliant
ULus		E201820
RoHS	2011/65/EU & 2015/863	Exception 6c&7a
China RoHS	SJ/T 11364-2014	25 EPUP

Hazardous substance (有害物質)						
Part Name 零件名稱	Lead (Pb) 铅	Mercury (Hg) 汞	Cadmium (Cd) 镉	Hexavalent Chromium (Cr (VI)) 六价铬	Polybrominated biphenyls (PBB) 多溴联苯	Polybrominated diphenyl ethers (PBDE) 多溴联苯醚
Component part PCB [1] [2] 组件部分 印刷电路板	X	O	O	O	O	O
Connection Terminal / Screws / Housing[3] 接线端子 /拧/ 外殼	X	O	O	O	O	O
O : Indicates that the content of the harmful substance in all homogeneous materials of the component part is below the limit defined in GB/T 26572. O: 表明該有害物質在組成部分的所有均質材料的含量低於按GB/ T26572定義的限制。 X: Indicates that the content of the harmful substance in at least one homogeneous material of the component part exceeds the limit defined in GB/T 26572. X: 表示該有害物質在組成部分中的至少一個均質材料的含量超過按GB / T26572定義的限制。						

1 EU RoHS Directive 2011/65/EU, Annex III: Exemption 7(a) Lead in high melting temperature type solders (i.e., lead-based alloys containing 85 % by weight or more lead)

2 EU RoHS Directive 2011/65/EU, Annex III: Exemption 7(c)-I Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g., piezoelectronic devices, or in a glass or ceramic matrix compound.

3 EU RoHS Directive 2011/65/EU, Annex III: Exemption 6(c) Copper alloy containing up to 4 % lead by weight.

4.6 IP ports used

Port	
TCP Port 80	Integrated Webserver
TCP Port 4840	Integrated OPC UA server. Port can be re-configured at runtime: netPROXY Object “OPC UA Server - Component Configuration”

For the MQTT client, no fixed or configurable port is provided.
If the MQTT client is active, the next free port of the IP stack is assigned to it.

5 Mounting

5.1 Requirements

➔ Prerequisites for mounting:

- Even mounting surface to avoid mechanical tension.
- Provide proper grounding.
- Suitable installation site in terms of vibration and shock load, temperature and humidity (see chap. 4 "Technical Data").
- Protected to avoid tearing off the connecting cables by personnel or device.

5.2 Dimensions

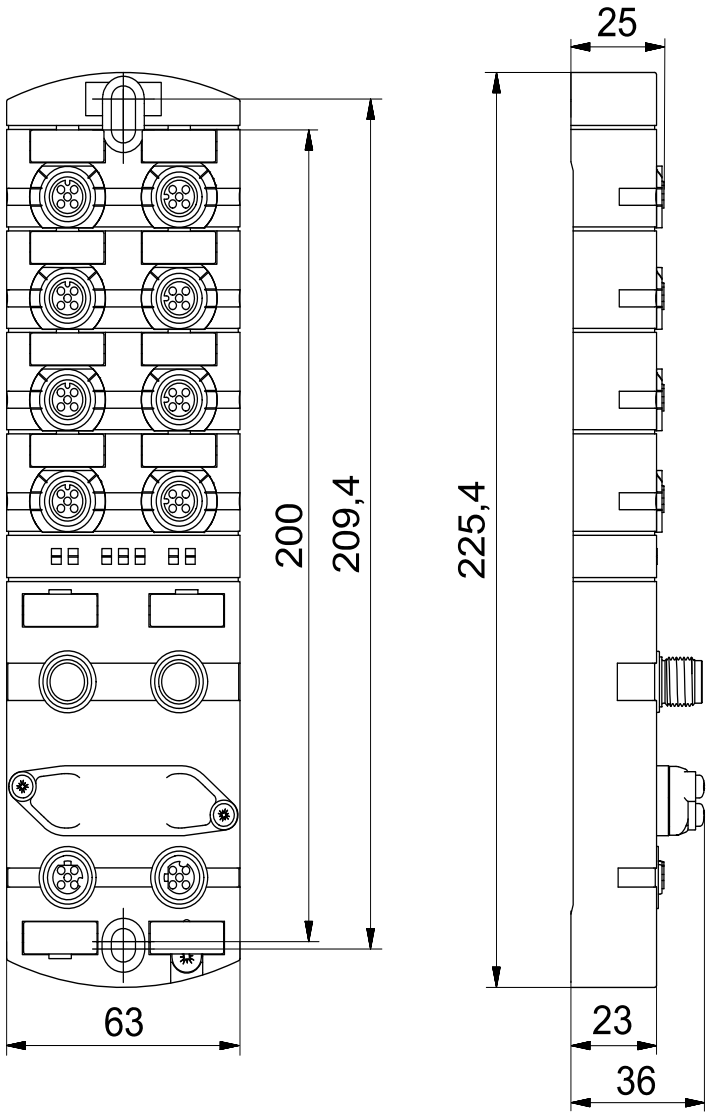


Fig. 5-1: Dimensions in mm

5.3 Mounting distance

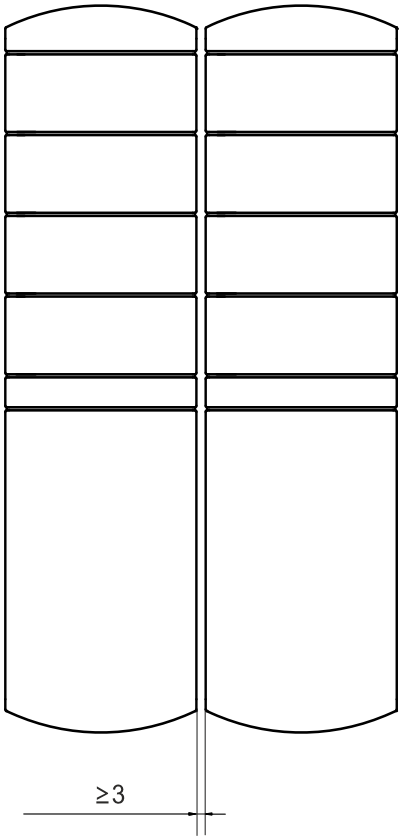


Fig. 5-2: Distance in mm

NOTE

➔ For correct installation and improved heat dissipation, we recommend keeping a minimum distance of 3 mm when mounting the IMPACT67.

NOTE

➔ If angled male connectors are used, a minimum distance of 50 mm is required.

5.4 Mounting the device

NOTICE

Material damage due to incorrect installation.

The fastening screws and tightening torques depend on the surface of the installation site.

➔ Use fastening screws that are suitable for the mounting surface structure.

➔ Carefully tighten the screws. The indicated tightening torques must be adhered to.

NOTICE

Material damage through improper use.

Do not use the devices as climbing aids. Improper use can cause the devices to break off or to be damaged otherwise.

➔ Install the devices in such a way that they cannot be used as climbing aid.

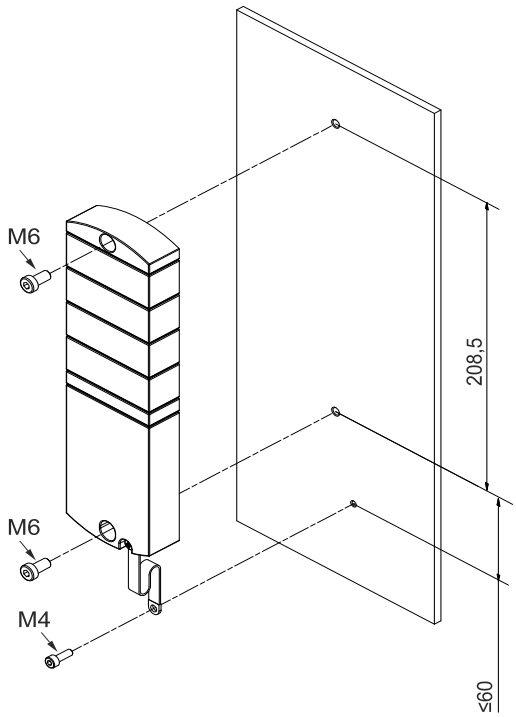


Fig. 5-3: Fasten device. Dimensions in mm (figure similar)

M6	3 Nm		Art.-No. 7000-98001-0000000
M4	1,2 Nm		Art.-No. 7000-98001-0000000

Mount the device in the order indicated below::

1 | Slightly tighten the top M6 bolt.
2 | Align the housing.
3 | Slightly tighten the lower M6 bolt.
4 | Tighten the M6 bolts to the specified tightening torque.
5 | *Ground device:* Attach the grounding strap (see chap. 5.4.1 "Functional ground").

NOTE
The screws and the grounding strap illustrated are not included with the device.

5.4.1 Functional ground

NOTE
Use a conductive screw to attach the grounding strap.

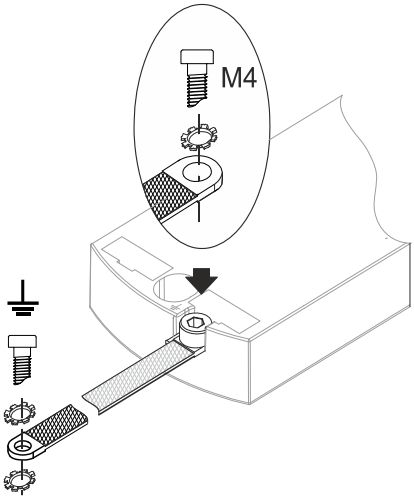


Fig. 5-4: Attach the grounding strap

M4	1,2 Nm		Art.-No. 7000-98001-0000000

For further information, refer to chap. 12.1.1 "System components".

The bolts and the grounding strap illustrated are not included in the scope of delivery. The grounding strap is available in the online shop of Murrelektronik GmbH
shop.murrelektronik.com.

5.4.2 Addressing lid

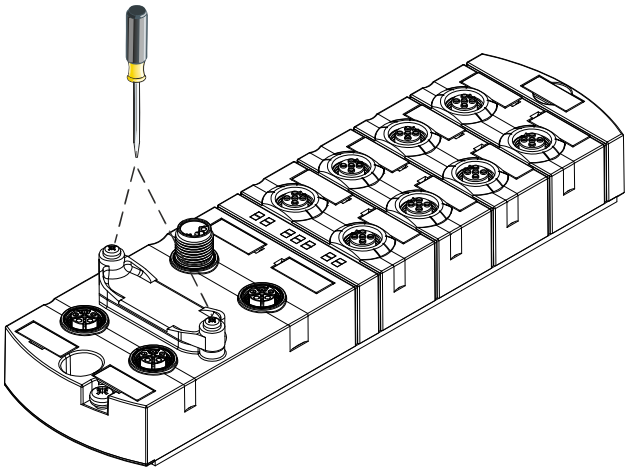


Fig. 5-5: Fasten rotary switch cover

M3	0,8 Nm		Art.-No. 7000-98001-0000000

For information on how to set the rotary switches, please refer to chap. 6.1.1 "Rotary switch settings"

6 Installation

6.1 Electrical Installation of the device

DANGER!

High electrical voltage in the machine/system.

Death or severe injuries resulting from electric shock

➔ When working on the machine/devices, comply with the five safety rules of electrical engineering.

Protection of persons and material assets

➔ According to DIN VDE 0105-100 - Operation of electrical systems - Part 100: General definitions

WARNING!

Risk of fire due to short circuit.

Damaged supply lines and/or devices may short circuit when damaged which may result in overheating and fire.

➔ Provide intelligent current monitoring or fuse. The fuse must be designed for max. 9 A.

CAUTION!

Loss of function due to improper installation.

When disregarding, injuries and/or damage to property may occur.

➔ Only install cables and accessories that meet the requirements and regulations for safety, electromagnetic compatibility and, if required, telecommunication terminal equipment specifications as well as the specification data.

CAUTION!

Hot surface.

Minor injuries and damage to devices caused by contact with the surface.

➔ Wear thermally suitable gloves.

➔ Use thermally suitable connecting cables only.

NOTICE

Damage to the machine/system due to improper switching on of the voltage sources.

When the device is switched on with separate actuator and sensor voltage, the function of the digital inputs and outputs cannot be guaranteed unless the proper power-on order is performed.

➔ Always switch on voltage sources in the following order:

1 | Switch on sensor voltage.

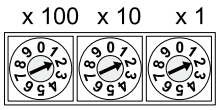
2 | Switch on actuator voltage.

NOTE
Use only a power supply unit that allows max. 60 V DC or 25 V AC under single-fault conditions. The power supply must comply with SELV or PELV.

6.1.1 Rotary switch settings

NOTE
Delivery state: The rotary switches are set to **000**.

NOTE
An unambiguous and unique device ID address must be assigned to each user in the network.



Address range 1 ... 999
x1 Rotary switch (ones)
x10 Rotary switch (tens)
x100 Rotary switch (hundreds)

Tab. 6-1: Device ID rotary switch

When the “„Explicit Device ID” is used, set the addresses of the devices (device ID).

Position/ Range	Web server	JSON	OPC UA	MQTT	Description	
0	-**	-**	-**	-**	Normal operation.	EtherCAT ID can be assigned via Mailbox (Explicit Device ID).
1 ... 99	-**	-**	-**	-**	EtherCAT ID	EtherCAT ID is set to the value of the rotary switch.
100 ... 910	-**	-**	-**	-**	Reserved**	
911	Disabled	Disabled	Disabled	Disabled	Secure Mode.	Fieldbus communication in normal operation.
912	-**	Disabled	Disabled	Disabled	IIoT mode disabled.	
913	Disabled	Disabled	-**	-**	Web server and JSON disabled.	
914	Enabled	Enabled	Enabled	Enabled	Activates all IIoT protocols and the web server.	
915-978	-**	-**	-**	-**	Reserved**	
979	Enabled	Enabled	Enabled (up to FWV1.05) Disabled (from FWV1.06)	Enabled (up to FWV1.05) Disabled (from FWV1.06)	Reset to factory settings	Sequence of actions only for this rotary switch position: 1 | Disconnect the device from the power supply. 2 | Set switch position 979. 3 | Supply the device with voltage. 4 | Wait until reset is completed. • ST LED **flashes** green: Device is performing the reset. • ST LED **lights up permanently** green: Reset is completed. ST LED indication, see 9.1.5 "LED indication for state" 5 | Disconnect the device from power. 6 | Switch position to 000 or any other desired position. 7 | Supply the device with voltage.
980-999	-**	-**	**-	-**	Reserved**	

Tab. 6-2: Setting the address

NOTE
Reserved switch positions do not have any fieldbus communication, see 9.1 "LED indication".

NOTE**
The last protocol setting is maintained.

Service Setting procedure

The switch positions 911, 912 and 913 disable the services of the device marked in the "Set address" matrix. The device starts normally in these switch positions with the previously set address configuration and has no restrictions on function except for the services disabled by the switch position. The services deactivated by this could not be reactivated by other means, e.g. the configuration data of the controller.

Switch position 914 reactivates all services. Again, the function of the device is not restricted.

1 | Supply power to the device.
2 | Power supply remove.
3 | Original Set address.

NOTE
Rotary witches are only taken over again with a power reset!

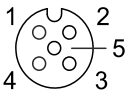
Setting an address

1 | Remove device supply.
2 | Dismantle the address cover.
3 | Set a unique address.
4 | Mount the address cover.
5 | Connect device supply.

The tightening torques can be found in chapter 5.4 "Mounting the device"

6.1.2 Sensors and actuators

Connecting the M12 ports



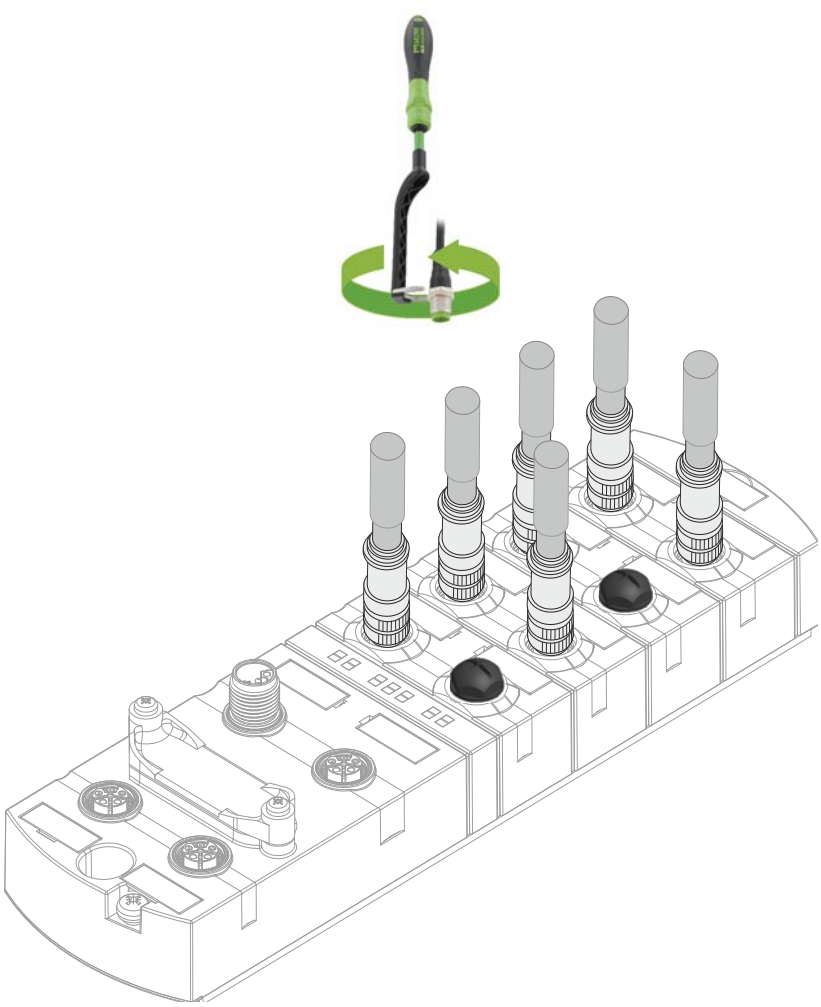


Fig. 6-1: Example of M12 connection inputs and outputs

M12	0,6 Nm		Art.-No. 7000-99102-0000000

The pin assignment of the slots can be found in the chap. 3.1.3 "Pin assignment"

NOTE
Feeding in an external ground via M12 female connectors can lead to faults.
➔ Do not feed external ground to the device via M12 female connectors.

NOTE
Maximum cable length of the sensor and actuator cables is limited to 30 m.

Sensor power supply

Please note:

- Sensors can be supplied via **pin 1** (24 V) and **pin 3** (0 V) of the M12 female connectors.
- The maximum permissible current for the power supply of the sensors is **2 A**.
- In case of overcurrent or short circuit, the connected cable or sensor must be ***disconnected*** from the M12 female connector.

Supported IO-Link communication

The device supports the IO-Link communication using the following speeds:

- 4,800 baud (COM 1)
- 38,400 baud (COM 2)
- 230,400 baud (COM 3)

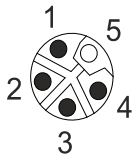
NOTE
The device automatically selects the appropriate communication speed for the IO-Link device.

NOTE
Maximum cable length is limited to 20 m for IO-Link connection.

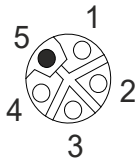
You will find a wide range of connecting wires in the catalog or in the online shop of Murrelektronik GmbH at: shop.murrelektronik.com

6.1.3 Power supply

Connect M12 male connector to POWER IN



and M12 female connector to POWER OUT



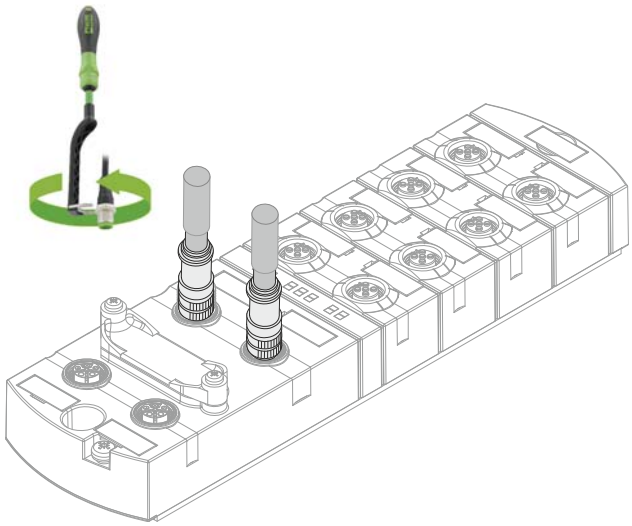


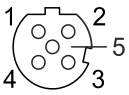
Fig. 6-2: Example of M12 connection POWER

M12	0,6 Nm		Art.-No. 7000-99102-0000000

The pin assignment of the slots can be found in the chap. 3.1.3 "Pin assignment"

6.1.4 EtherCAT communication

Connecting the M12 port



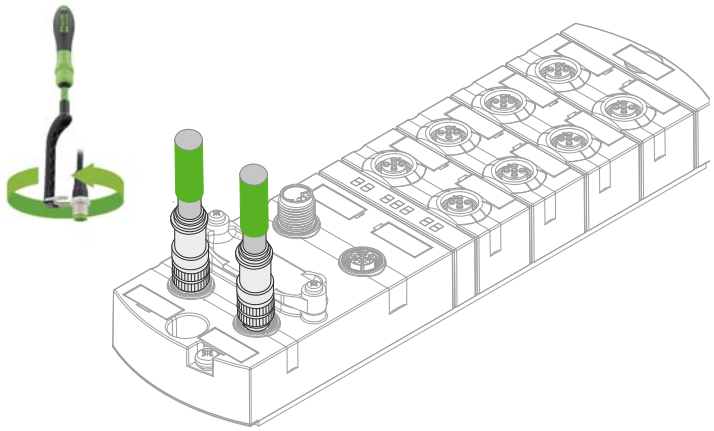


Fig. 6-3: Example of M12 connection bus

M12	0,6 Nm		Art.-No. 7000-99102-0000000

The pin assignment of the slots can be found in the chap. 3.1.3 "Pin assignment"

6.2 Ensuring Tightness (IP67)

CAUTION!

Leaky housing.

Risk of personal injury and material damage due to failure caused by ingress of conductive liquids.

➔ Seal unused male and female connectors.

Connection of cables

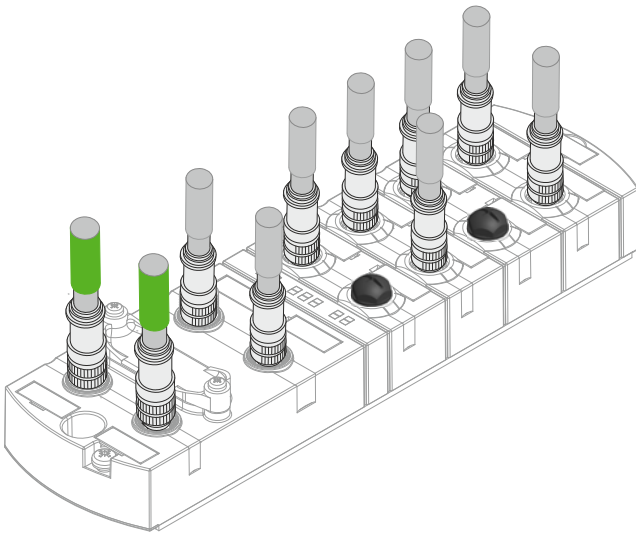


Fig. 6-4: Connection of cables

M12	0,6 Nm		Art.-No. 7000-99102-0000000

You will find a wide range of connecting wires in the catalog or in the online shop of Murrelektronik GmbH at: shop.murrelektronik.com

You will find suitable sealing connectors/screw plugs for the ports in our onlineshop shop.murrelektronik.com

7 Start-up

CAUTION!

Uncontrolled processes.

Personal injury and material damage due to incorrectly performed start-up phases (e.g. first start-up, restart and configuration changes).

➔ Always perform the start-up in this sequence:

1 | Mount and connect cables to the device.
2 | System check and approval by an expert.
3 | Put it into operation.

NOTICE

Functional errors in residential areas.

Devices of EMC Class A may cause interference in residential areas.

➔ The system operator must take appropriate measures.

7.1 EtherCAT

Component

An EtherCAT network consists of at least the following components:

- 1 EtherCAT master
- 1 or more slave nodes
- Ethernet cables and plugs for connecting the nodes

7.1.1 Integrate device into Beckhoff TwinCAT V3

The configuration and system integration are shown by way of example for the connection of a device to a Beckhoff TwinCAT control using the “TwinCAT ® System Manager”. The exact procedure depends on the engineering software used.

If other controls and engineering software are used, please refer to the corresponding documentation.

Installation of ESI files

Use import function.

1 | From the website www.murrelektronik.com, the EDI files can be downloaded.

2 | Copy the ESI file to the “TwinCAT” directory.
Default path: C:\TwinCAT\3.1\Config\Io\EtherCAT

After a restart of the TwinCAT System Manager, the installed devices will be available.

7.1.2 Adding a device

Adding a device

The device can be added by automatic scanning or manually.

Before connecting devices to the EtherCAT network, the EtherCAT system must be in a safe and de-energized condition.

Automatic scanning of the device

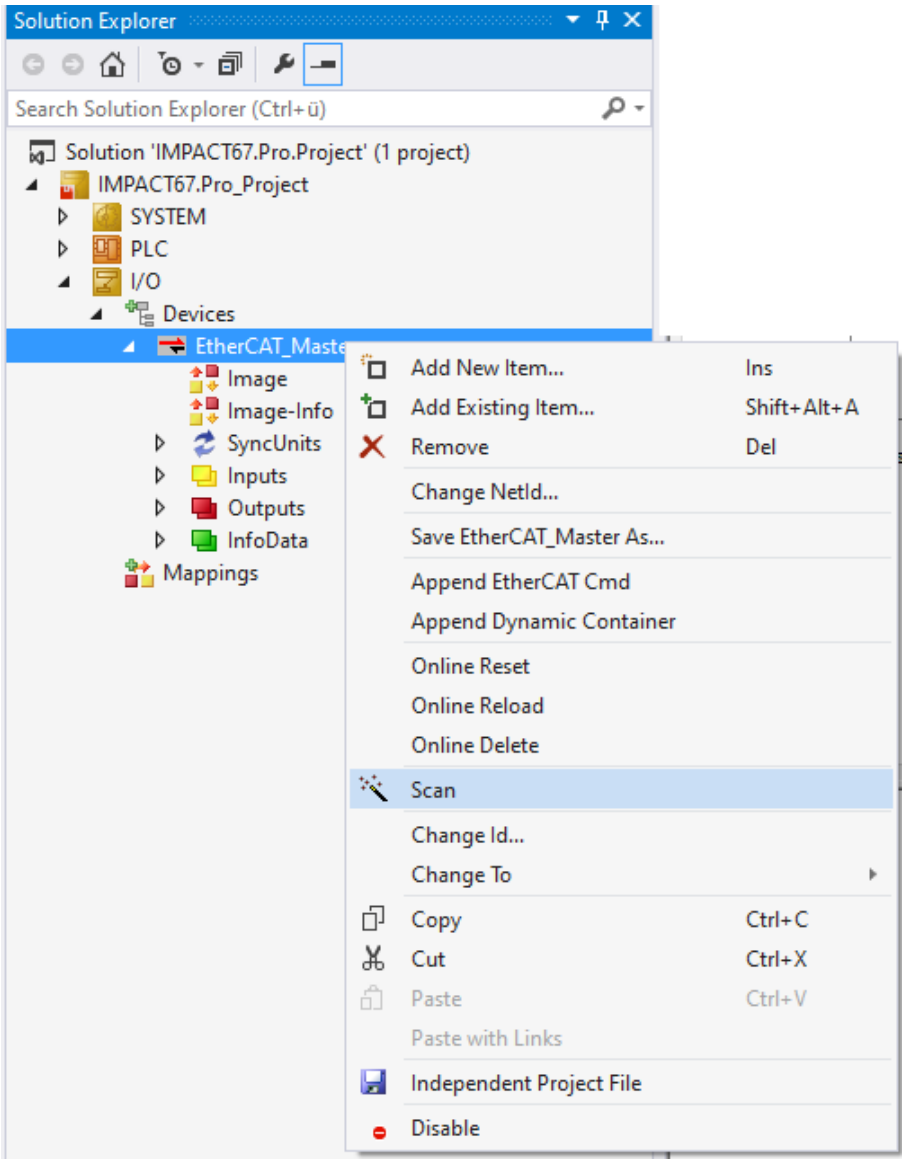


Fig. 7-1: Automatic scanning of the device

1 | Switch the operating voltage on and start the TwinCAT System Manager in the “Config mode”.

2 | Switch on the supply voltage.

3 | Scan the device.

Manual integration of the device

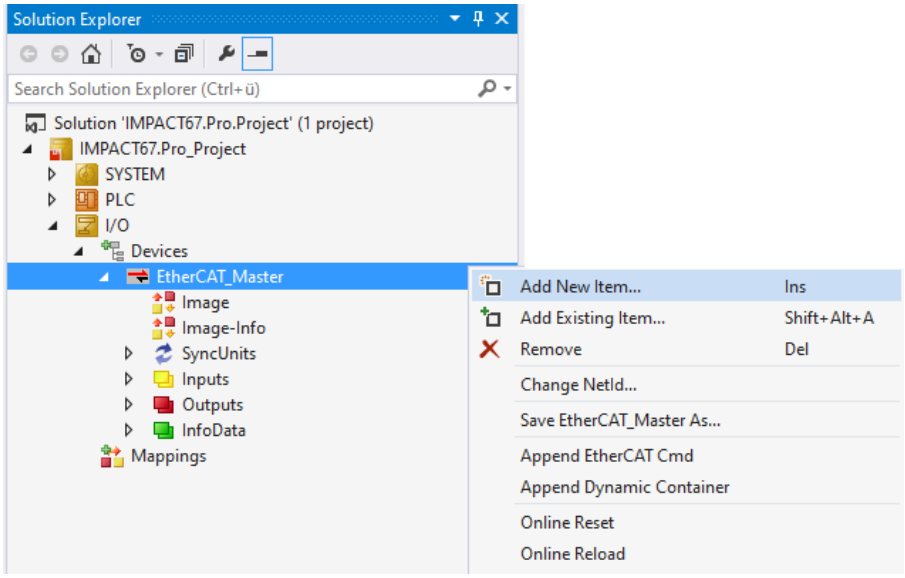


Fig. 7-2: Manual integration of the device

1 | Switch the operating voltage on and start the TwinCAT System Manager in the “Config mode”.

2 | Switch on the supply voltage.

Adding the device to the tree structure

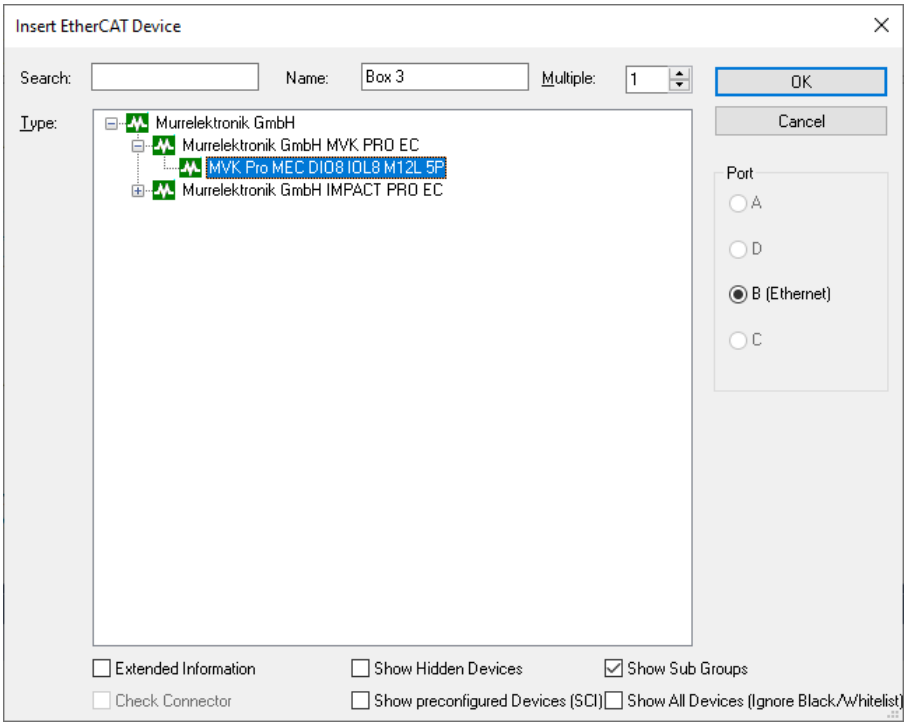


Fig. 7-3: Adding the device to the tree structure

1 | Select the device
2 | Click *OK*

Required settings on the device

After the automatic scanning or manual integration, the device is shown in the tree structure of TwinCAT.

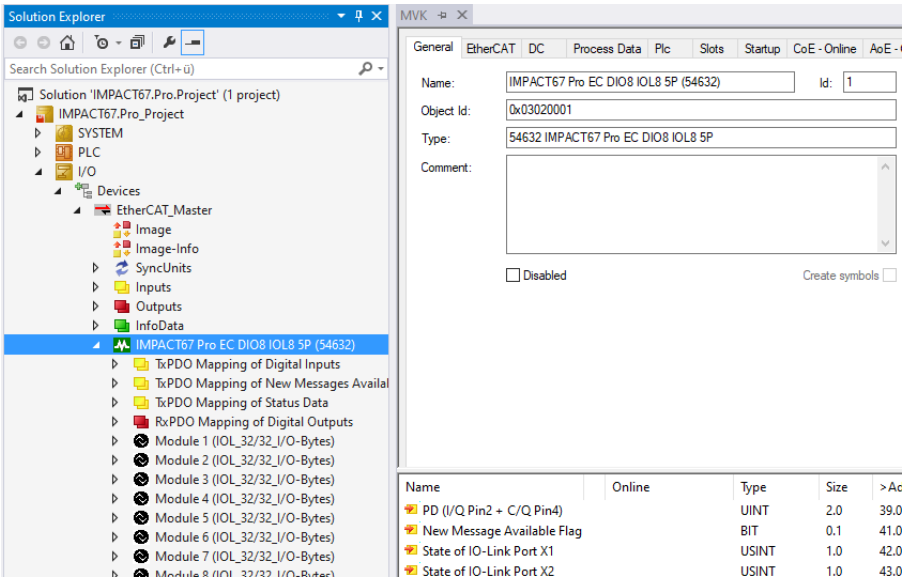


Fig. 7-4: Device settings

7.1.3 Explicit Device ID

Explicit Device ID is used for the EtherCAT function ***Hot-Connect***.

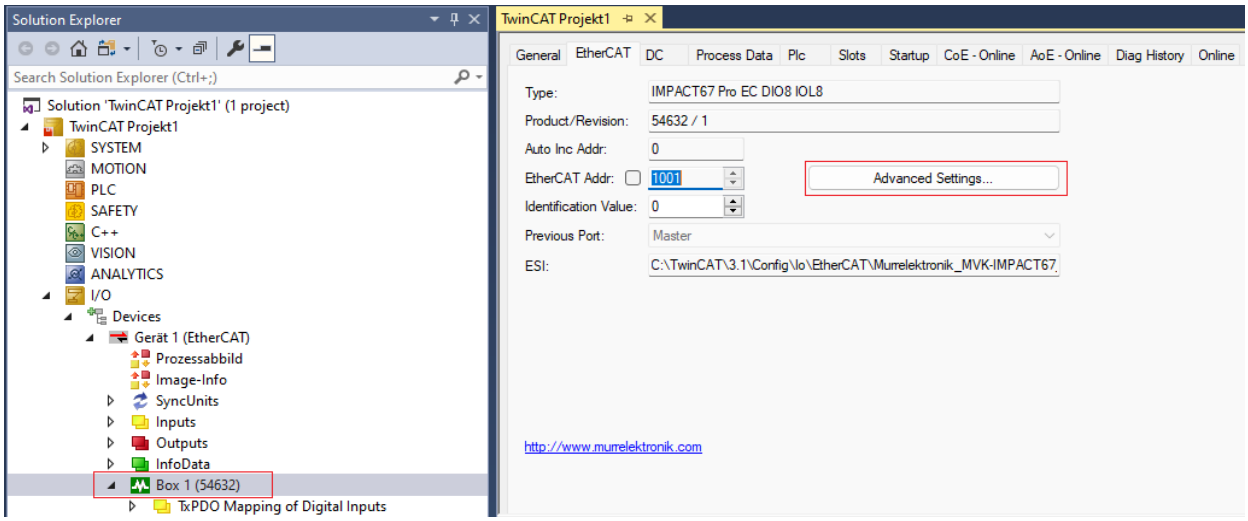
Impact67 PRO has two possibilities to set the “identification value”:

a | using rotary switch
b | writing the E^2PROM

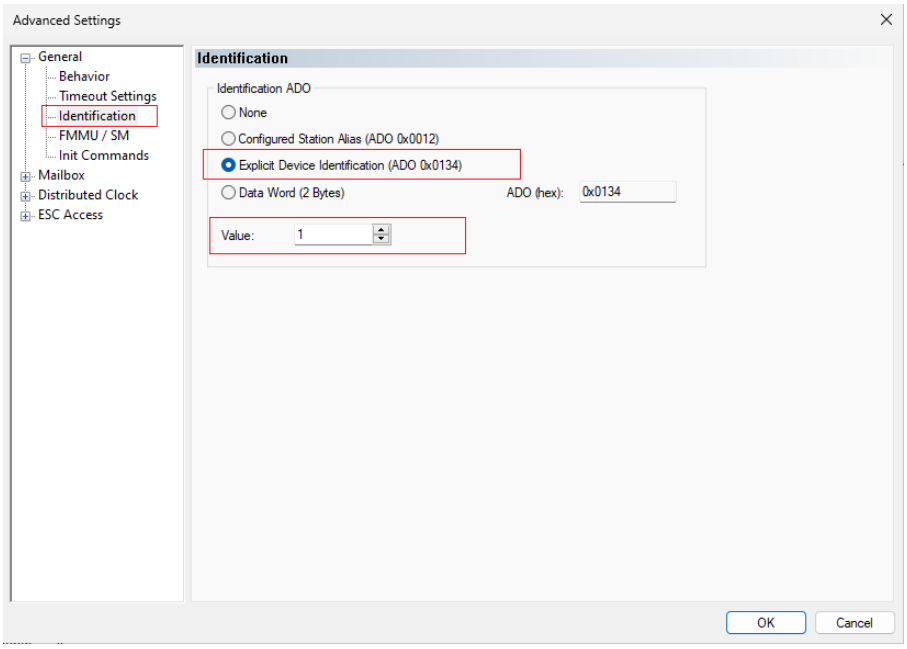
Set identification value using rotary switch

Set *Identification Value* in the *Ethercat* Tab.

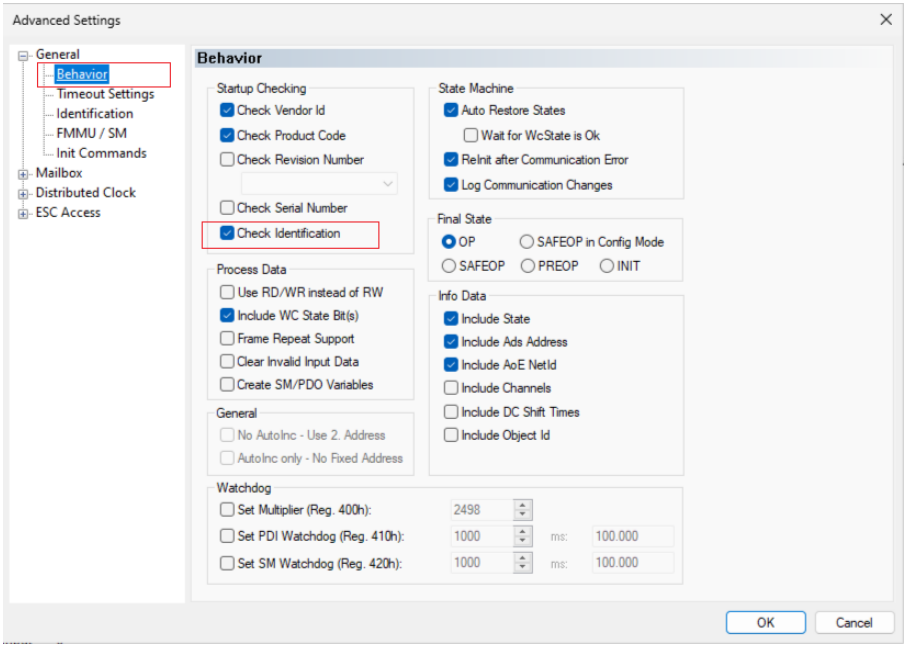
This value will be used to be compared with value that is set with the rotary switches.



1 | Select EtherCAT device MVK or IMPACT67.
2 | On the *EtherCAT* tab, select „*Advanced Settings*“.



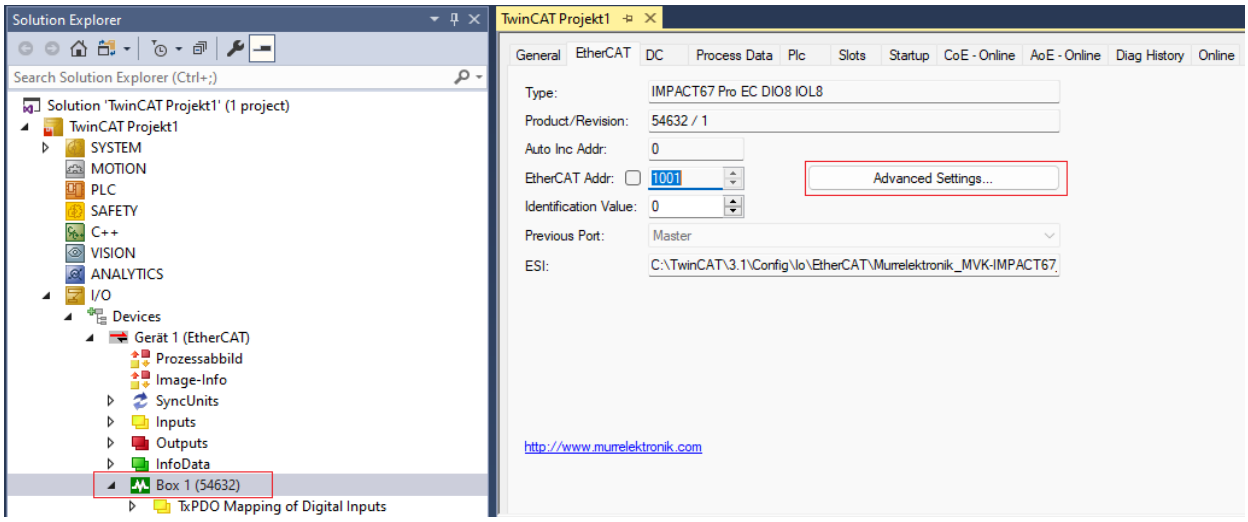
1 | Select *“Explicit Device Identification”* under *Identification*.
2 | Set an address in „*Value*”.



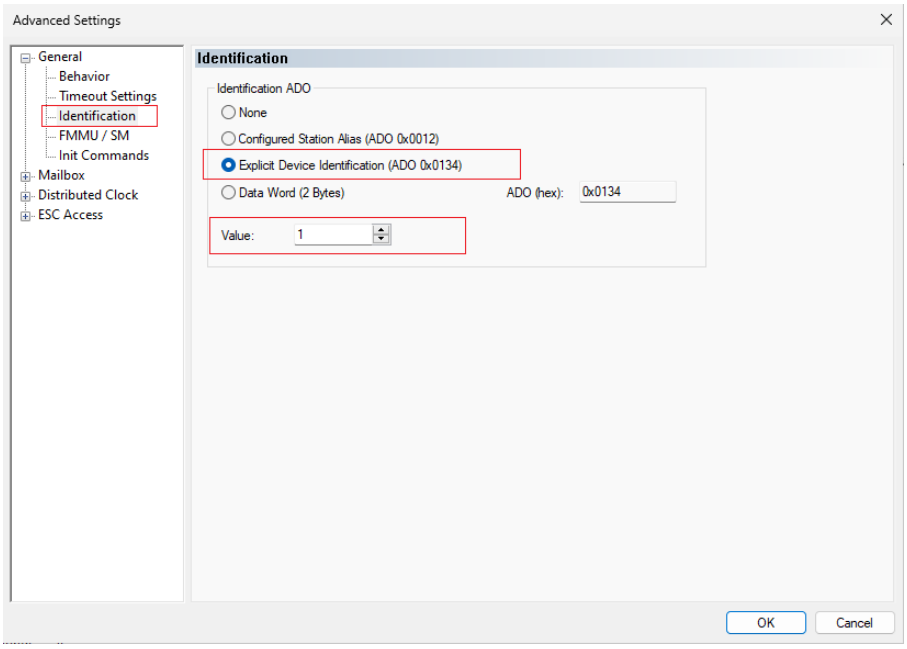
1 | Under *General* > *Behavior* activate the *„Identification Check”* checkbox.
2 | Press *OK* .
3 | Power off device and set the same Identification value using rotary switches.
4 | Power it on again.
5 | Compile your project and download it to the PLC.

Identification writing E²PROM

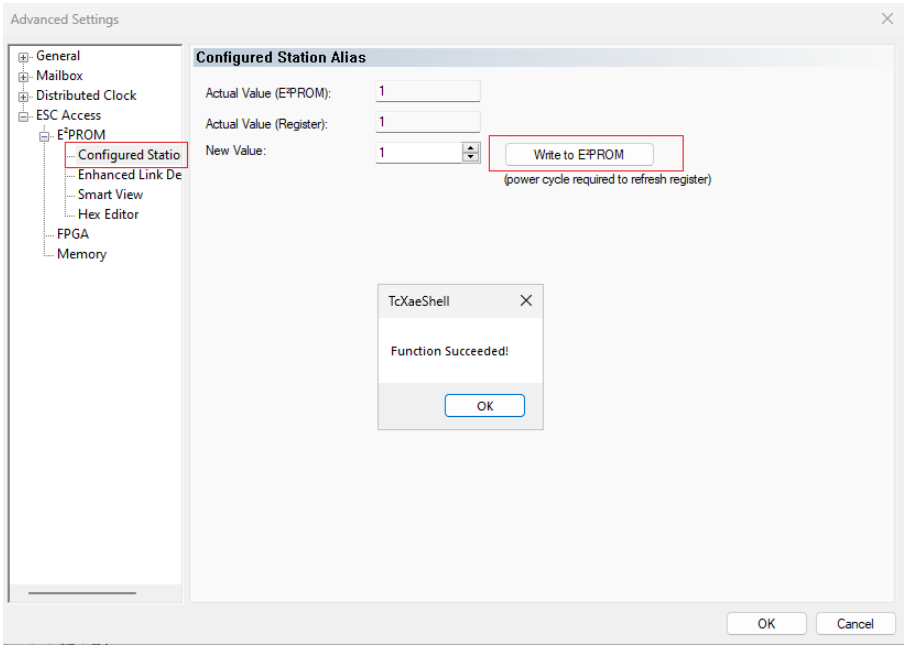
Set *"Identification Value"* in the *EtherCAT* tab.
This value will be used to be compared with value that is set in the E²PROM.



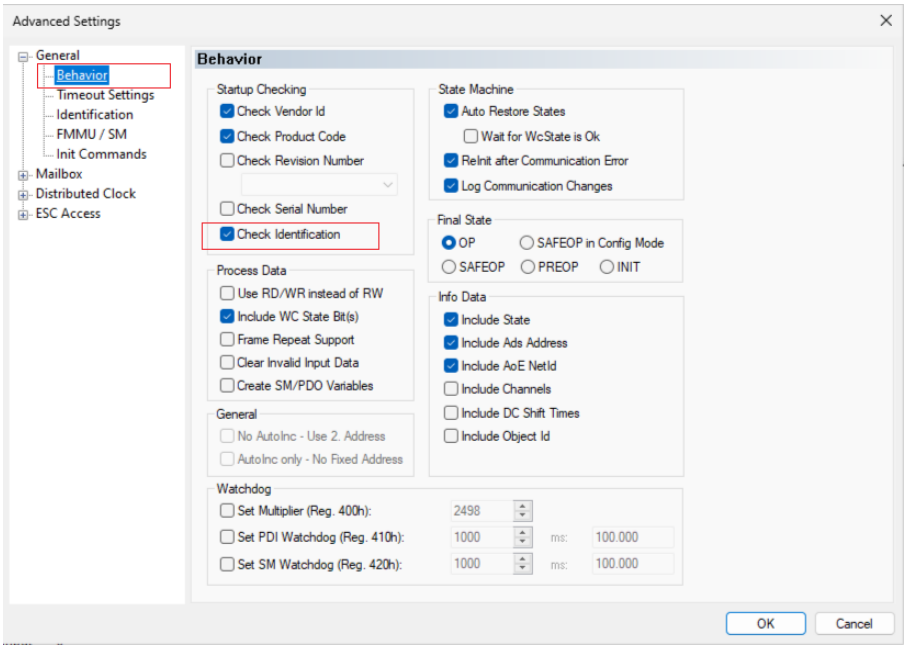
1 | Select EtherCAT device MVK or IMPACT67.
2 | On the EtherCAT tab, select *Advanced Settings*.



1 | Select *"Explicit Device Identification"* under *Identification*.
2 | Set an address in „*Value*".



1 | Select *Configured Station Alias*.
2 | In *New Value* set the same value *Identification* that was set previously.
3 | Press *Write to E²PROM*
Now the value address is saved in the E²PROM.



1 | Under *General* > *Behavior* activate the *„Identification Check”* checkbox.
2 | Press *OK*.
3 | Power cycle device.
4 | Compile your project and download it to the PLC.

7.1.4 AoE

The master device supports the reading and writing of IO-Link parameters via AoE (ADS over EtherCAT).

The acyclic communication with the IO-Link device is performed via an ADS command. The ADS address required for this consists of the NetID and the IO-Link mater port number.

AoE NetID

The master device receives an own AoE NetID for the communication with the IO-Link master part.
NetID is assigned by the configuration tool under:

➔ Box n 54632 or Box n 54612 > EtherCAT tab > Advanced Settings > Mailbox > AoE > Netid.

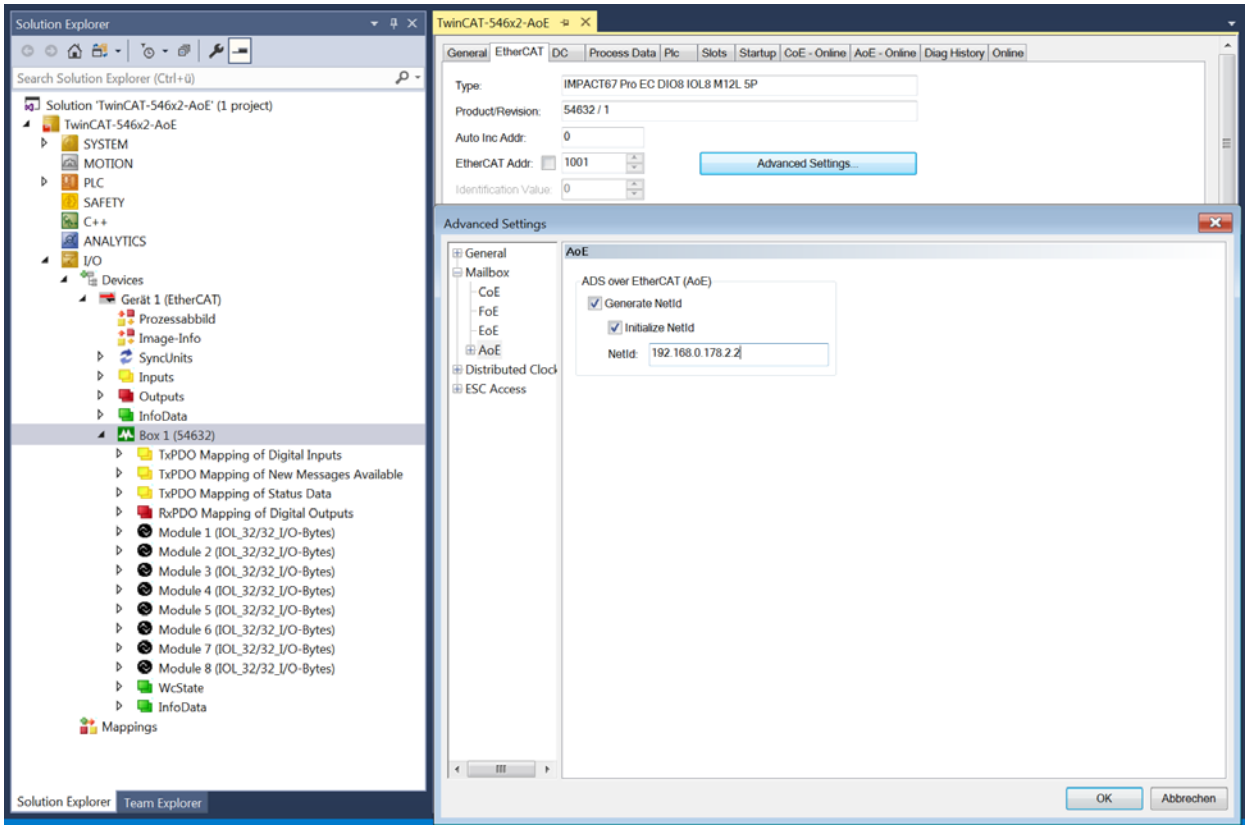


Fig. 7-5: AoE NetID

IO-Link master port number

The individual IO-Link ports of the master device are assigned via the port number. The port numbers are assigned in ascending order from 0x1000 (4096dec).

The following applies to the IO-Link master:

Female connector	Port number	Hex	Dec
X0	1	0x1000	4096
X1	2	0x1001	4097
X2	3	0x1002	4098
X3	4	0x1003	4099
X4	5	0x1004	5000
X5	6	0x1005	5001
X6	7	0x1006	5002
X7	8	0x1007	5003

ADS Index Group

In the IO-Link EtherCat Integration xyz, the Index Group for the ADS command has been set to **0xF302** as for the CoE.

ADS Index Offset

In the Index Offset, the index and subindex addressing of the IO-Link request is stored. The Index Offset has a length of 4 bytes and is divided as follows:

- 2 bytes index
- 1 byte reserved
- 1 byte subindex

For reading the subindex 0x20 (32dec) of index 0x40 (64dec), the index offset **0x00 40 00 20** is required:

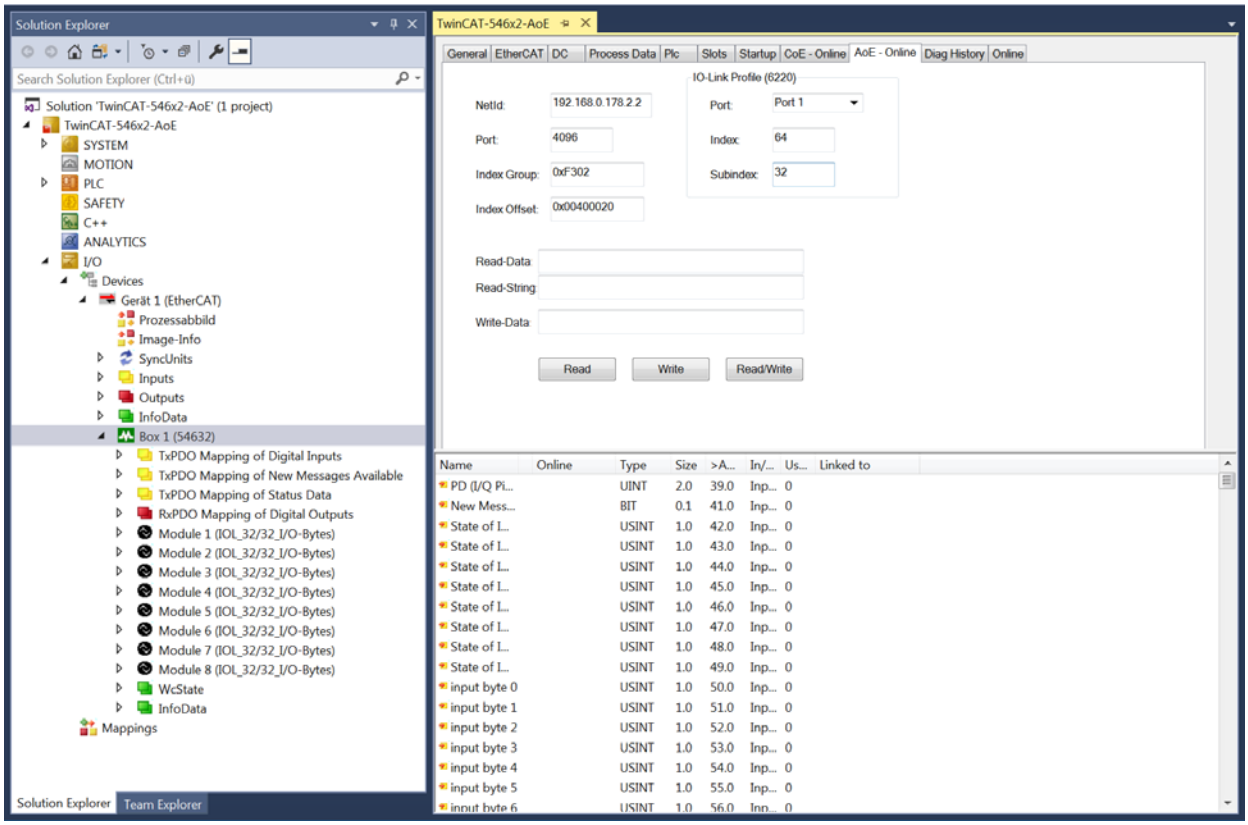


Fig. 7-6: AoE Index Offset

7.1.5 EoE

The device supports EoE (Ethernet over Ethercat).

To configure TwinCAT accordingly, select “Advanced Settings” in the EtherCAT tab.

➔ “EtherCAT®” tab > Advanced Settings > Mailbox > EoE

First a valid DNS name must be entered and then a valid IP address.

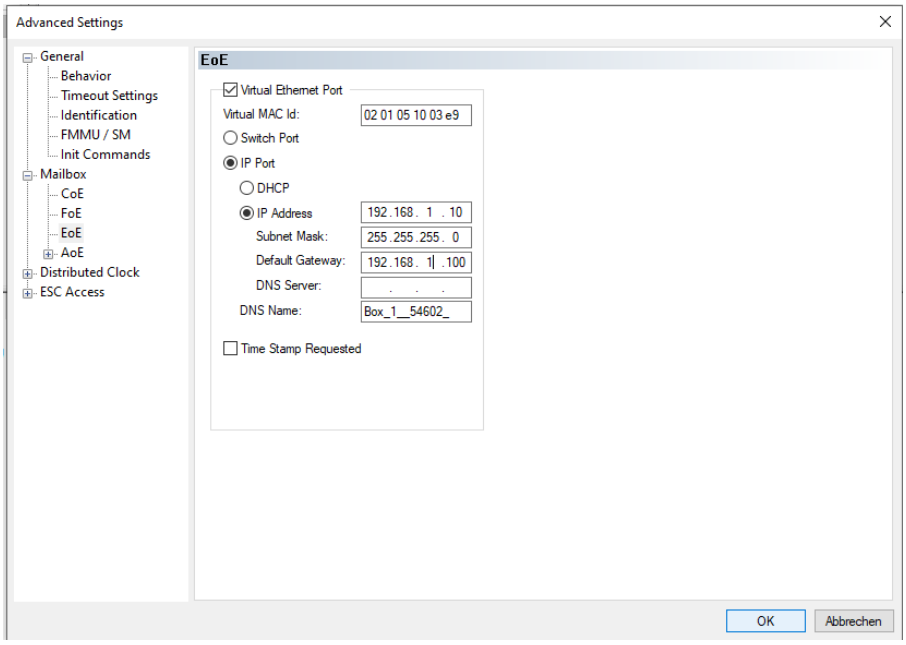


Fig. 7-7: EoE function

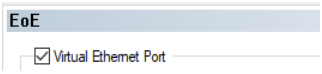


Fig. 7-8: Activation and deactivation of the EoE function

NOTE

The “EoE” function is enabled by default. By selecting the “Virtual Ethernet Port”, the function can be disabled.

7.1.6 Firmware-Update via FoE

Requires:

- TwinCAT V2 or V3
- Existing TwinCAT configuration including EtherCAT slave to update.

Firmware-Update (with TwinCAT V3)

1 | In TwinCAT open *Online* page of the EtherCAT slave and switch it to Pre-Op state.

2 | Click *Download* button.

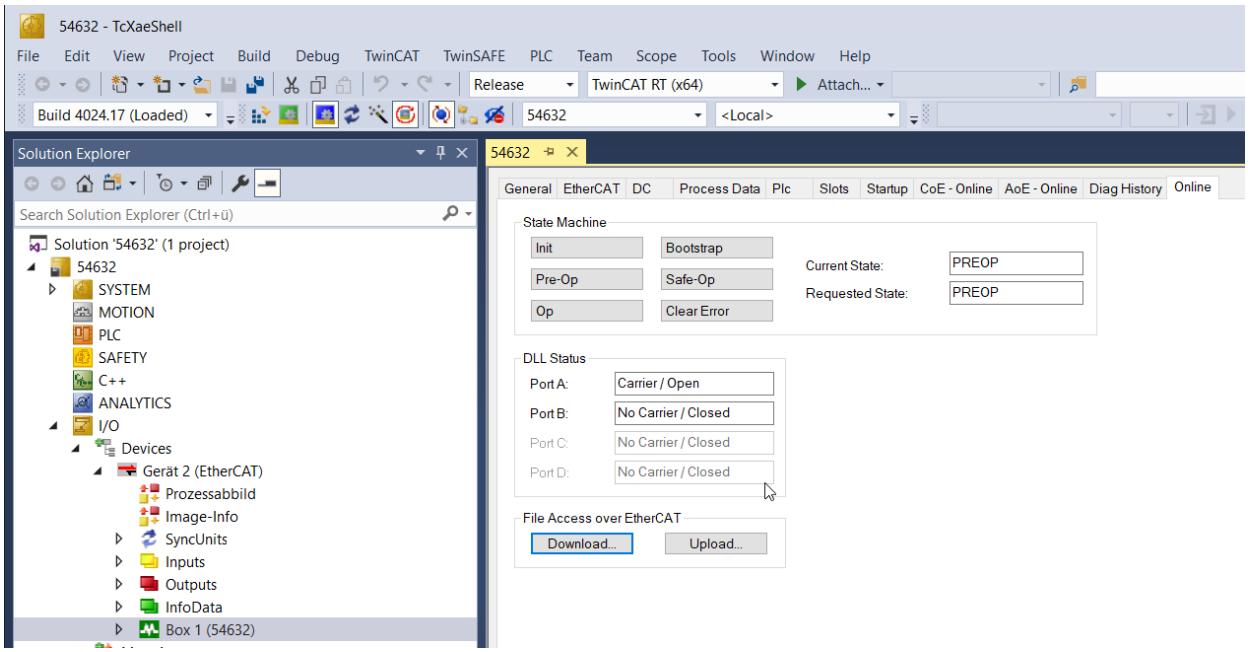


Fig. 7-9: Firmware-Update Download

Download Firmware update

1 | Select file type *All Files (*.*)*

2 | Then choose **„fwupdate.zip"** file to download

3 | Click *Open* button.

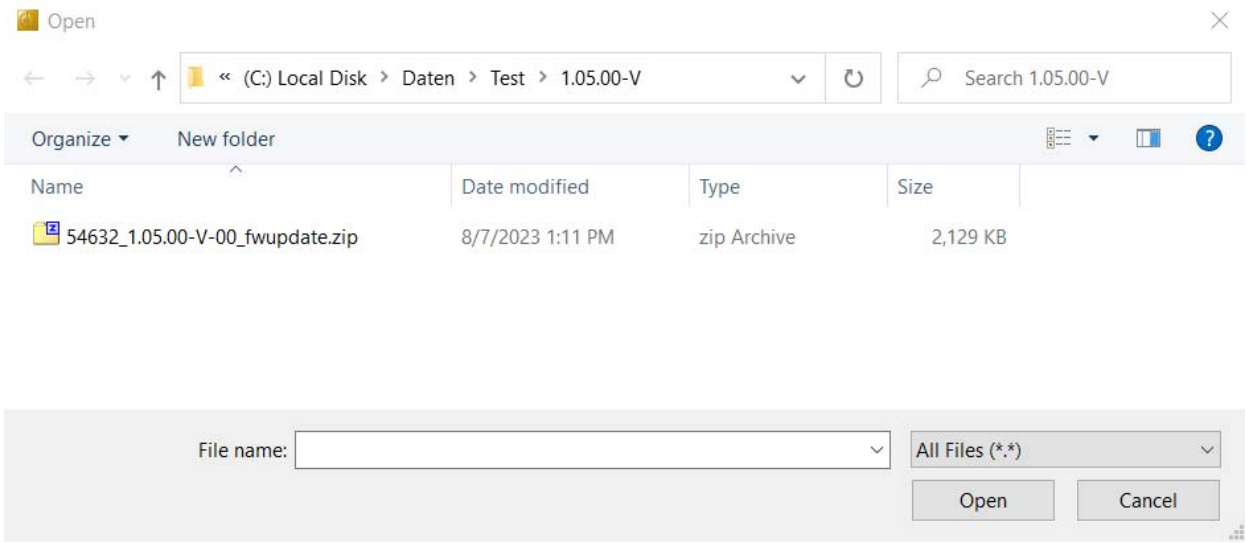


Fig. 7-10: Firmware update open

Edit FoE Name

1 | In window *Edit FoE Name* set *String* to value **„fwupdate.zip”**
2 | Click *OK button*.

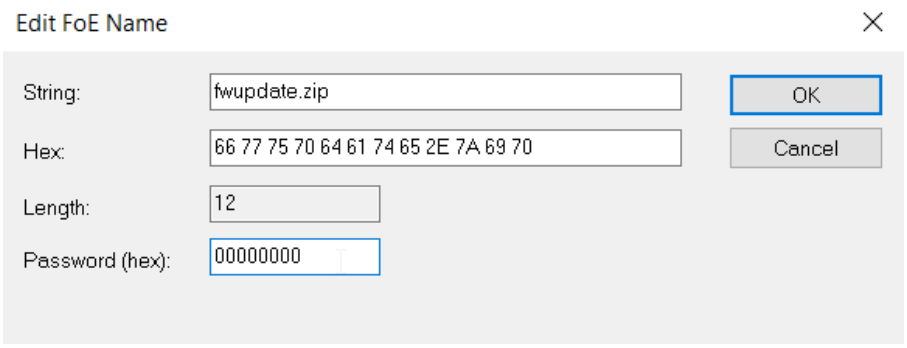


Fig. 7-11: Edit FoE Name

Wait until download has finished (about 1 minute). TwinCAT does not update the screen while download is active.

Open FW update

1 | Open the *CoE – Online* pade in TwinCAT
2 | Scroll down to the object „5FFE:0 Update Firmware" and open its sub-items „5FFE:01 Reset and Update FW Immediately".
3 | Double click object „5FFE:01 Reset and Update FW immediately”.

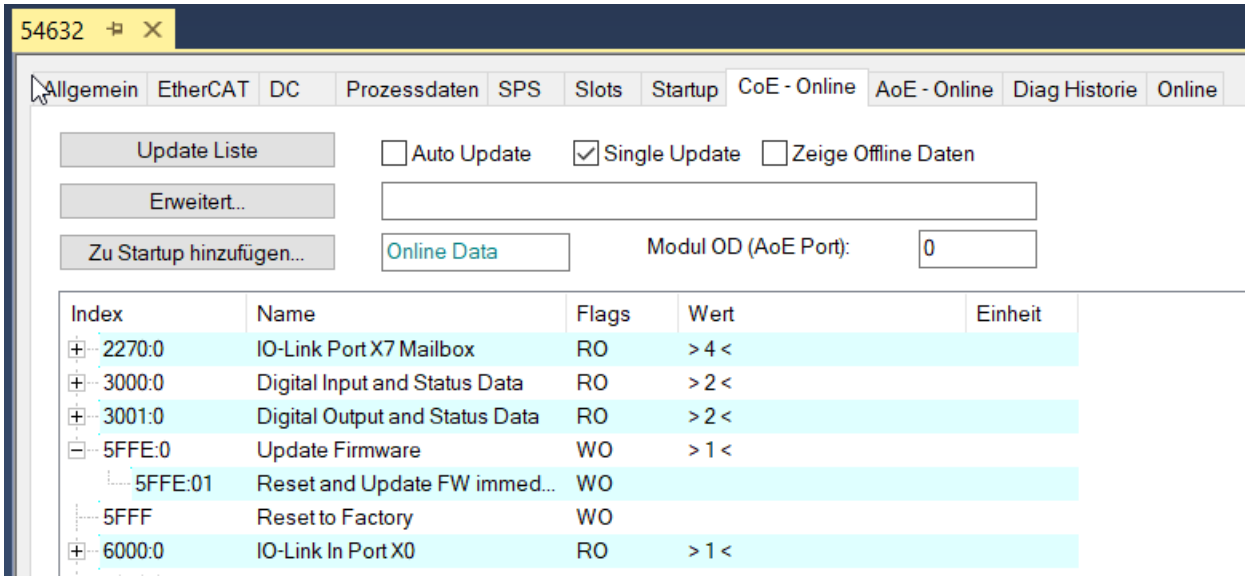


Fig. 7-12: open FW update

Enter value

1 | Enter any value in range 1..255.
2 | Click *OK* button.

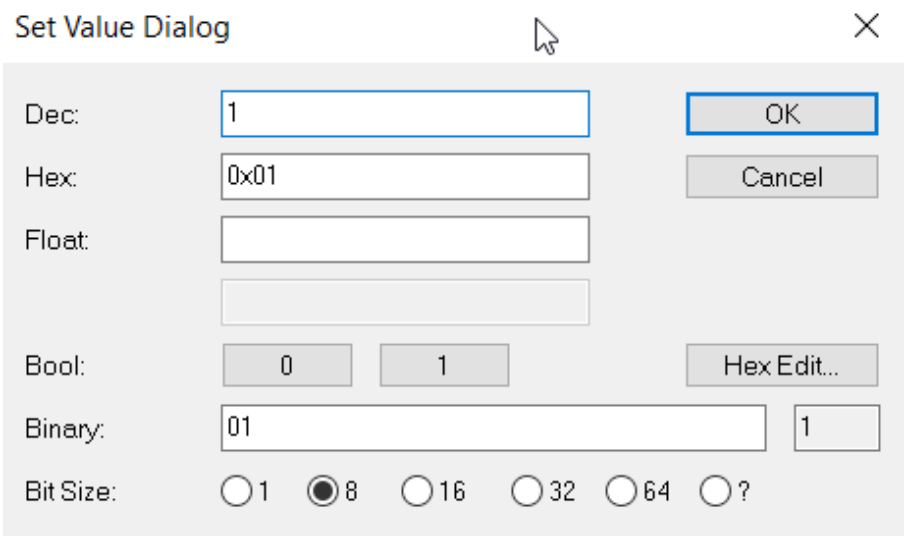


Fig. 7-13: Enter value

Start FW update

Device starts firmware update.
All status LEDs on the front are off. After less than one minute module stars with the new firmware, see CoE object „100A Manufacturer Software Version”.

8 Configuration/setting

8.1 Configuring the IO-Link master

Structure of the IO-Link master

The IO-Link master is a modular device with 8 slots.

Each individual slot corresponds to a M12 female connector pin 4.

A certain amount of process data (buffer size) can be assigned to the slot. The connected device determines the process data length at a port.

➔ Select the correct device depending on the connected one.

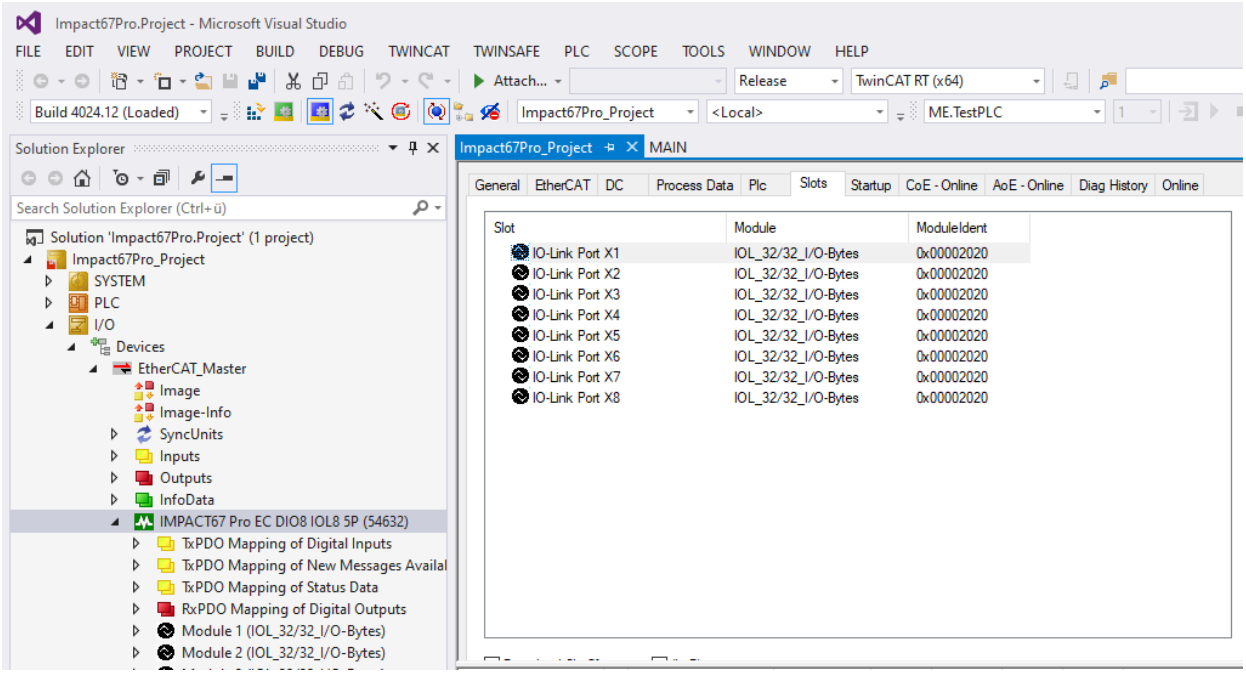


Fig. 8-1: Structure of the IO-Link master

Slot devices

The slot devices are structured according to the following scheme:

	Description
IOL_x/y_I/O bytes	Number of process data used for IO-Link device. The number should be equal or higher than the process data length of the IO-Link device. ■ x: input data ■ y: output data
Digital IN	Input pin 4
Digital OUT	Output pin 4
Slot disabled	If pin 4 on the slot is not used.

Module overview

Slot empty
Diginal_IN
Digital_OUT

IOL_1/0_I/O-Byte
IOL_2/0_I/O-Byte
IOL_4/0_I/O-Byte
IOL_8/0_I/O-Byte
IOL_16/0_I/O-Byte
IOL_32/0_I/O-Byte
IOL_0/1_I/O-Byte
IOL_0/2_I/O-Byte
IOL_0/4_I/O-Byte
IOL_0/8_I/O-Byte
IOL_0/16_I/O-Byte
IOL_0/32_I/O-Byte
IOL_1/1_I/O-Byte
IOL_2/2_I/O-Byte
IOL_4/4_I/O-Byte
IOL_8/8_I/O-Byte
IOL_16/16_I/O-Byte
IOL_32/32_I/O-Byte

8.2 Parameterizing the IO-Link master

The “Startup” tab can be used to set the individual parameters of the module and the individual ports.

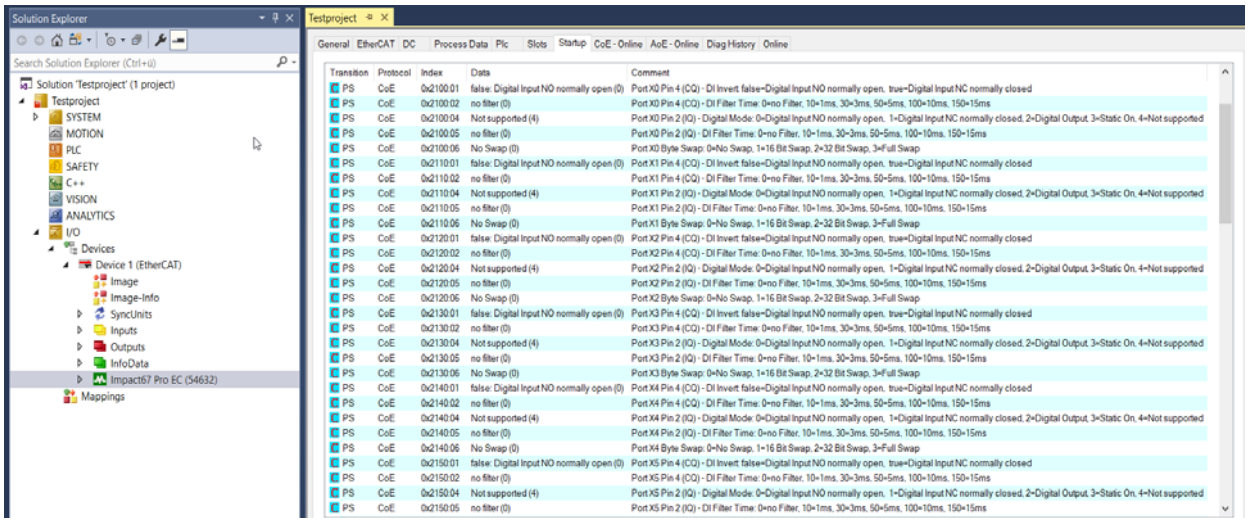


Fig. 8-2: Selecting an object

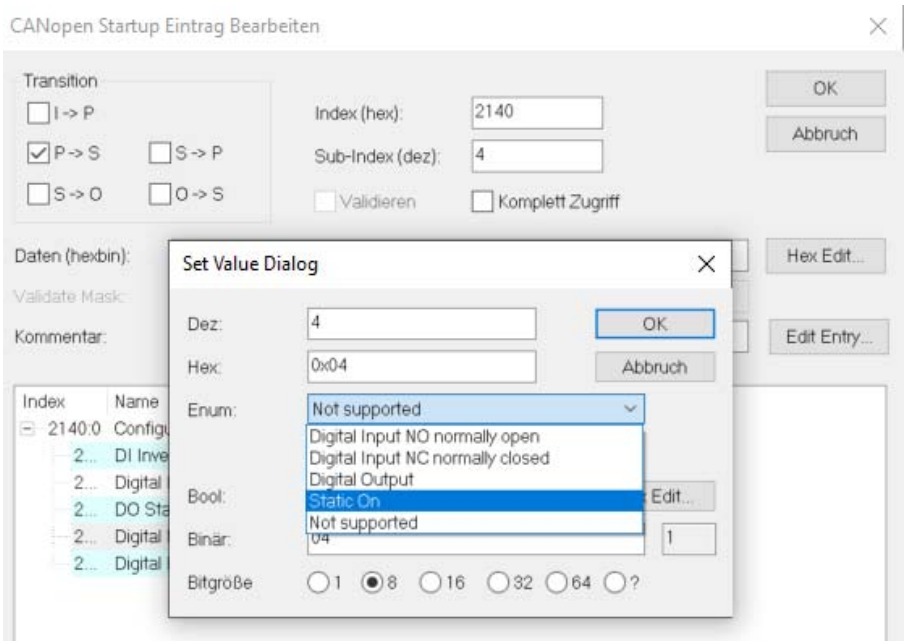


Fig. 8-3: Setting the values

1 | Select an object.

2 | If ENUM is supported, the context menu can be called and the values can be set.

The settings are transmitted during the transfer of the configuration.

PD layout configuration

The pin/port-based IO layout defines the arrangement of individual channels in the process data. This relates to inputs and outputs.

Selection	Index	Subindex	Meaning
0*	0x2001	00	**Port-based: The arrangement is sorted by ports in ascending order.**
1			Pin-based: The arrangement is sorted by pins in ascending order.

* Items shown in bold characters are the standard values of the specified parameters

DO Substitute Mode

If fieldbus communication is interrupted, the outputs will return to their predefined states.

Selection	Index	Subindex	Meaning
0	0x2002	01	**Off**
1			On
2			Last state

Port parameters Pin4 (C/Q) SIO Mode and Pin2 (I/Q)

Parameterization of the digital inputs and outputs for the ports X0... X7:

Port X_ Pin4 (C/Q) SIO DI Invert:

Selection	Index	Subindex	Meaning
0*	0x21n0	01	**Port-based: The arrangement is sorted by ports in ascending order.**
1			Pin-based: The arrangement is sorted by pins in ascending order.

Port X_ Pin4 (C/Q) SIO DI Filter Time:

Selection	Index	Subindex	Description
0	0x21n0	02	**Without filter**
10			1 ms
30			3 ms
50			5 ms
150			15 ms

Port X_ Pin2 (I/Q) Function:

Selection	Index	Subindex	Description
0	0x21n0	04	Digital input NO (normally open)
1			Digital input NC (normally closed)
2			Digital output
3			Static digital output
4			**Not supported**

Port X_ Pin2 (I/Q) DI Filter Time:

Selection	Index	Subindex	Description
0	0x21n0	05	**Without filter**
10			1 ms
30			3 ms
50			5 ms
150			15 ms

IO-Link Master Parameter

Configuration Data Port X_:

Selection	Description
Device ID	Device ID of the IO-Link device
Vendor ID	Vendor ID of the IO-Link device
IO-Link Revision	Version of the implemented IO-Link specification (connected IO-Link device). ■ 0: Plausibility check disabled ■ 11: Plausibility check enabled
Cycle time	Cycle time used by the master for the port. A value unequal to zero switches the IO-Link to the manual mode: ■ 0: as fast as possible ■ 32: 3,2 ms ■ 40: 4,0 ms ■ 48: 4,8 ms ■ 68: 6,8 ms ■ 73: 10 ms ■ 88: 16 ms ■ 100: 20,8 ms ■ 128: 32 ms ■ 133: 40 ms ■ 148: 64 ms ■ 158: 80 ms ■ 183: 120 ms ■ 188: 128 ms
Process data IN length	Number and structure of the input data
Process data OUT length	Number and structure of the output data
Master control	IO-Link DataStorage functionality * ■ **0x003= No data storage** ■ 0x023= Backup + Restore ■ 0x043= Restore

* When switching to the “Restore” state, any device configurations previously stored in the device are **discarded**, especially when switching from “Back-up&Restore” to “Restore”.
If a compatible device is connected for the first time in the “Restore” state:

- ➔ the master fetches the DataStorage data (one-time backup) from the device,
- ➔ saves them *and*
- ➔ then sends this data to each newly connected, compatible device with a different configuration (restore).

8.3 General EtherCAT objects

Explanation of the elements

Access	Read and/or write access: ■ RO: only read access ■ RW: read and write access
Default	Preset value
UINT	Data type Unsigned INT

Device type

Index	Name	Type	Access	Default value	Meaning
0x1000	Device type	UINT32	RO	0x00000000	Device type of the EtherCAT slave: ■ The Lo-Word contains the CoE profile used (5001). ■ The Hi-Word contains the module profile according to the modular device profile.

Error Register

Index	Name	Type	Access	Default value	Meaning
0x1001	Error Register	UINT32	RO	0x00000000	Error Register Object Bit 0 = 1: Generic error Bit 1 = 1: Current error (SSC or ASC) Bit 2 = 1: Voltage error (LVS or LVA) Bit 3 ... 6: Reserved Bit 7 = 1: Internal device error (IME)

Manufacturer Device Name

Index	Name	Type	Access	Default value	Meaning
0x1008	Name	VISIBLE STRING	RO	MVK Pro EC DIO8 IOL8	Device name of the EtherCAT slave

Manufacturer Hardware Version

Index	Name	Type	Access	Default value	Meaning
0x1009	Hardware version	VISIBLE STRING	RO	Actual hardware version	Hardware version of the EtherCAT slave

Manufacturer Software Version

Index	Name	Type	Access	Default value	Meaning
0x100A	Software version	VISIBLE STRING	RO	Actual firmware version	Firmware version of the EtherCAT slave

Identity Object

Index	Name	Type	Access	Default value	Meaning
0x1018:00	Identifiy object	UINT8	RO	0x04 (4dec)	Information of the slave
0x1018:01	Vendor ID	UINT32	RO	0x4F (79dec)	Vendor ID of EtherCAT slave device manufacturer
0x1018:02	Product code			0xDC70 (56432dec)	Product code of the EtherCAT slave
0x1018:03	Revision			0x00000000 (0dec)	Revision number of the EtherCAT slave; the Low Word (bit 0-15) indicates the special terminal number, the High Word (bit 16-31) refers to the device description
0x1018:04	Serial number			0x00000000 (0dec)	Serial number of EtherCAT slave ■ the high word (bits 31-16) contains a consecutive number ■ the upper byte of the low word (bits 15-8) contains the manufacturing week ■ the lower byte of the low word (bits 7-0) contains the manufacturing year

Timestamp Object

Index	Name	Type	Access	Default value	Meaning
0x10F8	Timestamp Object	UINT64	RO	-	Local timestamp of the device in ns

Diagnosis History

Index	Name	Type	Access	Length in bytes	Meaning
0x10F3	Diagnosis History	RECORD			
0x10F3:0	Diagnosis History	UINT8	RO	255	Highest supported subindex
0x10F3:1	Maximum Messag-es	UINT8	RO	0xFA (250dec)	Number of diagnosis messages which can be stored in the diagnosis history (subindex 6 onwards)
0x10F3:2	Newest Message	UINT8	RO	0	Subindex of the newest diagnosis message (6-255)
0x10F3:3	Newest Acknowl-edged Message	UINT8	RW	0	■ **Overwrite Mode (SI5, bit 4 = 0):** *Read = 0*: When the message queue will be overwritten, the slave sets SI3 to 0. *Writing = 0:* The slave clears all messages, i.e. resets SI2, SI3, SI4 and SI5 bit 5***** *Writing = 1...5:* The slave returns SDO abort with code 0x06090030 (value of parameter written too low) *Writing = 6..255*: SI3 = written value (without checking)****** ■ **Acknowledge Mode (SI5, bit 4 = 1):** *Read = 0*: No messages have been acknowledged so far *Read != 0*: Subindex of latest acknowledged diagnosis message (6-69) *Writing = 0*: All acknowledged messages will be deleted *Writing = 1...5*: The slave returns SDO abort with code 0x06090032 (value of parameter written too low) *Writing = 6...255:* *Messages are acknowledged********
0x10F3:4	New Messages Available	BIOOL	RO	0	Overwrite Mode: ■ 0: newest message was read ■ 1: newest message was not read Acknowledge mode: ■ 0: no unacknowledged message ■ 1: diagnosis messages are available which can be acknowledged (SI2 !=SI3)

Index	Name	Type	Access	Length in bytes	Meaning
0x10F3:5	Flags	UINT2	RW	0x0000 (0dec)	Flags to control sending and storing of diagnosis messages *Bit 0: Enable Emergency sending* 0: default if device does not support emergency sending 1: new diagnosis messages shall be sent as emergency message *Bit 1: Disable info messages* 0: Info messages are stored in the diagnosis message queue (default) 1: Info messages will not be stored in the diagnosis message queue *Bit 2: Disable warning messages* 0: Warning messages are stored in the diagnosis message queue (default) 1: Warning messages will not be stored in the diagnosis message queue *Bit 3:* Disable error messages 0: Error messages are stored in the diagnosis message queue (default) 1: Error messages will not be stored in the diagnosis message queue *Bit 4: Mode selection for diagnosis history handling* 0: Overwrite Mode: old messages are overwritten by new ones when buffer is full 1: Acknowledge mode: New messages do only overwrite messages which were acknowledged before *Bit 5: Overwrite/Discard Information (read only)* In Overwrite mode: 1: unacknowledged messages have been overwritten (= buffer overrun) (SI3 is set to 0, too) In Acknowledge mode: 1: message buffer is full with acknowledged messages and a new message is discarded *Bit 6.-15: reserved*
0x10F3: 6-255	Diagnosis Message	OCTET_ STRING	RO		Diagnosis message buffer. Depending on SI1 the EtherCAT slave can store up to 250 messages; the first message is stored in subindex 6, the second in subindex 7and so on. When the queue is full, the EtherCAT slave shall overwrite subindex 6 and so on, that always the latest maximum messages (SI1) shall be accessible by the EtherCAT master.

*) Messages are deleted even if they were not acknowledged or read before.

**) All messages up to the age of the message which is in the written subindex are acknowledged. The slave does not check if those messages have been read before. The slave returns SDO abort with code 0x06090030 (value range of parameter exceeded) in the following case: If SI3 is written with a value of a Subindex which does not hold a message.

***) All messages up to the age of the message which is in the written subindex are acknowledged. The slave does not check if those messages have been read before. The slave returns SDO abort with code 0x06090030 (value range of parameter exceeded) in the following case: If SI3 is written with a value of a Subindex which does not hold a message.

Subindex 0: Highest supported subindex

The diagnostic history can contain a maximum number of diagnostic messages as specified in subindex 1: Maximum Messages. These are available starting with subindex 6. Subindex 0 indicates the highest subindex under which a diagnostic message is stored.

Subindex 1: Maximum Messages

The diagnostic history can contain as many diagnostic messages as specified here. This value is a maximum of 250.

Subindex 2: Newest Message

With the subindex 2 you can query under which subindex in the diagnostic history the current newest diagnostic message is stored. The value should be between 6 and 255. If no diagnostic messages are currently stored, the value 0 is returned.

Subindex 3: Newest Acknowledged Message

This subindex includes the subindex of the newest acknowledged diagnostic message. It can both be read and written. In both cases, the meaning of the values depend on the current mode.
There are

- Overwrite Mode (subindex 5, Bit 4 = 0) and
- Acknowledge Mode (subindex 5, Bit 4 = 1).

Overwrite Mode:

Read = 0:
If the diagnostic message queue is overwritten, the EtherCAT slave sets subindex 3 to 0.

Writing = 0:
If the value 0 is written into subindex 3, the EtherCAT slave deletes subindex 2, subindex 3, subindex 4 and subindex 5 bit 5 respectively sets them to 0.

Note
Diagnostic messages are deleted even if they have not been previously acknowledged or read.

Writing = 1...5:
The slave returns SDO abort with error code 0x06090032 (written parameter value too small).

Writing = 6...255:
subindex 3 = Value is overwritten (without verification).

Acknowledge mode:

Read = 0:
Until now, no diagnostic messages have been acknowledged.

Read != 0:
Subindex of the last acknowledged diagnostic message (6-255)

Writing = 0:
All acknowledged diagnostic messages are deleted.

Writing = 1...5:
The slave returns SDO Abort with error code 0x06090032 (written parameter value too small).

Writing = 6...255:
The diagnostic messages are acknowledged.

Note
All diagnostic messages up to the age of the message located in the subindex just written are acknowledged.
The EtherCAT slave does not check whether these diagnostic messages have been read before.
If subindex 3 is written with the number of a subindex that does not contain a diagnostic message, the slave returns SDO Abort with error code 0x06090030 (exceeding the value range of the parameter).

Subindex 4: New Messages Available

Overwrite Mode:

0: The latest diagnostic message has been read.
1: The latest diagnostic message has not been read.

Acknowledge mode:

0: No unacknowledged diagnostic messages present.
1: There are diagnostic messages that can be acknowledged.

Subindex 5: Flags

Bit 0: Enable Emergency Messages	
0	Default if device cannot send Emergency Messages.
1	New diagnostic messages can be sent as Emergency Messages.

Bit 1: Disable info messages	
0	Info messages are saved in the queue for diagnostic messages.
1	Info messages are **not** saved in the queue for diagnostic messages.

Bit 2: Disable warning messages	
0	Warning messages are saved in the queue for diagnostic messages.
1	Warning messages are **not** saved in the queue for diagnostic messages.

Bit 3: Disable error messages	
0	Error messages are saved in the queue for diagnostic messages.
1	Error messages are **not** saved in the queue for diagnostic messages.

Bit 4: Mode selection for reaction to buffer overflow of the diagnostic history	
0	Overwrite mode: When the buffer is full, old diagnostic messages are overwritten with new ones.
1	Acknowledge mode: New diagnostic messages will only overwrite older messages if they have been previously acknowledged.

Bit 5: Overwriting and discarding of information (read only)	
In overwrite mode:	
1	Unacknowledged diagnostic messages have been overwritten (=buffer overflow). Subindex 3 has been set to 0.
In acknowledge mode:	
1	The buffer for diagnostic messages is full with acknowledged messages and a new diagnostic message is discarded.

Bit 6-15: Reserved	

Subindex 6-255: Diagnostic message

Subindex 6-255: Diagnostic message buffer

Depending on subindex 1, the EtherCAT slave can save up to 250 diagnostic messages. The first message is saved in subindex 6, the second in subindex 7 etc. As soon as the buffer is full, the EtherCAT slave overwrites subindex 6 etc. so that the last diagnostic message is accessible to the EtherCAT master. Their exact number is defined by subindex 1.

8.4 Bit mapping and process data of the device

When used in an EtherCAT master system, the Murrelektronik EtherCAT IO-Link master uses these objects in the address range of the EtherCAT master. Process data has the following structure:

TxPDO/RxPDO assignment of the IO-Link slot

- Process data assignment for digital channels or IO-Link device to pin 4.

✓ If a slot is set to **Digital IN** or **Digital OUT**, one byte of process data is always assigned to this slot.
The status channel of the respective slot is available in the overall volume of the process data, this means in “TxPDO Mapping of digital Inputs” oder “RxPDO Mapping of digital Outputs”.

✓ If the slot is set to **IOL_x / y_I / O Byte**, a specific number of bytes will always be assigned as process data which correspond to the type (input/output) and the size (x/y).

Input/output range							
Byte 0	Byte 1	Byte 2					Byte 31
Process data byte 0	Process data byte 1	Process data byte 2	-	-	-	-	Process data byte 31

Tab. 8-1: Input/output range

TxPDO assignment digital inputs

- Process data assignment for digital inputs to pin 4 and pin 2

Pin4 (C/Q) + Pin2 (I/Q) – Port-based data layout

Input byte n							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X0 Pin 4	Port X0 Pin 2	Port X1 Pin 4	Port X1 Pin 2	Port X2 Pin 4	Port X2 Pin 2	Port X3 Pin 4	Port X3 Pin 2
Input byte n+1							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X4 Pin 4	Port X4 Pin 2	Port X5 Pin 4	Port X5 Pin 2	Port X6 Pin 4	Port X6 Pin 2	Port X7 Pin 4	Port X7 Pin 2

Tab. 8-2: Port-based data layout_digital inputs pin 4 and pin 2

Pin4 (C/Q) + Pin2 (I/Q) – Pin-based data layout

Input byte n							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X0 Pin 4	Port X1 Pin 4	Port X2 Pin 4	Port X3 Pin 4	Port X4 Pin 4	Port X5 Pin 4	Port X6 Pin 4	Port X7 Pin 4
Input byte n+1							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X0 Pin 2	Port X1 Pin 2	Port X2 Pin 2	Port X3 Pin 2	Port X4 Pin 2	Port X5 Pin 2	Port X6 Pin 2	Port X7 Pin 2

Tab. 8-3: Pin-based data layout_digital inputs pin 4 and pin 2

TxPDO assignment of digital outputs

- Process data assignment for digital outputs to pin 4 and pin 2.

Pin4 (C/Q) + Pin2 (I/Q) – Port basiertes Daten-Layout

Input byte n							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X0 Pin 4	Port X0 Pin 2	Port X1 Pin 4	Port X1 Pin 2	Port X2 Pin 4	Port X2 Pin 2	Port X3 Pin 4	Port X3 Pin 2
Input byte n+1							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X4 Pin 4	Port X4 Pin 2	Port X5 Pin 4	Port X5 Pin 2	Port X6 Pin 4	Port X6 Pin 2	Port X7 Pin 4	Port X7 Pin 2

Tab. 8-4: Port-based data layout_digital outputs pin 4 and pin 2

Pin4 (C/Q) + Pin2 (I/Q) – Pin basiertes Daten-Layout

Input byte n							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X0 Pin 4	Port X1 Pin 4	Port X2 Pin 4	Port X3 Pin 4	Port X4 Pin 4	Port X5 Pin 4	Port X6 Pin 4	Port X7 Pin 4
Input byte n+1							
Bit 0	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**
Port X0 Pin 2	Port X1 Pin 2	Port X2 Pin 2	Port X3 Pin 2	Port X4 Pin 2	Port X5 Pin 2	Port X6 Pin 2	Port X7 Pin 2

Tab. 8-5: Pin-based data layout_digital outputs pin 4 and pin 2

TxPDO assignment of new available messages

Overwrite Mode	0: newest message was read
	1: newest message was not read
Acknowledge Mode	0: no unacknowledged message
	1: diagnosis messages are available which can be acknowledged

TxPDO assignment of status data

- A status byte is available for each port.

State of IO-Link Port X_

Input byte n	0: port not enabled
	1: SIO mode digital input
	2: SIO mode digital output
	3: IO-Link communication enabled
	4: IO-Link communication disabled

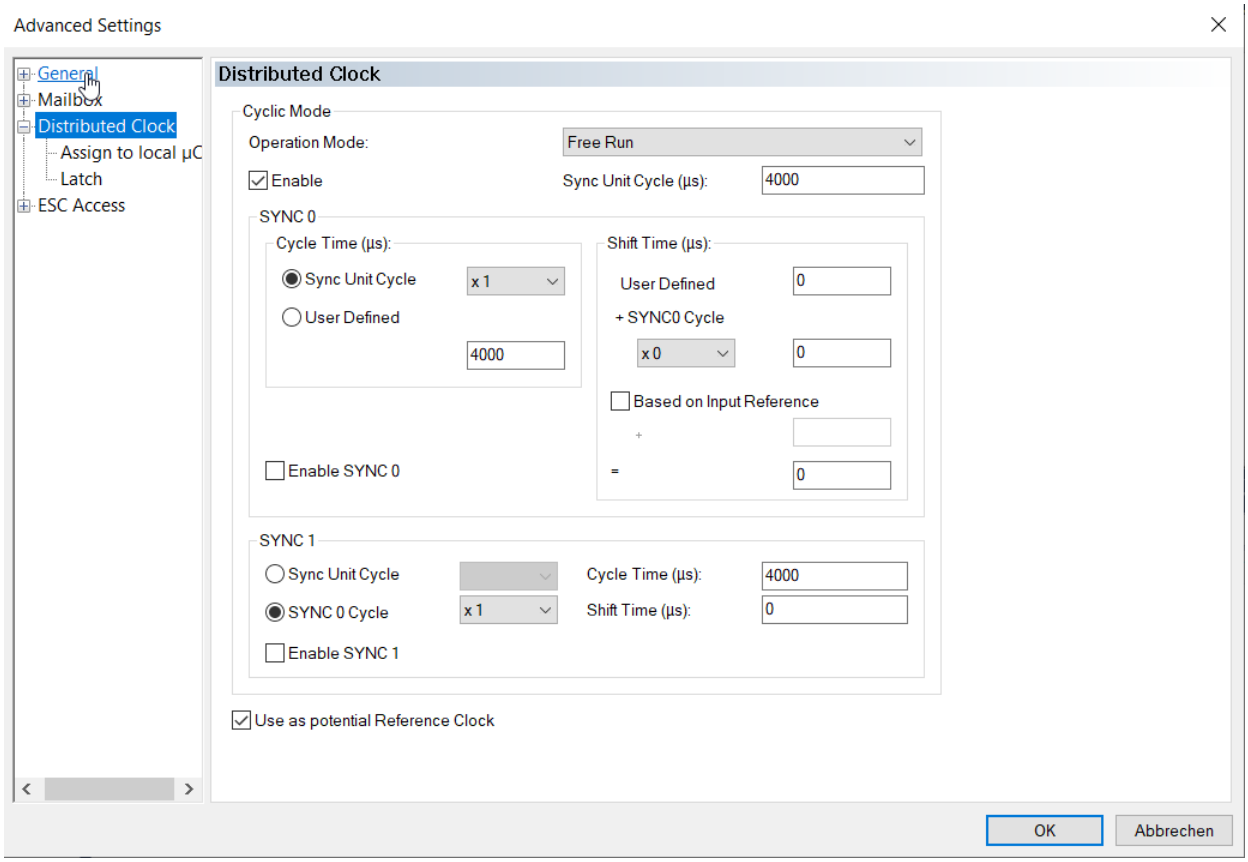
State of IO-Link Port n_(n represents the Subindex/Module position)

Bit 0...3 IO-Link State	0x00 (0dec)	Port Inactive
	0x01 (1dec)	Siomode Digital In
	0x02 (2dec)	Siomode Digital Out
	0x03 (3dec)	Communication OP
	0x04 (4dec)	Communication STOP

Bit 4...7 ErrorCode	0x00 (0dec)	No Error
	0x10 (16dec)	Watchdog Error
	0x20 (32dec)	Buffer Overflow
	0x30 (48dec)	Invalid Device ID
	0x40 (64dec)	Invalid Vendor ID
	0x50 (80ec)	Invalid IO-Link Revision
	0x60 (96dec)	Invalid Frame Capability
	0x70 (112dec)	Invalid Cycle Time
	0x80 (128dec)	Invalid Length processdata
	0x90 (144dec)	Invalid Length processdata
	0xA0 (160dec)	No Device deteced
	0xB0 (172dec)	Error PreOP

8.5 Distributed Clocks (DC)

The device supports the forwarding of DC messages and can itself serve as a reference clock. The internal time stamps are limited to 32 bits.



NOTE

Synchronization of the local ports of the device with the DC is not provided.

8.6 Industrial Internet of Things (IIoT)

8.6.1 JSON

General JSON settings

No.	REST API URL	Description	Support-ed
1	GET /iolink/v1/gateway/identification	Identification of the gateway	✓
2	GET /iolink/v1/gateway/capabilities	Capabilities of the gateway	✓
3	GET /iolink/v1/gateway/configuration	Read network configuration of the gateway	✓
4	POST /iolink/v1/gateway/configuration	Write network configuration of the gateway	✓
5	POST /iolink/v1/gateway/reset	Reset the gateway including all masters	-
6	POST /iolink/v1/gateway/reboot	Reboot the gateway including all masters	-
7	GET /iolink/v1/gateway/events	Event log containing all events from gateway, masters, ports and devices	✓
8	GET /iolink/v1/masters	Get all available master number keys and identification information	✓
9	GET /iolink/v1/masters/$MASTER_NUMBER/ capabilities	Capabilities of the master	✓
10	GET /iolink/v1/masters/$MASTER_NUMBER/ identification	Read identification of the master	✓
11	POST /iolink/v1/masters/$MASTER_NUMBER/ identification	Write identification of the master	✓
12	GET /iolink/v1/masters/$MASTER_NUMBER/ports	Get all available port number keys	✓
13	GET /iolink/v1/masters/$MASTER_NUMBER/ports/ $PORT_NUMBER/capabilities	Read capability information of the specified port	✓
14	GET /iolink/v1/masters/$MASTER_NUMBER/ports/ $PORT_NUMBER/status	Read status of the master	✓
15	GET /iolink/v1/masters/$MASTER_NUMBER/ports/ $PORT_NUMBER/configuration	Read configuration of the specified port	✓
16	POST /iolink/v1/masters/$MASTER_NUMBER/ ports/$PORT_NUMBER/configuration	Write configuration of the specified port	✓
17	GET /iolink/v1/masters/$MASTER_NUMBER/ports/ $PORT_NUMBER/datastorage	Read data storage content of the specified port	✓
18	POST /iolink/v1/masters/$MASTER_NUMBER/ ports/$PORT_NUMBER/datastorage	Write data storage content of the specified port	✓
19	GET /iolink/v1/devices	Address all devices of all masters	✓
20	GET /iolink/v1/devices/{deviceAlias}/capabilities	Read capability information of the specified device	✓
21	GET /iolink/v1/devices/{deviceAlias}/identification	Read identification information of the specified device	✓
22	POST /iolink/v1/devices/{deviceAlias}/identification	Write identification information of the specified device	-
23	GET /iolink/v1/devices/{deviceAlias}/processdata/ value?format=byteArray	Read process data value from the specified device	✓
24	GET /iolink/v1/devices/{deviceAlias}/processdata/ getdata/value?format=byteArray	Read process data input value from the specified device	✓
25	GET /iolink/v1/devices/{deviceAlias}/processdata/ setdata/value?format=byteArray	Read process data output value from the specified device	✓
26	POST /iolink/v1/devices/{deviceAlias}/processdata/ value	Write the process data output value to the specified device	✓
27	GET /iolink/v1/devices/{deviceAlias}/parameters/ {index}/value/?format=byteArray	Read a specific parameter value and its subparameter values (if the parameter has complex type) with the given index of the device	✓

No.	REST API URL	Description	Supported
28	GET /iolink/v1/devices/{deviceAlias}/parameters/{index}/subindices/{subindex}/value/?format=byteArray	Read the value of a specific sub-parameter with the given index and subindex	✓
29	GET /iolink/v1/devices/{deviceAlias}/parameters/{parameterName}/value/?format=byteArray	Read a specific parameter value with the given name	-
30	POST /iolink/v1/devices/{deviceAlias}/parameters/{index}/value	Write the parameter with the given index to the device	✓
31	POST /iolink/v1/devices/{deviceAlias}/parameters/{parameterName}/value	Write the parameter with the given name to the device	-
32	POST /iolink/v1/devices/{deviceAlias}/parameters/{index}/subindices/{subindex}/value	Write the sub-parameter with the given index and subindex to the device	✓
33	POST /iolink/v1/devices/{deviceAlias}/parameters/{parameterName}/subindices/{subParameterName}/value	Write the sub-parameter with the given parameter name and sub-parameter name to the device	-
34	POST /iolink/v1/devices/{deviceAlias}/blockparametrization/?format=byteArray	Read or write one or more parameters as a block	✓
35	GET /iolink/v1/devices/{deviceAlias}/events	Read event log from the specified device	✓
36	GET /iolink/v1/mqtt/configuration	Read configuration of MQTT clients	✓
37	POST /iolink/v1/mqtt/configuration	Write configuration of MQTT clients	-
38	GET /iolink/v1/mqtt/topics	Read list of MQTT topics	-
39	POST /iolink/v1/mqtt/topics	Write list of MQTT topics	-
40	DELETE /iolink/v1/mqtt/topics/{topicID}	Delete a specific MQTT topic	-
41	GET /iolink/v1/mqtt/topics/{topicID}	Read a specific MQTT topic	-
42	GET /iolink/v1/mqtt/connectionstatus	Read connection status	✓

Vendor-specific JSON settings

No.	REST API URL	Description	Supported
43	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/diagnostics/configuration	Diagnostic configuration of the master	✓
44	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/diagnostics/value	Diagnostic values of the master	✓
45	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/statistics/current	Current statistic values of the specified port of IO-Link master	✓
46	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/statistics/voltage	Voltage statistic values of the specified port of the master	✓
47	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/statistics/temperature	Temperature statistic values of the specified port of the master	✓
48	GET /iolink/v1/vendor/masters/1/ports/1/statistics/stack	IO-Link stack statistic values of the specified port of the master	-
49	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/configuration	Diagnostic configuration of the specified port of the master	✓
50	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/current	Diagnostic current value of the specified port of the master	✓
51	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/voltage	Diagnostic voltage value of the specified port of the master	✓
52	GET /iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/temperature	Diagnostic temperature value of the specified port of the master	✓

8.6.2 MQTT

If MQTT is enabled, the activation of JSON is required.

MQTT settings

No.	MQTT topics	Description
1	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/gateway/identification	Identification of the gateway
2	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/gateway/capabilities	Capabilities of the gateway
3	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/gateway/configuration	Network configuration of the gateway
4	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/masters	Get all available master number keys and identification information
5	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/diagnostics/value	Diagnostic values of the master
6	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/diagnostics/configuration	Diagnostic configuration of the master
7	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/masters/$MASTER_NUMBER/capabilities	Capabilities of the master
8	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/masters/$MASTER_NUMBER/identification	Identification of the master
9	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/masters/$MASTER_NUMBER/ports	Get all available port number keys
10	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/capabilities	Read capability information of the specified port
11	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/status	Read actual status of the specified port
12	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/configuration	Read/Write configuration of the specified port
13	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/configuration	Diagnostic configuration of the specified port of the master
14	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/current	Diagnostic current value of the specified port of the master
15	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/voltage	Diagnostic voltage value of the specified port of the master
16	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/diagnostics/temperature	Diagnostic temperature value of the specified port of the master
17	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/statistics/current	Current statistic values of the specified port of the master
18	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/statistics/voltage	Voltage statistic values of the specified port of the master
19	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/vendor/masters/$MASTER_NUMBER/ports/$PORT_NUMBER/statistics/temperature	Temperature statistic values of the specified port of the master
20	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/devices/$DEVICE_ALIAS/processdata/value	Read/Write process data value from/to the specified device
21	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/devices/$DEVICE_ALIAS/processdata/getdata/value	Read process data input value from the specified device
22	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/devices/$DEVICE_ALIAS/processdata/setdata/value	Read process data output value from the specified device
23	$MQTT_CLIENT_HEAD_TOPIC/iolink/v1/devices/$DEVICE_ALIAS/events	Read event log from the specified device

No.	MQTT topics	Description
24	$MQTT_CLIENT_HEAD_TOPIC/Asset	Information about the publisher (network, vendor, firmware)
25	$MQTT_CLIENT_HEAD_TOPIC/Online	Status of the publisher (online when connected)

8.6.3 OPC UA

The devices shown in the screenshots serve as examples.

The device has an OPC UA server. An OPC UA client can establish a connection to the device and access the following parameters:

- device identification,
- configuration parameters,
- process data,
- measured values,
- diagnostic information,
- statistical information, etc.

The OPC UA client establishes a connection via the following URL:

opc.tcp://IP address:4840

The device's ***IP address*** is used.

The client can access the device parameters anonymously (read access) or with user name/password
(read and write access). The user name and the password are set with the Webserver.

The following figure shows an excerpt of the device's information model.

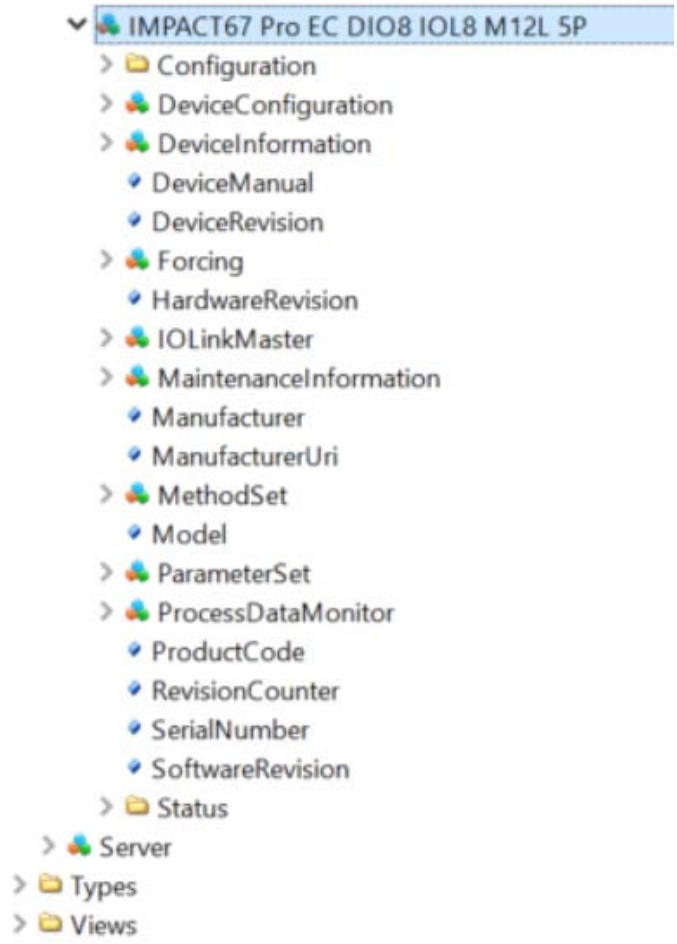


Fig. 8-4: OPC UA server - Information model of the device

The following figure shows an excerpt of an IO-Link port's information model.

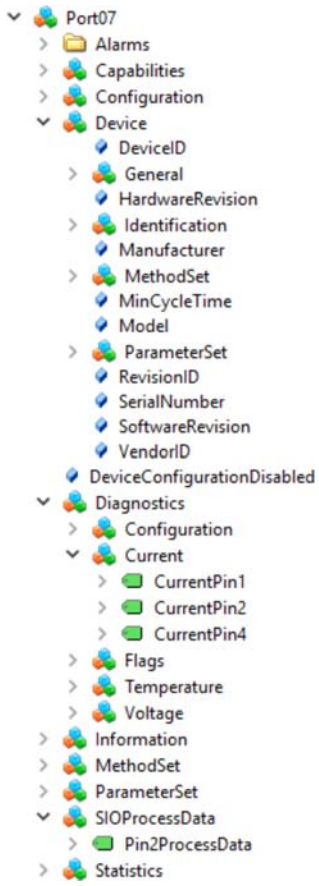


Fig. 8-5: OPC UA server - Information model of a port

8.6.3.1 Authentication

User login

For OPC UA, the same users and passwords as those documented in the web server description are used 10.2 "Access and login"

A connection with the OPC UA server is started using the user “guest”, which allows read access to the OPC UA objects.

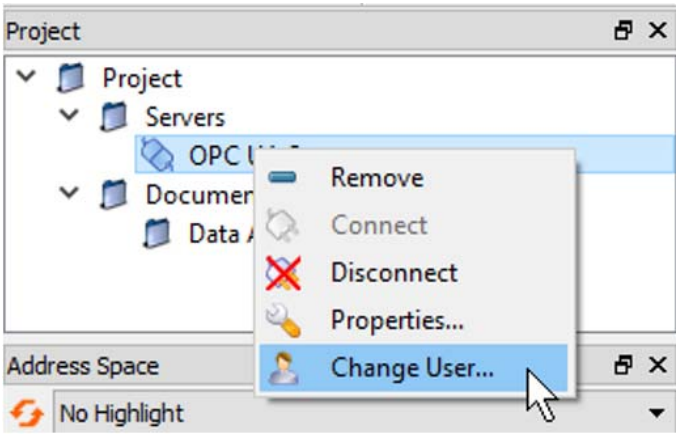


Fig. 8-6: Changing the user

For further actions, another user must be selected.

a | User name <admin>
b | Password <private>

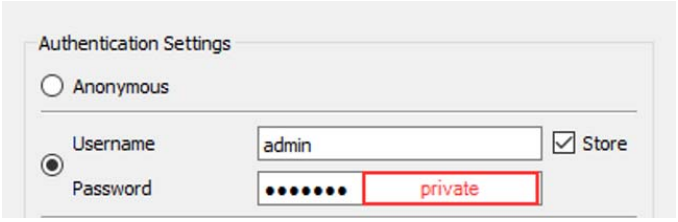


Fig. 8-7: User name and password

Forcing

Digital outputs can be switched manually via OPC UA (forcing).

Step 1

Create an ID from the device using the *GetForcingId* method.

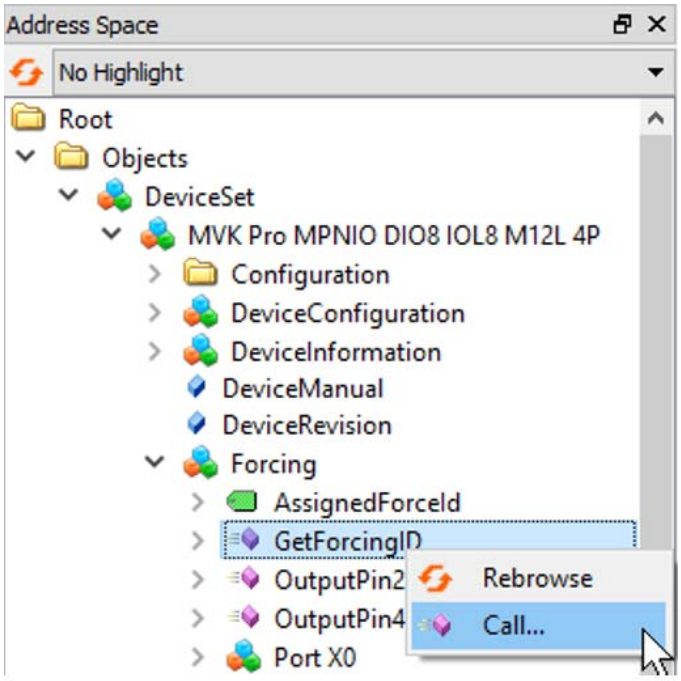


Fig. 8-8: Calling the GetForcingID method

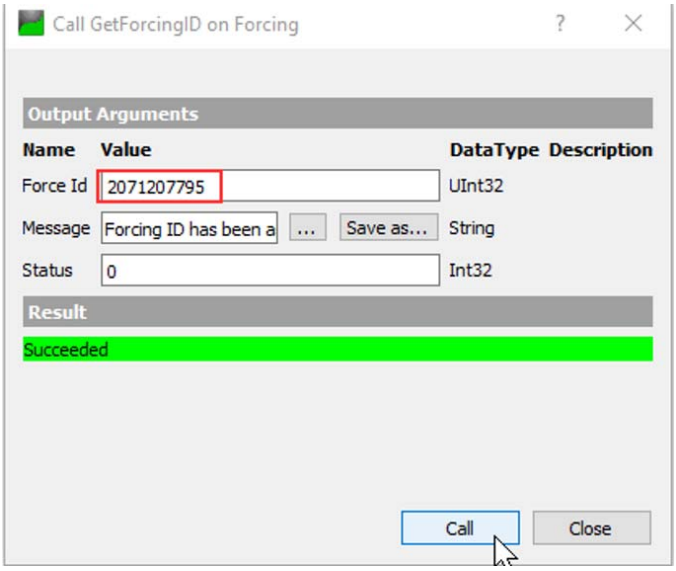


Fig. 8-9: Dialog window of the GetForcingID method

The forcing ID is only valid for 10 seconds. Every call of the forcing function will extend the validity again to 10 seconds.

Step 2

Set the digital outputs using the **OutputPin2** and **OutputPin4** methods.

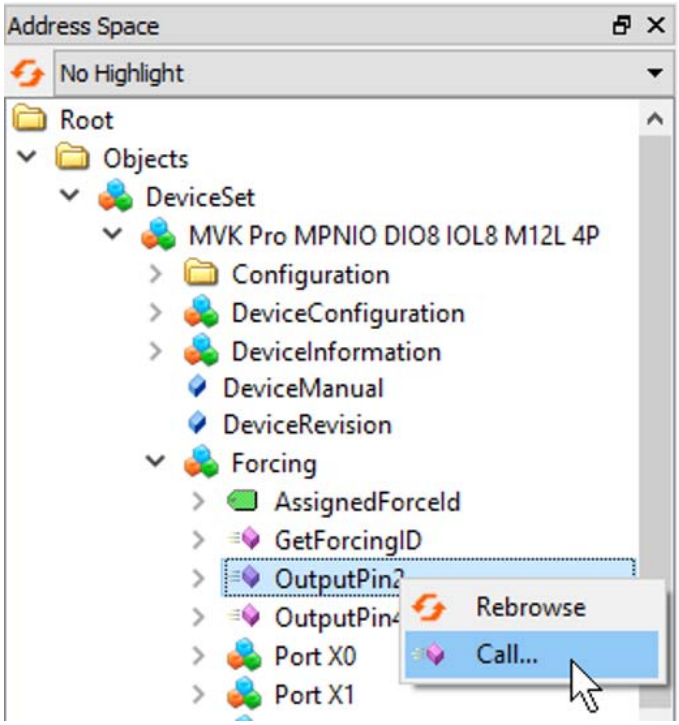


Fig. 8-10: Calling the OutputPin2 method

For this method, the following parameters must be entered: forcing ID that has been received, a bit mask and the data to be written.

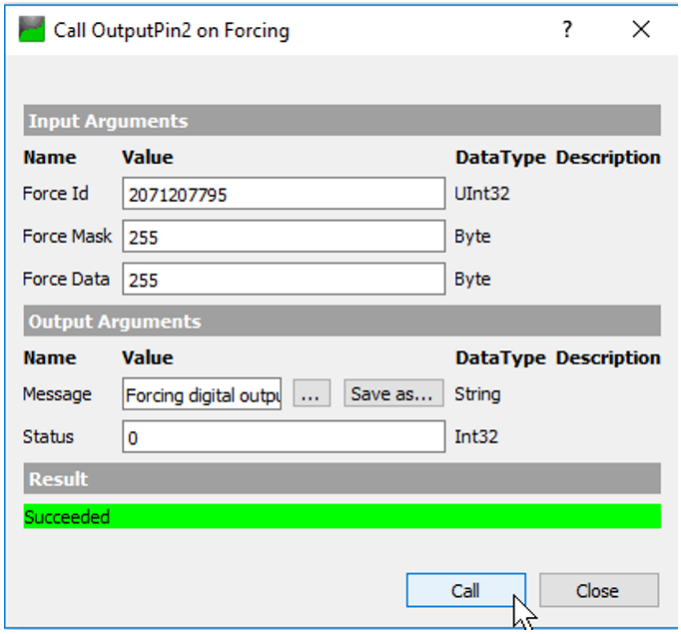


Fig. 8-11: Dialog window for Output method

8.6.3.2 Device identification

Nodes for the device identification are provided by the device. The OPC UA client, for example, can read the version of the device firmware from the ***SoftwareRevision*** node.

Node name	Node class	Access	Description
Manufacturer	Variable	Read	Device manufacturer
ManufacturerUrl	Variable	Read	URL of the device manufacturer
Model	Variable	Read	Model name of the device
ProductCode	Variable	Read	Product code of the device
RevisionCounter	Variable	Read	Hardware revision of the device
SerialNumber	Variable	Read	Serial number of the device
SoftwareRevision	Variable	Read	Revision/version of the device firmware

Tab. 8-6: Device identification

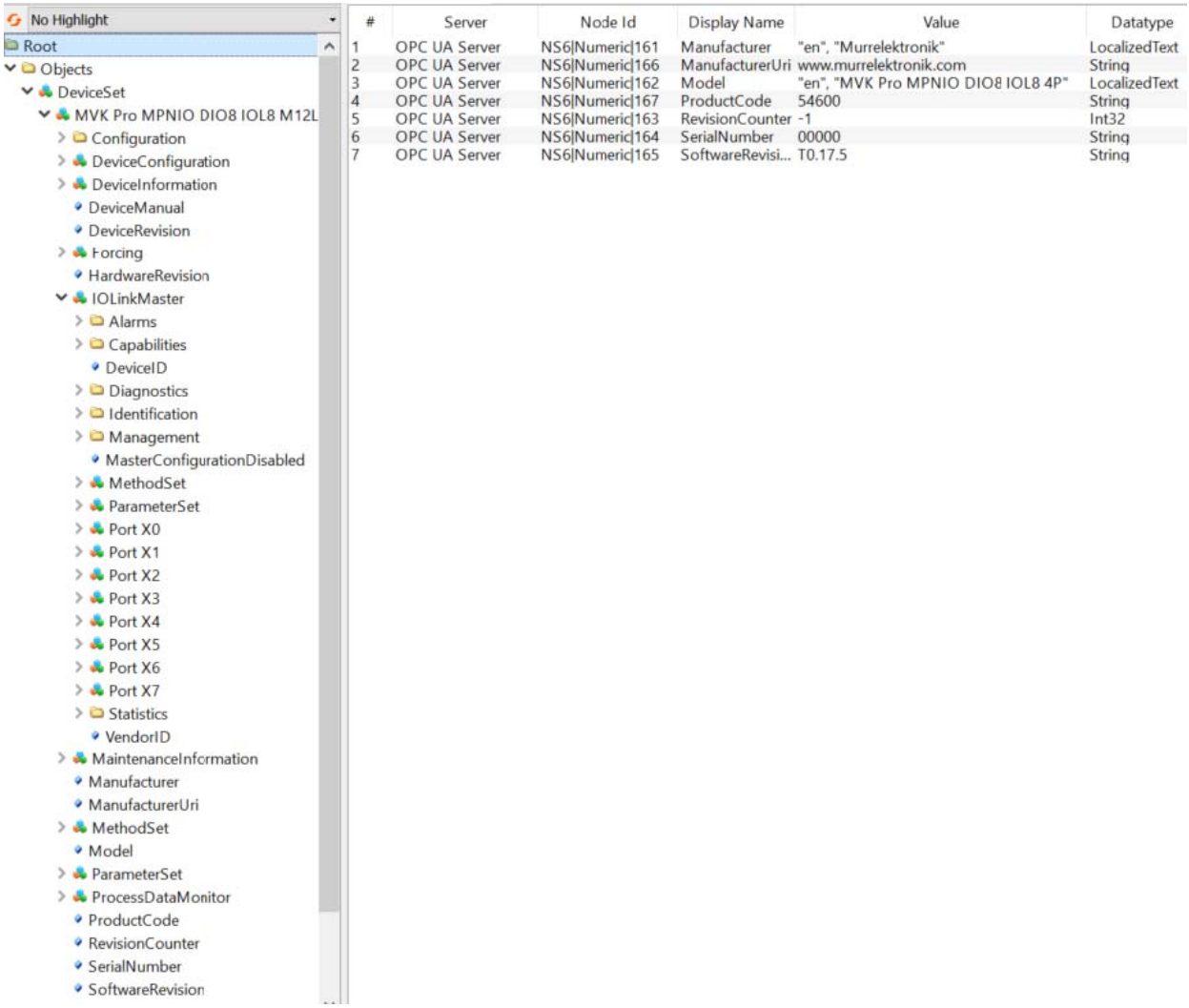


Fig. 8-12: Device identification

8.6.3.3 Configuration parameters

The OPC UA server provides nodes with configuration parameters of the device. In the node ***OverTemperature***, the OPC UA server can, for example, read the upper limit value for the temperature.

Device specific configuration parameter

Node name	Node class	Access	Default	Description
CurrentHysteresis	Variable	Read	10 mA	Current hysteresis, unit: mA If the current exceeds the limit value, the current must fall below the limit value by the hysteresis value in order to cancel the diagnostic.
OverTemperature	Variable	Read	70 °C	Upper limit value for the temperature of a port, unit: 0.1 °C
OverVoltageL	Variable	Read	30 V	Upper limit value for the voltage in the supply line 1, pins with the function L+, DI, DO, DIO, IO-Link can be monitored, unit: mV
OverVoltageL2	Variable	Read	30 V	Upper limit value for the voltage in the supply line 2, unit: mV
TemperatureHysteresis	Variable	Read	2 °C	Temperature hysteresis, unit: 0.1 °C If the temperature exceeds the limit value, the temperature must fall below the limit value by the hysteresis value in order to cancel the diagnostic.
UnderTemperature	Variable	Read	-25 °C	Lower limit value for the temperature of a port, unit: 0.1 °C
UnderVoltage L	Variable	Read	18 V	Lower limit value for the voltage in the supply line 1, pins with the function L+, DI, DO, DIO, IO-Link can be monitored, unit: mV
UnderVoltage L2	Variable	Read	18 V	Lower limit value for the voltage in the supply line 2, unit: mV
Voltage Hysteresis	Variable	Read	300 mV	Voltage hysteresis, unit: mV If the voltage exceeds the limit value, the voltage must fall below the limit value by the hysteresis value in order to cancel the diagnostic.

Tab. 8-7: Device specific configuration parameters

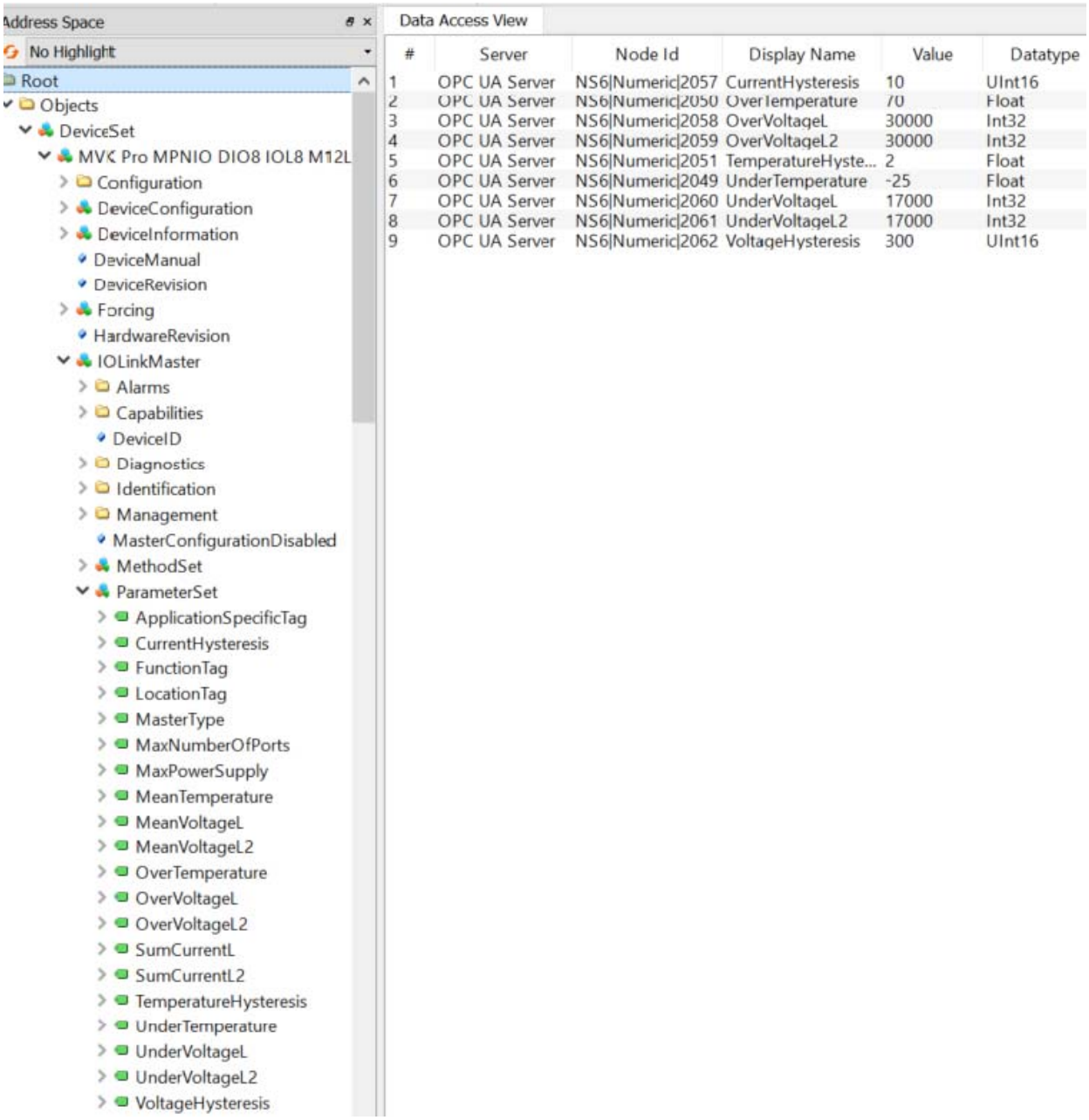


Fig. 8-13: Device-specific configuration parameters

Device-specific configuration parameters

No.	Node name	Node class	Access	Default	Description
	OverCurrentPin1, OverCurrentPin2, OverCurrentPin4	Variable	Read	0	Warning level for upper current limit at pin 1, pin 2 or pin 4, unit: 1mA 0: Monitoring not activated
	UnderCurrentPin1, UnderCurrentPin2, UnderCurrentPin4	Variable	Read	0	Warning level for lower current limit at pin 1, pin 2 or pin 4, unit: 1mA 0: Monitoring not activated

Tab. 8-8: Device-specific configuration parameters

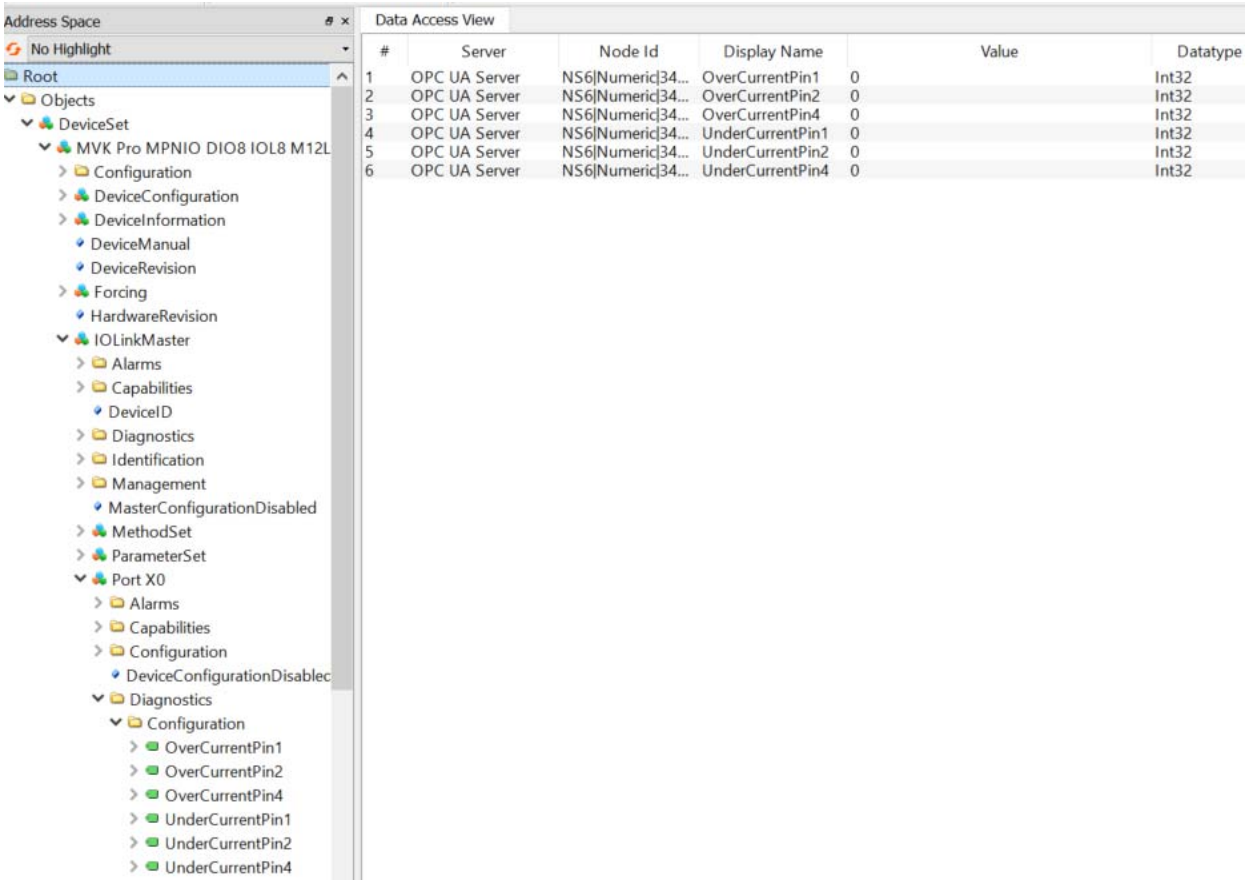


Fig. 8-14: Device-specific configuration parameters

8.6.3.4 Process data

The OPC UA server provides nodes with process data. In the node ***Pin2ProcessData***, the OPC UA client can, for example, read the value at pin 2 of a port.

Node name	Node class	Access	Description
Pin2ProcessData	Variable	Read	Process data at pin 2
Pin4ProcessData	Variable	Read	Process data at pin 4

Tab. 8-9: Process data

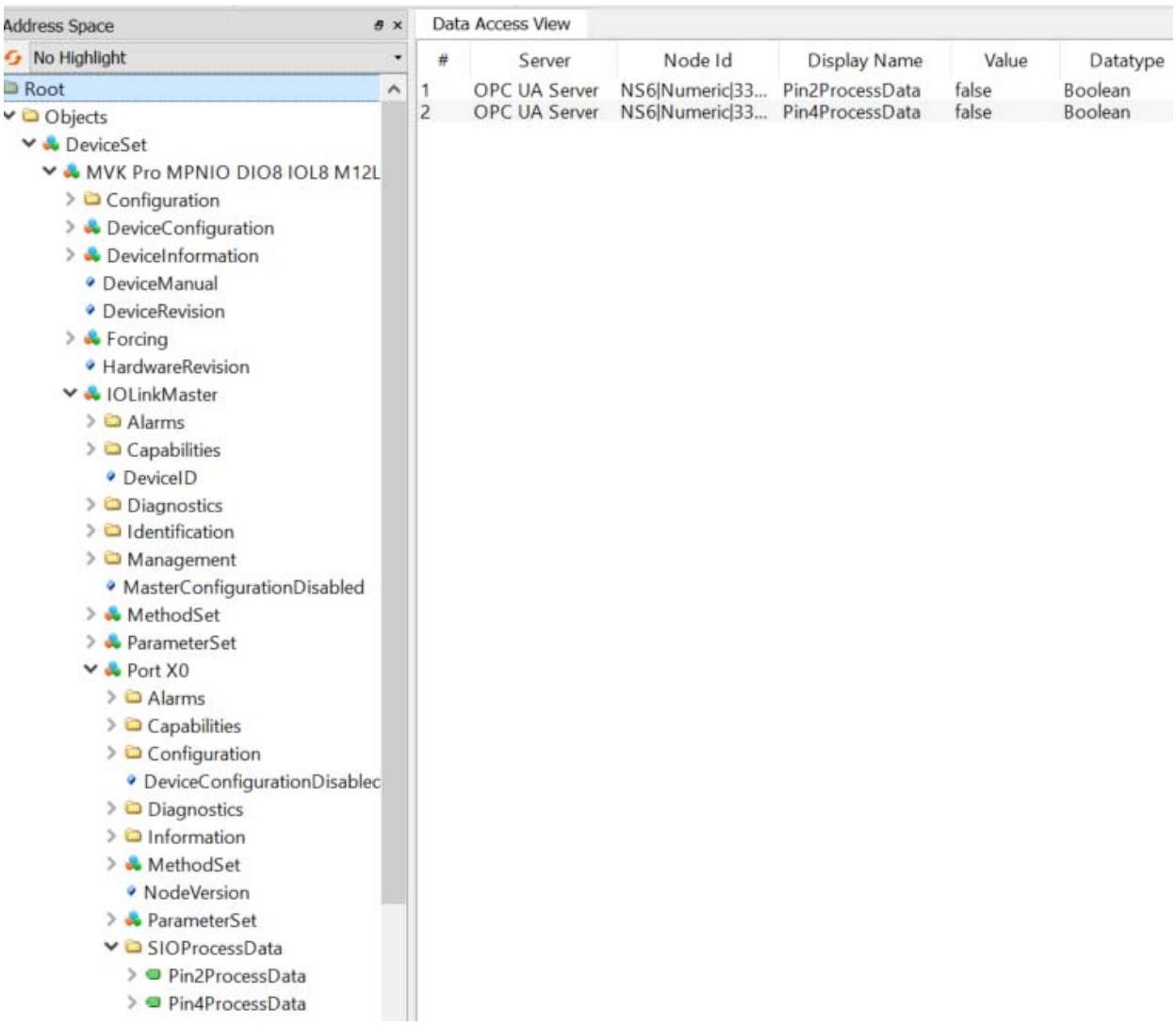


Fig. 8-15: Process data

8.6.3.5 Measured values

The OPC UA server provides nodes with calculated results. The OPC UA client, for example, can read in the node ***SumCurrentL*** the calculated total current of the supply line 1.

Device specific results

Node name	Node class	Access	Description
SumCurrentL	Variable	Read	The total current calculated from individual measurements in the supply line 1, unit: mA
SumCurrentL2	Variable	Read	The total current calculated from individual measurements in the supply line 2, unit: mA
MeanTemperature	Variable	Read	Average value for the temperature of the subassembly calculated from the temperature values measured individually at the three chips, unit: °C
MeanVoltageL	Variable	Read	Average voltage in the supply line 1, unit: mV
MeanVoltageL2	Variable	Read	Average voltage in the supply line 2, unit: mV

Tab. 8-10: Device specific (calculated) results

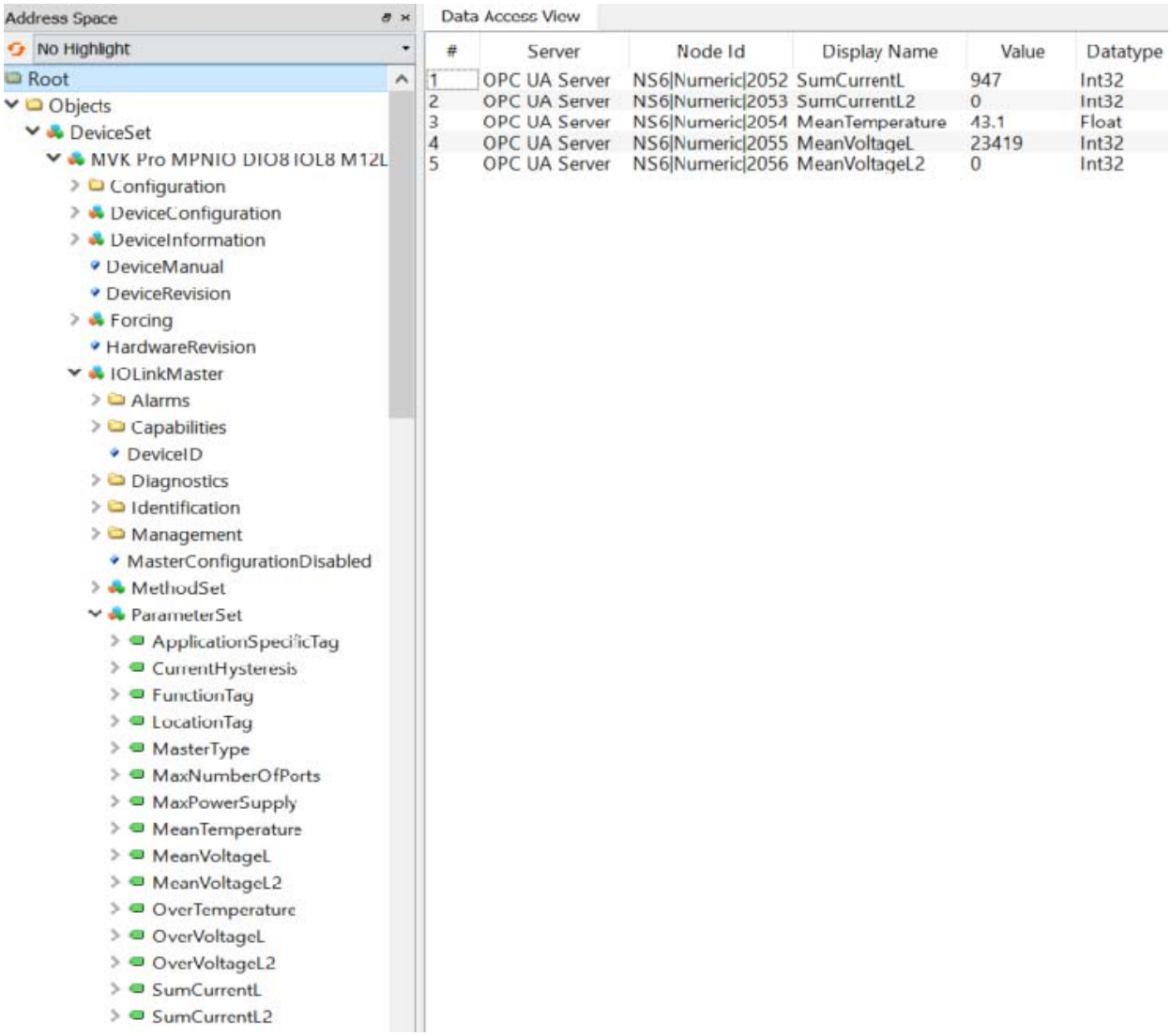


Fig. 8-16: Device specific (calculated) results

Port specific measuring values

Node name	Node class	Access	Description
CurrentPin1, CurrentPin2, CurrentPin4	Variable	Read	Current measured at pin 1, pin 2 or pin 4, unit: mA
TemperaturePin1, TemperaturePin2, TemperaturePin4	Variable	Read	Temperature measured at pin 1, pin 2 or pin 4, unit: °C
VoltagePin1, VoltagePin2, VoltagePin4	Variable	Read	Voltage measured at pin 1, pin 2 or pin 4, unit: mA

Tab. 8-11: Port specific measuring values

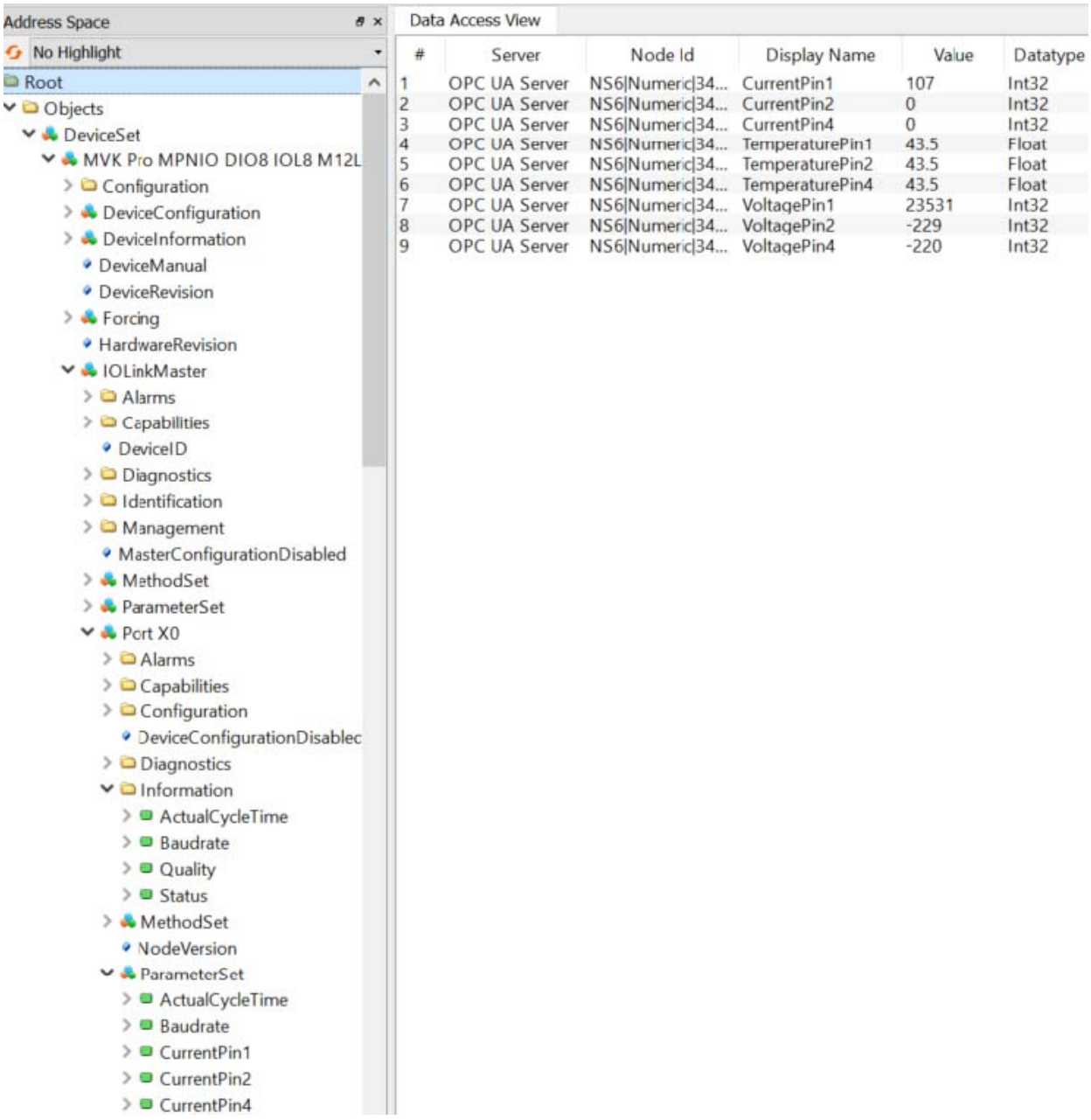


Fig. 8-17: Port specific measuring values

8.6.3.6 Diagnostic

The OPC UA server provides nodes with diagnostic information. In the node ***DiagnosticsPin1***, the OPC UA client can read, for example, whether the device has detected an overcurrent at pin 1 of a port.

Node name	Node class	Access	Description
DiagnosticsPin1, DiagnosticsPin2, DiagnosticsPin4	Variable	Read	Diagnostic at pin 1, pin 2 or pin 4. The numeric value contains bit-coded information: ■ Bit 0: Short circuit, ■ Bit 1: Overload protection, ■ Bit 2: Excess temperature protection, ■ Bit 3: Overvoltage protection, ■ Bit 4: Overcurrent, ■ Bit 5: Undercurrent ■ Bit 0: Excess temperature ■ Bit 1: Undertemperature ■ Bit 2: Overvoltage ■ Bit 3: Undervoltage ■ Bit 4: Watchdog 0: Diagnostic not active 1: Diagnostic active

Tab. 8-12: Port specific diagnostics

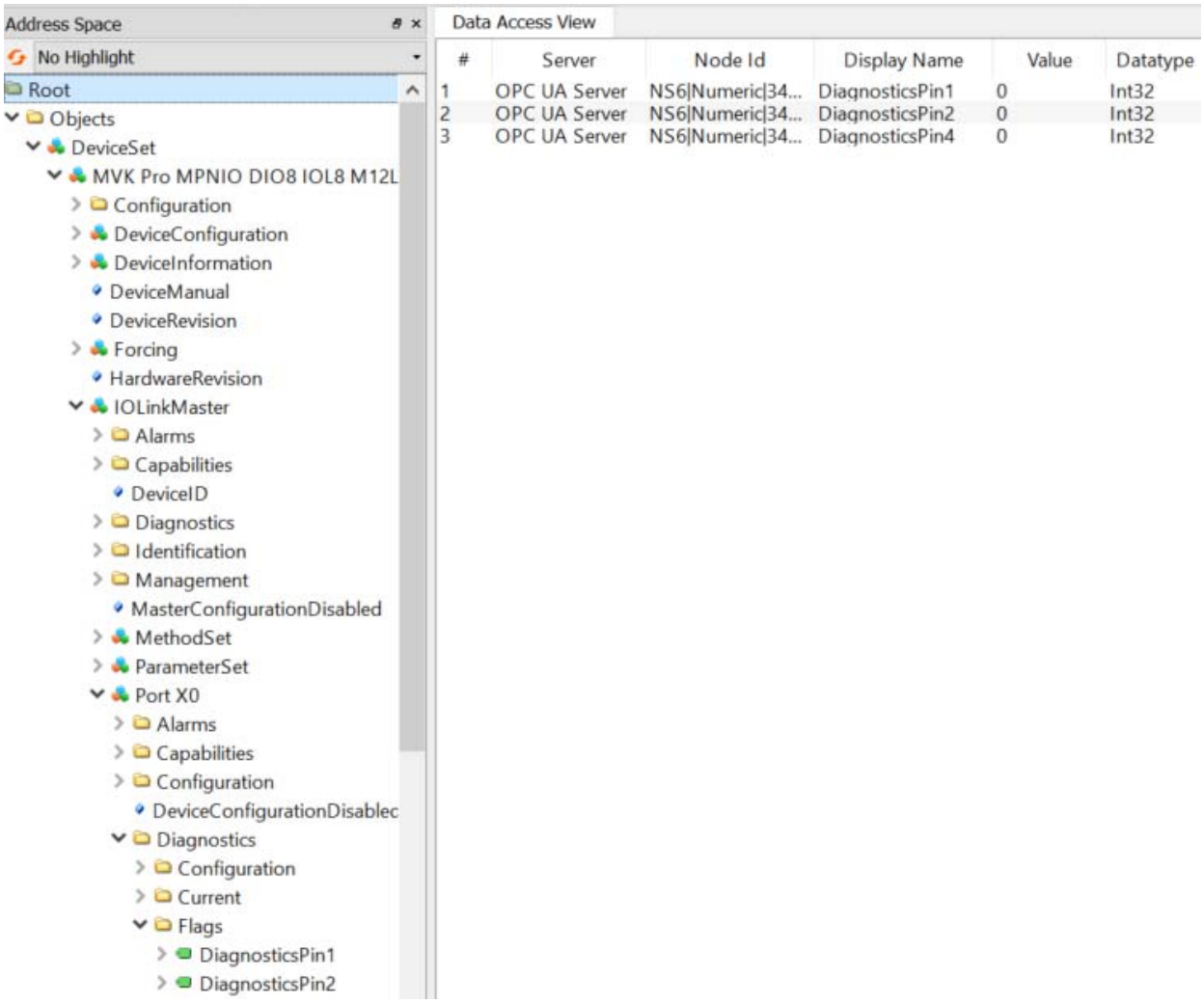


Fig. 8-18: Port specific diagnostics

8.6.3.7 Statistics

The OPC UA server provides nodes with statistical information. In the node ***MaxCurrentPin1,*** the OPC UA client can, for example, read the maximum measured current at pin 1 of a port.

Node name	Node class	Access	Description
MaxCurrentPin1, MaxCurrentPin2, MaxCurrentPin4	Variable	Read	Maximum current at pin 1, pin 2 or pin 4 since reset of the value, unit: mA
MinCurrentPin1, MinCurrentPin2, MinCurrentPin4	Variable	Read	Minimum current at pin 1, pin 2 or pin 4 since reset of the value, unit: mA
MaxTemperaturePin1, MaxTemperaturePin2, MaxTemperaturePin4	Variable	Read	Maximum temperature at pin 1, pin 2 or pin 4 since reset of the value, unit: °C
MinTemperaturePin1, MinTemperaturePin2, MinTemperaturePin4	Variable	Read	Minimum temperature at pin 1, pin 2 or pin 4 since reset of the value, unit: °C
MaxVoltagePin1, MaxVoltagePin2, MaxVoltagePin4	Variable	Read	Maximum voltage at pin 1, pin 2 or pin 4 since reset of the value, unit: mV
MinVoltagePin1, MinVoltagePin2, MinVoltagePin4	Variable	Read	Minimum voltage at pin 1, pin 2 or pin 4 since reset of the value, unit: mV

Tab. 8-13: Port specific statistical information

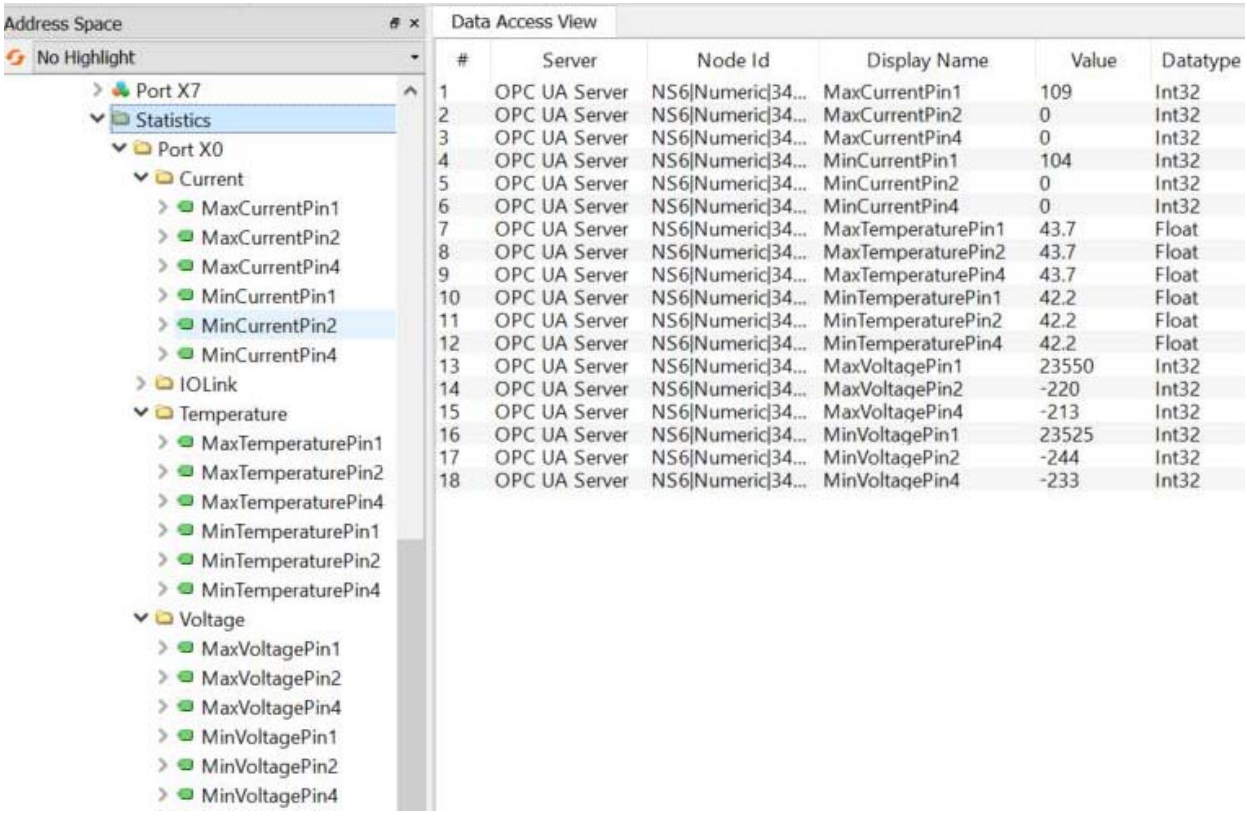


Fig. 8-19: Port specific statistical information

8.6.3.8 NTP client configuration

The OPC UA server provides nodes for the configuration of the NTP client.

Node name	Node class	Access	Description
NtpClientServerIpAddress	Variable	Read/ write	■ NTP server IP address ■ The NTP client uses the set IP address to fetch the time from an NTP server. ■ The IP address must be converted into a decimal number. The calculation is described in the table. ■ Value 0 disables the function.
NtpClientServerIpAddressFallback	Variable	Read/ write	■ IP address of the NTP server (fallback) ■ The optional IP address if the NTP server is not accessible via the IP address in node NtpClientServerIpAddress. ■ The IP address must be converted into a decimal number. The calculation is described in the table. ■ Value 0 disables the function.
NtpClientUpdateConfiguration	Variable	Write	Method to write the nodes NtpClientServerIpAddress and NtpClientServerIpAddressFallback.

Tab. 8-14: NTP client configuration

To convert the IP address into a decimal number, the following formula is used:
Starting from an IP address in the format **A.B.C.D:**

```
((A * 256 + B) * 256 + C) * 256 + D = IP address as decimal number
```

Example for the IP address 192.53.103.108

```
((192 * 256 + 53) * 256 + 103) * 256 + 108 = 3224725356
```

8.6.3.9 OPC UA PC client

The IMPACT67 device has an integrated OPC UA server. An OPC UA client can be used to communicate with the IMPACT67 device.

For test purposes, e.g. the UaExpert from Unified Automation GmbH can be used: www.unifiedautomation.com

An OPC UA client has read access to the IMPACT67 device using the authentication “Anonymous”.

An OPC UA client has read and write access to the IMPACT67 device using the authentication “User name and Password” if the respective user has write rights.

Connection to the IMPACT67 device

Prerequisites

- You have an OPC UA client.
- If you want to have read access to the IMPACT67 device:
  You know the user name and the password and have write rights.
- You know the IP address of the IMPACT67 device

Without user name and password you can access anonymously to the IMPACT67 device and read data.

Step-by-step instructions

Establish a connection to the IMPACT67 device:

➔ Start UaExpert

➔ Create a new project using File > New.

➔ Add a new server by selecting Server > Add.

The Add Server dialog window with the Discovery tab is displayed.

Discovery (Default) tab . . . . . **Advanced** tab

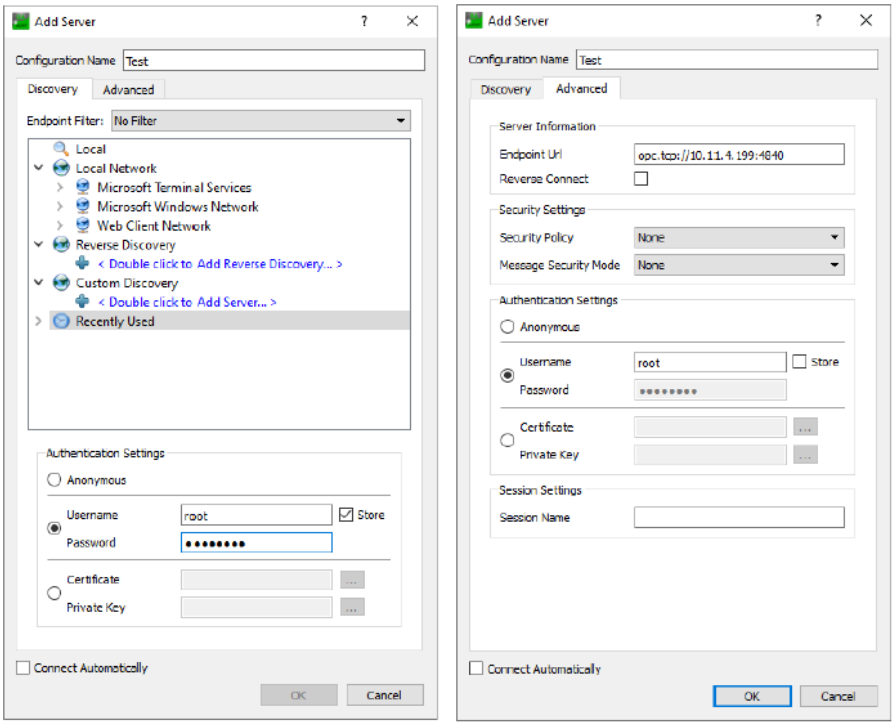


Fig. 8-20: Add Server dialog window – Discovery and Advanced tabs

➔ Enter a name for your configuration in the Configuration field, e.g. ***Test***.

➔ Select the Advanced tab.

➔ In the **Server Information** area of the Advanced tab, enter the following into the Endpoint Url data field:
opc.tcp://<IP address>:4840
For ***<IP address>***, enter the IP address of your device.

➔ In the **Authentication Settings** area, select the **Username/Password** option if you want to have write access to the device
or
Anonymous if read access is sufficient.

➔ If you have selected the **Username/Password** option, enter your user name and your password.

➔ Click **OK**.

In the project window, the UaExpert enters the server under Project >Servers, e.g. ***Test***.

➔ Open the context menu of the server (***Test***) and select **Connect.**

The connection is established.

Prerequisites

- You have an OPC UA client.
- You know the user name and the password and have write rights.
- You know the IP address of the NTP server.
- You have converted the IP address of this NTP server into a decimal number, as described below.
- You have already established a connection to the MVK device.

Example of an NTP server

NTP-Server ***ptbtime1.ptb.de*** of the German National Metrology Institute in Braunschweig with the IP address *192.53.103.108*

Spare NTP server (optional) of the NTP server ***ptbtime2.ptb.de*** of the German National Metrology Institute in Braunschweig with the IP address *192.53.103.104*

Conversion of an IP address into a decimal number

To convert the IP address into a decimal number, the following formula is used: Starting from an IP address in the format **A.B.C.D:**

*((A * 256 + B) * 256 + C) * 256 + D = IP address as decimal number*

Example for the IP address 192.53.103.108

*((192 * 256 + 53) * 256 + 103) * 256 + 108 = 3224725356*

Step-by-step instructions

➔ Open the context menu in the *Address Space* window:

Root> Objects> DeviceSet> [device name] > Configuration> NtpClient> NtpClientUpdateConfiguration.

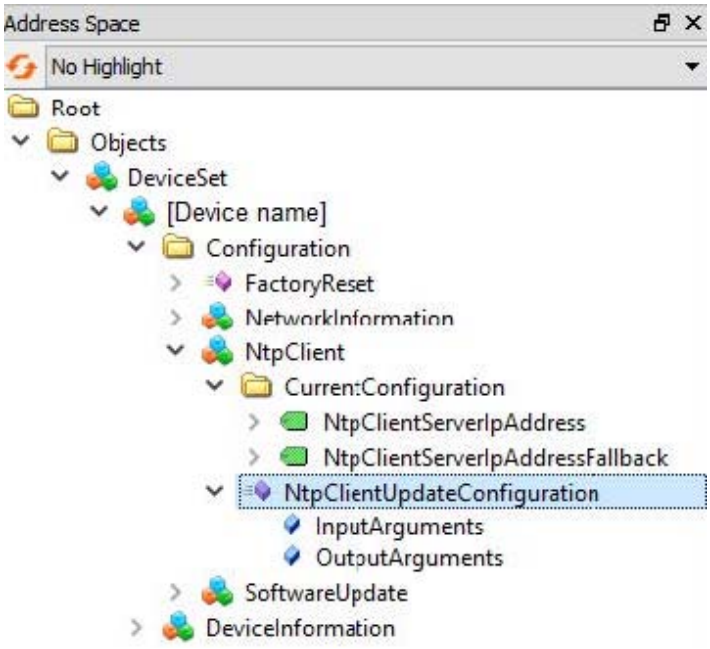


Fig. 8-21: NTP-Client update configuration

➔ Select ***Call*** from the context menu.

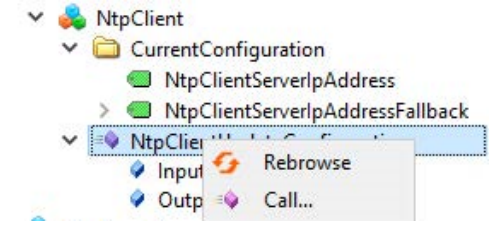


Fig. 8-22: NTP client configuration

*The dialog window **Call NtpClientUpdateConfiguration on NtpClient** is displayed:*

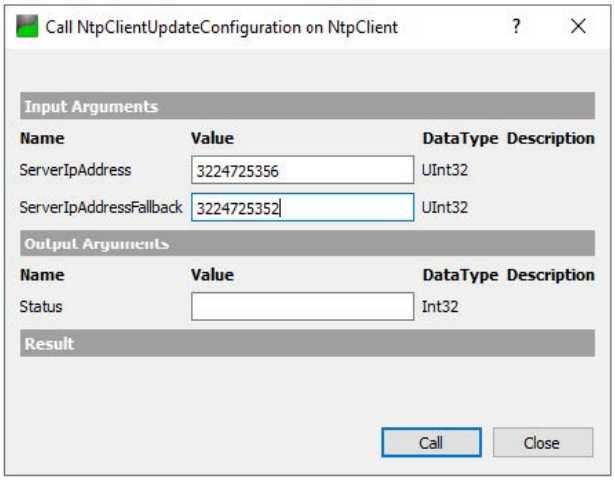


Fig. 8-23: Dialog window to configure the NTP client

- In the **Input Arguments** area, enter the value 3224725356 into the input field **ServerIpAddress** for the IP address of the NTP server.
- In the **Input Arguments** area, enter the number 3224725352 in the input field **ServerIpAddressFallback** for the IP address of the spare NTP server.
- Click **Call**.

If the function call has been successful, the output field on the right side of the status in the **Output Arguments** area shows the value 0. In the **Result** area, a green bar with the text “Succeeded” is shown.
The two variables ServerIpAddress and ServerIpAddressFallback are now set.
The device receives the current time from the time server via NTP and synchronizes its internal time.

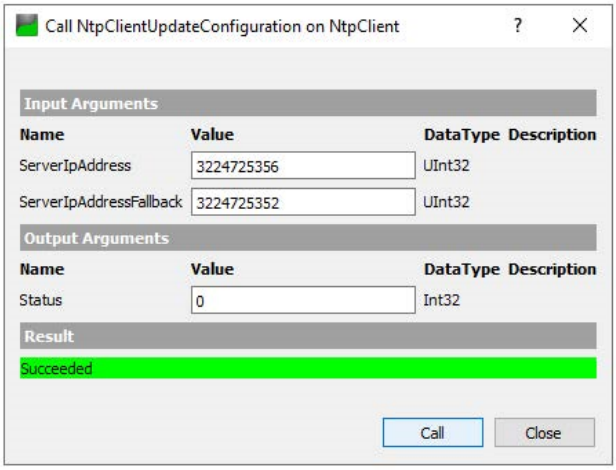


Fig. 8-24: Dialog window to configure the NTP client (successful)

8.7 Object directory

8.7.1 Configuring the IO-Link master

Digital IO layout configuration

Index	Name	Type	Access	Default value	Meaning
0x2001	PD Layout Configuration	UNIT8	RW	0	■ 0: Port-based ■ 1: Pin-based

NOTE

After a restart of the device, the changed settings will become effective.

DO Substitute Configuration

Index	Name	Type	Access	Default value	Meaning
0x2002:0	DO Substitute Configuration	RECORD			
0x2002.0	Highest supported subindex	UNIT8	RO	1	
0x2002.1	DO Substitue Mode	UNIRT8	RW	0	■ 0: Off ■ 2: Hold last

8.7.2 Configuring the IO-Link ports

Digital ports

IO-Link-Port Class A/B

Index	Name	Type
0x2100	Configuration port X0 parameter	RECORD
0x2110	Configuration port X1 parameter	
0x2120	Configuration port X2 parameter	
0x2130	Configuration port X3 parameter	
0x2140	Configuration port X4 parameter	
0x2150	Configuration port X5 parameter	
0x2160	Configuration port X6 parameter	
0x2170	Configuration port X7 parameter	

NOTE

Parameter **0x21n0** (n = ports X0 ... X7).

Index	Name	Type	Access	Default value	Meaning
0x21n:00	Port Xn Parameter	UNIT8	RO	5	
0x21n:01	Pin 4 (C/Q)	BOOL	RW	FALSE	■ 0x00 (0dec) Digital Input (NO) ■ 0x01 (1dec) Digital Input inverted (NC)
0x21n0.2	Digital input filter Pin 4 (C/Q)	UINT8	RW	0x00	■ 0x00 (0dec) No filter ■ 0x0A (10dec) 1ms filter ■ 0x1E (30dec) 3ms filter ■ 0x32 (50dec) 5ms filter ■ 0x64 (100dec) 10ms filter ■ 0x96 (150dec) 15ms filter
0x21n0.3	Reserved	-	-	-	-
0x21n0.4	Digital Mode Pin2 (I/Q)	UINT8	RW	0x04 (4dec)	■ 0x00 (0dec) Digital Input (NO) ■ 0x01 (1dec) Digital Input inverted (NC) ■ 0x02 (2dec) Digital Output ■ 0x03 (3dec) Static ON (24V) ■ 0x04 (4dec) Deaktiviert
0x21n0.5	Digital Input Filter Pin2 (I/Q)	UINT8	RW	0x0A (10dec)	■ 0x00 (0dec) = No filter ■ 0x0A (10dec) = 1 ms filter ■ 0x1E (30dec) = 3 ms filter ■ 0x32 (50dec) = 5 ms filter ■ 0x64 (100dec) = 10 ms filter ■ 0x96 (150dec) = 15 ms
0x21n0.6	IO-Link Process Data Swap	UINT8	RW	0	■ 0 = No Swap ■ 1 = 16 Bit Swap *In case of odd data length the last byte will not be touched* ■ 2 = 32 Bit Swap *In case the data length is not on 4 byte boundary* □ 3 byte, swap of byte x with x+2. x+1 will not be touched □ 3 byte, swap of byte x with x+2. x+1 will not be touched □ 1 byte, byte will not be touched ■ 3 = Full Swap

8.7.3 Geräte-Reset

Firmware Update

Index	Name	Typ	Zugriff	Default-Wert	Bedeutung
0x5FFF	Reset to Factory	UINT8	WO	-	■ 1: Device Config ■ 2: Network Config ■ 3: Application Config ■ 4: Factory reset

9 Operation

9.1 LED indication

The module has separate and clearly arranged indicators:

- LED indication for inputs and outputs
- LED indication for EtherCAT
- LED indication POWER
- EtherCAT diagnostic messages

The LEDs on the front panel of the module are labeled for clear identification of the displayed information.

9.1.1 LED flashing behavior

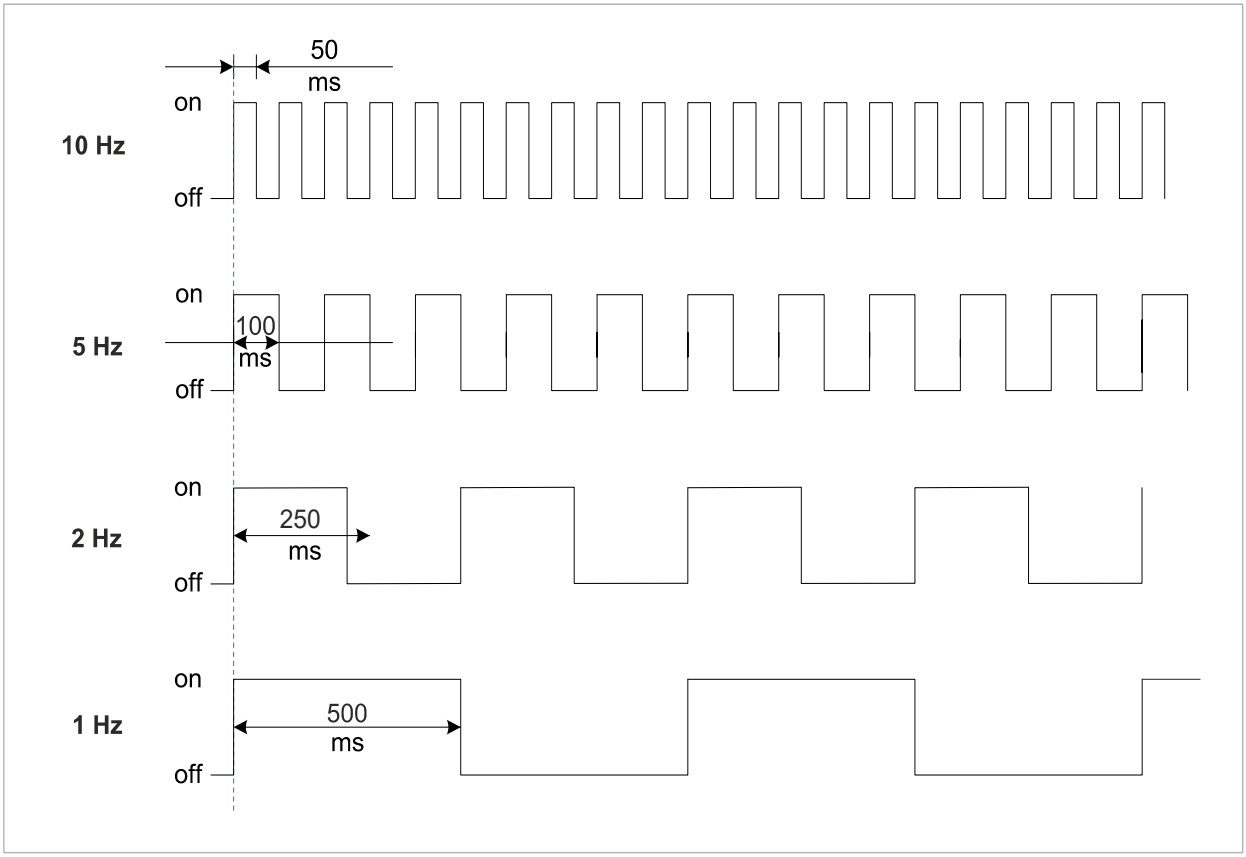
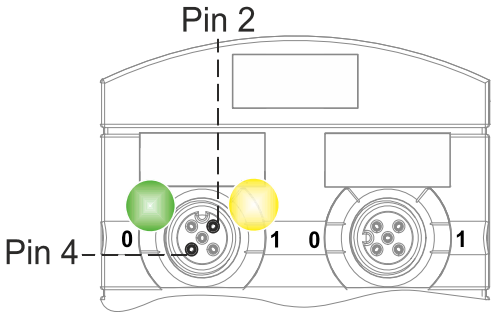


Fig. 9-1: LED flashing behavior

9.1.2 LED indication for inputs and outputs

A separate status display is assigned to each input and output.

- LED of channel **0**X (X=port number) is assigned to **pin 4**.
- LED of channel **1**X (X=port number) is assigned to **pin 2**.



Pin 2
Digital input DI

Indication	Condition	Description
Yellow	Permanently on	Fixed configuration: DI (NO) visible in process data. 24 V
Red	Flashing at 1 Hz	Overload/ short circuit in sensor supply 24 V + Pin1
	Off	Pin 2 is not used or deactivated

Tab. 9-1: LED indication DI pin 2

Pin 2
Digital output DO

Indication	Condition	Description
Yellow	Permanently on	Fixed configuration: DO switchable via process data 24 V
Red	Permanently on	Overload/ short-circuit at pin 2
Red	Flashing at 1 Hz	Overload/ short circuit in sensor supply 24 V + Pin1
	Off	Pin 2 is not used or deactivated

Tab. 9-2: LED indication DO pin 2

Error at input or output

If an error occurs at an input or output, the associated LED at the M12 port lights up red.

Pin 4
Digital input DI

Indication	Condition	Description
Yellow	Permanently on	Fixed configuration: DI (NO) visible in process data 24 V
Red	Flashing at 1 Hz	Overload/ short circuit in sensor supply 24 V + Pin1
	Off	Pin 4 is not used or deactivated

Tab. 9-3: LED indication DI pin 4

Pin 4
Digital output DO

Indication	Condition	Description
Yellow	Permanently on	Fixed configuration: DO switchable via process data 24 V
Red	Permanently on	Overload/ short-circuit at pin 4
Red	Flashing at 1 Hz	Overload/ short circuit in sensor supply 24 V + Pin1
	Off	Pin 4 is not used or deactivated

Tab. 9-4: LED indication DO pin 4

Error at input or output

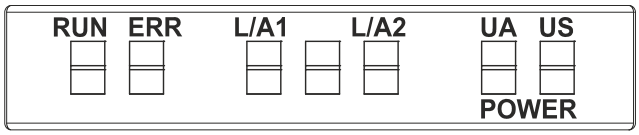
If an error occurs at an input or output, the associated LED at the M12 port lights up red.

Pin 4
IO-Link mode

Display	State	Description
Green	Permanently on	IO-Link in Operate status.
Green	Flashing at 1 Hz	- Device is not connected - No communication with the connected device.
Green	Flashing at 10 Hz	- IO-Link in Pre-Operate status during data storage - Validation failed. Incompatible IO-Link device connected.
Red	Permanently on	Overload/ short-circuit at pin 4
Red	Flashing at 2 Hz	- Validation failed. - Incompatible IO-Link device connected for data storage. - Data storage failed.
	Off	IO-Link connection deactivated.

Tab. 9-5: LED indication IO-Link mode pin 4

9.1.3 LED indication RUN_ERR



- **RUN LED** indicates the state of the bus system.

LED indication RUN

Display	State	Description
Green	Permanently on	Device in OPERATIONAL mode
Green	Short flash long pause (single flash)	Device in SAFE OPERATIONAL mode
Green	Flashing 2.5 Hz	Device in PRE-OPERATIONAL mode
	Off	Device in INIT mode

Tab. 9-6: LED indication RUN

LED indication flashing green

This is what you can do:

➔ Check the operating state of the PLC.

- **ERR-LED** indicates the state of the PLC configuration.

LED indication ERR

Display	State	Description
Red	Flashing 2.5 Hz	Configuration error
Red	Short flash long pause (single flash)	The slave device application has changed the EtherCAT status autonomously
Red	Flash, flash, pause (double flash)	Timeout for the application watchdog has occurred
	Off	The EtherCAT communication of the device is working

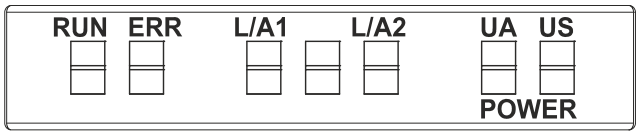
Tab. 9-7: LED indication ERR

LED indication, red

This is what you can do:

➔ Check the PLC configuration.

9.1.4 LED indication L/A1/LA2



- L/A1 and L/A2 (Link/Activity) indicate the state of the EtherCAT communication at each port.

LED indication L/A1 and L/A2

Indication	Condition	Description
Green	Permanently on	The device a | is connected to the EtherCAT network b | ***does not*** send/receive EtherCAT frames
Green	Flashing	The device a | is connected to the EtherCAT network b | sends/receives EtherCAT frames
	Off	The device has ***no*** connection to the EtherCAT network.

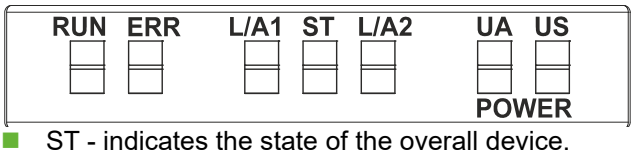
Tab. 9-8: Indication L/A1 and L/A2

LED indication Off

This is what to do:

➔ Check the line connections.

9.1.5 LED indication for state



- ST - indicates the state of the overall device.

LED indicator ST

Indication	Condition	Description
Green	Permanently on	The regular firmware is running. Normal operation.
Green	Flashing at 4 Hz	The operation requested by the position of the rotary switch is performed. Do not switch off the device.
Red	Flashing at 2 Hz	Invalid rotary switch position. The system does not start.
Red	Permanently on	Initialization error. Error during device initialization. a | HW problems, b | missing valid configuration, c | no COM FW found, d | rotary switch operation failed, etc.

Tab. 9-9: LED indicator ST

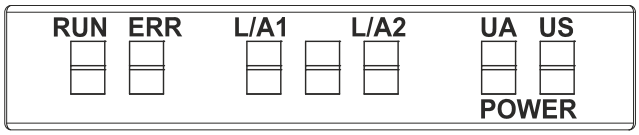
Red LED indicator flashing

This is what you can do:

➔ Select a valid position.

➔ Restart device.

9.1.6 LED indicator POWER US and UA



The power LEDs indicate the state of the supply voltages

- **UA** actuator voltage
- **US** operating voltage

LED indicator POWER US

Indication	Condition	Description
Green	Permanently on	18 V ≤ US ≤30 V Error-free operation
Red	Permanently on	11 V ≤ US ≤18 V Undervoltage
Red	Flashing at 4 Hz	US >30 V Overvoltage
	Off	US <11 V No voltage

Tab. 9-10: LED indicator POWER US

LED indicator POWER UA

Indication	Condition	Description
Green	Permanently on	18 V ≤ UA ≤30 V Error-free operation
Red	Permanently on	11 V ≤ UA ≤18 V Undervoltage
Red	Flashing at 4 Hz	UA >30 V Overvoltage
	Off	UA <11 V No voltage

Tab. 9-11: LED indicator POWER UA

NOTE
At US <18 V, an error-free operation is no longer guaranteed.

9.2 EtherCAT diagnostic messages

For the diagnostic function, the object **0x10F3** is available, where up to 250 diagnostic messages can be stored in a circular buffer. All events that have triggered a telegram in the device are recorded.

Possible messages

a | EtherCAT system diagnostics generated by the IO-Link master:
- Information
- Warning
- Error

b | IO-Link events which are sent to the master by the connected IO-Link device.

In addition, a timestamp [ns] is written to the object **0x10F8** “Timestamp Object” for each diagnostic message.

Emergency telegrams

Emergency telegrams are messages that are actively sent from the device to the EtherCAT master in case of certain events/problems. This is an unconfirmed CoE-based service.

Device-specific diagnostic messages

Error Identifier	EtherCAT Diag Code	EtherCAT Emergency (5 bytes)	Meaning
0x0100	0xFF00E800	0x0X, 0x00, 0x00, 0x01,0x00	Undervoltage Us
0x0101	0xFF01E800	0x0X, 0x00, 0x00, 0x01,0x01	Overvoltage Us
0x0102	0xFF02E800	0x0X, 0x00, 0x00, 0x01,0x02	Overtemperature
0x0103	0xFF03E800	0x0X, 0x00, 0x00, 0x01,0x03	Overload at Us
0x0104	0xFF04E800	0x0X, 0x00, 0x00, 0x01,0x04	Overload at Ua
0x0105	0xFF05E800	0x0X, 0x00, 0x00, 0x01,0x05	Undertemperature
0x0106	0xFF06E800	0x0X, 0x00, 0x00, 0x01,0x06	Undervoltage Ua
0x0107	0xFF07E800	0x0X, 0x00, 0x00, 0x01,0x07	Overvoltage Ua
0x0108	0xFF08E800	0x0X, 0x00, 0x00, 0x01,0x08	Force mode active

Tab. 9-12: Device-specific diagnostic messages

NOTE
EtherCAT telegram: the first byte is:
- 0x00 for appearing diagnostics *and*
- 0x01 for disappearing diagnostics.

Port-specific diagnostic messages

Error Identifier	EtherCAT Diag Code	EtherCAT Emergency (5 bytes)	Text ID	Meaning
0x1800	0x0001E002	0xE0, 0x02, 0xXX, 0x18, 0x00	0x002C	No device (communication)
0x1801		0xE0, 0x02, 0xXX, 0x18, 0x01	0x0001	Startup parametrization error
0x1802		0xE0 0x02, 0xXX, 0x18, 0x02	0x0002	Incorrect Vendor ID
0x1803		0xE0, 0x02, 0xXX, 0x18, 0x03	0x0003	Incorrect DeviceID
0x1804		0xE0, 0x02, 0xXX, 0x18, 0x04	0x0004	Short circuit at pin 4 (IOL)
0x1805		0xE0, 0x02, 0xXX, 0x18, 0x05	0x0005	Overtemperature
0x1806		0xE0, 0x02, 0xXX, 0x18, 0x06	0x0006	Short circuit at pin 1
0x1807		0xE0, 0x02, 0xXX, 0x18, 0x07	0x0007	Overcurrent at pin 1
0x1808		0xE0, 0x02, 0xXX, 0x18, 0x08	0x0008	Device Event overflow
0x1809		0xE0, 0x02, 0xXX, 0x18, 0x09	0x0009	Backup inconsistency – memory out of range
0x180A		0xE0, 0x02, 0xXX, 0x18, 0x0A	0x000A	Backup inconsistency – identity fault
0x180B		0xE0, 0x02, 0xXX, 0x18, 0x0B	0x000B	Backup inconsistency – Data storage error
0x180C		0xE0, 0x02, 0xXX, 0x18, 0x0C	0x000C	Backup inconsistency – upload fault
0x180D		0xE0, 0x02, 0xXX, 0x18, 0x0D	0x000D	Backup inconsistency – download fault
0x180E		0xE0, 0x02, 0xXX, 0x18, 0x0E	0x000E	Class B power (pin 2) missing or undervoltage
0x180F		0xE0, 0x02, 0xXX, 0x18, 0x0F	0x000F	Class B power (pin 2) short circuit
0x1810		0xE0, 0x02, 0xXX, 0x18, 0x10	0x0010	Short circuit at pin 2
0x1811		0xE0, 0x02, 0xXX, 0x18, 0x11	0x0011	Short circuit at pin 4 (digital out)
0x1812		0xE0, 0x02, 0xXX, 0x18, 0x12	0x0012	Overcurrent at pin 2
0x1813		0xE0, 0x02, 0xXX, 0x18, 0x13	0x0013	Overcurrent at pin 4 (digital out)
0x6000		0xE0, 0x02, 0xXX, 0x60, 0x00	0x0014	Invalid cycle time
0x6001		0xE0, 0x02, 0xXX, 0x60, 0x01	0x0015	Revision fault – incompatible protocol version
0x6002		0xE0, 0x02, 0xXX, 0x60, 0x02	0x0016	ISDU batch failed
0xFF26		0xE0, 0x02, 0xXX, 0xFF, 0x26	0x0017	Port status changed – Use "SMI_PortStatus" service for port status in detail
0xFF27		0xE0, 0x02, 0xXX, 0xFF, 0x27	0x0018	Data Storage upload completed and new data object available
0xFF31		0xE0, 0x02, 0xXX, 0xFF, 0x31	0x0019	DL: Incorrect Event signalling

Tab. 9-13: Port-specific diagnostic messages

NOTE
EtherCAT telegram structure:
- 0xE002 + Port number + error code for appearing diagnostics,
- 0x0000 + Port number + error code for disappearing diagnostics.

10 Web server

The Murrelektronik web server is a graphic tool that you can use to obtain information about the device quickly and intuitively.

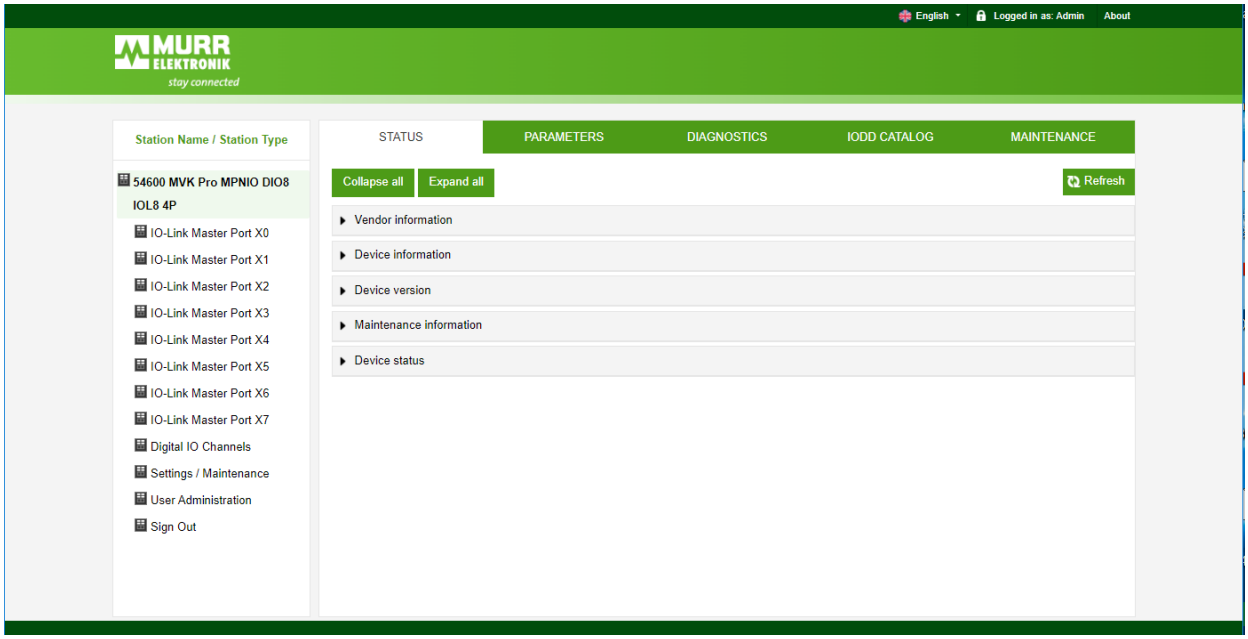


Fig. 10-1: The Murrelektronik web server

The devices shown in the screenshots serve as examples.

10.1 Starting the web server

Prerequisites

Prerequisite for a correct graphic display of the web server:

➔ The following browsers with HTML5 and ES5 are supported by:

- Mozilla Firefox
- Microsoft Edge
- Google Chrome

To start the web server, proceed as follows:

➔ Start the web browser.

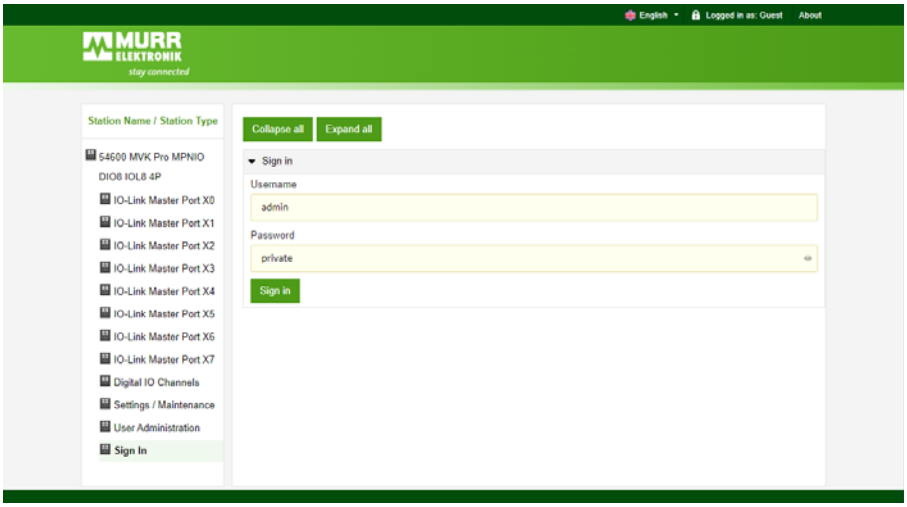
➔ Enter the IP address of the device in the web browser.
The web server start screen is displayed.

10.2 Access and login

Username and password

Username and password at first start

1 | Enter the login data for user name and password at the first start:
   a) Username <admin>
   b) Password <private>
2 | Click ***Sign In***.

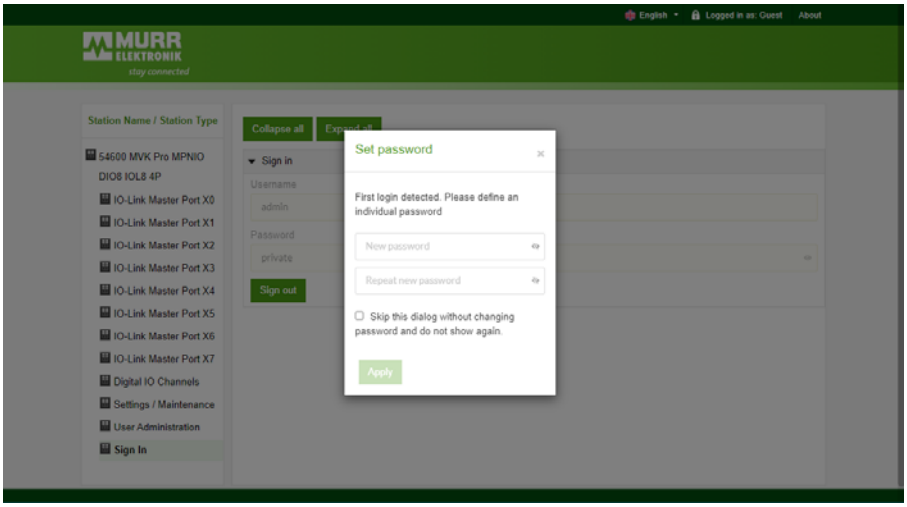


Change password

NOTE

Ensure data security!

➔ Change username and password after first login and after every factory reset.



10.3 Start screen

Operating areas The web server is divided into 4 operating areas.

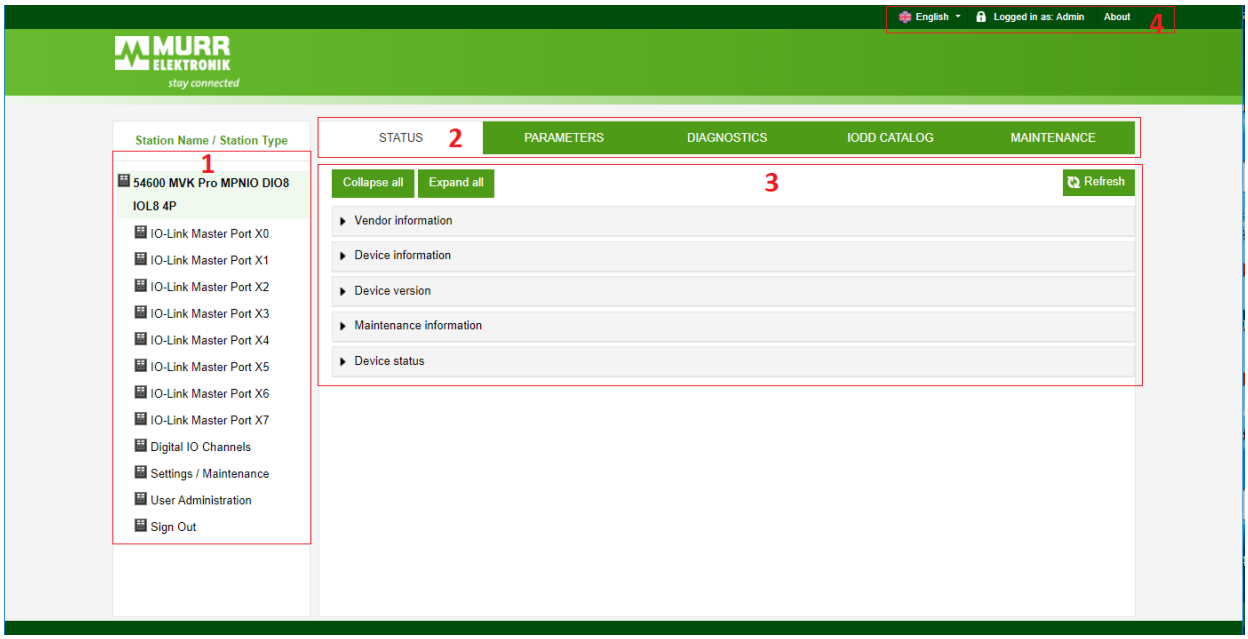


Fig. 10-2: Operating areas

1 | **System tree**
Shows the device and the available sub-functions.

2 | **Menu bar**
The menu bar enables you to switch between the different pages of the device or the sub-function. In addition, the white tab highlights the current page.

3 | **Page content**
This area shows the contents of the selected page.

4 | **Header bar**
Language and interface settings, system information.

10.4 Menu bar

In the first line of the system tree, the device is displayed with article number and product name.

The menu bar comprises the following clickable menu items:

- STATUS
- PARAMETERS
- DIAGNOSTICS
- IODD CATALOG
- MAINTENANCE

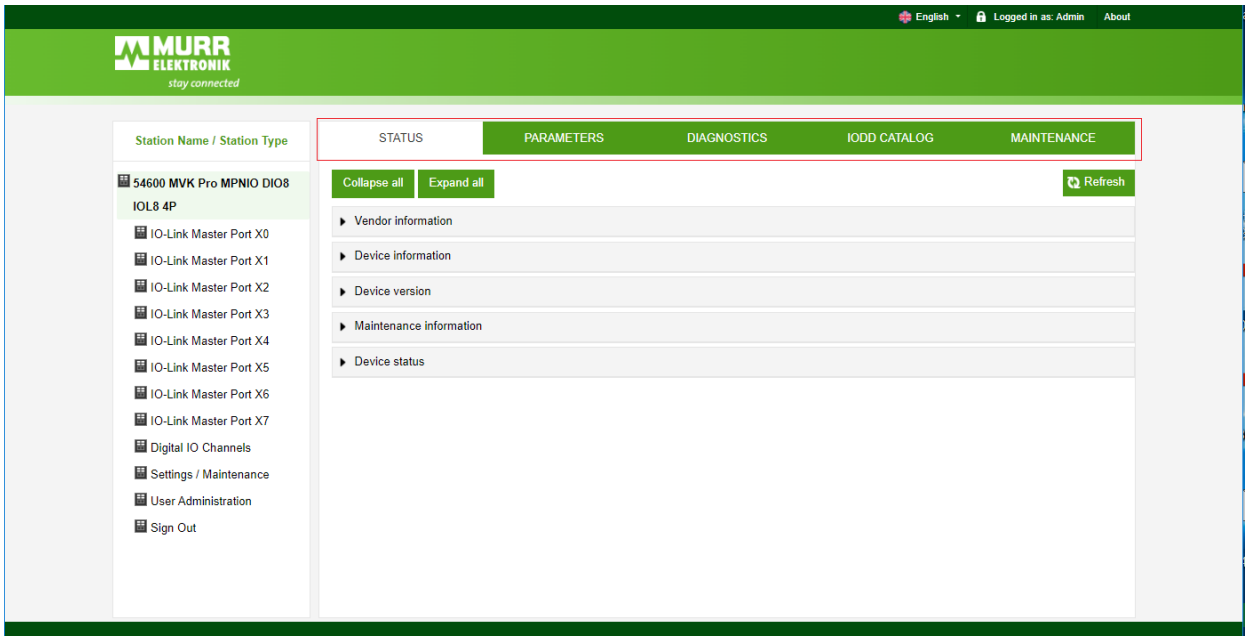


Fig. 10-3: Menu bar

10.4.1 STATUS menu

The “Status” menu item contains the following subitems:

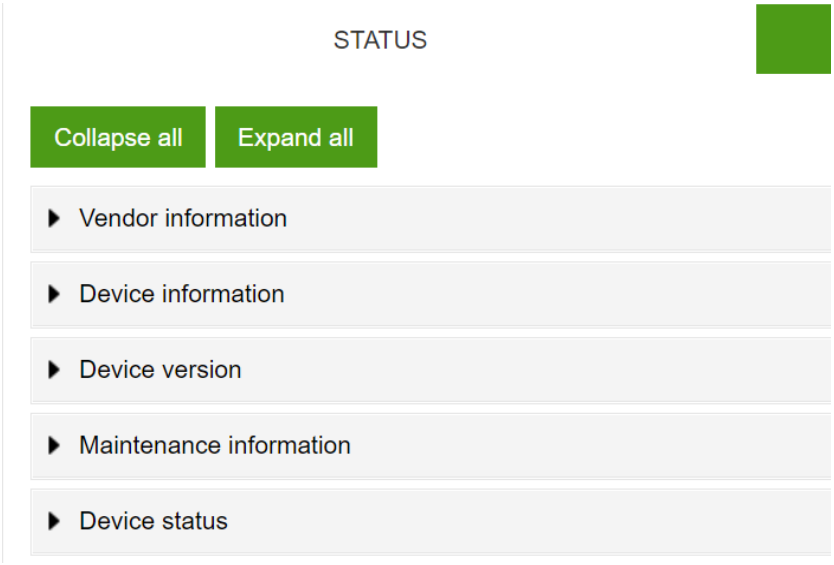


Fig. 10-4: “Status” menu item

Manufacturer information

“Manufacturer Information” displays the following information:

Parameter designation	Meaning
Manufacturer name	Fixed manufacturer data
Manufacturer address	Fixed manufacturer data
Manufacturer phone	Fixed manufacturer data
Manufacturer URL	Manufacturer website

Device information

“Device information” displays the following information:

Parameter designation	Meaning
Order number	Article number of the device
Hardware name	Fixed article designation of the device
Software name	Fieldbus designation of the device
Software number	Serial number of the device

Device version

“Device version” displays the following information:

Parameter designation	Meaning
Hardware version	Design version of the hardware
Software version	Currently running software version in the device
Website version	Currently running version of the web server in the device

Maintenance information

The maintenance information can only be read here. Any entry or changes to the fields is done via “Settings/Maintenance → Maintenance information”.

“Maintenance information” displays the following information:

Parameter designation	Meaning
Name	Name of the device, free text
Mounting location	Location name, free text
Contact information	Contact, free text
Description	Description, free text
Last maintenance date (yyyy-mm-dd)	Free date entry
Next maintenance date (yyyy-mm-dd)	Free date entry

IO-Link device information

The “IO-Link device information” displays the following information:

Parameter designation	Meaning
1L Voltage [V]	Display of the sensor voltage in Volt
1L Current [A]	Display of the sensor voltage in Ampere
2L Voltage [V]	Display of the actuator voltage in Volt
2L Current [A]	Display of the actuator voltage in Ampere
Temperature [°C]	Display of internal device temperature in degrees Celsius
Total operating time [hh:mm:ss]	Operating time since the device has been switched on
Number of starts	Number of device restarts

10.4.2 PARAMETER menu

The “Parameters” menu item contains the following subitems:

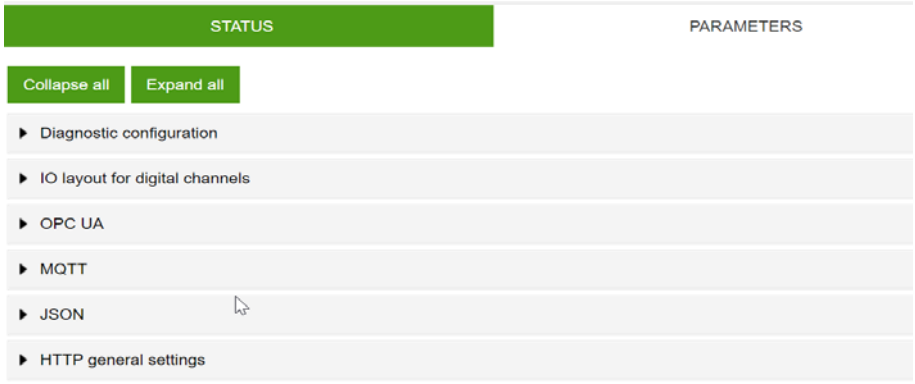


Fig. 10-5: “Parameters” menu

OPC UA

Users with admin and operator rights can change settings and enter the OPC UA port number. Guest users have reading rights.

“OPC UA” displays the following information:

Parameter designation	Meaning
Enable OPC UA server	OPC UA server on the assembly active / passive
Allow OPC UA clients to write ISDU data	OPC UA client is allowed to write ISDU (Indexed Service Data Unit) data to the assembly on the IO-Link master
Allow OPC UA clients to write PDO data	OPC UA client is allowed to write PDO (Process Data Objects) to the assembly on the IO-Link master
OPC UA port number	Display / definition of the OPC UA port

MQTT

Users with admin and operator rights can change settings and enter the IP address of the MQTT server. Guest users have reading rights.

“MQTT” displays the following information:

Parameter designation	Meaning
Enable MQTT	MQTT client on the assembly active / passive
MQTT server IP address	IP address of the MQTT server
MQTT Client ID	Read/write the MQTT client ID
Client head topic	Read/write an MQTT topic
Topic for system data	Read/write an MQTT topic

JSON

Users with admin and operator rights can activate and deactivate JSON. Guest users have reading rights.

“JSON” displays the following information:

Parameter designation	Meaning
Enable JSON	JSON interface on the assembly active / passive

10.4.3 DIAGNOSTICS menu

The “Diagnostics” menu item shows the incoming and outgoing alarms of the master.

The menu shows an overview of diagnostic messages.

Depending on the setting in the “Please select an entry” drop-down menu, the following diagnostics of the device are displayed:

- Active

✓ All diagnostics pending at the time of the web server call.

✓ All diagnostics that are no longer available are not displayed.

- History

✓ All diagnostics from the remanent diagnostic memory that are no longer available are displayed.

✓ The device can hold up to 40 diagnostic entries in memory. The latest diagnostics overwrites the oldest one in the memory.

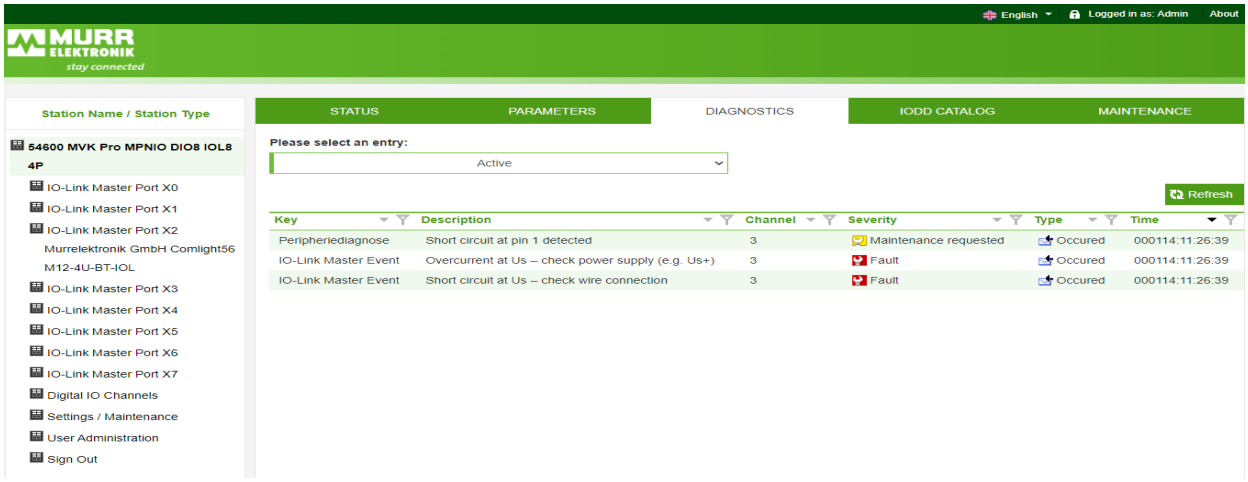


Fig. 10-6: Menu item “Diagnostics”

10.4.4 IODD CATALOG menu

Im Menüpunkt „IODD KATALOG“ können die Benutzer die IODD-Dateien auf dem Gerät verwalten.

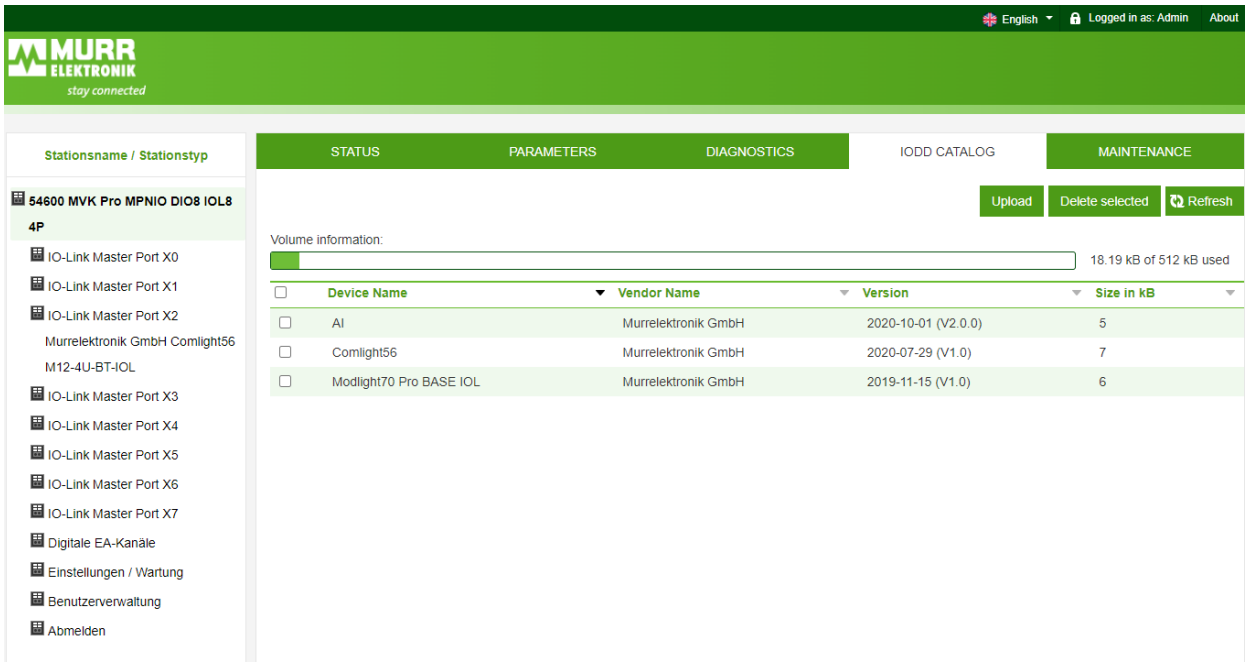


Fig. 10-7: Menüpunkt „IODD Catalog“

10.4.5 MAINTENANCE menu

In the “Maintenance” menu item, users with admin and operator rights can delete the diagnostic memory.

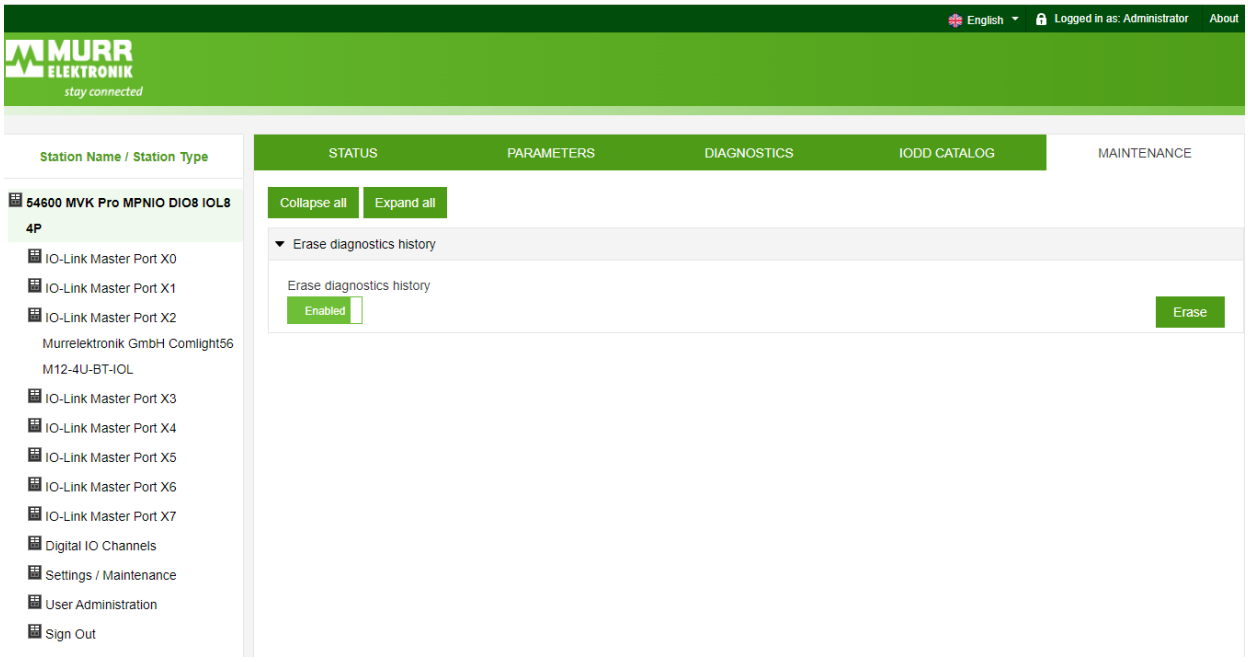


Fig. 10-8: Deleting the diagnostic memory

10.5 IO-Link master port

The system tree displays 8 IO-Link master ports (X0 ... X7) that can be selected individually. Depending on the user role, information can be read or functions can be configured here. When IO-Link communication is active, the IO-Link device name automatically appears under the relevant port.

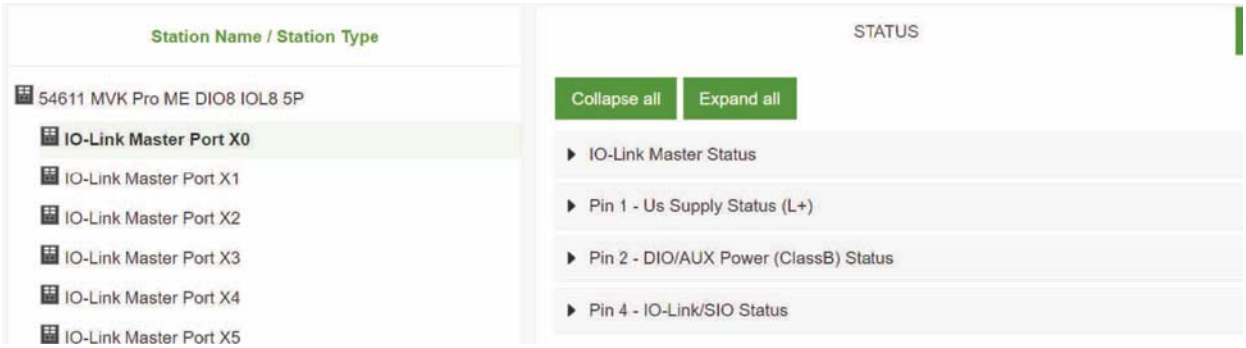


Fig. 10-9: IO-Link master port

10.5.1 STATUS menu

The IO-Link master status is displayed here in the Status menu.

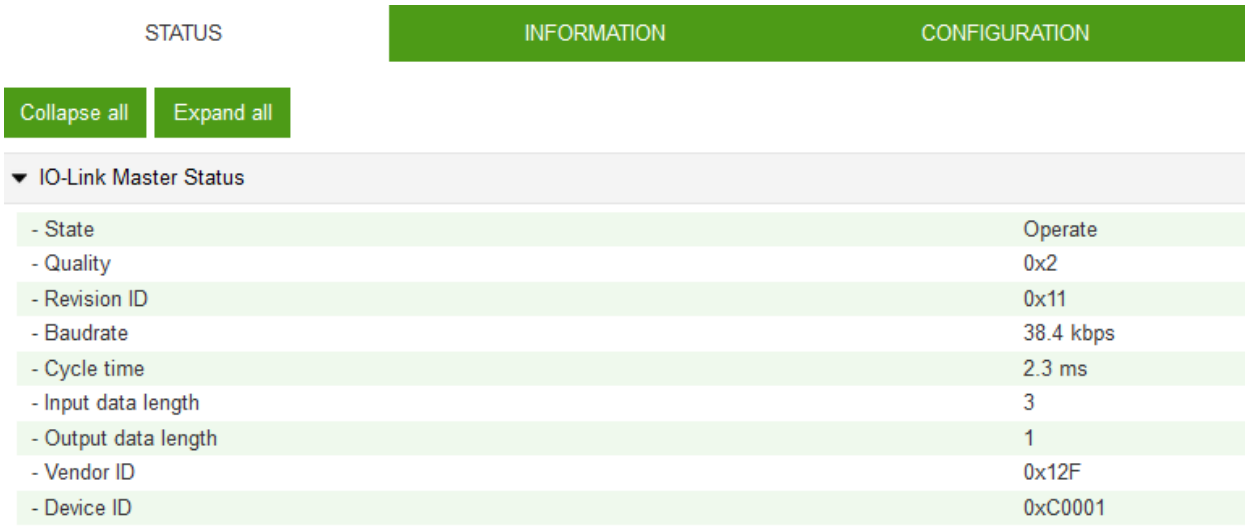


Fig. 10-10: IO-Link master port – IO-Link master status

If pin 4 is in IO-Link operation, all relevant IO-Link data including the I/O bytes of the device are displayed (see Fig. 10-10: "IO-Link master port – IO-Link master status").

If pin 4 is in operation without a connected IO-Link device, a message appears indicating that no device is connected.

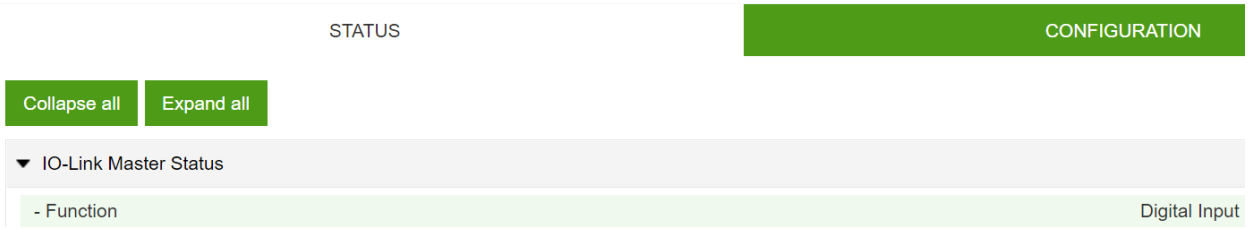


Fig. 10-11: IO-Link master port – IO-Link master status in digital operation

If pin 4 is configured as a digital input, for example, this is also indicated here (see Fig. 10-11: "IO-Link master port – IO-Link master status in digital operation").

Possible displays are:

- Status: Disabled
- Status: Digital input
- Status: Digital output

Port status - pin 1

“Port status - pin 1” displays the following information:

Parameter designation	Meaning
Temperature [°C]	Temperature in degrees Celsius
Voltage [V]	Voltage in Volt
Current [A]	Current in Ampere
Status	State of the pin

Port status - pin 2

“Port status - pin 2” displays the following information:

Parameter designation	Meaning
Temperature [°C]	Temperature in degrees Celsius
Voltage [V]	Voltage in Volt
Current [A]	Current in Ampere
Status	State of the pin

Port status - pin 4

“Port status - pin 4” displays the following information:

Parameter designation	Meaning
Temperature [°C]	Temperature in degrees Celsius
Voltage [V]	Voltage in Volt
Current [A]	Current in Ampere
Status	State of the pin

10.5.2 INFORMATION menu

The “Information” menu item contains the following subitems:

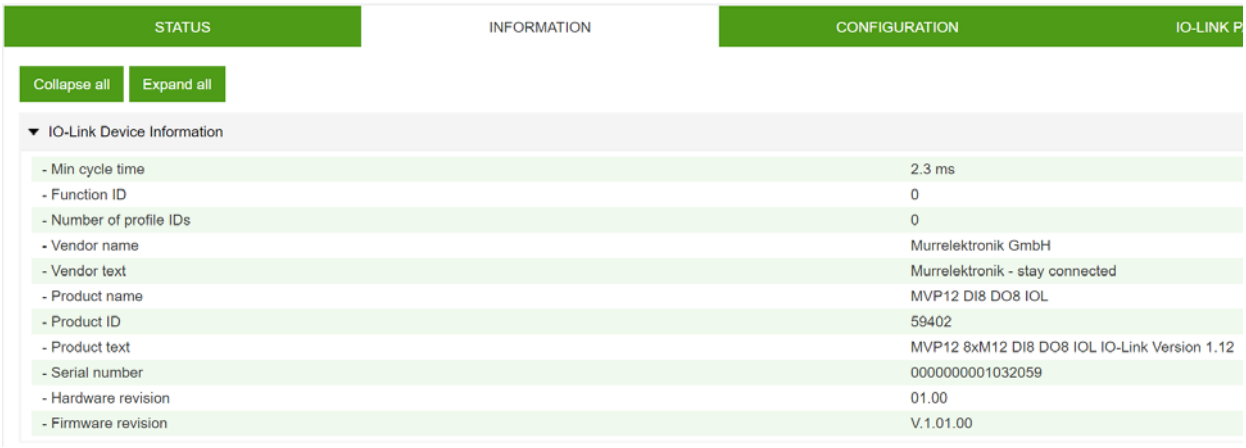


Fig. 10-12: IO-Link master port – “Information”

IO-Link device information

The technical data and manufacturer information of a connected and active IO-Link device at the corresponding master port are displayed here.

“IO-Link device information” displays the following information:

Parameter designation	Meaning
Min. cycle time	Minimum process cycle time of the IO-Link device
Function ID	Function ID of the IO-Link device
Number of profile IDs	Number of profiles supported by the IO-Link device
Manufacturer name	Name of the IO-Link device manufacturer
Manufacturer text	Manufacturer text of the IO-Link device
Product name	Product name of the IO-Link device
Product ID	Article number of the IO-Link device
Product text	Additional description of the IO-Link device
Serial number	Serial number
Hardware version	Hardware version
Firmware version	Firmware version

10.5.3 CONFIGURATION menu

In the “Configuration” menu item of the selected IO-Link port, the setting for pin 1, pin 2 and pin 4 is indicated at the selected port and can be configured there.

Users with operator and admin rights can set the functions and behavior of pin 1, pin 2 and pin 4.

Users with service and maintenance rights have reading rights.

Pin 4 can be deactivated or configured as IO-Link master, input, or output.

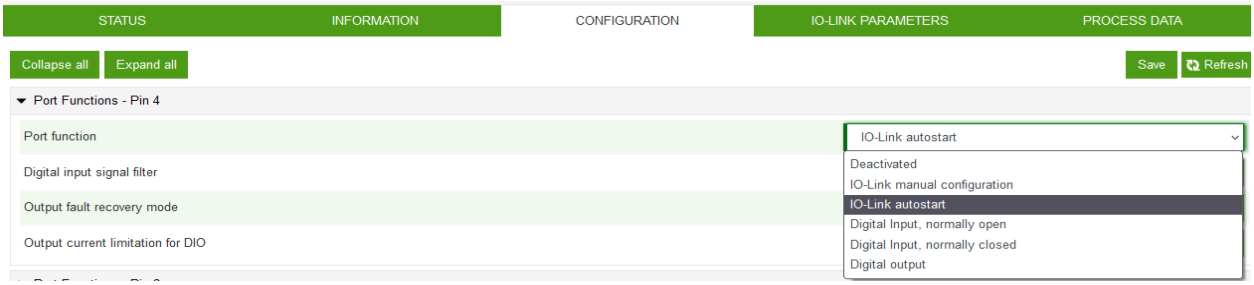


Fig. 10-13: IO-Link master port – configuration (pin 4)

Pin 2 can be deactivated or configured as input, output, or DIO in “Automatic Mode”.

Fig. 10-14: IO-Link master port – configuration – IQ behavior (pin 2)

If pin 2 or pin 4 are configured as input, the digital input filters can be set individually.

Fig. 10-15: IO-Link master port – configuration – setting digital input filters

10.5.4 IO-LINK PARAMETER menu

In this menu item, the ISDU (Index Service Data Unit) of the device can be read and written during IO-Link operation. This enables an IO-Link device to be evaluated or configured without a controller. The input can be in hex or ASCII format.

Observe the information in the IO-Link device manufacturer's manual.

Users with maintenance and admin rights can write ISDU values.
Users with service rights have reading rights.

Fig. 10-16: IO-Link master port – IO-LINK PARAMETER

10.5.5 PROCESS DATA menu

In the “Process data” menu item, the current process data of the connected IO-Link device is continuously displayed if pin 4 of the corresponding port has been configured as an IOL port. Example: port X2: pin 4 (IO-Link autostart) and pin 2 (digital output statically on).

Fig. 10-17: IO-Link master port - PROCESS DATA

In this menu item the current states of the digital inputs are displayed. Example: port X1: pin 4 (DI) and pin 2 (DI)

Fig. 10-18: IO-Link master port – digital inputs – PROCESS DATA

10.6 Digital IO Channels / IO Overview

In the “Configuration” menu of the selected IO-Link port, the setting for pin 2 and pin 4 is indicated at the selected port. Outputs can be set under certain conditions.

10.6.1 Input data

Every user can observe the digital states of the inputs configured on the device.

Fig. 10-19: Input data overview

10.6.2 Output data

Allowing of output setting

Users with admin, service and maintenance rights can allow the setting of outputs in this menu.

The right to do this is only granted if the device is not in an active fieldbus connection with the controller. The controller has priority.

Fig. 10-20: Allowing of output setting

Setting of output data

Guest users are not allowed to force outputs.

All other users (admin, operator, maintenance) are allowed to force outputs.

As soon as the user (admin, operator, maintenance) logs out, the outputs default to “0”.

As soon as a fieldbus is actively working with the device, the outputs go to “0” and then adopt the status they receive from the controller.

Fig. 10-21: Force output data

10.7 Settings / Maintenance

10.7.1 MAINTENANCE INFORMATION menu

The maintenance information appears in the device under the menu item “Status” and submenu “Maintenance information”.

Fig. 10-22: Maintenance information status

Users with service, maintenance and admin rights can enter the device information here.

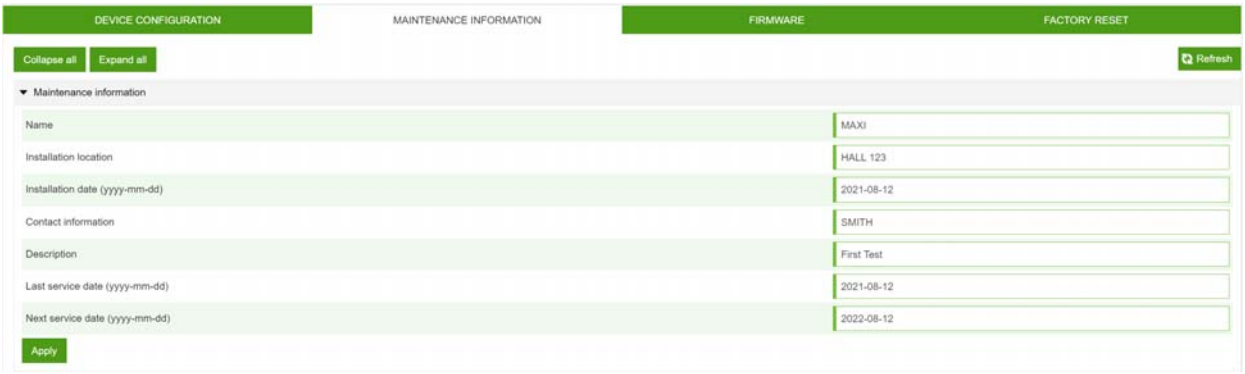


Fig. 10-23: Setting maintenance information

10.7.2 FIRMWARE menu

This menu item displays the data of the firmware running on the device. Users with service, maintenance and admin rights can upload new firmware, provided in ZIP folders, to the device. After a successful upload, the device checks the firmware container and automatically starts with the new firmware version.

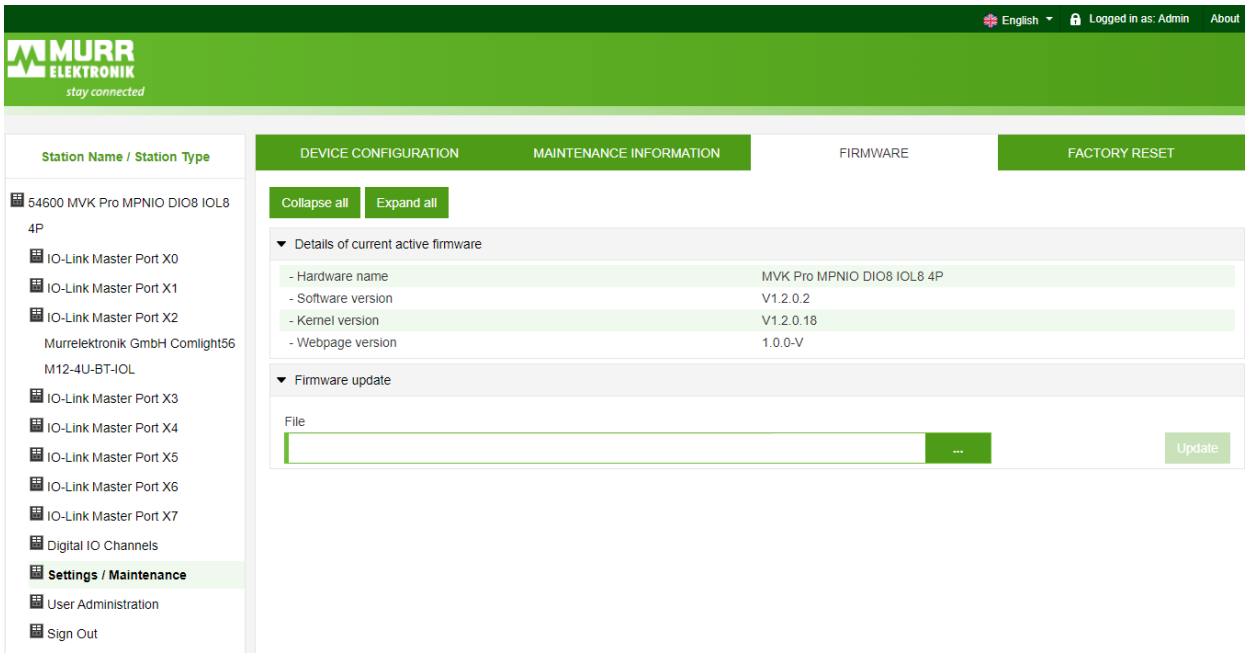


Fig. 10-24: Firmware

10.7.3 FACTORY RESET menu

In this menu item, users with service, maintenance and admin rights can reset the entire device or individual areas (device information, network, application).

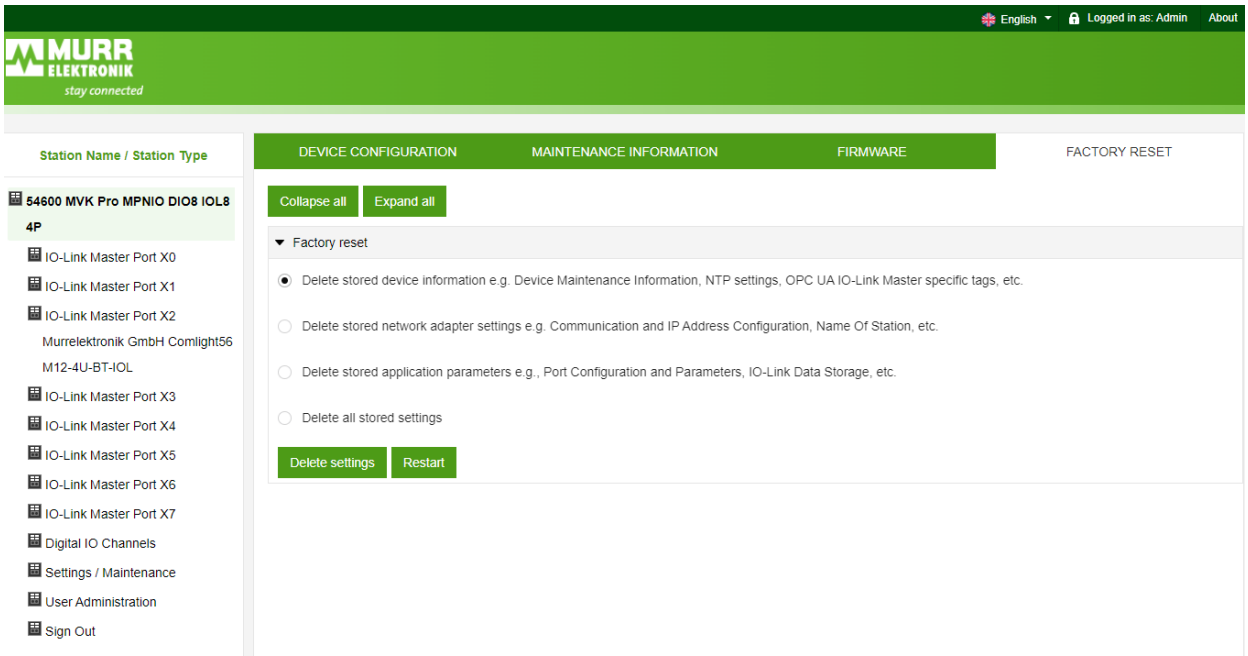


Fig. 10-25: Factory reset

10.8 User Administration

User management can only be performed with admin rights.

Upon receipt of the product, the administrator account is “admin” and the password is “private”.

The default administrator password can be changed from the controller in the plant with the fieldbus running.

Users log in and out at the bottom left of the system tree.

➔ Click ***Sing Out***

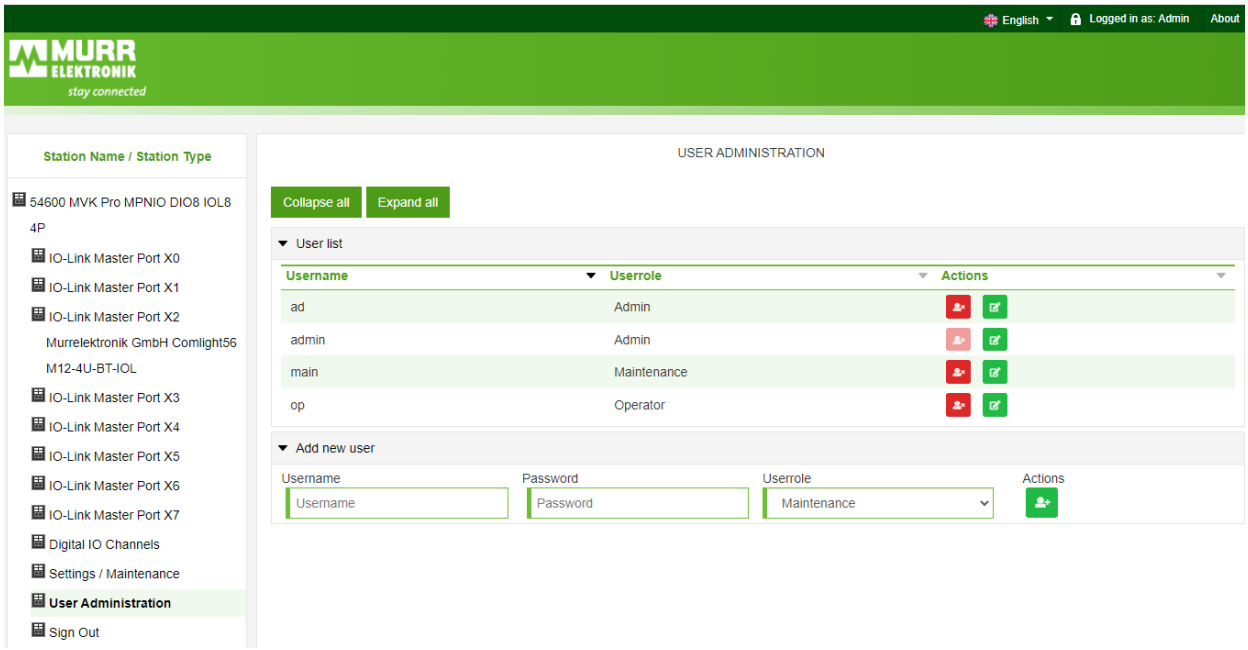


Fig. 10-26: User management

11 Maintenance and cleaning

NOTICE

Material damage caused by defective or damaged devices.

The functioning of the devices is not guaranteed.

➔ Replace defective or damaged devices.

NOTE

In the event of maintenance work, you can replace the device with the same type.

➔ **Check whether the switch settings of the old and new device are identical.**

12 Appendix

12.1 Accessories

12.1.1 System components

Description	Art.-No.
Screw Plug M12 Metal	996049
Plastic M12 screw plug, VE10	58627
Ground strap 4 mm^2 100 mm for M4	4000-71001-0410004
Grounding strap screw-down set M4	4000-71003-0101604
Designation label 20x8 in a set (20 pcs)	55318

12.1.2 Tools

Designation	Art.-No.
6-part screwdriver set	7000-98001-0000000
M12 torque wrench set, AF 13	7000-99102-0000000

Fig. 12-1: Installation wrench

PRODUCTS AND ACCESSORIES
You will find a wide range of products in our catalog or in our Murrelektronik online shop: shop.murrelektronik.com

12.2 Glossary

EtherCAT

Term	Meaning
AoE	ADS over EtherCAT
CoE	CANopen over EtherCAT
EMCY	Emergency messaging
EoE	Ethernet over EtherCAT
ESI file	Device description (EtherCAT slave information) in form of an XML file provided by the manufacturer.
ESM	The states of the EtherCAT slave are controlled by means of the EtherCAT state machine. Depending on the state, different functions are accessible and can be executed in the EtherCAT slave. In particular, when the slave boots, specific commands have to be sent from the EtherCAT master to the device in each state.
ETG	EtherCAT Technology Group The ETG is the worldwide largest international user and manufacturer association for Industrial Ethernet.
EtherCAT	Ethernet for Controller and Automation Techology. EtherCAT was originally developed by Beckhoff Automation GmbH and is now supported and further developed by ETG (EtherCAT Technology Group).
EtherCAT master	EtherCAT master is the I/O controller. It has to support MDP.
FMMU	Fieldbus Memory Management Unit
FoE	File access over EtherCAT
IGMP	The Internet Group Management Protocol (IGMP) is a network protocol of the internet protocol family and is used for organizing multi-cast groups. IGMP uses the Internet Protocol (IP) and is part of IP on all hosts that support the receipt of IP multicasts.
MDP	Modular Device Profile
MQTT	Client/Server protocol
PDO	Process Data Objects are payload which are expected in the application or are sent to the slave.
SDO	Service Data Objects

13 Legal notes

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