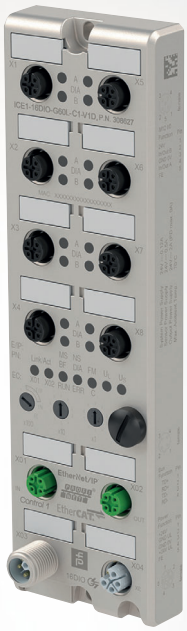
ICE1-8IOL-G60L-V1D, ICE1-8IOL-G30L-V1D

Fieldbus Module with Multiprotocol Technology and I/O-Link

Manual



PROFINET IO-Link EtherNet/IP™

Your automation, our passion.

PEPPERL+FUCHS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

Worldwide

Pepperl+Fuchs Group

Lilienthalstr. 200

68307 Mannheim

Germany

Phone: +49 621 776 - 0

E-mail: info@de.pepperl-fuchs.com

North American Headquarters

Pepperl+Fuchs Inc.

1600 Enterprise Parkway

Twinsburg, Ohio 44087

USA

Phone: +1 330 425-3555

E-mail: sales@us.pepperl-fuchs.com

Asia Headquarters

Pepperl+Fuchs Pte. Ltd.

P+F Building

18 Ayer Rajah Crescent

Singapore 139942

Phone: +65 6779-9091

E-mail: sales@sg.pepperl-fuchs.com

https://www.pepperl-fuchs.com

2022-06

2022-06

1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal

Note

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.

Note

For specific device information such as the year of construction, scan the QR code on the device. As an alternative, enter the serial number in the serial number search at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Other documents

1.2 Manufacturer

Pepperl+Fuchs Group Lilienthalstraße 200, 68307 Mannheim, Germany
Internet: www.pepperl-fuchs.com

1.3 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.4 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols

Note

This symbol brings important information to your attention.

Action

1. This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

2022-06

2 Product Description

2.1 Use and Application

The ICE1-8IOL-* modules function as an interface in an industrial fieldbus system. They enable communication between a central controller at the control level and the decentralized sensors and actuators at the field level. The resulting potential line or ring topologies that can be achieved enable reliable data communication and a significant reduction in the amount of wiring required, which therefore makes the costs for installation and maintenance reasonable. Simple and quick extension is also possible.

The ICE1-8IOL-* series modules have a robust metal housing made of die-cast zinc. Due to the fully encapsulated device housing, the module electronics are protected against environmental influences and can be used in a wide range of temperatures. Despite the robust design, the modules have compact dimensions and a low weight. They are especially suitable for use in machines and plants with a moderate I/O concentration on distributed assemblies.

Multiprotocol (EtherNet/IP, PROFINET)

The multiprotocol modules allow you to select different protocols for communication within a fieldbus system. As a result, multiprotocol modules can be integrated into different networks without the need to purchase protocol-specific modules. Thanks to this technology, you can also use one and the same module in different environments.

Using rotary coding switches in the lower area of the modules, you can comfortably and easily set both the protocol and the address of the module, provided the protocol to be used supports this. If you have chosen a protocol and started the cyclic communication once, the module remembers this setting and uses the selected protocol from this point on. To use another supported protocol with this module, perform a factory reset.

Input/Output Channels for the Field Level

For the field level, the modules have the following input/output channels

- 8 IO-Link master ports
  - 4 IO-Link master ports Class A
  - 4 IO-Link master ports Class B

If one or more of the IO-Link ports are not required, these can also be freely configured as digital inputs or outputs (SIO mode).

- 4 hardwired digital inputs
- 4 configurable digital outputs (instead of the voltage outputs of Class B master ports on pin 2)

IO-Link Characteristics of the Modules

The modules support IO-Link Standard V1.1.

- Parametrization of IO-Link devices in PROFINET using Siemens IO_LINK_DEVICE functional modules for Step 7 and the TIA Portal

8 x IO-Link master ports

- 4 Class A connections with an additional hard-wired digital input at pin 2 of the I/O port.
- 4 Class B connections with a galvanically isolated auxiliary power supply for up to 2 A per port at pins 2 and 5 with a total current of 8 A.
- The auxiliary power supply can optionally be configured as a digital output.

IO-Link connections

- 5-pin M12 connector

Parameter memory

- The parameter storage function stores and monitors the parameters of the IO-Link device and the IO-Link master.
- The function makes it possible for you to easily replace the IO-Link device or the IO-Link master.

  This is possible from the IO-Link specification V1.1 and only if the IO-Link device and the IO-Link master support the function.

IO-Link device parameterization

- The IO-Link devices can be parameterized in the PROFINET protocol using the Siemens IO_LINK_DEVICE functional module for STEP 7 and the TIA Portal.

Special Product Features

- **Robust design:**

  Connectivity options for the module series include the widespread M12 connector with A encoding for I/O signals and D coding for the network. In addition, the connectors are color-coded to prevent confusion of the ports. The output circuits are galvanically isolated from the rest of the network and the sensor electronics. Controllers are therefore reliably protected against noise.
- **Integrated web server:**

  Network parameters such as IP address, subnet mask, and gateway can be adjusted via the integrated web server. The modules support the communication protocols BOOTP and DHCP for automated assignment of network parameters via the corresponding servers.
  You can read the parameters of the IO-Link device via the integrated web server and write new parameters to the modules in single-write mode. Single-write mode does not activate the automatic parameter storage mechanism.
- **Force Mode**

  In Force Mode, the module ports can be temporarily configured as digital inputs/outputs or IO-Link ports. The configuration applies until the module is next switched off.
  "Force Mode" allows the simulation of process data at the digital inputs/outputs without the need to connect sensors and actuators. This means you can test an application in advance without a full physical application. It is possible to simulate input switching states or to switch outputs even without a controller. This feature eases and accelerates machine commissioning and can be used to test new production plants.
- **Integrated network switch:**

  The integrated two-port Ethernet switch of the modules allows you to set up a line topology or a ring topology for the EtherNet/IP network or PROFINET network. The additionally implemented DLR or MRP protocol allows you to design a highly available network infrastructure.
- **Redundancy function:**

  The module firmware supports the redundancy function DLR (Device Level Ring) or MRP (Media Redundancy Protocol) for ring topologies. This means that if the connection is interrupted, the modules switch immediately to an alternative ring segment and thus ensure interruption-free operation. The DLR class supported is "beacon-based" in accordance with the EtherNet/IP specification.
- **Fail-safe function:**

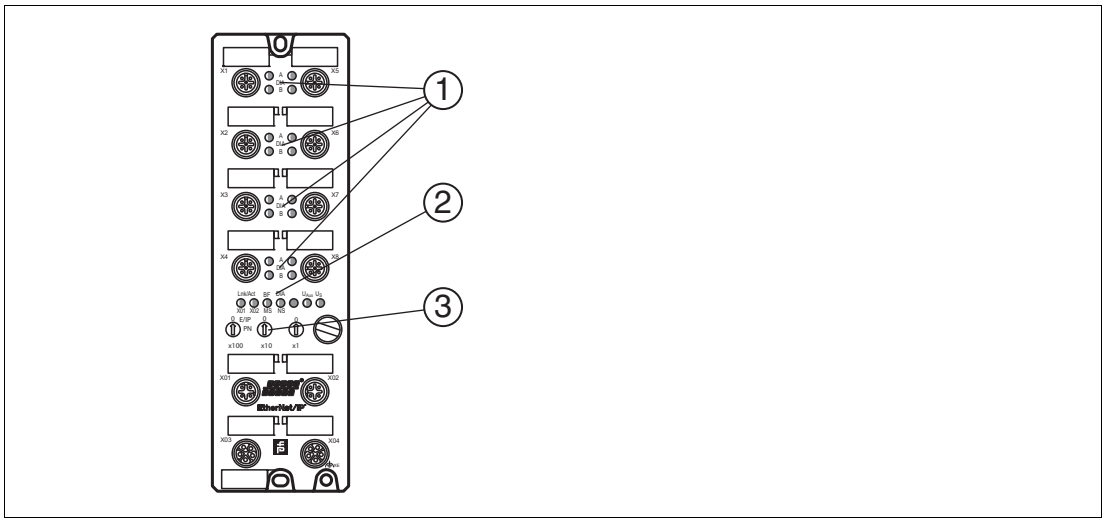
  The modules provide a fail-safe function. You can therefore choose the behavior of each individual output channel in the event of an interruption or a loss of communication.
- **QuickConnect:**

  QuickConnect allows the modules to record the communication in an EtherNet/IP network particularly quickly through an accelerated boot-up process. This allows you to switch tools faster, for example.

2022-06

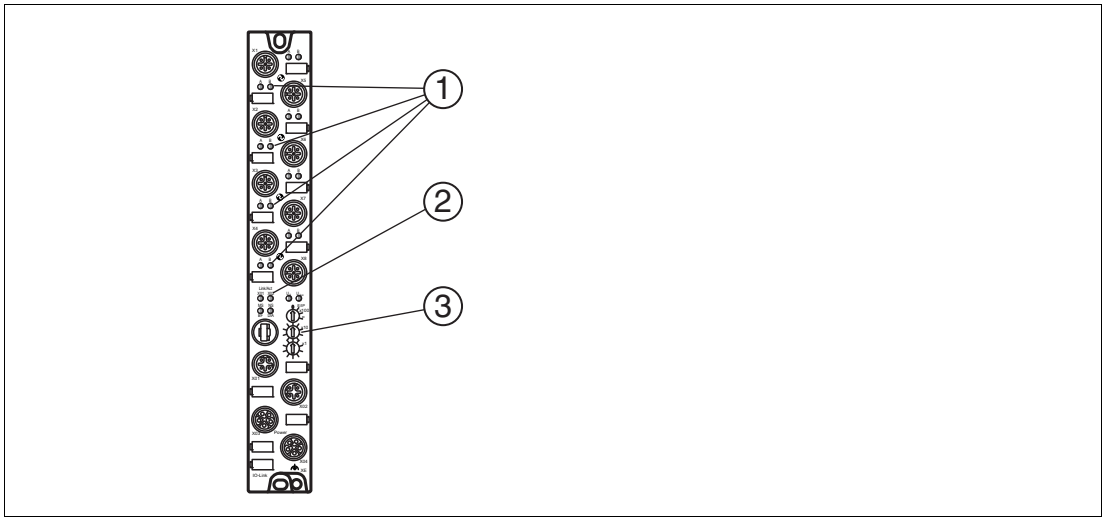
2.2 Displays and Operating Elements

ICE1-8IOL-G30L-V1D



1 LED channel indicator
2 LED status indicator
3 Rotary switch

ICE1-8IOL-G30L-V1D



1 LED channel indicator
2 LED status indicator
3 Rotary switch

Note

The LEDs in the lower area of the Ethernet IO module have different names and functions depending on the selected protocol. The following LED descriptions are therefore divided into a general part (1), which is valid for all protocol settings, and LED descriptions for a specific protocol setting (2).

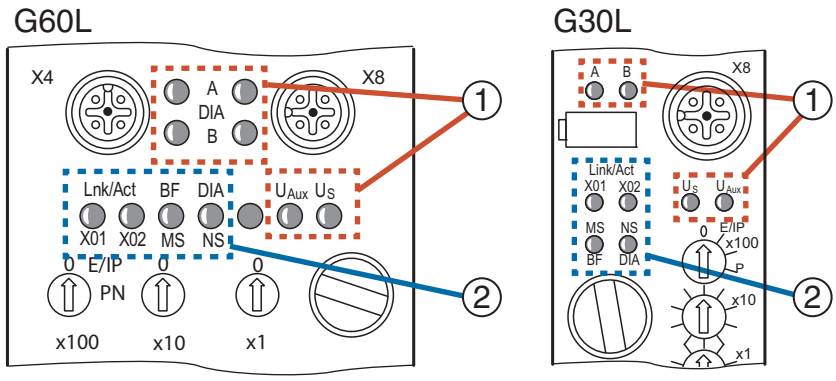


Figure 2.1

Displays - General Part

Description for LED A, B, DIA, U_S, U_{Aux}

LED	Function
DIA LED A (for each of X1 - X8 A)	Red: peripheral error (sensor/actuator overload or short circuit) **SIO mode** Yellow: channel A status (pin 4) is "on" Off: no error, not connected **IO-Link mode** Green: IO-Link communication present Flashing green: no IO-Link device connected Off: not configured for IO-Link
DIA LED B (for each of X1 - X8 B)	Red: peripheral fault (sensor and actuator overload or short circuit at line L+ (pin 1)) **SIO mode** White: Channel B status (pin 2) is "on" Red: Overload or short circuit at C/Q (pin 4) line Off: no error, not connected **IO-Link mode** Red: IO-Link COM mode: IO-Link communication error or overload or short circuit at C/Q (pin 4) line Flashing green: no IO-Link device connected Off: not configured for IO-Link
LED U_S	Green: voltage 19 V ≤ U_S ≤ 30 V Red: voltage U_S < 19 V or U_S > 30 V
LED U_{Aux}	Green: voltage 19 V ≤ U_{Aux} ≤ 30 V Red: voltage U_{Aux} < 19 V or U_L > 30 V Red alert is only possible if, for EtherNet/IP, the option "Report U_{Aux} supply voltage fault" is enabled in "General Diagnosis Settings" or, for PROFINET, the option "U_{Aux} supply diagnosis" is enabled in "Global Diagnostic Parameters."

Table 2.1

2022-06

EtherNet/IP Displays

E/IP areas: relevant LEDs Lnk/Act X01, Lnk/Act X02, MS, NS

LED	Function
LED Lnk/Act X01 LED Lnk/Act X02	Green: connection to an Ethernet node Flashing yellow: data exchange with an IO device Off: no connection
LED MS	Green: module ready for operation Flashing green: missing configuration Flashing red/green: self-test Red: non-recoverable, serious error Flashing red: minor recoverable error (e.g., incorrect configuration) Off: module switched off
LED NS	Green: module has at least one connection Flashing green: module has no connections. IP address is available Red/green: module is performing a self-test Red: module has determined that the assigned IP address already exists Flashing red: the connection has timed out or been interrupted Off: module is turned off or does not have an IP address

Table 2.2

PROFINET Displays

P area: relevant LEDs Lnk/Act X01, Lnk/Act X02, BF, DIA

LED	Function
LED Lnk/Act X01 LED Lnk/Act X02	Green: connection to an Ethernet node Flashing yellow: data exchange with an IO device Off: no connection
LED BF	Red: no configuration, slow or no physical connection Flashing red: link exists but no communication link to the PROFINET controller Off: no error
LED DIA	Red: PROFINET diagnostic alarm active Flashing red (1 Hz): time-out or fail-safe mode is active Flashing red (2 Hz) for 3 sec: DCP signal service triggered via the bus Red double flashing: firmware update Off: no error

Table 2.3

Operating Elements

Switch	Function
Rotary switch X100	Setting the fieldbus protocol Setting the IP address[1]
Rotary switch X10	Setting the IP address[1]<Default ¬[1] Font>
Rotary switch X1	Setting the IP address[1]<Default ¬[1] Font>

1. Only EtherNET/IP

2.3 Interfaces and Connections

The contact arrangements below show the front view of the plug-in area of the connectors.

Fieldbus Connection X01, X02

Caution!
Risk of destruction!
Never route the power supply to the data cable.

- Connection: M12 socket, 4 pin, D-coded
- Color coding: green

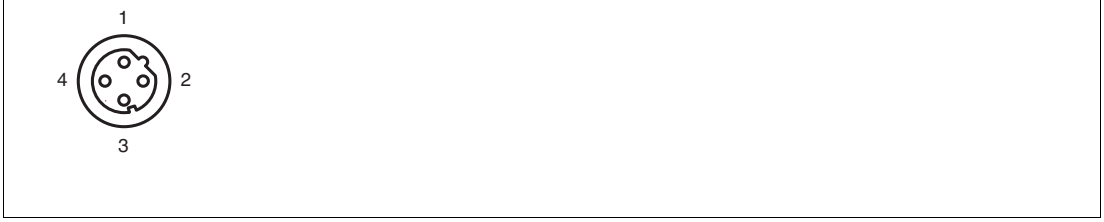


Figure 2.2 Schematic drawing of port X01, X02

Port	Pin	Signal	Function
Ports X01, X02	1	TD+	Transmit data +
	2	RD+	Receive data +
	3	TD-	Transmit data -
	4	RD-	Receive Data -

Table 2.4 Assignment of port X01, X02

Connection for IO-Link, digital inputs/outputs X1 - X8

- Connection: M12 socket, 5 pin, A-coded
- Color coding: black

Caution!
Risk of destruction with external sensor supply!
The module infeed for the sensor supply U_S may only be provided over the specified power connection (Power X03/X04 >> U_S +24 V/GND_U_S) for the module. It is not permitted to supply external power via the IO-Port (port X1 - X8 >> pin 1/pin 3) and this may destroy the module electronics through power feedback.

Caution!
Do not compromise galvanic isolation through incorrect cabling!
The sensor supply (port X5 - X8 >> pin 1/pin 3) and extended sensor supply (port X5 - X8 >> pin 2/pin 5) are galvanically isolated from each other. If the reference potentials (GND_U_S – pin 3) and (GND_U_{Aux} – pin 5) are connected, excessive equalization currents may flow. In this case, it is not permitted for a sensor to be connected to (port X5 - X8 >> pin 2)!
Eliminating the galvanic isolation is not recommended.

Caution!
Risk of destruction!
Never route the power supply to the data cable.

2022-06

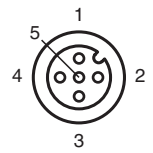


Figure 2.3 Schematic drawing of inputs/outputs 1 - 8

Port	Pin	Signal	Function
IO-Link Class A, inputs/outputs X1 ... X4	1	L+	IO-Link sensor power supply +24 V
	2	IN-x	Channel B: digital input (type 1)
	3	L-	IO-Link sensor power supply GND_U_S
	4	C/Q	Channel A: IO-Link data exchange
	5	n.c.	Not used

Port	Pin	Signal	Function
IO-Link Class B, inputs/outputs X5 ... X8	1	L+	IO-Link sensor power supply +24 V
	2	U_{AUX} (+24 V)	Channel B: auxiliary voltage, galvanically isolated from the IO-Link/module power supply
	3	L-	IO-Link sensor power supply GND_U_S
	4	C/Q	Channel A: IO-Link data exchange
	5	GND_U_{AUX}	Protective earth, reference potential U_{AUX}

Connection for Power Supply X03, X04

- Power supply with M12 power L-coded
- Color coding: gray

Note

For the system/sensor and actuator supply, use only power supplies that comply with PELV (protective extra-low voltage) or SELV (safety extra-low voltage). Power supplies according to EN 61558-2-6 (transformer) or EN 60950-1 (switching power supplies) fulfill these requirements.

Caution!

Loss of function when the system supply voltage is too low.

Ensure in all cases that the supply voltage measured at the most remote participants (sensor/actuator) does not drop below 18 V DC in terms of system supply voltage.

Note

Power supply connection

When connecting the power supply, ensure a separate power supply to the sensor and system via U_s and auxiliary voltage via U_{Aux} for e.g., actuators. Where the plant has a separate power supply concept for system current and load current, this means the sensor and system area of the Ethernet IO module can continue working even if there is a failure of the load power supply.

Where several Ethernet IO modules are connected in series, ensure the separate power supplies are connected properly U_s .U_{Aux}.

Figure 2.4 Schematic drawing of M12 L-encoding (plug); port X03 (IN)

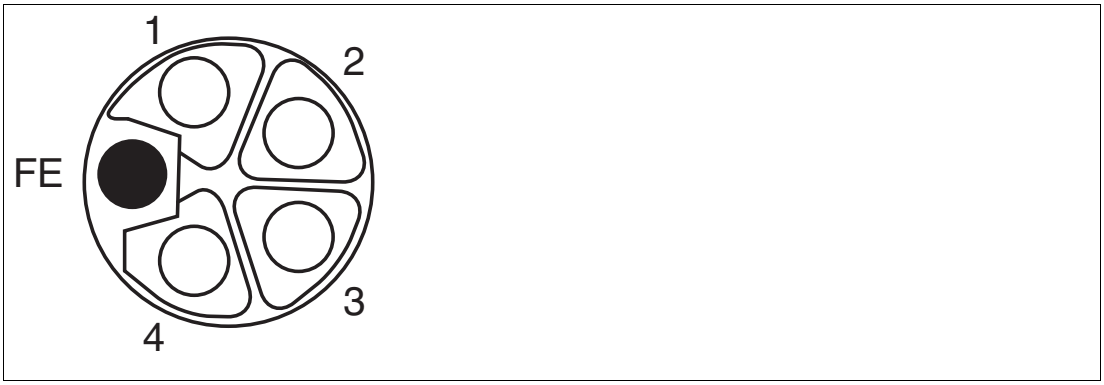


Figure 2.5 Schematic drawing of M12 L-encoding (socket); port X04 (OUT)

Port	Pin	Signal	Function
Power supply X03, X04	1	U_S(+24 V)	Sensor/system supply
	2	GND U_{Aux}	Ground/reference potential U_{Aux}
	3	GND U_S	Ground/reference potential U_s
	4	U_{Aux} (+24 V)	Auxiliary voltage (galv. insulated)
	FE (5)	FE (FE)	Functional ground

2022-06

2.4 Dimensions

ICE1-8IOL-G60L-V1D

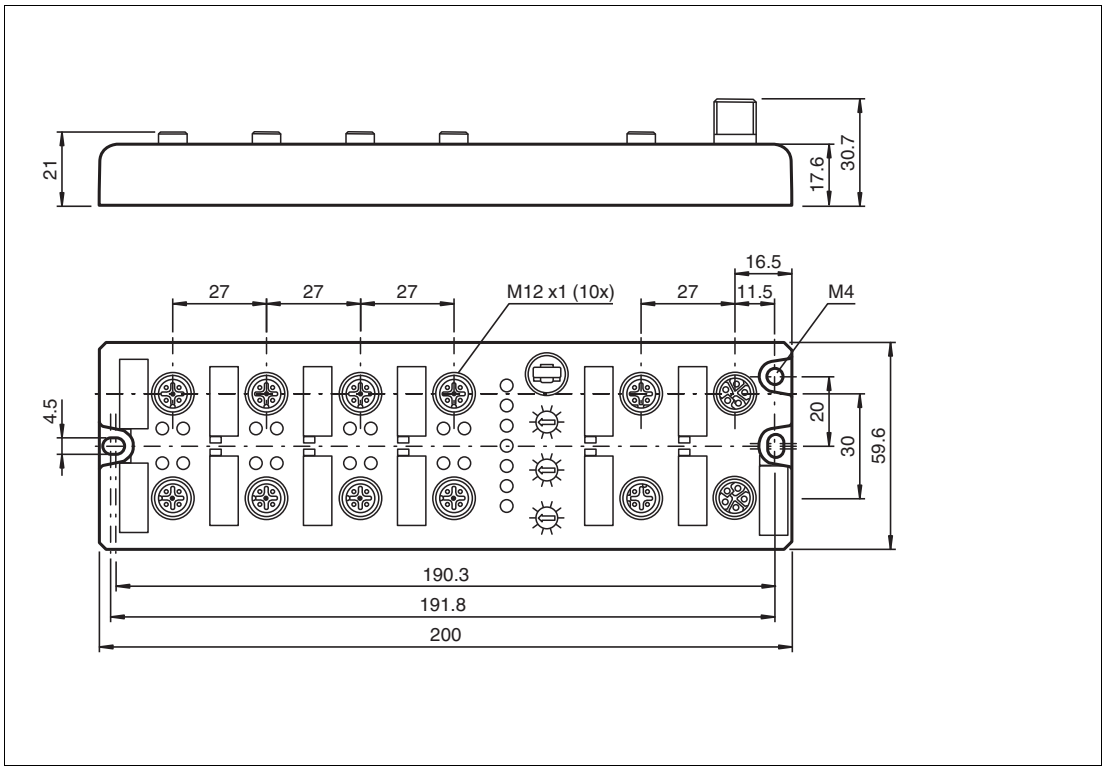


Figure 2.6

ICE1-8IOL-G30L-V1D

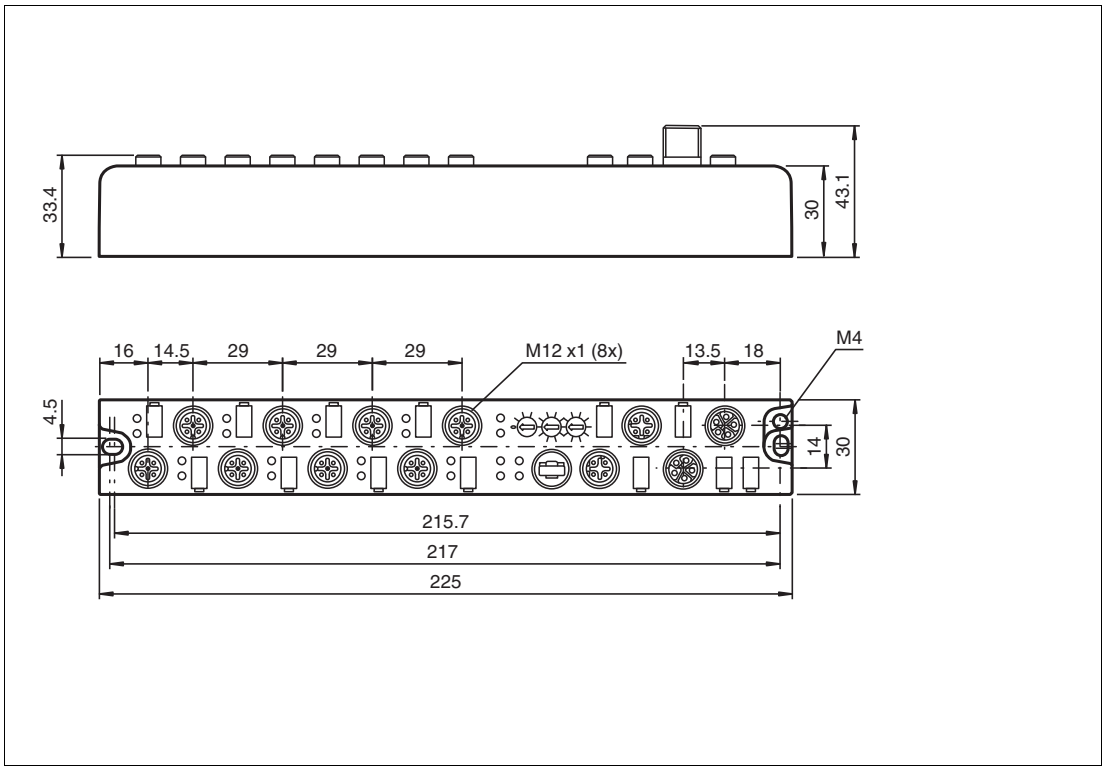


Figure 2.7

3 Installation

3.1 General Information

Install the module with two M6x25/30 size screws on a level surface. The required torque is 1 Nm. Use washers according to DIN 125. For the installation holes, use a spacing of 237.3 mm to 239.7 mm.

Note

Power supply connection

When connecting the power supply, ensure a separate power supply to the sensor and system via U_s and auxiliary supply via U_{Aux} for e.g., actuators. Where the plant has a separate power supply concept for system current and load current, this means the sensor and system area of the Ethernet IO module can continue working even if there is a failure of the load power supply.

Where several Ethernet IO modules are connected in series, ensure the separate power supplies are connected properly U_s .U_{Aux}.

Note

To dissipate interference currents and the EMC resistance, the modules use a short circuit to ground with an M4 thread. This is marked with the symbol for grounding and the label "XE."

Note

Connect the module using a low-impedance connection with the reference ground. In the case of a grounded mounting surface, you can connect the module directly via the fixing screws.

Note

For non-grounded mounting surfaces, use a ground strap or a suitable FE conductor. Connect the ground strap or FE conductor to the grounding point using an M4 screw and place a washer and a serrated washer under the fixing screw if possible.

Note

Use a suitable UL-certified cable (CYJV or PVVA). To program the controller, please consult the manufacturer information and use only the appropriate accessories.

Note

For UL application:

Approved only for indoor use. Please observe the maximum altitude of 2000 meters. Approved up to a maximum of pollution degree 2.

Warning!

Terminals, the housing of field-wired terminal boxes or components may exceed a temperature of 60 °C.

Warning!

Use temperature-resistant cables with the following properties:

Heat resistant up to at least 96 °C.

2022-06

4 Commissioning, Protocol Setting

4.1 Setting Protocols

Multiprotocol

You can use the multiprotocol modules to select various protocols for communication within a fieldbus system. This allows you to integrate the multiprotocol modules into different networks without having to obtain a specific module for each protocol. This technology also allows you to use the same module in different environments. Using the rotary switches on the front of the modules, you can easily and conveniently set the protocol and address of the module if the protocol to be used supports this. Once you have selected a protocol and started the cyclical communication, the module recognizes these settings and uses the selected protocol from this point on. To use another supported protocol with this module, perform a factory reset.

Setting a Protocol

Multiprotocol modules have a total of three rotary switches. Alter the switch position for the first rotary switch X100 to set the protocol. If you use EtherNet/IP, set the last octet of the IP address using the rotary switches (X100, X10, X1).

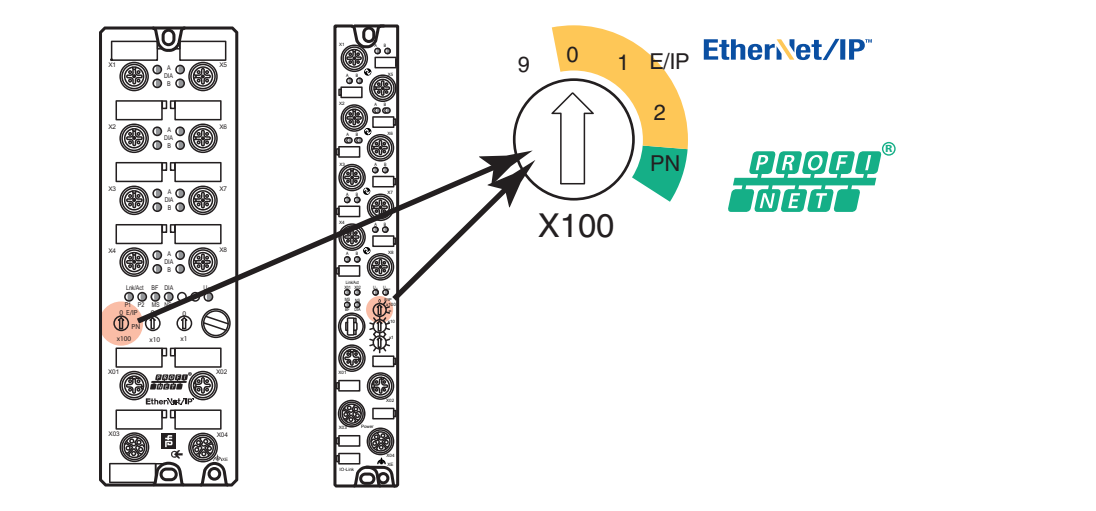


Figure 4.1 Rotary switch X100

Assigning the Protocol Using the Rotary Switches

Protocol	X100	X10	X1
EtherNet/IP	0 - 2	0 - 9	0 - 9
PROFINET	P	-	-

The default settings of the module do not contain any protocol settings. In this case, simply select the desired protocol. To use a modified rotary switch setting (protocol setting), you have to execute a power cycle or "Reset" of the web interface. Once you have set the protocol using the rotary switches, the module saves these settings as soon as it starts a cyclical communication. From this point, you can no longer change the protocol using the rotary switch. To change the protocol, perform a factory reset first.

If you set the rotary coding switch to an invalid position, the device signals this with a flash code: the BF/MS/ERR LED flashes red three times.

You can change the IP address depending on the selected protocol.

EtherNet/IP

If you use EtherNet/IP as the protocol, use rotary switch X100 to set the value 100 as the last octet of the IP address for the module. With the X100 rotary switch, you can set a value of 0 to 2 for the IP address. With the X10 and X1 rotary switches, you can set values between 0 and 9. You can use rotary switch X10 to configure position 10 of the last octet of the IP address. With rotary switch X1 you can configure position 1 of the last octet of the IP address.

The default setting for the first three octets of the IP address is 192.168.1.

Example: Rotary switch settings 2 (X100), 1 (X10), and 0 (X1) result in an IP address of 192.168.1.210 for EtherNet/IP.

PROFINET

If you use PROFINET as the protocol, only set rotary switch X100 to the value "P."

Factory Settings

A factory reset erases any changes you have made to settings etc. and restores the factory settings. The saved protocol selection is also reset.

To perform a factory reset, set rotary switch X100 to 9, rotary switch X10 to 7 and rotary switch X1 to 9. Then switch the module off and on again. The factory settings are restored after 10 seconds.

To select a new protocol, follow the instructions in this chapter.

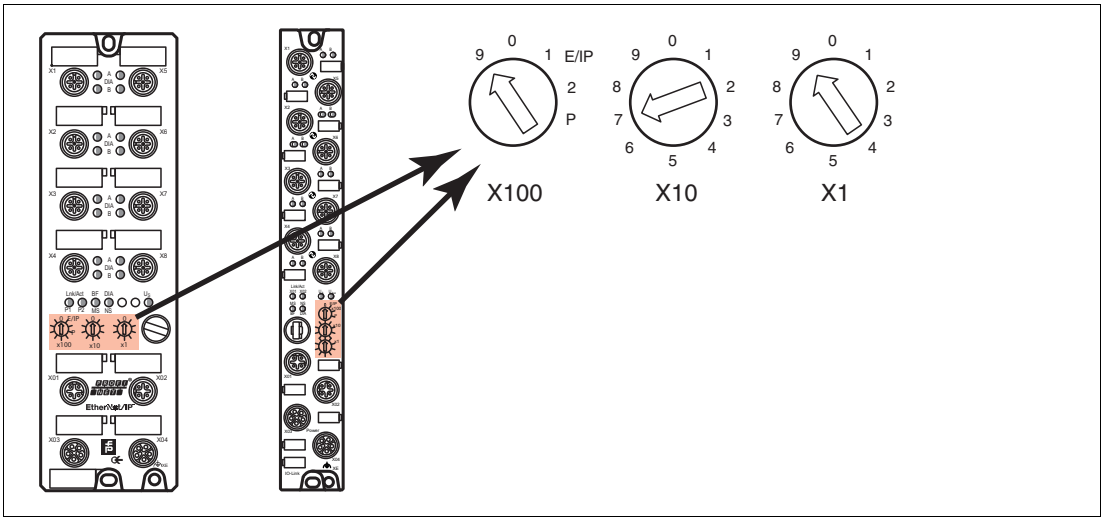


Figure 4.2 Restoring factory settings: X100 = 9, X10 = 7, X1 = 9

Caution!

Destruction of the Operating System

When restoring the factory settings, ensure that the module is connected to the power supply and switched on for **at least** 10 seconds. If it has been on for less than 10 seconds, the operating system may be destroyed. The module then has to be sent to Pepperl+Fuchs for repair.

2022-06

5 Commissioning for EtherNet/IP

5.1 Preparation

To configure a module in the controller, you need an EDS file.

Downloading the EDS File

You can find the relevant EDS file in the **Software** section of the product detail page for the device.

To access the product detail page for the device, go to http://www.pepperl-fuchs.com and type e.g., the product description or the item number into the search function.

Use the hardware or network configuration tools from your controller manufacturer to install the EDS file for the module version used. After installation, the modules can be found in the hardware catalog as "General Purpose Discrete I/O" devices.

Reading MAC IDs

Each module has a unique, manufacturer-assigned MAC ID that cannot be changed by the user. The assigned MAC ID is printed on the module.

Setting the Network Parameters

The IP address can be pre-set using the three rotary switches on the front side of the modules.

Please note that a fixed IP address is required to use QuickConnect.

Once the power supply has been restored, the modules read in the switch positions. The selected operating mode overwrites the saved settings.

The devices support the DHCP and BOOTP protocols for receiving the required network parameters such as IP address and subnet mask.

The factory settings of the static network parameters are:

- IP address: 192.168.001.001
- Subnet mask: 255.255.255.000
- Gateway address: 000.000.000.000

The following settings are possible via the rotary coding switches:

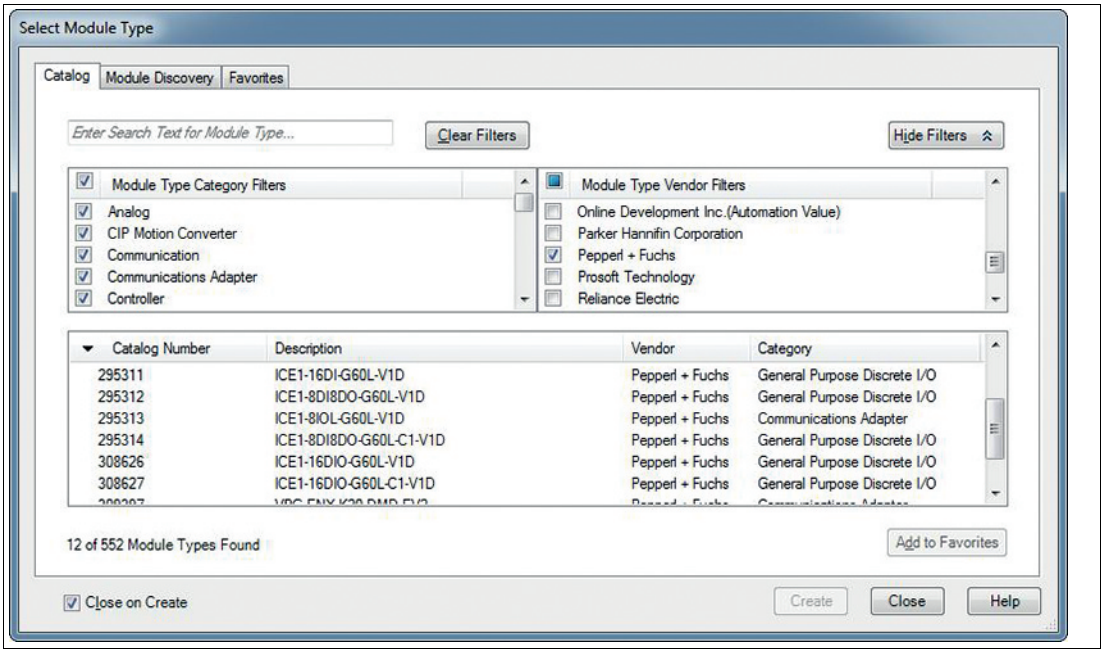
Rotary switch position	Function
000 (As delivered)	The DHCP and BOOTP functionality is activated as standard on delivery. The network parameters are initially requested using DHCP requests. If this is not successful, the request is made using BOOTP requests. The network parameters are not saved; however, it is possible to save them via the integrated web server.
000 (Network parameters already saved)	The last-saved network parameters are used (IP address, subnet mask, gateway address, DHCP on/off, BOOTP on/off).
001 to 254	The last three digits of the saved or default IP address are overwritten by the control switch setting.
979	The device performs a reset to factory settings. The network parameters are also reset to the default values. Communication is not possible in this operating mode.

5.2 Configuration Example

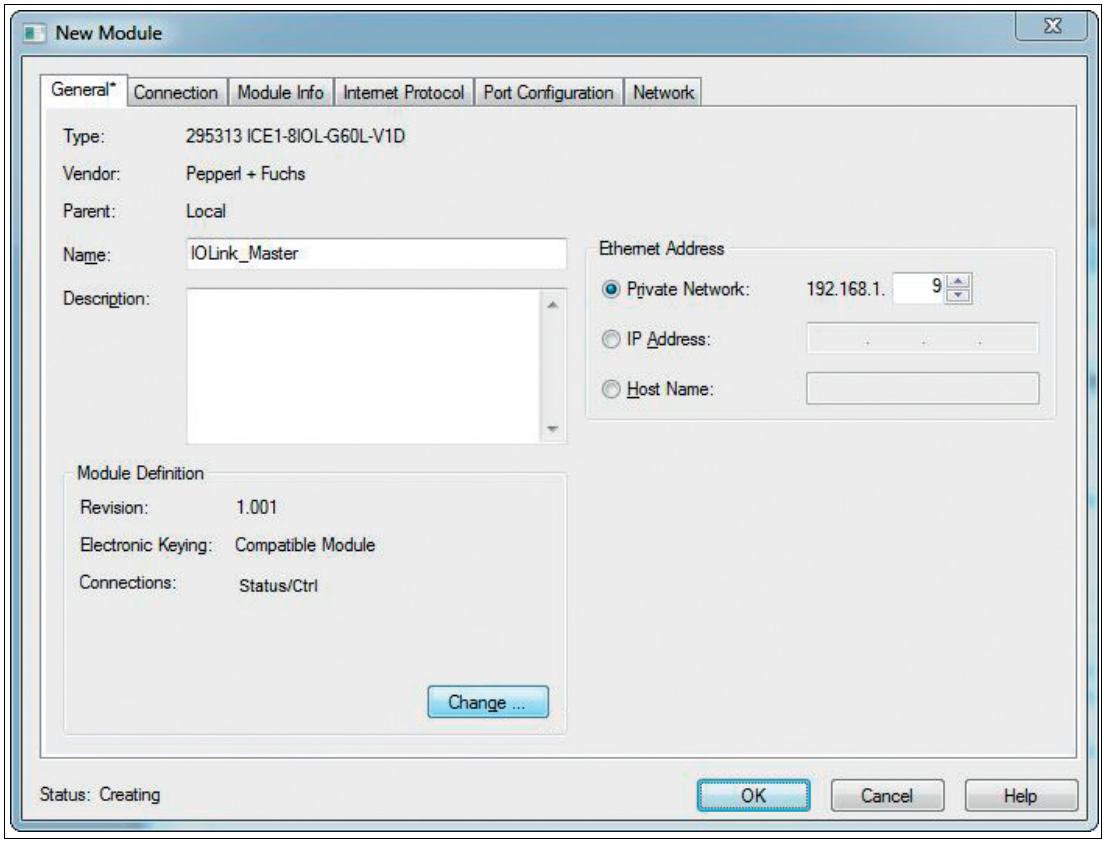
Configuration with RSLogix5000

The configuration and commissioning procedure for modules that is described on the following pages is based on the RSLogix5000 software from Rockwell Automation. When using a control system from a different provider, please refer to the corresponding documentation.

1. Install the EDS files for the modules in RSLogix5000 using the EDS hardware installation tool in the "Tools" menu.
2. Select the correct controller.
3. Select the "New Module" menu item. The following selection window opens:

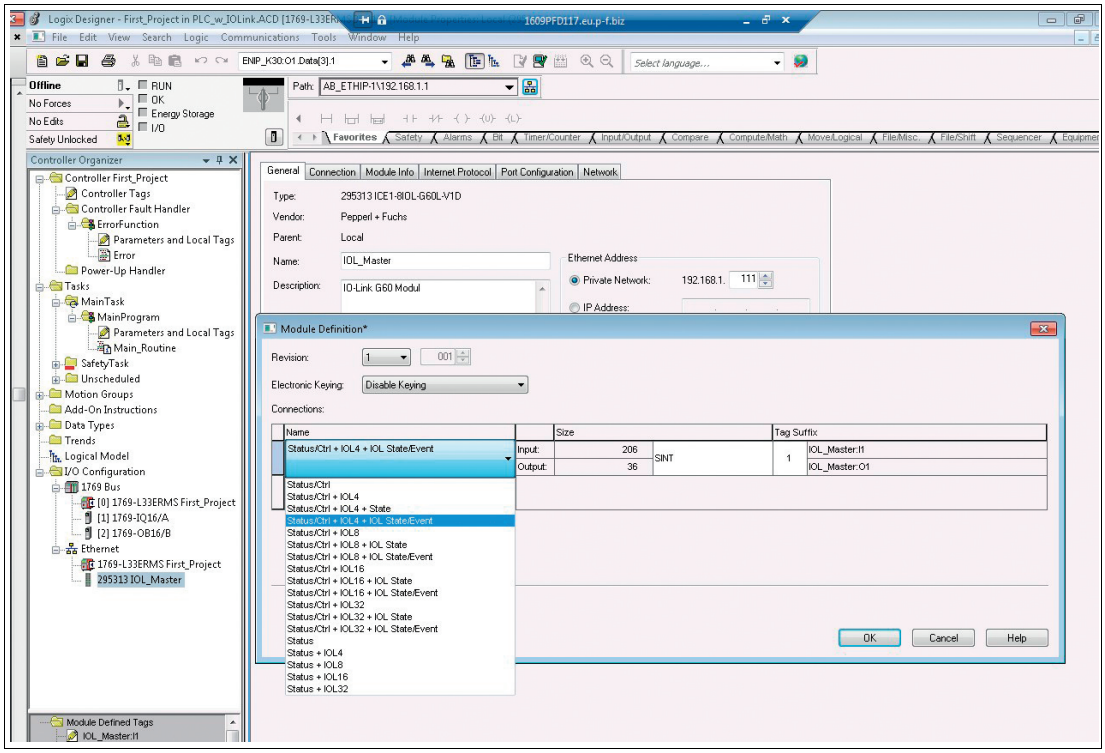


4. On the right-hand side in "Module Type Vendor Filters," select the option "Pepperl + Fuchs" to view all installed modules from Pepperl+Fuchs.
5. Select the module you want to add and click the "Create" button.



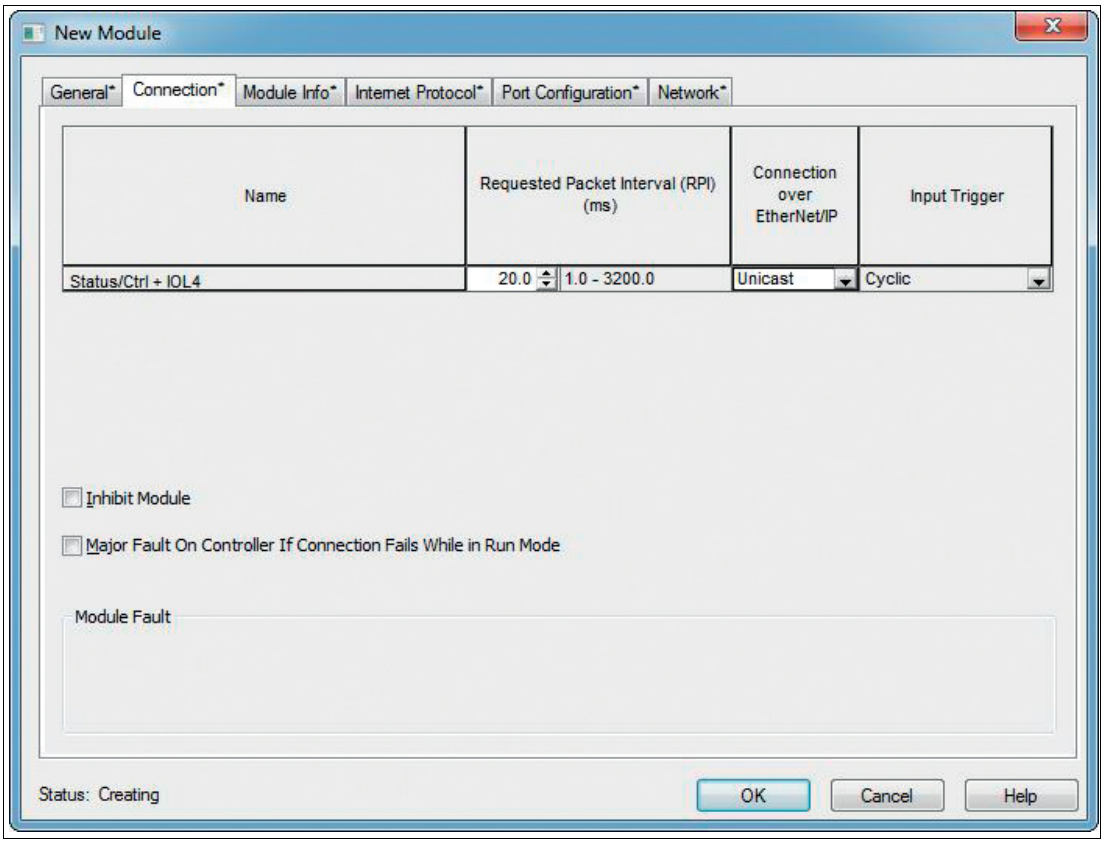
6. Enter a name for the module and the correct IP address. The name "IOLink_Master" and IP address "192.168.1.9" have been used in this example.

7. Click the "Change" button and change the module revision and the electronic keying settings, as well as the type of connection.

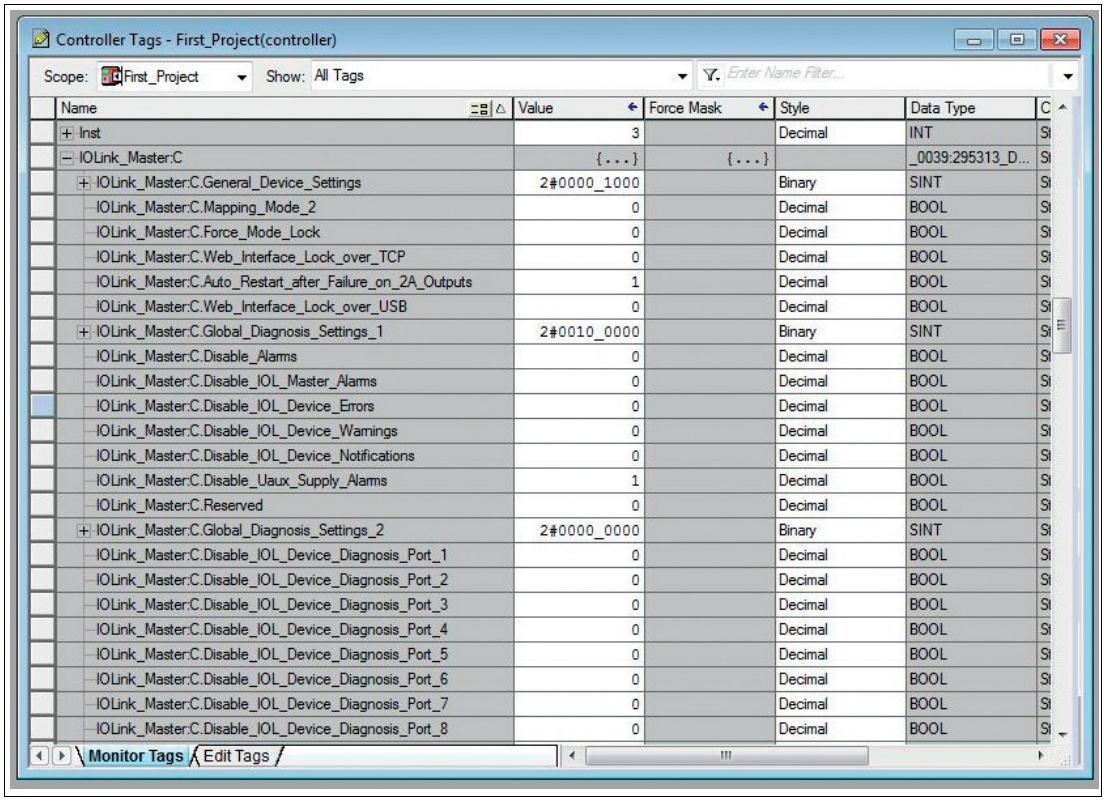


8. Select the type of connection in "Connections." This determines which process and diagnostic data the module provides.

9. In the "Connection" tab of "Module Properties," you will see the selected connection type. You can also set the "Requested Packet Interval (RPI)" and "Input Type" on this tab. The minimum value for the RPI parameter is 5 ms.



10. Go to the "Controller Tags" section in "Controller Organizer." The controller tags for the configuration parameters have the same name as the module, followed by: C. You can define the parameters for surveillance timeout and fail-safe individually for each output channel, as shown in the following image:



5.3 IO-Link Master Parameters

The parameters must be transferred to the IO-Link master after switching on. The parameters also include the IO-Link port mode. The IO-Link port data length is selected from the various available connections.

Parameter 1: General Device Setting

Bit	Function
0	**0 = mapping mode 1** 1 = mapping mode 2
1	**0 = force mode adjustable via web interface** 1 = force mode not adjustable via web interface
2	**0 = web interface accessible via TCP** 1 = web interface not accessible via TCP
3	0 = automatic restart of outputs after fault (ports 5 - 8) disabled **1 = automatic restart of outputs after fault (ports 5 - 8) enabled**
4	**0 = web interface lock via USB enabled** 1 = web interface lock via USB disabled
5	0 = Reserved; do not use
6	0 = Reserved; do not use
7	0 = Reserved; do not use

Table 5.1 **Bold** = default setting

Mapping mode, bit 0

With the "Digital IO Bit Mapping Mode" parameter, you can define the assignments of input/output bits that are transferred in the cyclic status and monitor the control data of the module.

MM1: standard mapping

- In mapping mode 1 (MM1), the first channel bit (C/Q, channel A/pin 4) and the second channel bit (channel B/Pin2) are alternately transferred in ascending order for all ports.

MM2: alternative Mapping

- In mapping mode 2 (MM2), the first channel bits (C/Q, channel A/pin 4) and the second channel bits (channel B/Pin2) are transferred in succession in ascending order for all ports.

The different formats are also illustrated in the chapter "Connections and Assembly Objects" (See chapter 5.4.

Parameter 2: Global Diagnostic Parameters

Bit	Function
0	**0 = all diagnostics enabled** 1 = all diagnostics disabled
1	**0 = IO-Link master diagnosis enabled** 1 = IO-Link master diagnosis disabled
2	**0 = IO-Link device fault diagnosis enabled** 1 = IO-Link device fault diagnosis disabled
3	**0 = IO-Link device warning diagnosis enabled** 1 = IO-Link device warning diagnosis disabled
4	**0 = IO-Link device notification diagnosis enabled** 1 = IO-Link device notification diagnosis disabled
5	0 = U_{AUX} supply diagnosis enabled **1 = U_{AUX} supply diagnosis disabled**
6	0 = Reserved; do not use
7	0 = Reserved; do not use

Table 5.2 **Bold** = default setting

Parameter 3: global diagnostic parameters

Bit	Function
0	**0 = IO-Link port 1 device diagnosis enabled** 1 = IO-Link port 1 device diagnosis disabled
1	**0 = IO-Link port 2 device diagnosis enabled** 1 = IO-Link port 2 device diagnosis disabled
2	**0 = IO-Link port 3 device diagnosis enabled** 1 = IO-Link port 3 device diagnosis disabled
3	**0 = IO-Link port 4 device diagnosis enabled** 1 = IO-Link port 4 device diagnosis disabled
4	**0 = IO-Link port 5 device diagnosis enabled** 1 = IO-Link port 5 device diagnosis disabled
5	**0 = IO-Link port 6 device diagnosis enabled** 1 = IO-Link port 6 device diagnosis disabled
6	**0 = IO-Link port 7 device diagnosis enabled** 1 = IO-Link port 7 device diagnosis disabled
7	**0 = IO-Link port 8 device diagnosis enabled** 1 = IO-Link port 8 device diagnosis disabled

Table 5.3 **Bold** = default setting

2022-06

Parameters 4 - 16: fail-safe parameters for digital outputs

The IO-Link master supports a fail-safe function for channels used as digital outputs (DO).

During configuration of the devices, the status of the outputs after an interruption or loss of communication in the EtherNet/IP network can be defined.

The following options can be selected:

- **Set Low**: the output channel is disabled and/or the output bit is set to 0.
- **Set High**: the output channel is enabled and/or the output bit is set to 1.
- **Hold Last**: the last output status is retained.

Parameter	Description	Bit	Function
4	Fail-safe value DO mode port 1 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
5	Fail-safe value DO mode port 2 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
6	Fail-safe value DO mode port 3 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
7	Fail-safe value DO mode port 4 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
8	Fail-safe value DO mode port 5 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
9	Fail-safe value DO mode port 6 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
10	Fail-safe value DO mode port 7 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
11	Fail-safe value DO mode port 8 Channel A	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
12	Fail-safe value DO mode port 5 Channel B	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
13	Fail-safe value DO mode port 6 Channel B	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use

Parameter	Description	Bit	Function
14	Fail-safe value DO mode port 7 Channel B	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
15	Fail-safe value DO mode port 8 Channel B	0-1	**0 = Set low** 1 = Set high 2 = Hold last
		2-7	0 = Reserved; do not use
16	Reserved 1	0 to 7	0 = Reserved; do not use

Table 5.4 **Bold** = default setting

Parameters 24 - 27: Surveillance Timeout Parameters

The separate auxiliary voltage, U_{AUX}, available on type-B IO-Link channels (channel B/pin 2), ports 5 - 8, can also be configured as an additional digital output. This enables you to switch the power supply like a digital output.

The firmware of the module allows you to configure a delay time before output current monitoring is enabled for this particular application. The delay time is referred to as the "Surveillance timeout" and can be configured for each output channel. The delay time starts after the status of the output channel changes, i.e., if it is enabled (after a rising edge) or disabled (after a falling edge). Once this time has elapsed, the output is monitored and fault states are reported by the diagnostics.

The "Surveillance timeout" parameter can be set to a value between 0 and 255 ms. The default value for this parameter is 80 ms. If an output channel is in a static state, i.e., permanently switched on or off, the typical value is 5 ms.

Parameter	Description	Bit	Function
24	Monitoring time exceeded Port 5 Channel B	0-16	0 ms = min. value **80 ms = default value** 255 ms = max. value
25	Monitoring time exceeded Port 6 Channel B	0-16	0 ms = min. value **80 ms = default value** 255 ms = max. value
26	Monitoring time exceeded Port 7 Channel B	0-16	0 ms = min. value **80 ms = default value** 255 ms = max. value
27	Monitoring time exceeded Port 8 Channel B	0-16	0 ms = min. value **80 ms = default value** 255 ms = max. value

Table 5.5 **Bold** = default setting

Parameters 28 - 29: Digital Input Logic

The standard input logic is defined as NO (normally open). It can be changed to NC (normally closed).

If it is set to normally-closed, a logical 1 is transmitted to the EtherNet/IP scanner for a physically low level at the digital input port.

The port LED logic remains unchanged by the input logic settings. The LED indicates the physical input status of the connection.

Parameter	Description	Bit	Function
28	Digital input logic Channel A	0	**0 = normally open port 1A** 1 = normally closed port 1A
		1	**0 = normally open port 2A** 1 = normally closed port 2A
		2	**0 = normally open port 3A** 1 = normally closed port 3A
		3	**0 = normally open port 4A** 1 = normally closed port 4A
		4	**0 = normally open port 5A** 1 = normally closed port 5A
		5	**0 = normally open port 6A** 1 = normally closed port 6A
		6	**0 = normally open port 7A** 1 = normally closed port 7A
		7	**0 = normally open port 8A** 1 = normally closed port 8A
29	Digital input logic Channel B	0	**0 = normally open port 1B** 1 = normally closed port 1B
		1	**0 = normally open port 2B** 1 = normally closed port 2B
		2	**0 = normally open port 3B** 1 = normally closed port 3B
		3	**0 = normally open port 4B** 1 = normally closed port 4B
		4	0 = input not available, do not use
		5	0 = input not available, do not use
		6	0 = input not available, do not use
		7	0 = input not available, do not use

Table 5.6 **Bold** = default setting

Parameters 30 - 37: Digital IO Mode, Channel B

These parameters can be used to select the function for connections 5 - 8 (IO-Link type B) of channel B.

Parameter	Description	Bit	Function
30	Digital IO mode Port 1 Channel B	0 to 7	0 = digital input, function cannot be changed
31	Digital IO mode Port 2 Channel B	0 to 7	0 = digital input, function cannot be changed
32	Digital IO mode Port 3 Channel B	0 to 7	0 = digital input, function cannot be changed
33	Digital IO mode Port 4 Channel B	0 to 7	0 = digital input, function cannot be changed

Parameter	Description	Bit	Function
34	Digital IO mode Port 5 Channel B	0-1	0 = Reserved **1 = auxiliary energy**[1][2] 2 = digital output[3] 3 = inactive
		2-7	0 = Reserved; do not use
35	Digital IO mode Port 6 Channel B	0-1	0 = Reserved **1 = auxiliary energy** 2 = digital output 3 = inactive
		2-7	0 = Reserved; do not use
36	Digital IO mode Port 7 Channel B	0-1	0 = Reserved **1 = auxiliary energy** 2 = digital output 3 = inactive
		2-7	0 = Reserved; do not use
37	Digital IO mode Port 8 Channel B	0-1	0 = Reserved **1 = auxiliary energy** 2 = digital output 3 = inactive
		2-7	0 = Reserved; do not use

Table 5.7 **Bold** = default setting

1. **ICE1-8IOL-G60L-V1D**: in this mode, pin 2 and pin 5 of IO-Link ports 5 - 8 (type B) act as auxiliary voltage outputs. The auxiliary voltage is provided via the U_{AUX} supply input. The auxiliary voltage output cannot be controlled.
2. **ICE1-8IOL-G30L-V1D**: Parameter is permanently set to 1 = auxiliary power.
3. **ICE1-8IOL-G60L-V1D**: in this mode, pin 2 of IO-Link ports 5 - 8 (type B) can be used as a digital output. The control bits are transferred from the digital output control bytes to the device. A "monitoring time exceeded" parameter can be set for the outputs (see parameters 20 - 27: monitoring time exceeded parameters).

Parameters 53 - 60: IO-Link Port Mode, Channel A

This parameter can be used to select the function of the IO-Link port at channel A.

The following modes are available:

Inactive This mode should be selected when the channel is not used. In this case, the power supply L+ to pin 1 of the port is disabled.

Digital Input (DI) In this mode the channel works as a digital input. The IO-Link master does not attempt to independently establish communication with the connected IO-Link device.

Note

Please note that the status of the digital input signal is not updated for optional COM operations.

Digital Output (DO) In this mode the channel works as a digital output. It is not possible to communicate with the connected device.

SIO mode (DI) This mode is used for the parameterization of IO-Link devices. The mode uses the fallback mechanism of "COM mode" in "SIO mode." In this mode, the IO-Link device can be parameterized when the module starts, and it switches back to digital input mode via the fallback mechanism.
In addition, the cyclical output bits in the IO-Link master COM control byte (See chapter 5.5.5 Control of IO-Link COM Mode) can be used at any time to set the corresponding channels to COM mode and therefore to carry out parameterization for the IO-Link device.

IO-Link In this mode (COM mode), process data is exchanged with the device via a communication connection. The IO-Link master automatically starts when the IO-Link device is connected, taking into account the baud rate. This mode also offers the possibility to parameterize the IO-Link device. Connections with data lengths of 1, 2, 4, 8, 16, and 32 input and output bytes are available. If the device does not have a suitable data length, the next larger data length will be selected.

Parameter	Description	Bit	Function
53	Digital IO mode Port 1 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use
54	Digital IO mode Port 2 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use
55	Digital IO mode Port 3 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use
56	Digital IO mode Port 4 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use
57	Digital IO mode Port 5 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use
58	Digital IO mode Port 6 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use

Parameter	Description	Bit	Function
59	Digital IO mode Port 7 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use
60	Digital IO mode Port 8 Channel A	0-2	0 = inactive **1 = DI** 2 = DO 3 = SIO 4 = IO-Link
		3-7	0 = Reserved; do not use

Table 5.8 **Bold** = default setting

Parameter 62 - 140: Extended IO-Link Port Parameters

The "parameter memory" and "validation mode" of the IO-Link master can be set for each IO-Link port (channel A). A parameter block with 22 bytes is available for each IO-Link port.

Parameter	Description	Function
62-70	IO-Link port 1 Parameter	See table below
72-80	IO-Link port 2 Parameter	See table below
82-90	IO-Link port 3 Parameter	See table below
92-100	IO-Link port 4 Parameter	See table below
102-110	IO-Link port 5 Parameter	See table below
112-120	IO-Link port 6 Parameter	See table below
122-130	IO-Link port 7 Parameter	See table below
132-140	IO-Link port 8 Parameter	See table below

Table 5.9 **Bold** = default setting

Parameter	Description	Bit	Function
62	Parameter memory Port 1	0-3	**0 = Disabled** 1 = Download (master to device) 2 = Upload (device to master) 3 = Download & Upload 4 = Disabled and Deleted
		4-7	0 = Reserved; do not use
63	Device validation mode Port 1	0-3	**0 = no validation** 1 = compatible with input values 2 = identical to input values
		4-7	0 = Reserved; do not use
64	Vendor ID (MSB) Port 1	0 to 7	0 ... 255

2022-06

Parameter	Description	Bit	Function
65	Vendor ID (LSB) Port 1	0 to 7	0 ... 255
66	Device ID (MSB) Port 1	0 to 7	0 ... 255
67	Device ID Port 1	0 to 7	0 ... 255
68	Device ID (LSB) Port 1	0 to 7	0 ... 255
69	Serial number of IO-Link device Port 1 (16 bytes)	0 to 7	Serial number, byte 1 (MSB)
		...	...
		0 to 7	Serial number, byte 16 (LSB)
70	Fail-safe behavior IO-Link port 1	0-3	0 = Set low 1 = Set high 2 = Hold last value 3 = Replace value (transferred via class code 0x81) 4 = Command
		4-7	0 = Reserved; do not use

Table 5.10 **Bold** = default setting

IO-Link Parameter Memory

The parameter server of the IO-Link master can be parameterized on the "Parameter Memory" tab.

The "parameter memory" function manages the IO-Link device parameters to enable the simple replacement of a device or master.

The following options can be set:

- **Disabled:**

  This is the default setting upon delivery and the data storage function is disabled. If parameter data has been previously saved for a device, this will remain unchanged. Any parameter changes in the IO-Link device have no effect on the parameter server.

- **Download only (master to device):**

  Activates the function to download the parameter data to the IO-Link device on the master. Parameter data can only be loaded onto an IO-Link device if the data is available on the parameter server and is compatible with the device. When an IO-Link device is connected, the master compares the stored parameter data with the device data. If the function (Parameter storage locked) is not active on the device, the master will download the stored data onto the device where there are discrepancies.

  IO-Link device parameter data can be loaded in the **Upload only** Or **Download and Upload** modes. If the master has not saved a device parameter set, the mode should be compared with the **Disabled** mode.

  The IO-Link device can be replaced in this mode.

- **Upload only (device to master):**

  Activates the function to upload the IO-Link device parameter data to the IO-Link master. An upload is executed automatically when an IO-Link device is connected and the master has no valid data. This is the case if the mode **Disabled and Cleared** has previously been configured, or in **Disabled** mode, as per the default settings. The uploaded parameter data is permanently stored on the master.

  If parameter data on the device is changed at runtime, the parameter sets stored in the master can be overwritten using the command "ParamDownloadStore" (Index 0x0002, Subindex 0x00, Value 0x05). This command sets the flag "DS_UPLOAD_REQ" in the device and thus executes an upload. Flags are set, for example, by the local teach-in buttons on the IO-Link device or through parameterization via the IO-Link device tool.

  The IO-Link master can be easily replaced in this mode.

- **Download and Upload:**

  Activates the function to download and upload the IO-Link device parameter data. An upload is executed automatically when an IO-Link device is connected and the master has no valid data. This is the case if the mode **Disabled and Cleared** has previously been configured, or in **Disabled** mode, as per the default settings. The uploaded parameter data is stored permanently in the master.

  If parameter sets on the device are changed at runtime, the device data stored in the master can be overwritten using the command "ParamDownloadStore" (Index 0x0002, Subindex 0x00, Value 0x05). This command sets the flag "DS_UPLOAD_REQ" in the device and thus executes an upload. Flags are set automatically by the local teach-in buttons on the IO-Link device or through parameterization via the IO-Link device tool.

  Each time a new connection is established with an IO-Link device, the master compares the stored parameter data with the device data. If the function (Parameter storage locked) is not active on the device, the master will download the stored data onto the device where there are discrepancies.

  The IO-Link device and IO-Link master can be replaced in this mode.

- **Disabled and Cleared:**

  The data storage function is disabled and the stored parameter sets are deleted.

Note

The IO-Link device sets the "DS_UPLOAD_REQ Flag" flag independently if parameters have been written in block mode.

IO-Link Device Validation

With IO-Link device validation (IO-Link device identification), you can check the connected devices with regard to the values set in the control program, e.g., to identify correctly connected devices before the port starts IO-Link communication.

	Validation mode
No validation	In this case, neither the vendor ID, the device ID nor the serial number are synchronized between the IO-Link device and entered IO-Link master data after switching on and before communication is started. This option is the default setting.
Compatible with values entered	With this option, the vendor ID and device ID are synchronized between the IO-Link device and entered IO-Link master data after switching on and before communication is started. Process data communication only takes place if the configured values match the values reported by the device. It is therefore possible to replace IO-Link devices of the same type without changes in the engineering tool.
Identical to values entered	In this case, the vendor ID, device ID and the serial number are synchronized between the IO-Link device and the entered IO-Link master data after switching on and before communication is started. Process data communication only takes place if the configured values match the values reported by the device. It is therefore only possible to replace an IO-Link device of the same type if the serial number is changed in the engineering tool at the same time.
Vendor ID	The vendor ID of the IO-Link device used can be entered as a decimal value in the "VendorID (MSB)" (most significant byte) and "VendorID (LSB)" (least significant byte) fields.
Device ID	The device ID of the IO-Link device used can be entered as a decimal value in the "DeviceID (MSB)" (most significant byte) and "DeviceID (LSB)" (least significant byte) fields.
Serial number	The serial number of the IO-Link device can be entered as a string in the "Serial number" entry field. The input is limited to 16 characters.

2022-06

Fail-Safe Behavior (for Outputs Only)

This option only applies to IO-Link channels in COM mode, in which output data is used.

In COM mode, IO-Link data is exchanged between the IO-Link master and the IO-Link device via serial communication.

	Fail-Safe Value Options
Set low	All bits of the output data with a value of 0 are transferred to the IO-Link device. This option is the default setting.
Set high	All bits of output data with a value of 1 are transferred to the IO-Link device.
Hold last	The last valid output value received by the control unit is continuously and cyclically transferred to the IO-Link device.
Replace value	If this option is selected, the values transferred via the "IO-Link Fail-Safe Parameters Object (Class Code 0x81)" are continuously and cyclically transferred to the IO-Link device.
IO-Link master command	The "IO-Link Master Command" option enables the use of IO-Link-specific mechanisms for valid or invalid output process data. In this way, the behavior is determined by the device itself.

5.4 Connections and Assembly Object

The modules support exclusive owner, input only, and listen only connections.

- **Exclusive owner**

  This connection is bidirectional: the controller sends data to the module and the module sends data to the controller. This type of connection is known as exclusive owner because it connects **one** module to the controller in each case.
- **Input only**

  With this type of connection, only the module sends data to the controller. The module sends a heartbeat, possibly at reduced intervals. This enables the controller to detect interruptions to the connection.
- **Listen only**

  This connection corresponds to the input only connection but can only be established if an exclusive owner or input only connection also exists between another module and the controller.

An exclusive owner connection is only available for modules with output functionality. By selecting the corresponding assembly ID for the assembly object, you determine whether the module adds diagnostic data to the standard process data.

The modules provide the following connections and assembly IDs:

The EtherNet/IP IO-Link master supports different permanent IO data connections. Actual values are specified for input data and target values are specified for output data.

"Exclusive Owner" Connection

"Exclusive Owner" connections can be configured as multicast or point-to-point connections in the target to source direction.

Size of input data The volume of the provider data (input data) is variable and depends on the connection number selected. The first data block within the input data is always the status data block. This block contains the digital input statuses of the IO ports, the IO-Link port statuses, and diagnostic data. The volume of the input data depends on the IO Link input/output data size configured.

Configurable length of IO Link input/output data The IO Link input/output data length can be set to 4, 8, 16, or 32 bytes for all IO-Link channels in parallel. The length must be selected for the maximum data length of all IO-Link devices used on an IO-Link master. The selected data length is used for the input and output data size for all IO-Link master ports in parallel. This offers simple and constant data offsets in the input data stream with reduced input/output data quantities.

Configured extended IO-Link status data This block contains IO-Link communication statuses, parameter memory statuses, and the IDs of the IO-Link devices connected.

Configured IO-Link event data This block can contain up to three IO-Link device event data records.

The following EtherNet/IP assembly pairs are available for the configuration of input and output data: (connection = CONN, assembly = ASSY)

CONN No.	Input Assembly-ID	Input Data	Output Assembly-ID
1	101	IO-Link master status data (without IO-Link device and optional data)	100 (0 bytes IO-Link)
2	103	IO-Link master status data + 4 bytes per port for IO-Link device	102 (4 bytes IO-Link)
5	105	IO-Link master status data + 8 bytes per port for IO-Link device	104 (8 bytes IO-Link)
8	107	IO-Link master status data + 16 bytes per port for IO-Link device	106 (16 bytes IO-Link)
11	109	IO-Link master status data + 32 bytes per port for IO-Link device	108 (32 bytes IO-Link)
3	111	IO-Link master status data + 4 bytes per port for IO-Link + extended IO-Link status	102 (4 bytes IO-Link)
6	113	IO-Link master status data + 8 bytes per port for IO-Link + extended IO-Link status	104 (8 bytes IO-Link)
9	115	IO-Link master status data + 16 bytes per port for IO-Link + extended IO-Link status	106 (16 bytes IO-Link)
12	117	IO-Link master status data + 32 bytes per port for IO-Link + extended IO-Link status	108 (32 bytes IO-Link)
4	F119	IO-Link master status data + 4 bytes per port for IO-Link + extended IO-Link status + IO-Link events	102 (4 bytes IO-Link)
7	121	IO-Link master status data + 8 bytes per port for IO-Link + extended IO-Link status + IO-Link events	104 (8 bytes IO-Link)
10	123	IO-Link master status data + 16 bytes per port for IO-Link + extended IO-Link status + IO-Link events	106 (16 bytes IO-Link)
13	125	IO-Link master status data + 32 bytes per port for IO-Link + extended IO-Link status + IO-Link events	108 (32 bytes IO-Link)

Table 5.11

2022-06

Size of Output Data

The size of the consumption data (output data) is variable. The first data block within the output data is always the control data block of the IO-Link master. This block contains the digital output control bits of the IO ports.

The variable size of the output data depends on the size of the configured IO Link input/output data. The IO Link output data length can be set to 4, 8, 16, or 32 bytes for all IO-Link channels in parallel. The length must be selected for the maximum data length of all IO-Link devices used on an IO-Link master. The selected data length is used for the input and output data size for all IO-Link master ports in parallel. This offers simple and constant data offsets in the data stream.

The following EtherNet/IP assembly pairs are available for the configuration of input and output data: (connection = CONN, assembly = ASSY)

CONN No.	Output Assembly-ID	Output Data	Input Assembly-ID
1	100	IO-Link master status data (without IO-Link device and optional data)	101 (0 bytes IO-Link)
2	102	4 bytes of IO-Link master control data + 4 bytes per port for IO-Link device	103 (4 bytes IO-Link)
3	102	4 bytes of IO-Link master control data + 4 bytes per port for IO-Link device	111 (4 bytes IO-Link + status)
4	102	4 bytes of IO-Link master control data + 4 bytes per port for IO-Link device	119 (4 bytes IO-Link + status + event)
5	104	4 bytes of IO-Link master control data + 8 bytes per port for IO-Link device	105 (8 bytes IO-Link)
6	104	4 bytes of IO-Link master control data + 8 bytes per port for IO-Link device	113 (8 bytes IO-Link + status)
7	104	4 bytes of IO-Link master control data + 8 bytes per port for IO-Link device	121 (8 bytes IO-Link + status + event)
8	106	4 bytes of IO-Link master control data + 16 bytes per port for IO-Link device	107 (16 bytes IO-Link)
9	106	4 bytes of IO-Link master control data + 16 bytes per port for IO-Link device	115 (16 bytes IO-Link + status)
10	106	4 bytes of IO-Link master control data + 16 bytes per port for IO-Link device	123 (16 bytes IO-Link + status + event)
11	108	4 bytes of IO-Link master control data + 32 bytes per port for IO-Link device	109 (32 bytes IO-Link)
12	108	4 bytes of IO-Link master control data + 32 bytes per port for IO-Link device	117 (32 bytes IO-Link + status)
13	108	4 bytes of IO-Link master control data + 32 bytes per port for IO-Link device	125 (32 bytes IO-Link + status + event)

"Listen Only" Connection

"Listen Only" connections are available in both directions.

The following EtherNet/IP assembly pairs are available for the configuration of input data: (connection = CONN, assembly = ASSY)

CONN No.	Input Assembly-ID	Input Data	Output Assembly-ID
14	100	IO-Link master status data (without IO-Link device and optional data)	-
15	101	IO-Link master status data + 4 bytes per port for IO-Link device	-
16	102	IO-Link master status data + 8 bytes per port for IO-Link device	-
17	103	IO-Link master status data + 16 bytes per port for IO-Link device	-
18	104	IO-Link master status data + 32 bytes per port for IO-Link device	-

5.5 Bit Assignment

5.5.1 Status Data of the IO-Link Master (Inputs)

Overview of the IO-Link Master Status Data (Inputs)

Status data	Description
Byte 0	Status of the digital inputs, ports 1 - 4 (mapping mode 1, default)
Byte 1	Status of the digital inputs, ports 5 - 8 (mapping mode 1, default)
Byte 2	Status of the IO-Link communication
Byte 3	Status of the IO-Link process data validity
Byte 4	Status of the module diagnosis (byte 0)
Byte 5	Status of module diagnosis (byte 1)
Byte 6	Status of the sensor supply diagnosis, ports 1 - 8
Byte 7	Reserved
Byte 8	Status of the digital output diagnosis for channel A, ports 1 - 8
Byte 9	Status of the digital output diagnosis for channel B, ports 5 - 8
Byte 10	Status of the IO-Link device error diagnosis, ports 1 - 8
Byte 11	Status of the IO-Link device warning diagnosis, ports 1 - 8
Byte 12	Status of the IO-Link device notification diagnosis, ports 1 - 8
Byte 13	Reserved

Detailed information about input status data can be found below.

Status of the Digital Inputs (Mapping Mode 1, Default)

If mapping mode 1 has been selected in the device configuration, the digital input data of the module is transferred as follows.

Byte 0	Digital input status of connections 1 - 4							
Bit	7	6	5	4	3	2	1	0
Connection	X4	X4	X3	X3	X2	X2	X1	X1
Pin	2	4	2	4	2	4	2	4
Channel	4B	4A	3B	3A	2B	2A	1B	1A

2022-06

Byte 1	Digital input status of ports 5 - 8							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X8	X7	X7	X6	X6	X5	X5
Pin	2	4	2	4	2	4	2	4
Channel	8B	8A	7B	7A	6B	6A	5B	5A

Status of the Digital Inputs (Mapping Mode 2)

If mapping mode 2 has been selected in the device configuration, the digital input data of the module is transferred as follows.

Byte 0	Digital input status of connections 1 - 8, channel B							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Byte 1	Digital input status of connections 1 - 8, channel B							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	2	2	2	2	2	2	2	2
Channel	8B	7B	6B	5B	4B	3B	2B	1B

Status of the IO-Link Communication

The "IOL-COM State" indicates whether the connection has established communication with the IO-Link device.

Byte 2	IOL-COM state							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Status of the IO-Link Process Data Validity

"IOL-PD Valid" indicates whether the IO-Link process data of the corresponding connection is valid.

Byte 3	IOL-PD valid							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Status of Module Diagnosis

This data provides the information collected from the available module diagnosis.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	MI-SCB	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 5	0	0	0	0	0	IOL-DN	IOL-DW	IOL-DE

This includes:

- **MI-LVS**: Module information—low-voltage system/sensor power supply
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-SCS**: Module information—sensor short circuit
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-VAL**: Module information—IO-Link validation error
- **MI-FMA**: Module information—force mode active
- **IOL-DE**: Module information—IO-Link device error
- **IOL-DW**: Module information—IO-Link device warning
- **IOL-DN**: Module information—IO-Link device notification

Status of the Sensor Supply Diagnosis

This data provides status information of the sensor supply diagnosis for each connection (pin 1 of X1 - X8).

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 6	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1

This includes:

- **SCS-X1 ... SCS-X8**: Sensor short circuit at connections X1 to X8

Status of the Digital Outputs Diagnosis

This data provides information on the digital output diagnosis for channel A and Channel B for each connection. Information for channel B is also available if the connection is configured as an auxiliary voltage.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 8	CE-X8A	CE-X7A	CE-X6A	CE-X5A	CE-X4A	CE-X3A	CE-X2A	CE-X1A
Byte 9	CE-X8B	CE-X7B	CE-X6B	CE-X5B	0	0	0	0

This includes:

- **CE-X1A ... CE-X8A**: Channel error, channel A (pin 4) of connections X1 to X8
- **CE-X5B ... CE-X8B**: Channel error, channel B (pin 2) of connections X1 to X8

Status of Module Diagnosis

For each connection, this data provides information about whether an IO-Link device has sent an error, warning, or notification.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 10	DE-X8A	DE-X7A	DE-X6A	DE-X5A	DE-X4A	DE-X3A	DE-X2A	DE-X1A
Byte 11	DW-X8A	DW-X7A	DW-X6A	DW-X5A	DW-X4A	DW-X3A	DW-X2A	DW-X1A
Byte 12	DN-X8A	DN-X7A	DN-X6A	DN-X5A	DN-X4A	DN-X3A	DN-X2A	DN-X1A
Byte 13	VAL-X8A	VAL-X7A	VAL-X6A	VAL-X5A	VAL-X4A	VAL-X3A	VAL-X2A	VAL-X1A

2022-06

This includes:

- **DE-X1A ... DE-X8A**: IO-Link device error message, channel A (pin 4, C/Q) of connections X1 to X8
- **DW-X1A ... DW-X8A**: IO-Link device warning message, channel A (pin 4, C/Q) of connections X1 to X8
- **DN-X1A ... DN-X8A**: IO-Link device notification, channel A (pin 4, C/Q) of connections X1 to X8
- **VAL-X1A ... VAL-X8A**: IO-Link master validation error, channel A (Pin 4, C/Q) of connections X1 to X8

5.5.2 IO-Link Device Input Data

Depending on the selected input, the data for each IO-Link connection is added to the producer data at address offset 14. The IO-Link device input data received is transferred to the EtherNet/IP controller without byte swapping.

Assembly	Description
103	4 bytes of IO-Link input data
105	8 bytes of IO-Link input data
107	16 bytes of IO-Link input data
109	32 bytes of IO-Link input data
111	4 bytes of IO-L input data + 8 bytes of extended IO-Link status
113	8 bytes of IO-L input data + 8 bytes of extended IO-Link status
115	16 bytes of IO-L input data + 8 bytes of extended IO-Link status
117	32 bytes of IO-L input data + 8 bytes of extended IO-Link status
119	4 bytes of IO-L input data + 8 bytes of ext. IO-Link status + 12 bytes of IO-Link event data
121	8 bytes of IO-L input data + 8 bytes of ext. IO-Link status + 12 bytes of IO-Link event data
123	16 bytes of IO-Link input data + 8 bytes of ext. IO-Link status + 12 bytes of IO-Link event data
125	32 bytes of IO-Link input data + 8 bytes of ext. IO-Link status + 12 bytes of IO-Link event data

IO-Link data, 4 bytes of input data, assembly 103

Assembly 103 provides 4 bytes of IO-Link input data for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 14 - 17	X1	Byte 0 - byte 3 of the IO-Link input data
Bytes 18 - 21	X2	Byte 0 - byte 3 of the IO-Link input data
Bytes 22 - 25	X3	Byte 0 - byte 3 of the IO-Link input data
Bytes 26 - 29	X4	Byte 0 - byte 3 of the IO-Link input data
Bytes 30 - 33	X5	Byte 0 - byte 3 of the IO-Link input data
Bytes 34 - 37	X6	Byte 0 - byte 3 of the IO-Link input data
Bytes 38 - 41	X7	Byte 0 - byte 3 of the IO-Link input data
Bytes 42 - 45	X8	Byte 0 - byte 3 of the IO-Link input data

The 4 bytes of input data for each connection are zero if no IO-Link device is connected.

IO-Link data, 8 bytes of input data, assembly 105

Assembly 105 provides 8 bytes of IO-Link input data for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 14 - 21	X1	Byte 0 - byte 7 of the IO-Link input data
Bytes 22 - 29	X2	Byte 0 - byte 7 of the IO-Link input data
Bytes 30 - 37	X3	Byte 0 - byte 7 of the IO-Link input data
Bytes 38 - 45	X4	Byte 0 - byte 7 of the IO-Link input data
Bytes 46 - 53	X5	Byte 0 - byte 7 of the IO-Link input data
Bytes 54 - 61	X6	Byte 0 - byte 7 of the IO-Link input data
Bytes 62 - 69	X7	Byte 0 - byte 7 of the IO-Link input data
Bytes 70 - 77	X8	Byte 0 - byte 7 of the IO-Link input data

The 8 bytes of input data for each port are zero if no IO-Link device is connected.

IO-Link data, 16 bytes of input data, assembly 107

Assembly 107 provides 16 bytes of IO-Link input data for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 14 - 29	X1	Byte 0 - byte 15 of the IO-Link input data
Bytes 30 - 45	X2	Byte 0 - byte 15 of the IO-Link input data
Bytes 46 - 61	X3	Byte 0 - byte 15 of the IO-Link input data
Bytes 62 - 77	X4	Byte 0 - byte 15 of the IO-Link input data
Bytes 78 - 93	X5	Byte 0 - byte 15 of the IO-Link input data
Bytes 94 - 109	X6	Byte 0 - byte 15 of the IO-Link input data
Bytes 110 - 125	X7	Byte 0 - byte 15 of the IO-Link input data
Bytes 126 - 141	X8	Byte 0 - byte 15 of the IO-Link input data

The 16 bytes of input data for each port are zero if no IO-Link device is connected.

IO-Link data, 32 bytes of input data, assembly 109

Assembly 109 provides 32 bytes of IO-Link input data for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 14 - 45	X1	Byte 0 - byte 31 of the IO-Link input data
Bytes 46 - 77	X2	Byte 0 - byte 31 of the IO-Link input data
Bytes 78 - 109	X3	Byte 0 - byte 31 of the IO-Link input data
Bytes 110 - 141	X4	Byte 0 - byte 31 of the IO-Link input data
Bytes 142 - 173	X5	Byte 0 - byte 31 of the IO-Link input data
Bytes 174 - 205	X6	Byte 0 - byte 31 of the IO-Link input data
Bytes 206 - 237	X7	Byte 0 - byte 31 of the IO-Link input data
Bytes 238 - 269	X8	Byte 0 - byte 31 of the IO-Link input data

The 32 bytes of input data for each port are zero if no IO-Link device is connected.

2022-06

5.5.3 IO-Link Input & Extended IO-Link Status Data

Depending on the selected input, the data for each IO-Link connection is added to the producer data at address offset 14. The IO-Link device input data received is transferred to the EtherNet/IP controller without byte swapping.

Assembly	Description
111	4 bytes of IO-Link input data + 8 bytes of extended IO-Link status
113	8 bytes of IO-Link input data + 8 bytes of extended IO-Link status
115	16 bytes of IO-Link input data + 8 bytes of extended IO-Link status
117	32 bytes of IO-Link input data + 8 bytes of extended IO-Link status

The extended IO-Link status data is defined as follows:

Byte	Bit	Description
0	7	Reserved
	6	Reserved
	5	Reserved
	4	Reserved
	3	Reserved
	2	Reserved
	1	1 = communication with IO-Link device established
	0	1 = connection configured in IO-Link mode
1	7	Reserved
	6	Reserved
	5	Reserved
	4	Reserved
	3	1 = IO-Link device detected and serial number is identical
	2	1 = detected IO-Link device is not compatible (VendorID or DeviceID)
	1	1 = parameter memory error
	0	1 = direct parameter page not plausible
2		Vendor ID (LSB)
3		Vendor ID (MSB)
4		Device ID (LSB)
5		Device ID
6		Device ID (MSB)
7		Reserved

IO-Link, 4 bytes of input data & extended status, assembly 111

For each IO-Link connection, assembly 111 offers 4 bytes of IO-Link input data and 8 bytes of extended IO-Link status data with the following mapping:

Input	Connection	Description
Bytes 14 - 17	X1	Byte 0 - byte 3 of the IO-Link input data
Bytes 18 - 25	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 26 - 29	X2	Byte 0 - byte 3 of the IO-Link input data
Bytes 30 - 37	X2	Byte 0 - byte 7 of the extended IO-Link status

Input	Connection	Description
Bytes 38 - 41	X3	Byte 0 - byte 3 of the IO-Link input data
Bytes 42 - 49	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 50 - 53	X4	Byte 0 - byte 3 of the IO-Link input data
Bytes 54 - 61	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 62 - 65	X5	Byte 0 - byte 3 of the IO-Link input data
Bytes 66 - 73	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 74 - 77	X6	Byte 0 - byte 3 of the IO-Link input data
Bytes 78 - 85	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 86 - 89	X7	Byte 0 - byte 3 of the IO-Link input data
Bytes 90 - 97	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 98 - 101	X8	Byte 0 - byte 3 of the IO-Link input data
Bytes 102 - 109	X8	Byte 0 - byte 7 of the extended IO-Link status

The 4 bytes of input data and the extended IO-Link status data for each connection are zero if no IO-Link device is connected.

IO-Link, 8 bytes of input data & extended status, assembly 113

Assembly 113 offers 8 bytes of IO-Link input data for each IO-Link connection and 8 bytes of extended IO-Link status data with the following mapping:

Input	Connection	Description
Bytes 14 - 21	X1	Byte 0 - byte 7 of the IO-Link input data
Bytes 22 - 29	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 30 - 37	X2	Byte 0 - byte 7 of the IO-Link input data
Bytes 38 - 45	X2	Byte 0 - byte 7 of the extended IO-Link status
Bytes 46 - 53	X3	Byte 0 - byte 7 of the IO-Link input data
Bytes 54 - 61	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 62 - 69	X4	Byte 0 - byte 7 of the IO-Link input data
Bytes 70 - 77	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 78 - 85	X5	Byte 0 - byte 7 of the IO-Link input data
Bytes 86 - 96	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 94 - 101	X6	Byte 0 - byte 7 of the IO-Link input data
Bytes 102 - 109	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 110 - 117	X7	Byte 0 - byte 7 of the IO-Link input data
Bytes 118 - 125	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 126 - 133	X8	Byte 0 - byte 7 of the IO-Link input data
Bytes 134 - 141	X8	Byte 0 - byte 7 of the extended IO-Link status

The 8 bytes of input data and the extended IO-Link status data for each port are zero if no IO-Link device is connected.

IO-Link, 16 bytes of input data & extended status, assembly 115

Assembly 115 offers 16 bytes of IO-Link input data for each IO-Link connection and 8 bytes of extended IO-Link status data with the following mapping:

2022-06

Input	Connection	Description
Bytes 14 - 29	X1	Byte 0 - byte 15 of the IO-Link input data
Bytes 30 - 37	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 38 - 53	X2	Byte 0 - byte 15 of the IO-Link input data
Bytes 54 - 61	X2	Byte 0 - byte 7 of the extended IO-Link status
Bytes 62 - 77	X3	Byte 0 - byte 15 of the IO-Link input data
Bytes 78 - 85	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 86 - 101	X4	Byte 0 - byte 15 of the IO-Link input data
Bytes 102 - 109	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 110 - 125	X5	Byte 0 - byte 15 of the IO-Link input data
Bytes 126 - 133	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 134 - 149	X6	Byte 0 - byte 15 of the IO-Link input data
Bytes 150 - 157	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 158 - 173	X7	Byte 0 - byte 15 of the IO-Link input data
Bytes 174 - 181	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 182 - 197	X8	Byte 0 - byte 15 of the IO-Link input data
Bytes 198 - 205	X8	Byte 0 - byte 7 of the extended IO-Link status

The 16 bytes of input data and the extended IO-Link status data for each port are zero if no IO-Link device is connected.

IO-Link, 32 bytes of input data & extended status, assembly 117

Assembly 117 offers 32 bytes of IO-Link input data for each IO-Link connection and 8 bytes of extended IO-Link status data with the following mapping:

Input	Connection	Description
Bytes 14 - 45	X1	Byte 0 - byte 31 of the IO-Link input data
Bytes 46 - 53	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 54 - 85	X2	Byte 0 - byte 31 of the IO-Link input data
Bytes 86 - 93	X2	Byte 0 - byte 7 of the extended IO-Link status
Bytes 94 - 125	X3	Byte 0 - byte 31 of the IO-Link input data
Bytes 126 - 133	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 134 - 165	X4	Byte 0 - byte 31 of the IO-Link input data
Bytes 166 - 173	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 174 - 205	X5	Byte 0 - byte 31 of the IO-Link input data
Bytes 206 - 213	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 214 - 245	X6	Byte 0 - byte 31 of the IO-Link input data
Bytes 246 - 253	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 254 - 285	X7	Byte 0 - byte 31 of the IO-Link input data
Bytes 286 - 293	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 294 - 325	X8	Byte 0 - byte 31 of the IO-Link input data
Bytes 326 - 333	X8	Byte 0 - byte 7 of the extended IO-Link status

The 32 bytes of input data and the extended IO-Link status data for each port are zero if no IO-Link device is connected.

5.5.4 IO-Link Input Data & Extended IO-Link Status Data & IO-Link Event Data

Depending on the selected input, the data for each IO-Link connection is added to the producer data at address offset 14. The IO-Link device input data received is transferred to the EtherNet/IP controller without byte swapping.

119: 4 bytes of IO-Link input data + 8 bytes of extended IO-Link status + 12 bytes of IO-Link event data

121: 8 bytes of IO-Link input data + 8 bytes of extended IO-Link status + 12 bytes of IO-Link event data

123: 16 bytes of IO-Link input data + 8 bytes of extended IO-Link status + 12 bytes of IO-Link event data

125: 32 bytes of IO-Link input data + 8 bytes of extended IO-Link status + 12 bytes of IO-Link event data

The event data is defined as follows:

Byte	Event	Description
0	1	Event Qualifier
1	1	Event code 1 (LSB)
2	1	Event code 1 (MSB)
3	1	Reserved
4	2	Event Qualifier
5	2	Event code 2 (LSB)
6	2	Event code 2 (MSB)
7	2	Reserved
8	3	Event Qualifier
9	3	Event code 3 (LSB)
10	3	Event code 3 (MSB)
11	3	Reserved

This data set can contain up to three event messages for the connected IO-Link device. Event 1 always displays the last event messages; earlier event messages are moved to event block two or three.

The event data is only deleted after the IO-Link master has been restarted.

Event Qualifier

	Mode		Type		Reserved	Instance		
Bit	7	6	5	4	3	2	1	0

Event qualifier instance:

Value	Description
0	Unknown
1	Phy.
2	DL
3	AL
4	Application
5 ... 7	Reserved

2022-06

Event qualifier res.:

This bit is reserved, the module reports 0.

Event qualifier type:

Value	Description
0	Reserved
1	Information
2	Warning
3	Error

Event qualifier mode:

Value	Description
0	Reserved
1	Single event recording
2	Event disappears
3	Event appears

Event codes 1 and 2

Diagnostic code reported by the IO-Link device.

Use the IO-Link device documentation to interpret the error message.

IO-Link, 4 bytes of input & extended status & event data, assembly 119

For each IO-Link connection, assembly 119 offers 4 bytes of IO-Link input data, 8 bytes of extended IO-Link status data, and 12 bytes of IO-Link event data with the following mapping:

Input	Connection	Description
Bytes 14 - 17	X1	Byte 0 - byte 3 of the IO-Link input data
Bytes 18 - 25	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 26 - 37	X1	Byte 0 - byte 11 of the IO-Link event data
Bytes 38 - 41	X2	Byte 0 - byte 3 of the IO-Link input data
Bytes 42 - 49	X2	Byte 0 - byte 7 of the extended IO-Link status
Bytes 50 - 61	X2	Byte 0 - byte 11 of the IO-Link event data
Bytes 62 - 65	X3	Byte 0 - byte 3 of the IO-Link input data
Bytes 66 - 73	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 74 - 85	X3	Byte 0 - byte 11 of the IO-Link event data
Bytes 86 - 89	X4	Byte 0 - byte 3 of the IO-Link input data
Bytes 90 - 97	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 98 - 109	X4	Byte 0 - byte 11 of the IO-Link event data
Bytes 110- 113	X5	Byte 0 - byte 3 of the IO-Link input data
Bytes 114 - 121	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 122 - 133	X5	Byte 0 - byte 11 of the IO-Link event data
Bytes 134 - 137	X6	Byte 0 - byte 3 of the IO-Link input data
Bytes 138 - 145	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 146 - 157	X6	Byte 0 - byte 11 of the IO-Link event data
Bytes 158 - 161	X7	Byte 0 - byte 3 of the IO-Link input data

Input	Connection	Description
Bytes 162 - 169	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 170 - 181	X7	Byte 0 - byte 11 of the IO-Link event data
Bytes 182 - 185	X8	Byte 0 - byte 3 of the IO-Link input data
Bytes 186 - 193	X8	Byte 0 - byte 7 of the extended IO-Link status
Bytes 194 - 205	X8	Byte 0 - byte 11 of the IO-Link event data

The 4 bytes of input data, the extended IO-Link status data, and the IO-Link event data for each connection are zero if no IO-Link device is connected.

IO-Link, 8 bytes of input data & extended status & event data, assembly 121

Assembly 121 offers 8 bytes of IO-Link input data for each IO-Link connection, 8 bytes of extended IO-Link status data and 12 bytes of IO-Link event data with the following mapping:

Input	Connection	Description
Bytes 14 - 21	X1	Byte 0 - byte 7 of the IO-Link input data
Bytes 22 - 29	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 30 - 41	X1	Byte 0 - byte 11 of the IO-Link event data
Bytes 42 - 49	X2	Byte 0 - byte 7 of the IO-Link input data
Bytes 50 - 57	X2	Byte 0 - byte 7 of the extended IO-Link status
Bytes 58 - 69	X2	Byte 0 - byte 11 of the IO-Link event data
Bytes 70 - 77	X3	Byte 0 - byte 7 of the IO-Link input data
Bytes 78 - 85	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 86 - 97	X3	Byte 0 - byte 11 of the IO-Link event data
Bytes 98 - 105	X4	Byte 0 - byte 7 of the IO-Link input data
Bytes 106 - 113	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 114 - 125	X4	Byte 0 - byte 11 of the IO-Link event data
Bytes 126 - 133	X5	Byte 0 - byte 7 of the IO-Link input data
Bytes 134 - 141	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 142 - 153	X5	Byte 0 - byte 11 of the IO-Link event data
Bytes 154 - 161	X6	Byte 0 - byte 7 of the IO-Link input data
Bytes 162 - 169	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 170 - 181	X6	Byte 0 - byte 11 of the IO-Link event data
Bytes 182 - 189	X7	Byte 0 - byte 7 of the IO-Link input data
Bytes 190 - 197	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 198 - 209	X7	Byte 0 - byte 11 of the IO-Link event data
Bytes 210 - 217	X8	Byte 0 - byte 7 of the IO-Link input data
Bytes 218 - 225	X8	Byte 0 - byte 7 of the extended IO-Link status
Bytes 226 - 237	X8	Byte 0 - byte 11 of the IO-Link event data

The 8 bytes of input data, the extended IO-Link status data and the IO-Link event data for each port are zero if no IO-Link device is connected.

2022-06

IO-Link, 16 bytes of input data & extended status & event data, assembly 123

Assembly 123 offers 16 bytes of IO-Link input data for each IO-Link connection, 8 bytes of extended IO-Link status data and 12 bytes of IO-Link event data with the following mapping:

Input	Connection	Description
Bytes 14 - 29	X1	Byte 0 - byte 15 of the IO-Link input data
Bytes 30 - 37	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 38 - 49	X1	Byte 0 - byte 11 of the IO-Link event data
Bytes 50 - 65	X2	Byte 0 - byte 15 of the IO-Link input data
Bytes 66 - 73	X2	Byte 0 - byte 7 of the extended IO-Link status
Bytes 74 - 85	X2	Byte 0 - byte 11 of the IO-Link event data
Bytes 86 - 101	X3	Byte 0 - byte 15 of the IO-Link input data
Bytes 102 - 109	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 110 - 121	X3	Byte 0 - byte 11 of the IO-Link event data
Bytes 122 - 137	X4	Byte 0 - byte 15 of the IO-Link input data
Bytes 138 - 145	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 146 - 157	X4	Byte 0 - byte 11 of the IO-Link event data
Bytes 158 - 173	X5	Byte 0 - byte 15 of the IO-Link input data
Bytes 174 - 181	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 182 - 193	X5	Byte 0 - byte 11 of the IO-Link event data
Bytes 194 - 209	X6	Byte 0 - byte 15 of the IO-Link input data
Bytes 210 - 217	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 218 - 229	X6	Byte 0 - byte 11 of the IO-Link event data
Bytes 230 - 245	X7	Byte 0 - byte 15 of the IO-Link input data
Bytes 246 - 253	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 254 - 265	X7	Byte 0 - byte 11 of the IO-Link event data
Bytes 266 - 281	X8	Byte 0 - byte 15 of the IO-Link input data
Bytes 282 - 289	X8	Byte 0 - byte 7 of the extended IO-Link status
Bytes 290 - 301	X8	Byte 0 - byte 11 of the IO-Link event data

The 16 bytes of input data, the extended IO-Link status data and the IO-Link event data for each port are zero if no IO-Link device is connected.

IO-Link, 32 bytes of input data & extended status & event data, assembly 125

Assembly 125 offers 32 bytes of IO-Link input data for each IO-Link connection, 8 bytes of extended IO-Link status data and 12 bytes of IO-Link event data with the following mapping:

Input	Connection	Description
Bytes 14 - 45	X1	Byte 0 - byte 31 of the IO-Link input data
Bytes 46 - 53	X1	Byte 0 - byte 7 of the extended IO-Link status
Bytes 54 - 65	X1	Byte 0 - byte 11 of the IO-Link event data
Bytes 66 - 97	X2	Byte 0 - byte 31 of the IO-Link input data
Bytes 98 - 105	X2	Byte 0 - byte 7 of the extended IO-Link status
Bytes 106 - 117	X2	Byte 0 - byte 11 of the IO-Link event data

Input	Connection	Description
Bytes 118 - 149	X3	Byte 0 - byte 31 of the IO-Link input data
Bytes 150 - 157	X3	Byte 0 - byte 7 of the extended IO-Link status
Bytes 158 - 169	X3	Byte 0 - byte 11 of the IO-Link event data
Bytes 170 - 201	X4	Byte 0 - byte 31 of the IO-Link input data
Bytes 202 - 209	X4	Byte 0 - byte 7 of the extended IO-Link status
Bytes 210 - 221	X4	Byte 0 - byte 11 of the IO-Link event data
Bytes 222 - 253	X5	Byte 0 - byte 31 of the IO-Link input data
Bytes 254 - 261	X5	Byte 0 - byte 7 of the extended IO-Link status
Bytes 262 - 273	X5	Byte 0 - byte 11 of the IO-Link event data
Bytes 274 - 305	X6	Byte 0 - byte 31 of the IO-Link input data
Bytes 306 - 313	X6	Byte 0 - byte 7 of the extended IO-Link status
Bytes 314 - 325	X6	Byte 0 - byte 11 of the IO-Link event data
Bytes 326 - 357	X7	Byte 0 - byte 31 of the IO-Link input data
Bytes 358 - 365	X7	Byte 0 - byte 7 of the extended IO-Link status
Bytes 366 - 377	X7	Byte 0 - byte 11 of the IO-Link event data
Bytes 378 - 409	X8	Byte 0 - byte 31 of the IO-Link input data
Bytes 410 - 417	X8	Byte 0 - byte 7 of the extended IO-Link status
Bytes 418 - 429	X8	Byte 0 - byte 11 of the IO-Link event data

The 32 bytes of input data, the extended IO-Link status data and the IO-Link event data for each port are zero if no IO-Link device is connected.

5.5.5 Control Data of the IO-Link Master (Outputs)

The following EtherNet/IP consumption modules are available for the configuration of output data:

Assembly	Description
100	4 bytes of IO-Link master control data (without IO-Link device output data)
102	4 bytes of IO-Link master control data + 4 bytes per connection for IO-Link device
104	4 bytes of IO-Link master control data + 8 bytes per connection for IO-Link device
106	4 bytes of IO-Link master control data + 16 bytes per connection for IO-Link device
108	4 bytes of IO-Link master control data + 32 bytes per connection for IO-Link device

The digital output at the corresponding connection can be controlled via the control data of the IO-Link master. The IO-Link connection must be parameterized as a digital output in the engineering tool.

The IO-Link master requires the following control data of the IO-Link master digital outputs:

Control of Digital Outputs (Mapping Mode 1, Default)

If mapping mode 1 is selected in the IO-Link master parameterization, the digital output data of the module is transferred as follows.

Byte 0	Control of digital outputs of connections 1 - 4							
Bit	7	6	5	4	3	2	1	0
Connection	X4	X4	X3	X3	X2	X2	X1	X1
Pin	-	4	-	4	-	4	-	4
Channel	-	4A	-	3A	-	2A	-	1A

Byte 1	Control of digital outputs, connections 5 - 8							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X8	X7	X7	X6	X6	X5	X5
Pin	2	4	2	4	2	4	2	4
Channel	8B	8A	7B	7A	6B	6A	5B	5A

Control of Digital Outputs (Mapping Mode 2)

If mapping mode 2 is selected in the IO-Link master parameterization, the digital output data of the module is transferred as follows.

Byte 0	Control of digital outputs, channel A of connections 1 - 8							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Byte 1	Control of digital outputs, channel B of connections 1 - 8							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	2	2	2	2	-	-	-	-
Channel	8B	7B	6B	5B	-	-	-	-

Control of IO-Link COM Mode

This mode can be used temporarily as long as the corresponding COM control bit is set. It switches one or more IO-Link connections previously configured as "IOL SIO" to IO-Link operating mode. This makes it possible to establish communication with the connected IO-Link device for parameterization.

No process data is exchanged during this time.

Byte 2	COM mode							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Reserved

Byte 3	Reserved, do not use							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1

Byte 3	Reserved, do not use							
Pin	-	-	-	-	-	-	-	-
Channel	-	-	-	-	-	-	-	-

5.5.6 Control Data of the IO-Link Device (Outputs)

IO-Link device, 4 bytes of output data, assembly 102

Assembly 102 provides 4 bytes of IO-Link output data (master to device) for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 4 - 7	X1	Byte 0 - byte 3 of the IO-Link output data
bytes 8 - 11	X2	Byte 0 - byte 3 of the IO-Link output data
Bytes 12 - 15	X3	Byte 0 - byte 3 of the IO-Link output data
Bytes 16 - 19	X4	Byte 0 - byte 3 of the IO-Link output data
Bytes 20 - 23	X5	Byte 0 - byte 3 of the IO-Link output data
Bytes 24 - 27	X6	Byte 0 - byte 3 of the IO-Link output data
Bytes 28 - 31	X7	Byte 0 - byte 3 of the IO-Link output data
Bytes 32 - 35	X8	Byte 0 - byte 3 of the IO-Link output data

IO-Link device, 8 bytes of output data, assembly 104

Assembly 104 provides 8 bytes of IO-Link output data (master to device) for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 4 - 11	X1	Byte 0 - byte 7 of the IO-Link output data
Bytes 12 - 19	X2	Byte 0 - byte 7 of the IO-Link output data
Bytes 20 - 27	X3	Byte 0 - byte 7 of the IO-Link output data
Bytes 28 - 35	X4	Byte 0 - byte 7 of the IO-Link output data
Bytes 36 - 43	X5	Byte 0 - byte 7 of the IO-Link output data
Bytes 44 - 51	X6	Byte 0 - byte 7 of the IO-Link output data
Bytes 52 - 59	X7	Byte 0 - byte 7 of the IO-Link output data
Bytes 60 - 67	X8	Byte 0 - byte 7 of the IO-Link output data

IO-Link device, 16 bytes of output data, assembly 106

Assembly 106 provides 16 bytes of IO-Link output data (master to device) for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 4 - 19	X1	Byte 0 - byte 15 of the IO-Link output data
Bytes 20 - 35	X2	Byte 0 - byte 15 of the IO-Link output data
Bytes 36 - 51	X3	Byte 0 - byte 15 of the IO-Link output data
Bytes 52 - 67	X4	Byte 0 - byte 15 of the IO-Link output data
Bytes 68 - 83	X5	Byte 0 - byte 15 of the IO-Link output data
Bytes 84 - 99	X6	Byte 0 - byte 15 of the IO-Link output data

2022-06

Input	Connection	Description
Bytes 100 - 115	X7	Byte 0 - byte 15 of the IO-Link output data
Bytes 116 - 131	X8	Byte 0 - byte 15 of the IO-Link output data

IO-Link device, 32 bytes of output data, assembly 108

Assembly 108 provides 32 bytes of IO-Link output data (master to device) for each IO-Link connection with the following mapping:

Input	Connection	Description
Bytes 4 - 35	X1	Byte 0 - byte 31 of the IO-Link output data
Bytes 36 - 67	X2	Byte 0 - byte 31 of the IO-Link output data
Bytes 68 - 99	X3	Byte 0 - byte 31 of the IO-Link output data
Bytes 100 - 131	X4	Byte 0 - byte 31 of the IO-Link output data
Bytes 132 - 163	X5	Byte 0 - byte 31 of the IO-Link output data
Bytes 164 - 195	X6	Byte 0 - byte 31 of the IO-Link output data
Bytes 196 - 227	X7	Byte 0 - byte 31 of the IO-Link output data
Bytes 228 - 259	X8	Byte 0 - byte 31 of the IO-Link output data

5.6 EtherNet/IP Objects

The following EtherNet/IP objects are supported by the device:

- Identity object (class code 0x01)
- Assembly object (class code 0x04)
- Connection manager object (class code 0x06)
- EtherNet/IP link object (class code 0xF6)
- TCP/IP object (class code 0xF5)
- Quality of service object (class code 0x48)
- DLR object (class code 0x47)
- IO-Link device parameters object (class code 0x80), manufacturer-specific
- IO-Link fail-safe parameters object (class code 0x81), manufacturer-specific

IO-Link Device Parameters Object (Class Code 0x80)

This manufacturer-specific object supports the reading or writing of IO-Link device parameters.

Read ISDU Service (Class Code 0x80)

Indexed **S**ervice **D**ata **U**nit (ISDU): The ISDU enables access to data objects (parameters and commands). The data objects must be addressed by the "Index" element.

The ISDU service request parameter is defined as follows:

Name	Value	Type	Description
Class	0x80		IO-Link device parameters object
Instance	1		IO-Link master
Instance attribute	1 – 8		IO-Link connection number
Service code	0x4B		Read ISDU code
Index	1	UINT	IO-Link ISDU object index
Subindex	1	USINT	IO-Link ISDU object sub-index

1. Depending on the connected IO-Link device, see appropriate documentation

If the read request was successful ("general status" of the CIP response is 0), the following response format is available.

Name	Type	Description
ISDU	Array of bytes	Max. 232 bytes

If the read request was not successful ("general status" of the CIP response is not 0), the following response format is available:

Name	Type	Error code description	Error code
IO-Link master error	UINT	Service not available	1
		Connection blocked	2
		Timeout	3
		Invalid index	4
		Invalid sub-index	5
		Incorrect connection	6
		Incorrect connection function	7
		Invalid length	8
		ISDU not supported	9
IO-Link Device Error	USINT	See IO-Link specification	-
IO-Link device additional error	USINT	See IO-Link specification	-

Write ISDU Service (Class Code 0x80)

The ISDU service request parameter is defined as follows:

Name	Value	Type	Description
Class	0x80		IO-Link device parameters object
Instance	1		IO-Link master
Instance attribute	1 – 8		IO-Link connection number
Service code	0x4C		Write ISDU code
Index	[1]	UINT	IO-Link ISDU object index
Subindex	[1]	USINT	IO-Link ISDU object sub-index
Data	[1]	Array of bytes	IO-Link ISDU data, max. 232 bytes

1. Depending on the connected IO-Link device, see appropriate documentation

If the write request was successful, i.e., "general status" of the CIP response is 0, the following response format is available.

If the write request was not successful, i.e., "general status" of the CIP response is not 0, the following response format is available:

Name	Type	Error code description	Error code
IO-Link master error	UINT	Service not available	1
		Connection blocked	2
		Timeout	3
		Invalid index	4
		Invalid sub-index	5
		Incorrect connection	6
		Incorrect connection function	7
		Invalid length	8
		ISDU not supported	9
IO-Link Device Error	USINT	See IO-Link specification	-
IO-Link device additional error	USINT	See IO-Link specification	-

IO-Link Fail-Safe Parameter Object (Class Code 0x81)

In case of a loss of EtherNet/IP communication, fail-safe values can be defined for the IO-Link device output data. If the "Replacement Value" option has been set in the IO-Link parameters of the connection, the replacement value transferred from this class code 0x81 is transferred to the IO-Link device as output data. The values must be written to the IO-Link master after every power-up cycle.

The value must be entered in MSB in LSB byte order, depending on the configured data length and the IO-Link device used.

Setting Fail-Safe Parameters (Class Code 0x81)

The set fail-safe service request parameters are defined as follows:

Name	Value	Type	Description
Class	0x81		IO-Link device parameters object
Instance	1		IO-Link master
Instance attribute	1 – 8		IO-Link connection number
Service code	0x10		Set attribute single
Index	[1]	UINT	IO-Link ISDU object index
Subindex	[1]	USINT	IO-Link ISDU object sub-index
Data	[1]	Array of bytes	Fail-safe value of the IO-Link connection

1. Depending on the connected IO-Link device, see appropriate documentation

If the write request was successful, the "general status" of the CIP response is 0.

Reading Fail-Safe Parameters (Class Code 0x81)

The fail-safe service request parameters read are defined as follows:

Name	Value	Type	Description
Class	0x81		IO-Link device parameters object
Instance	1		IO-Link master
Instance attribute	1 – 8		IO-Link connection number
Service code	0x0E		Get attribute single

Name	Value	Type	Description
Index	1	UINT	IO-Link ISDU object index
Subindex	1	USINT	IO-Link ISDU object sub-index
Data	1	Array of bytes	Fail-safe value of the IO-Link connection

1. Depending on the connected IO-Link device, see appropriate documentation

If the write request was successful, the "general status" of the CIP response is 0.

6 Commissioning for PROFINET

6.1 Preparation

The configuration and commissioning process for the modules described over the following pages was performed using TIA Portal V15 project planning software from SIEMENS. When using a control system from a different control system provider, please refer to the corresponding documentation.

GSDML File

To configure the modules in the control system, you need a GSD file in XML format. You can download this file from our website, https://www.pepperl-fuchs.com.

The file for the PROFINET modules is named GSDML-V2.3*-Pepperl+Fuchs-ICE1-yyyymmdd.xml. In this case, **yyyymmdd** is the issue date of the file.

Integrate the GSDML file into the TIA Portal using the GSD manager via the main menu "Options > Manage general station description files (GSD)." The modules with a PROFINET interface are subsequently available in the hardware catalog.

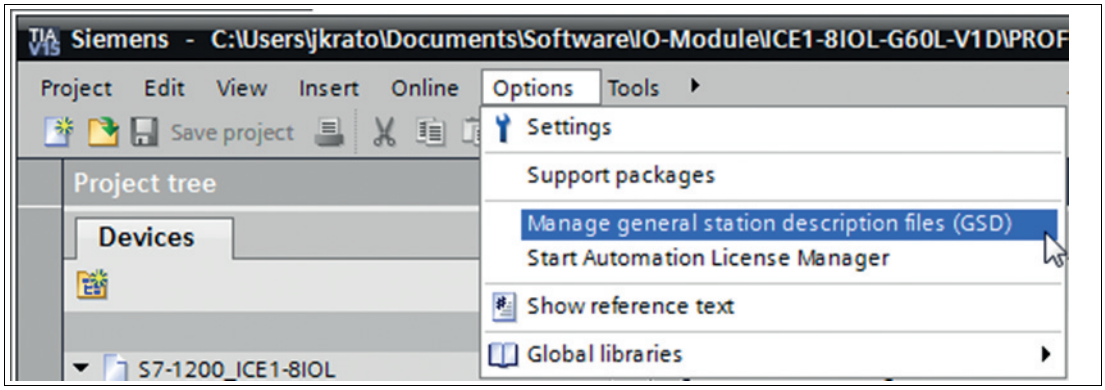


Figure 6.1

MAC IDs

The modules have three MAC IDs assigned when they are delivered. These are unique and cannot be changed by the user.

The first assigned MAC ID is printed on the module.

SNMP

The modules support the SNMP Ethernet network protocol (Simple Network Management Protocol). The information from the network management system is displayed in accordance with MIB-II (Management Information Base), which is defined in RFC 1213.

Passwords:

Read community: `public`

Write community: `private`

6.2 Configuration Example

The configuration and commissioning process for the modules described over the following pages was performed using TIA Portal V15 project planning software from SIEMENS. The configuration is based on the example of an ICE1-8IOL-G60L-V1D module. For other module versions, configuration is carried out with a few minor changes.

Note

To configure a module in the control system, you need a GSDML file.

6.2.1 Integration of PROFINET IO Modules in the TIA Portal

As an example, the following is an explanation of how to configure an Ethernet IO module as a Profinet type in the TIA portal, based on the ICE1-8IOL-G60L-V1D module.

1. Install the GSDML file for the desired module in the TIA Portal.

   ↳ Once the GSDML file for the PROFINET modules has been installed, the modules are available in the TIA portal hardware catalog.

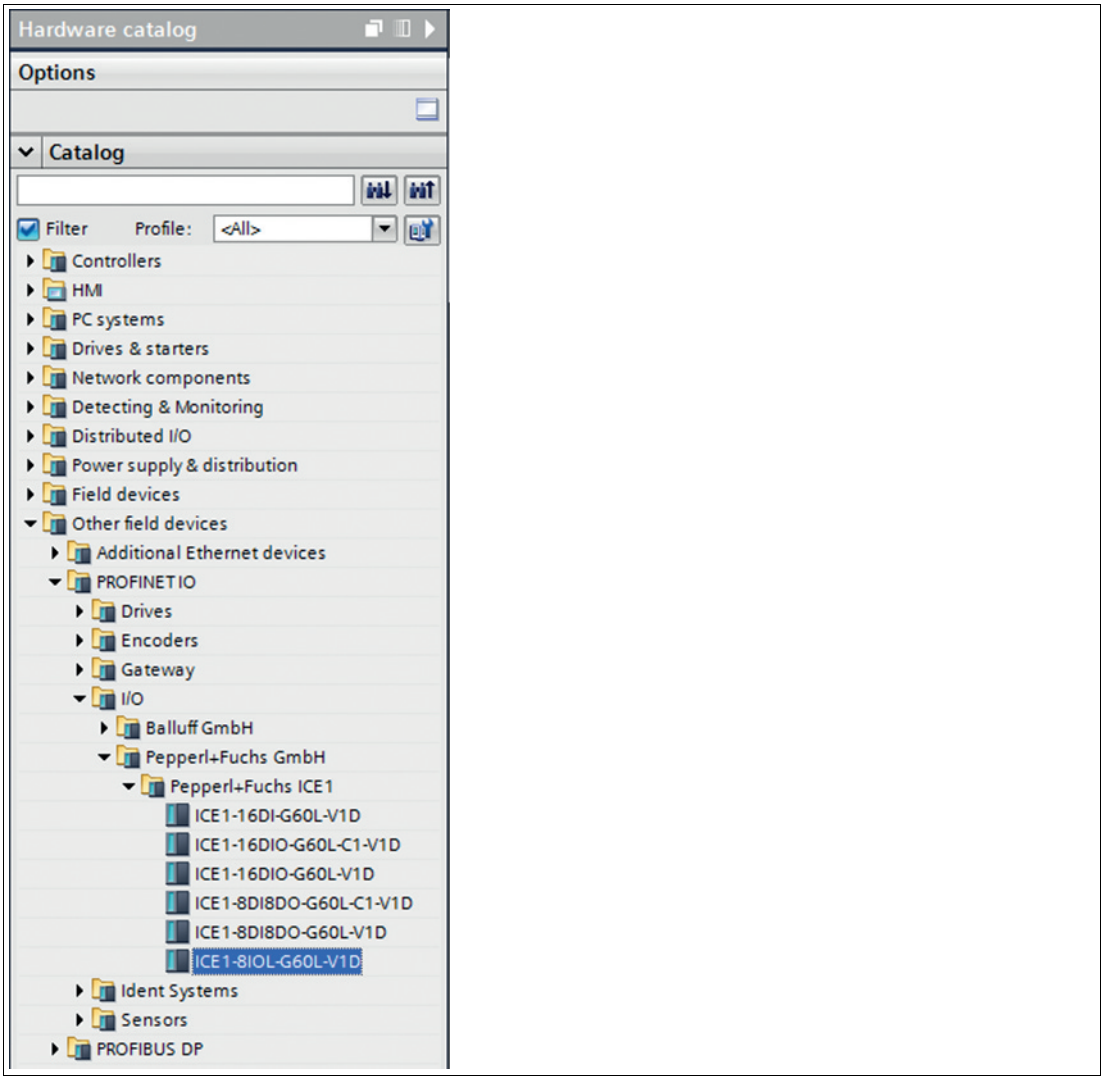


Figure 6.2

2. Double-click on the desired module and select the corresponding PROFINET interface.

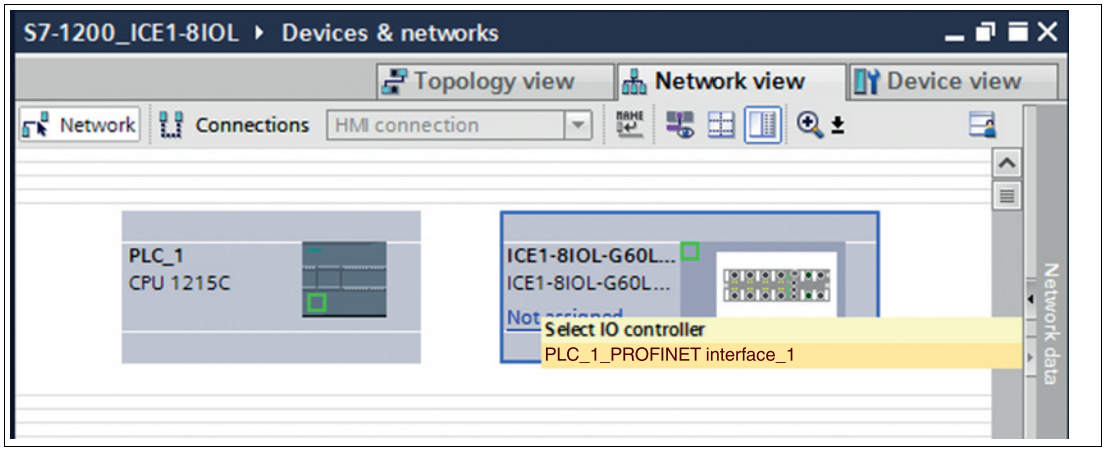


Figure 6.3

↳ Slot 1 is automatically occupied with the status/control module, which cannot be deleted. The remaining sub-slots are configured as a digital input (DI) by default and can be changed.

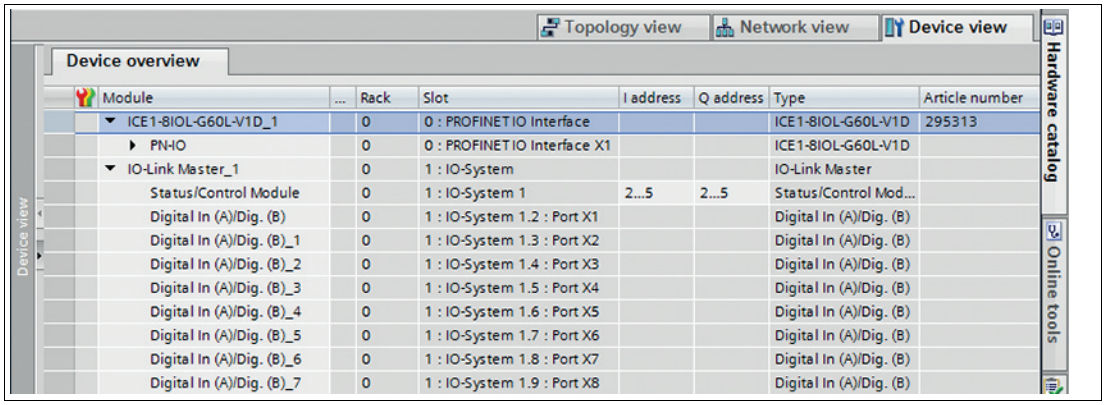


Figure 6.4

↳ The following sub-module profiles are available for configuration of an 8IOL module:

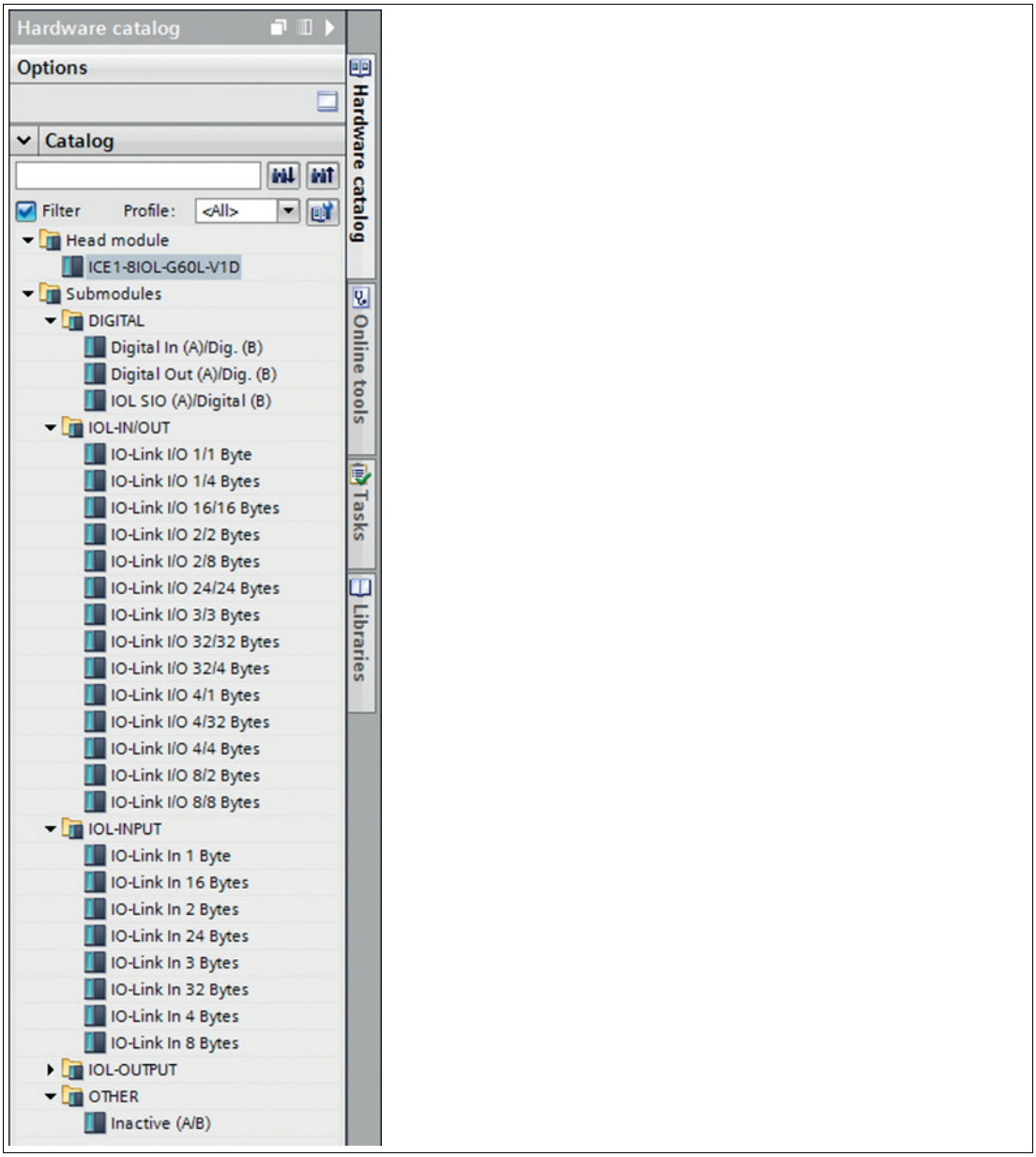


Figure 6.5

6.2.2 Assigning a Unique Device Name in the Control System

PROFINET IO devices are addressed in the PROFINET network via a unique device name. This can be freely assigned by the user but may only appear once in the network.

1. Select slot 0 in the module device view and assign an appropriate module name. In this example, the product identifier is "ICE1-8IOL-G60L-V1D_1."

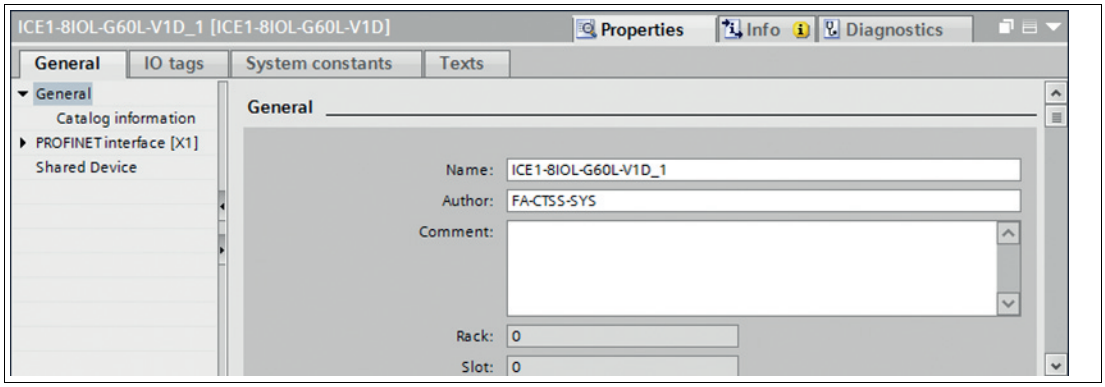


Figure 6.6

2. Check the automatically assigned IP address in "PROFINET interface [x1] -> Ethernet addresses."

3. Check whether control system and module are on the same Ethernet subsystem. If necessary, change the setting.

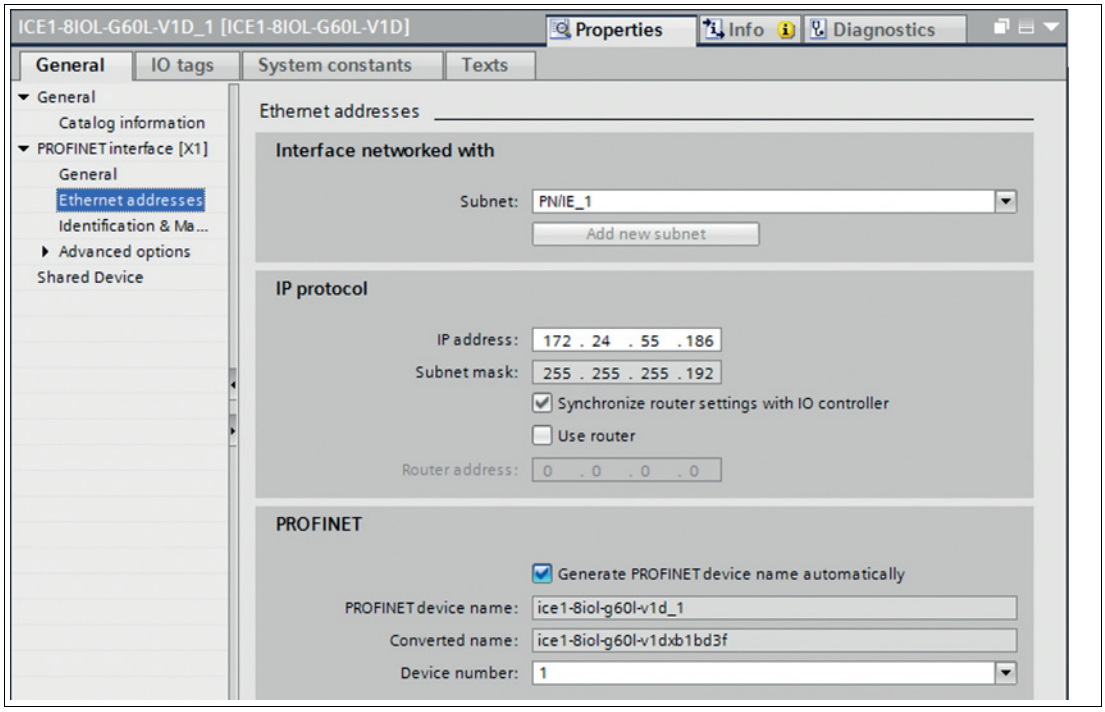


Figure 6.7

4. Activate the selection "Generate PROFINET device name automatically," so that the device name is that which was assigned previously.

Note

Using a modified device name is not recommended for clarity reasons.

6.2.3 Assigning the Device Name to a PROFINET IO Module

So that each node in the PROFINET network can be assigned an IP address, each module must have a device name. A participant search displays the PROFINET devices which have been found.

The Ethernet IO modules have three MAC IDs assigned when they are delivered. These are unique and cannot be changed by the user. The first MAC address is shown on the housing of the Ethernet IO module. (See between X2 and X3). Using this, each device can be found in the list of available nodes and assigned a device name.

1. Connect the module to the PROFINET network.
2. In "Device View," select the module "Slot 0."
3. Open the dialog "Accessible devices" via the main menu "Online -> Accessible devices ...."

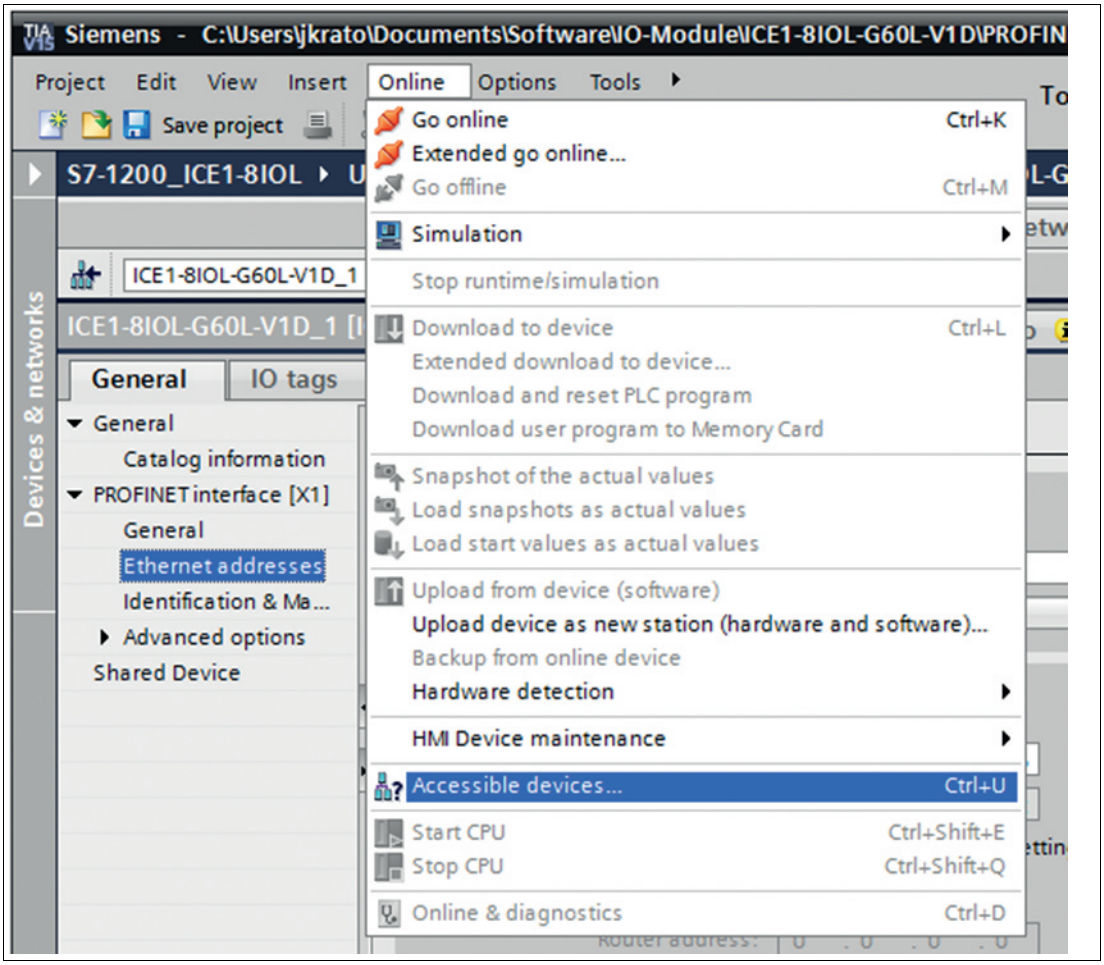


Figure 6.8

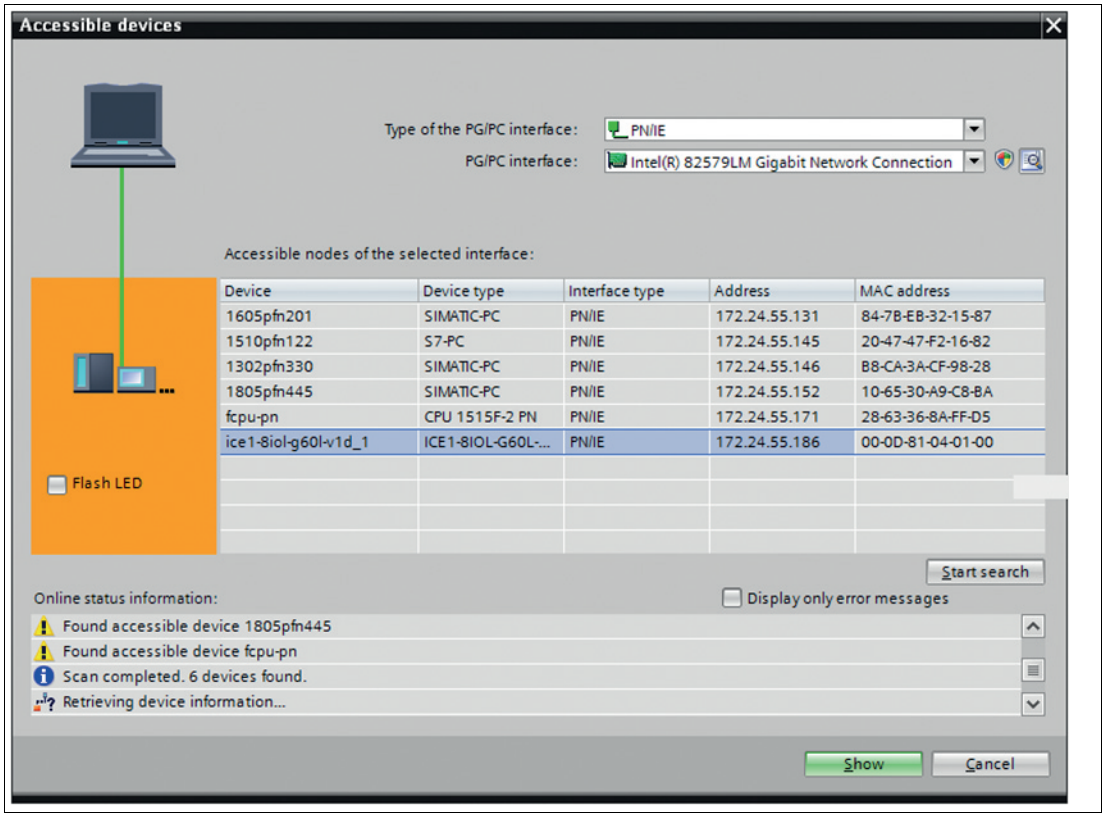


Figure 6.9

4. Select a module from those found.

   ↳ If the desired module is not displayed in the list of available nodes on the network, you can change the device filter and refresh the list. If the device still does not appear, please check your firewall settings.

5. Assign the selected PROFINET device name to the module.

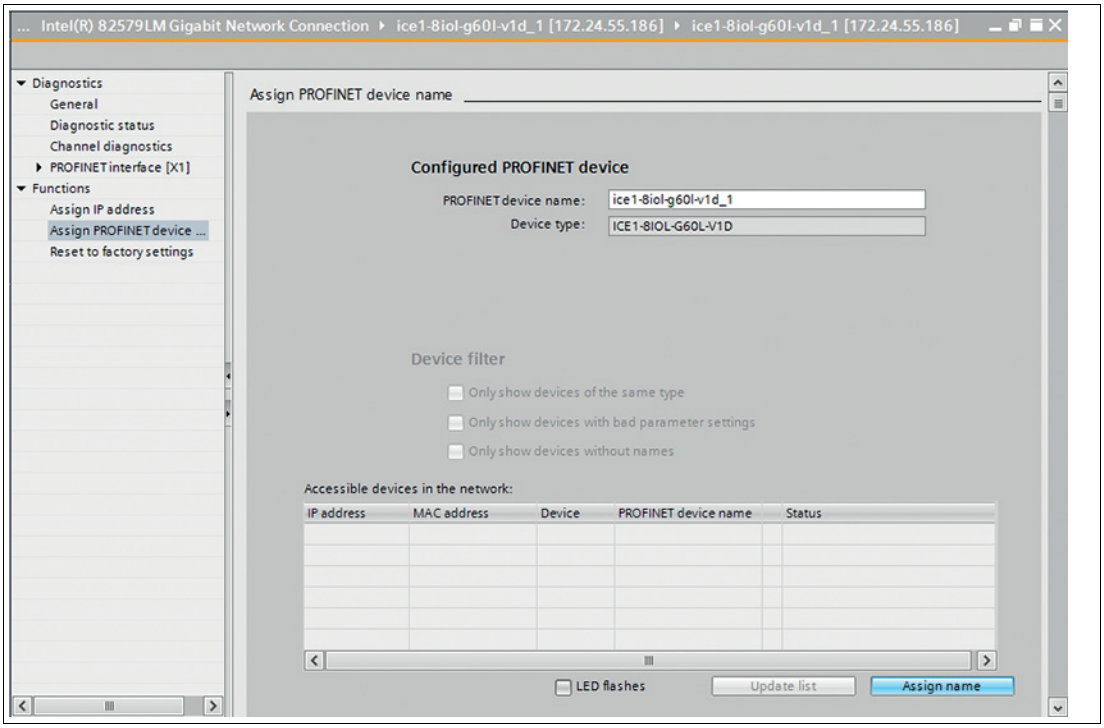


Figure 6.10

↳ If the device name was set successfully, this will be indicated by the status.

6. Complete the process by pressing the "Assign Name" button.

6.2.4 Configuring the IO-Link Channels

A preconfiguration of the I/O function is automatically used for slot 1 of the rack.

By default, all channels are preconfigured as digital inputs in accordance with the IO-Link specification. The configurations of the IO-Link channels (C/Q or channel A/pin 4 of the IO port) in sub-slots 2 - 9 (port 1 of the device corresponds to sub-slot 2, ..., port 8 of the device corresponds to sub-slot 9) can be flexibly defined. The input and output addresses defined by the hardware manager can be changed.

Deleting an IO-Link Channel Configuration

1. To delete an IO-Link channel, select the desired IO-Link channel in "Device View."

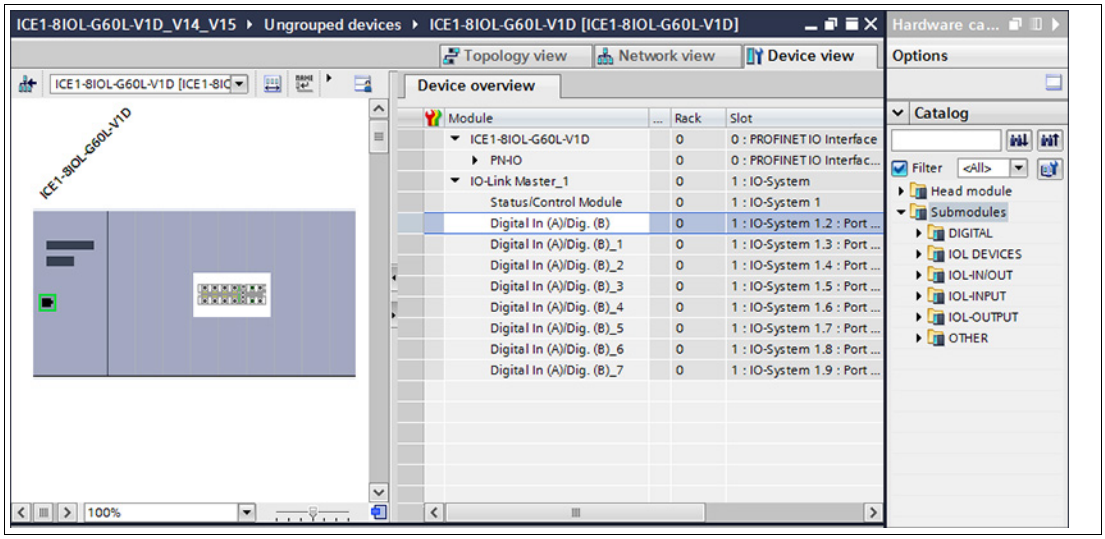


Figure 6.11

2. Right-click this entry.

↳ The following menu appears:

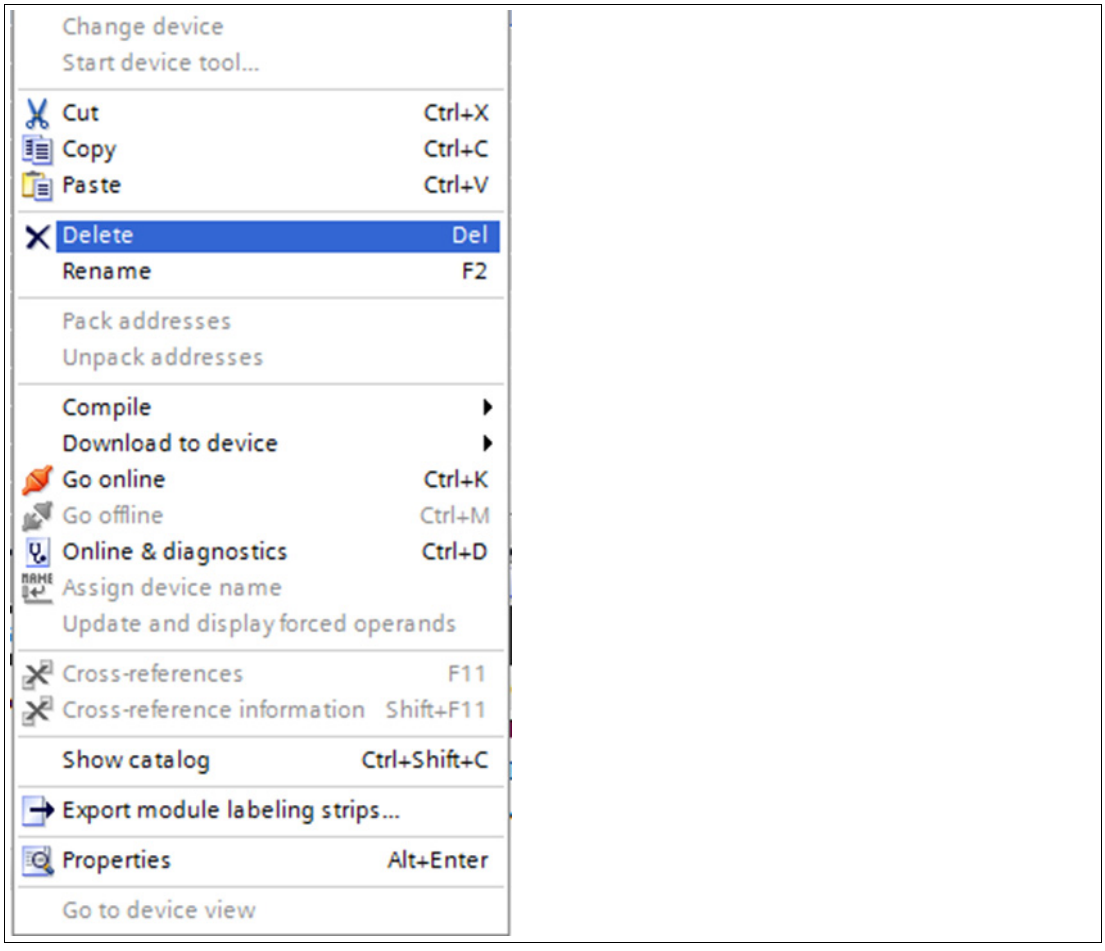


Figure 6.12

3. Select the "Delete" option. Click "Yes" to confirm the following dialog box.

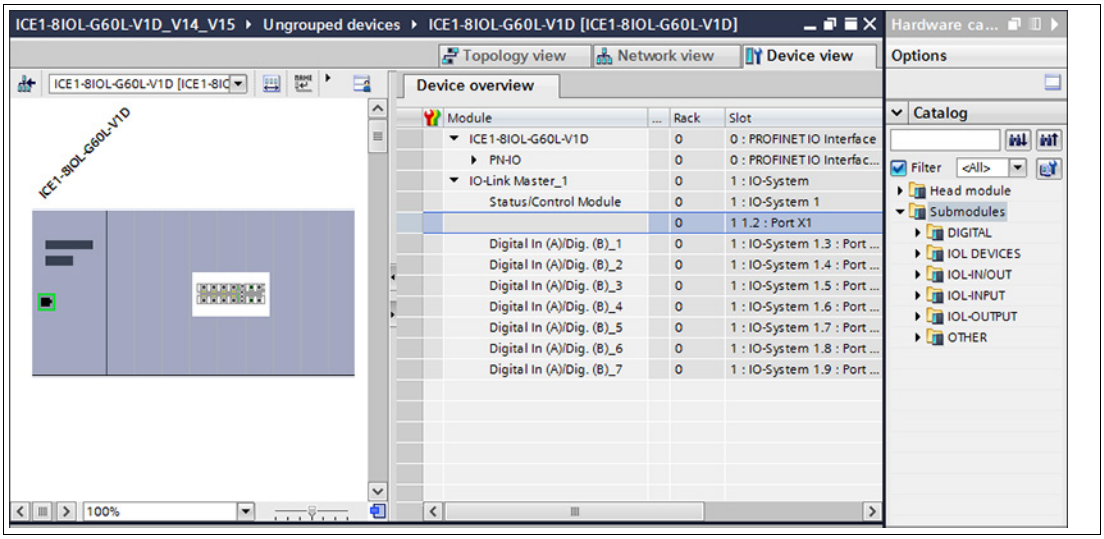
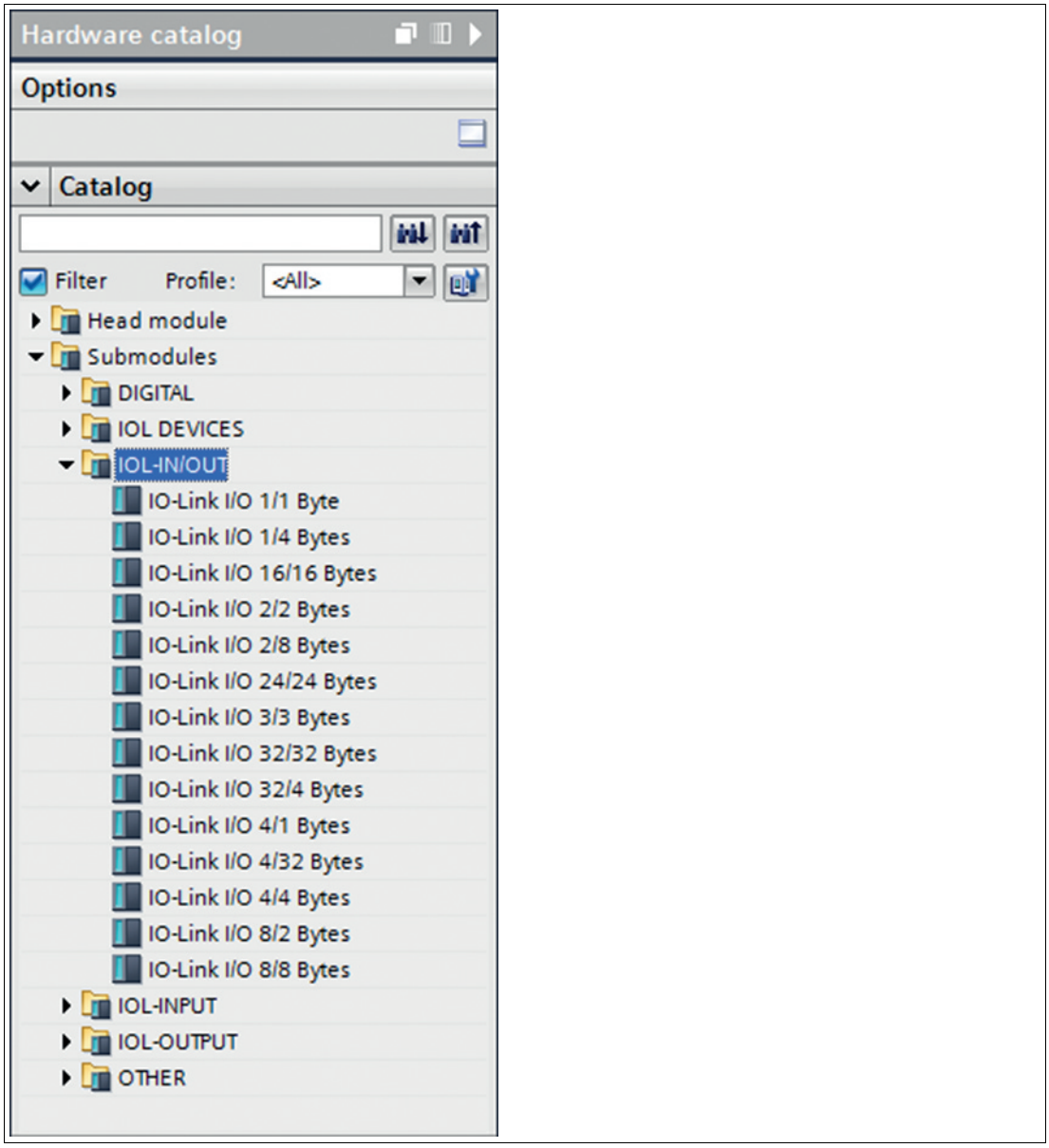


Figure 6.13

Creating an IO-Link Channel Configuration

1. Different IO-Link communication channels (input channel, output channel or input/output channel) are available in addition to the digital input and output channels. Click the corresponding folder in the hardware catalog to view a selection of options:



2. Select the desired option and then click and hold the left mouse button to drag the configuration to a free IO-Link sub-slot.

The following options are available for the IO-Link C/Q channel (channel A/pin 4):

Digital Input: In this mode the channel works as a digital input. The IO-Link master does not attempt to independently establish communication with the connected IO-Link device.

SIO mode (DI): This mode is used for the parameterization of IO-Link devices. It uses the fallback mechanism of COM mode in SIO mode.
In this mode, data transfer starts conventionally, i.e., without IO-Link (COM mode) in digital input mode.
At runtime, the cyclical output bits in the COM control byte of the IO-Link master (See chapter 6.3) can be used at any time to put the appropriate channels into IO-Link (COM mode) in order to carry out parameterization for the IO-Link device.

Note

In case of optional COM operations, the status of the digital input signal is not updated.

Digital Output: In this mode the channel works as a digital output.
It is not possible to communicate with the connected device.

Inactive: This mode should be selected when the channel is not used.
In this case, the power supply L+ to pin 1 of the connection is disabled.

IO-Link ... : In this mode (COM mode), process data is exchanged from or to the device via a communication connection.
The IO-Link master automatically starts communication with the connected IO-Link device, taking into account the baud rate.
In this mode, all IO-Link functions can be used without limitation (parameterization, diagnosis, etc.).
Configuration modules with data lengths of 1 - 32 input and/or output bytes are available.
If the IO-Link device does not have a suitable configuration module, the next largest data length must be selected.

6.2.5 Parameterization of the IO-Link Channels

Parameterization of the IO-Link Channels

By double-clicking the relevant IO-Link sub-slot in the hardware configuration and selecting the "Module parameters" tab, you can set the following parameters:

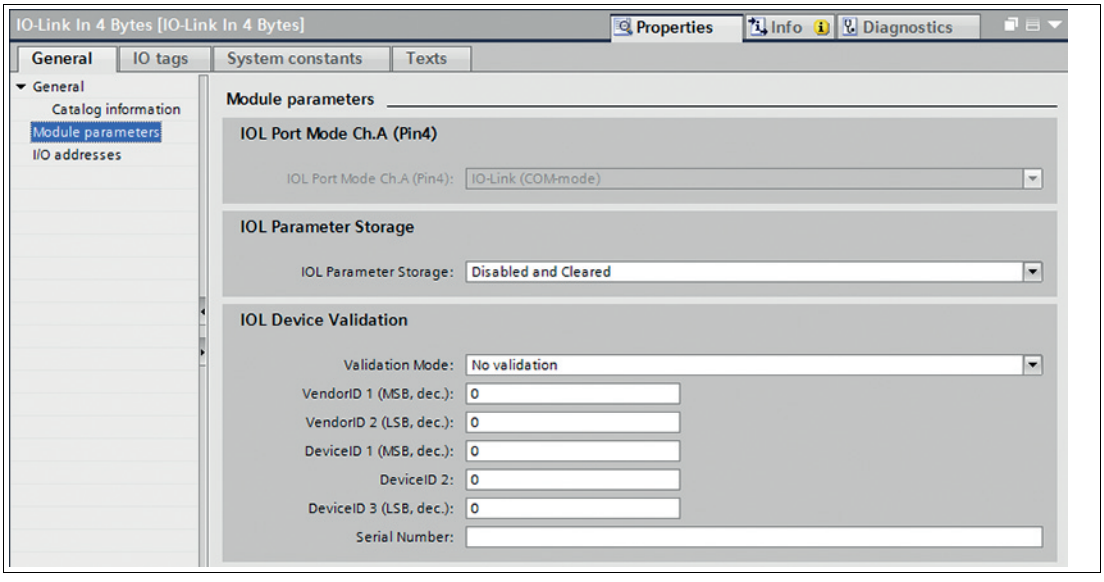


Figure 6.14

IOL Parameter Storage

The parameter server of the IO-Link master can be parameterized in the "IOL Parameter Storage" section.

The "parameter memory" function manages the IO-Link device parameters to enable the simple replacement of a device or master.

The following options can be set:

- **Disabled:**

  This is the default setting upon delivery and the data storage function is disabled. If parameter data has been previously saved for a device, this will remain unchanged. Any parameter changes in the IO-Link device have no effect on the server.
- **Download only (master to device):**

  Activates the function to download the parameter data to the IO-Link device on the master. Parameter data can only be loaded onto an IO-Link device if the data is available on the parameter server and is compatible with the device. When an IO-Link device is connected, the master compares the stored parameter data with the device data. If the function (Parameter storage locked) is not active on the device, the master will download the stored data onto the device where there are discrepancies.

  IO-Link device data can be loaded in the **Upload only** Or **Download and Upload** modes. If the master has not saved a device parameter set, the mode should be compared with the **Disabled** mode.

  The IO-Link device can be replaced in this mode.
- **Upload only (device to master):**

  Activates the function to upload the IO-Link device parameter data to the IO-Link master. An upload is executed automatically when an IO-Link device is connected and the master has no valid data. This is the case if the mode **Disabled and Cleared** has previously been configured, or in **Disabled** mode, as per the default settings. The uploaded parameter data is permanently stored on the master.

  If parameter data is changed on the device during runtime, the device data stored on the master can be overwritten using the "ParamDownloadStore" command (index 0x0002, subindex 0x00, value 0x05). This command sets the flag "DS_UPLOAD_REQ" in the device and thus executes an upload. Flags are set, for example, by the local teach-in buttons on the IO-Link device or through parameterization via the IO-Link device tool.

  The IO-Link master can be easily replaced in this mode.
- **Download and Upload:**

  Activates the function to download and upload the IO-Link device parameter data. An upload is executed automatically when an IO-Link device is connected and the master has no valid data. This is the case if the mode **Disabled and Cleared** has previously been configured, or in **Disabled** mode, as per the default settings. The uploaded parameter data is stored permanently in the master.

  If parameter data is changed on the device during runtime, the device data stored on the master can be overwritten using the "ParamDownloadStore" command (index 0x0002, subindex 0x00, value 0x05). This command sets the flag "DS_UPLOAD_REQ" in the device and thus executes an upload. Flags are set automatically by the local teach-in buttons on the IO-Link device or through parameterization via the IO-Link device tool.

  Each time a new connection is established with an IO-Link device, the master compares the stored parameter data with the device data. If the function (Parameter storage locked) is not active on the device, the master will download the stored data onto the device where there are discrepancies.

  The IO-Link device and IO-Link master can be replaced in this mode.
- **Disabled and Cleared:**

  The data storage function is disabled and stored data is deleted.

Note

An IO-Link device sets the upload flag independently if parameters have been written to the IO-Link device in block mode.

IOL Device Validation

With IO-Link device validation (IO-Link device identification), you can check the connected devices with regard to the values set in the control program, e.g., to identify correctly connected devices before the port starts IO-Link communication.

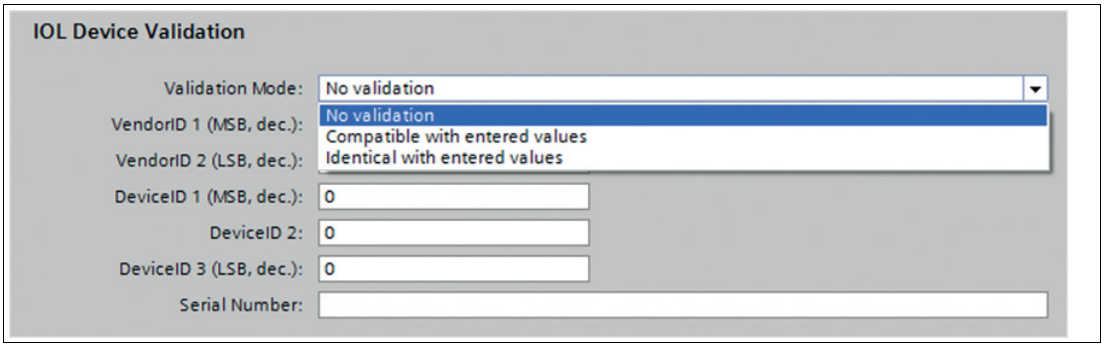


Figure 6.15

- **No validation:**

  This option is the default setting.
  In this case, neither the vendor ID, the device ID nor the serial number are synchronized between the IO-Link device and entered IO-Link master data after switching on and before communication is started.
- **Compatible with entered values:**

  With this option, the vendor ID and device ID are synchronized between the IO-Link device and entered IO-Link master data after switching on and before communication is started. Process data communication only takes place if the configured values match the values reported by the device.
  It is therefore possible to replace IO-Link devices of the same type without changes in the engineering tool.
- **Identical with entered values:**

  In this case, the vendor ID, device ID and the serial number are synchronized between the IO-Link device and the entered IO-Link master data after switching on and before communication is started. Process data communication only takes place if the configured values match the values reported by the device.
  It is therefore only possible to replace IO-Link devices of the same type if the serial number is changed in the engineering tool at the same time.

VendorID:

The vendor ID of the IO-Link device used can be entered as a decimal value in the "VendorID 1" (most significant byte) and "VendorID 2" (least significant byte) fields.

DeviceID:

The device ID of the IO-Link device used can be entered as a decimal value in the "DeviceID 1" (most significant byte) and "DeviceID 2" (least significant byte) fields.

Serial Number:

The serial number of the IO-Link device can be entered as a string in the "Serial Number" input field.

The input is limited to 16 characters.

Fail-Safe Configuration (Outputs Only)

This option only applies to IO-Link channels in COM mode, in which output data is used. In COM mode, IO data is exchanged between the IO-Link master and the IO-Link device via serial communication.

Fail-Safe Value (COM mode)

The following values can be selected:

Figure 6.16

- **Set Low:**

  All bits of the output data with a value of 0 are transferred to the IO-Link device. (Default setting)
- **Set High:**

  All bits of output data with a value of 1 are transferred to the IO-Link device.
- **Hold Last:**

  The last valid output value received by the control unit is continuously and cyclically transferred to the IO-Link device.
- **Replacement Value:**

  If this option is selected, you can enter a substitute value (MSB, LSB) in the following input fields which will be continuously and cyclically transmitted to the IO-Link device.
- **IO-Link master command:**

  The "IO-Link master command" option enables the use of IO-Link-specific mechanisms for valid/invalid output process data.
  In this way, the behavior is determined by the device itself.

Replacement Value:

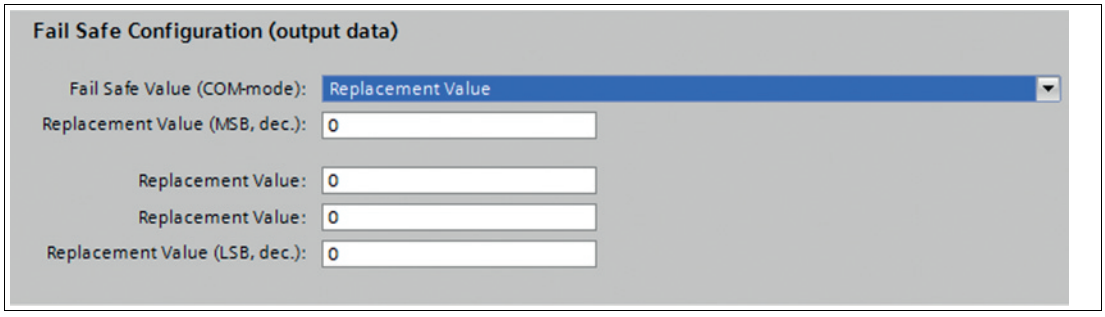


Figure 6.17

If the "Replacement Value" option has been set for the "Fail-Safe Value" below the parameter option, then the replacement value entered in this input field is used.

The value must be entered as a decimal value.

Depending on the planned data length, the values must be entered in the order shown as bytes (0 - 255) or word decrement values (0 - 65535).

- MSB = most significant byte
- LSB = least significant byte
- MSW = most significant word
- LSW = least significant word

6.2.6 Parameterization of the Status/Control Module

The status/control module in slot 1/sub-slot 1 is permanently preconfigured for each module. It contains 4 bytes of input data and 4 bytes of output data for the digital IO data as well as status and control bits of the IO-Link master.

The bit assignments are described in the main chapter "Commissioning for PROFINET" in the "Bit Assignment" section (See chapter 6.3).

Using the status/control module, it is also possible to carry out all of the global module-specific parameterization that is not related to ports in the IO-Link COM mode.

1. Select "Device View" (1) and the desired module (2) (in this example, slot 1 with an 8IOL module).
2. Then, in the "General" tab, select the "Module parameters" (3) area.

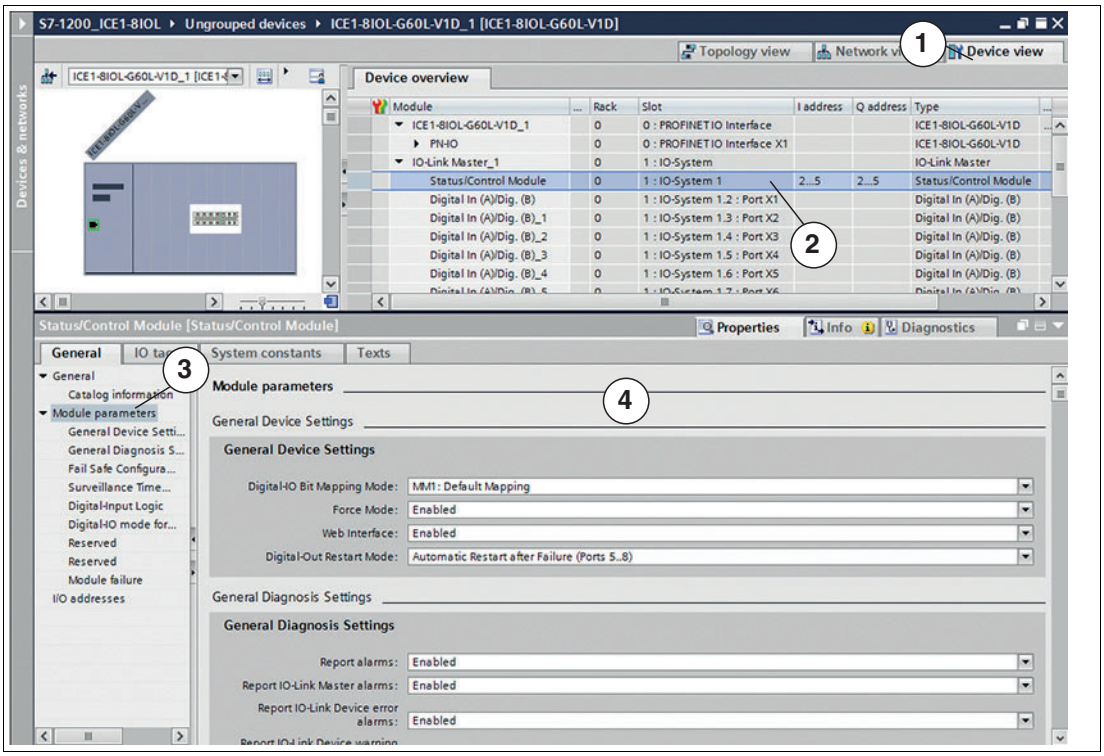


Figure 6.18

↳ You can now carry out the desired parameter settings in the dialog (4).

The following is a brief description of the individual areas for parameter setting.

General Device Settings

■ Digital-IO Bit Mapping Mode

Using the "Digital-IO Bit Mapping Mode" parameter, you can adjust the assignment of digital input/output bits which are transmitted from the control panel to the device or from the device to the control panel within the cyclical data of the "status/control module."

- **Default setting**:
  MM1: standard mapping
- **MM1: standard mapping**:
  In mapping mode 1 (MM1), the first channel bit (C/Q, channel A/pin 4) and the second channel bit (channel B/Pin2) are alternately transferred in ascending order for all connections.
- **MM2: alternative Mapping**:
  In mapping mode 2 (MM2), the first channel bits (C/Q, channel A/pin 4) and the second channel bits (channel B/Pin2) are transferred in ascending order for all ports.
  The different formats are also described in the "Bit Assignment" chapter (See chapter 6.3).

- **Force Mode**

  Using the "Force Mode" parameter, you can allow/disallow the use of force mode via the web server.
- **Web Interface**

  Using the "Web Interface" parameter, you can allow/disallow the use of the web server.
- **Digital-Out Restart Mode**

  Using the "Digital-Out Restart Mode" parameter, you can enable/disable automatic restarting of the digital output following a short circuit or resetting of the channel diagnosis when resetting the digital output for ports X5 - X8.

General Diagnosis Settings

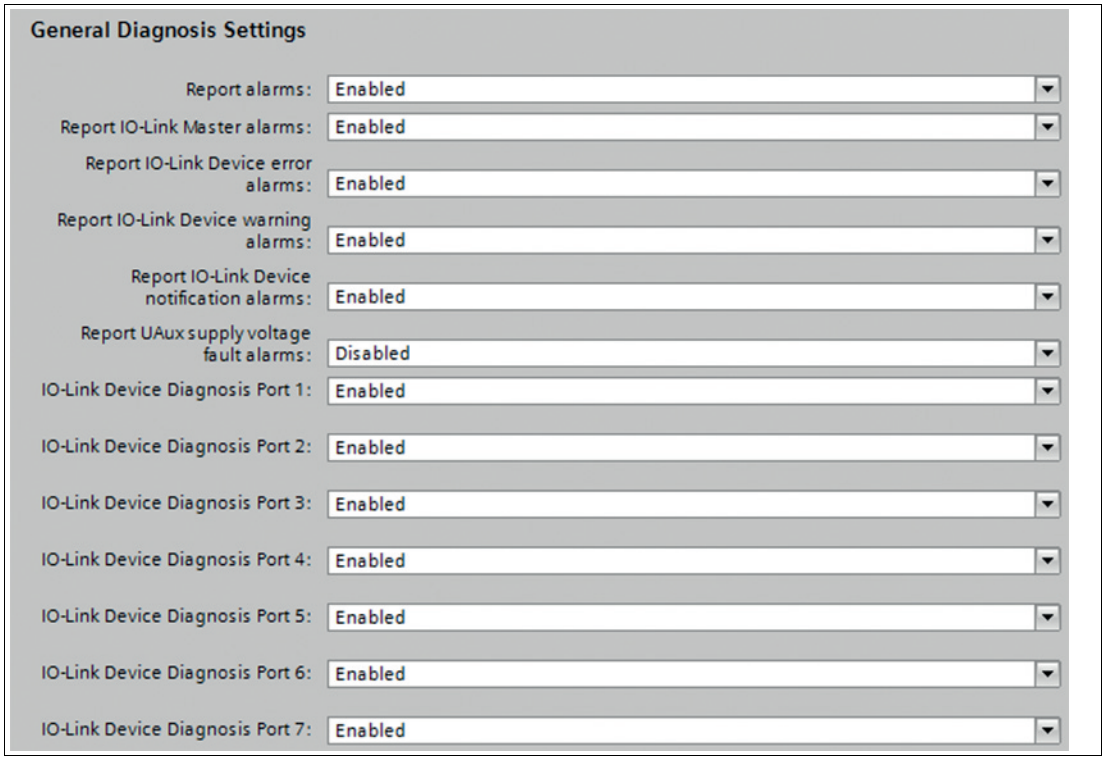


Figure 6.19

In the "General Diagnosis Settings" area, you can enable or disable diagnosis and diagnostic stages such as alarm signals for events.

Note

"Report U_{AUX} Supply Voltage Error" is disabled in the default setting to prevent diagnostic messages if the supply voltage is switched on or off later.

Fail-Safe Configuration

The device supports a fail-safe function for channels that are used as digital outputs. During configuration of the devices, the status of the outputs after an interruption or loss of communication in the PROFINET IO network can be defined.

The following options can be selected:

- Set low - the output channel is disabled and/or the output bit is set to 0.
- Set high - the output channel is enabled and/or the output bit is set to 1.
- Hold last - the last output status is retained.

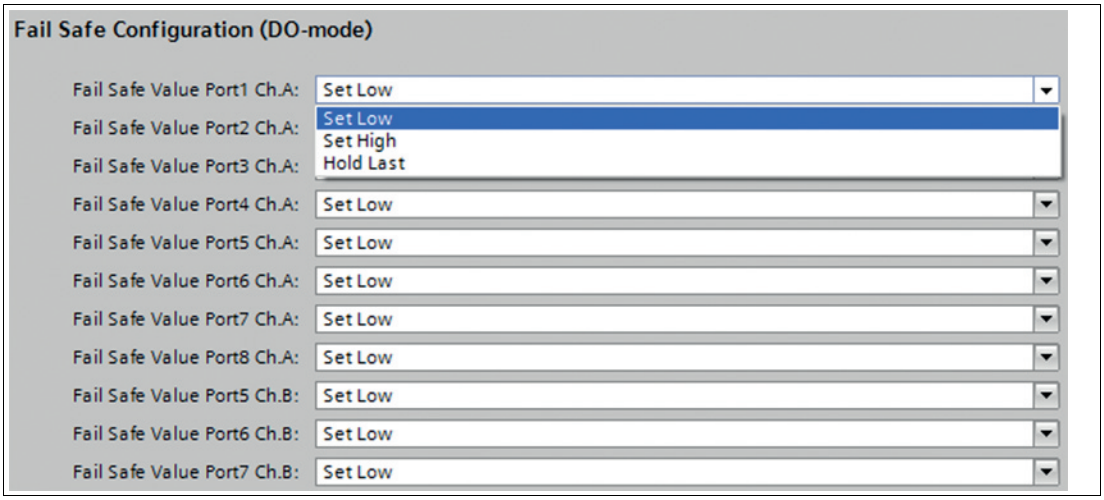


Figure 6.20

Surveillance Timeout Configuration

You can also configure the separate auxiliary voltage U_{Aux} that is available on type B IO-Link channels (channel B/pin2) of ports 5 - 8 as an additional digital output ("Digital IO Mode for Ch. B" area). This enables you to switch the power supply like a digital output.

The firmware of the module allows you to configure a delay time before output current monitoring is enabled for this particular application. The delay time is referred to as the "Surveillance timeout" and can be configured for each output channel. The delay time starts after the status of the output channel changes, i.e., if it is enabled after a rising edge or disabled after a falling edge. Once this time has elapsed, the output is monitored and fault states are reported by the diagnostics.

The "Surveillance timeout" parameter can be set to a value between 0 and 255 ms. The default value for this parameter is 80 ms.

If an output channel is in a static state, i.e., permanently switched on or switched off, the typical value is 5 ms.

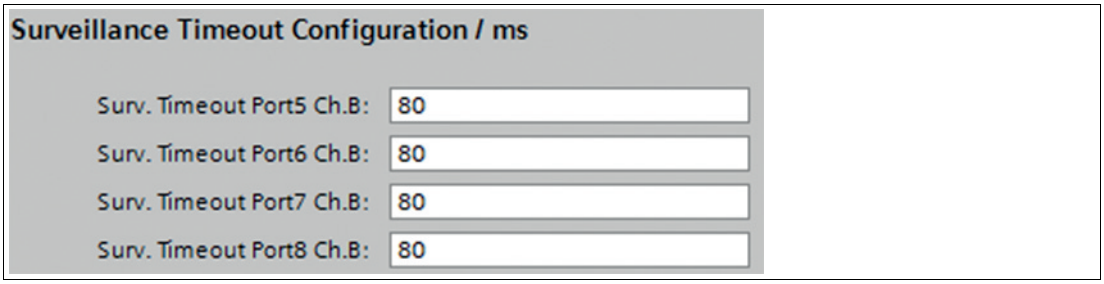


Figure 6.21

Digital-Input Logic

This parameter can be used to configure the logic of channels that are used as digital inputs.

- **Default setting**:

  NO (normally open) for all channels
- **NO (normally open)**:

  In this case, an undamped sensor has an open switch output (low signal).
  The device input detects a low level and returns a 0 to the control unit.
- **NC (normally closed)**:

  In this case, an undamped sensor has a closed switch output (high signal).
  The device input detects a high level, inverts the signal, and returns a 0 to the control unit.

2022-06

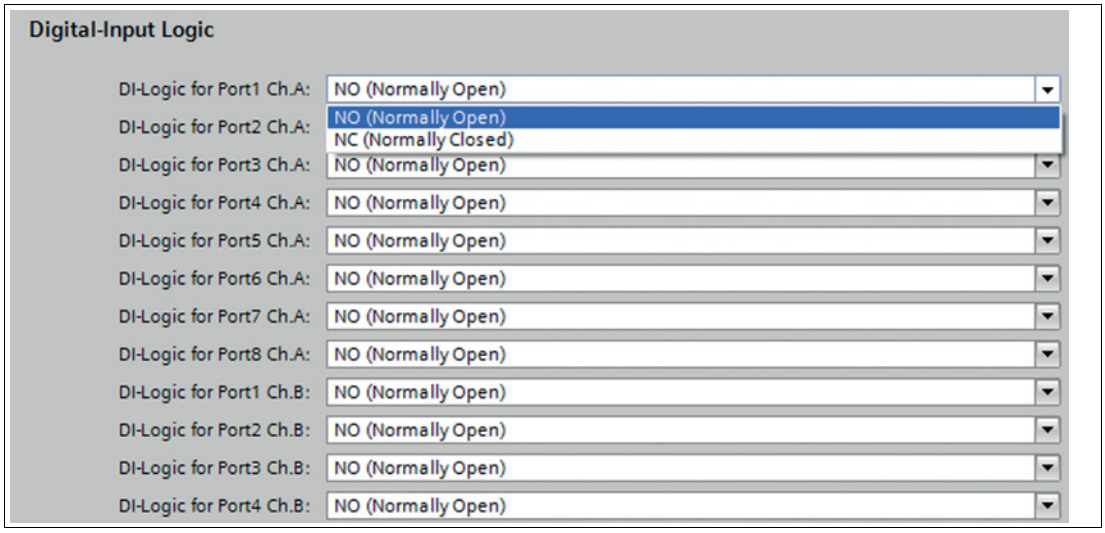


Figure 6.22

Digital-IO-mode for Ch. B/Pin2

In this area, you can parameterize the IO-Link connections of ports 5 - 8, class B, as follows:

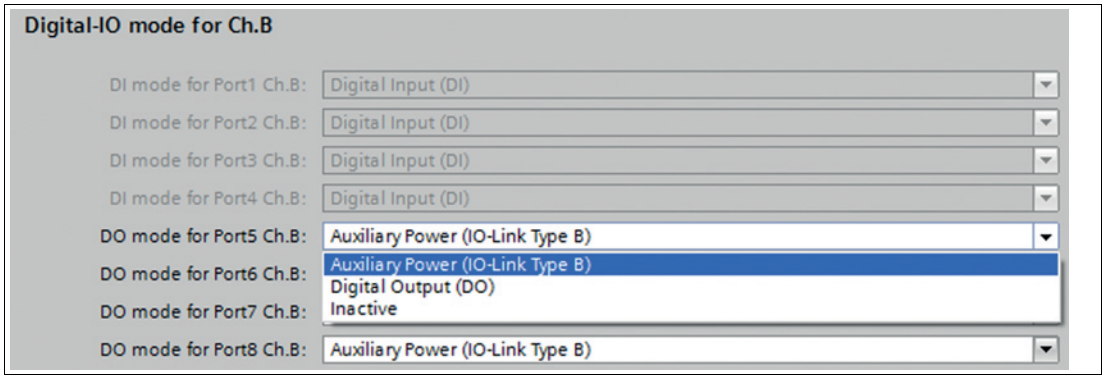


Figure 6.23

Note

All type B IO-Link ports (X5 - X8) of the **ICE1-8IOL-G30L-V1D** are preconfigured as "Auxiliary power (IO-Link Type B)" and cannot be changed.

- **Default setting**:

  Auxiliary Power (IO-Link Type B)
- **Auxiliary Power (IO-Link Type B)**:

  In this mode, pin 2 and pin 5 of the IO-Link connections of class B ports 5 - 8 serve as an auxiliary voltage output.
  The auxiliary voltage is provided via the U_{AUX} supply input.
  The auxiliary voltage output cannot be controlled.
- **Digital Output (DO)**:

  In this mode, pin 2 of the IO-Link connections of class B ports 5 - 8 can be used as a digital output.
  The control bits are transferred to the device by the control unit within the status/control module.
  A "surveillance timeout" can be parameterized for the outputs ("Surveillance Timeout Configuration" area).

6.2.7 Siemens IO-Link Library

IO-Link Device Parameterization

SIEMENS IO-Link Library

With the Siemens TIA Portal "IO_LINK_DEVICE" functional module, device parameters can be written to an IO-Link device and parameters, measured values, and diagnostic data can be read acyclically. For STEP7 Classic V5.5, the original version "IO_LINK_CALL" is to be used for acyclic communication with IO-Link devices.

In a revised version of this library, "IO_LINK_CALL" was replaced by the "IO_LINK_DEVICE" functional module for acyclic communication with IO-Link devices.

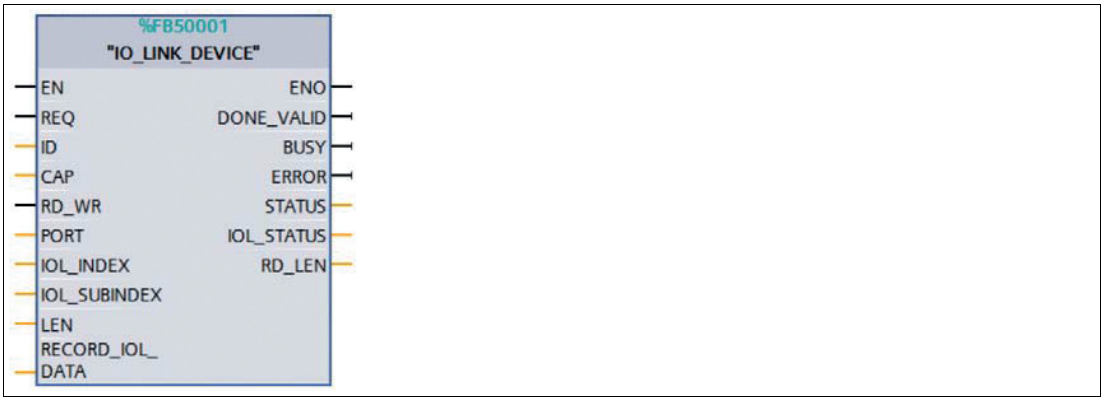


Figure 6.24 TIA Portal IO_LINK_DEVICE

Figure 6.25 STEP 7 V5.5 IO_LINK_CALL

The service data is clearly addressed via the index and sub-index. Using the hardware identifier of the status/control module (ID), you can read and write the Client Access Point (CAP = 255) and the corresponding IO-Link port (PORT: 1 - 8 for IO-Link ports).

Note

If the logical input address for the IO_LINK_CALL module is used, it may be necessary for the input address to be less than or equal to the output address.

You may need to change this value manually in the engineering tool.

6.2.8 Replacing Devices Without a Removable Medium/Programming Unit

Note

The replacement device that will be used for a replacement without a removable medium/programming unit must still have its factory settings applied. If necessary, the factory settings must be restored.

PROFINET IO devices that support the "Device replacement without removable medium or programming unit" function can be replaced by identical devices in an existing PROFINET network. In such cases, the IO controller assigns the device name. To do so, it uses the configured topology and the neighborhoods determined by the IO devices. The Ethernet IO modules support the device replacement function without a removable medium/programming unit.

1. Click on the PLC in slot 1 (1).
2. In the "Profinet interface_1 [Module]" area, click on "Advanced options" (2).
3. Change to the "Properties" tab (3) and click on the option to replace a device without a removable medium (4).

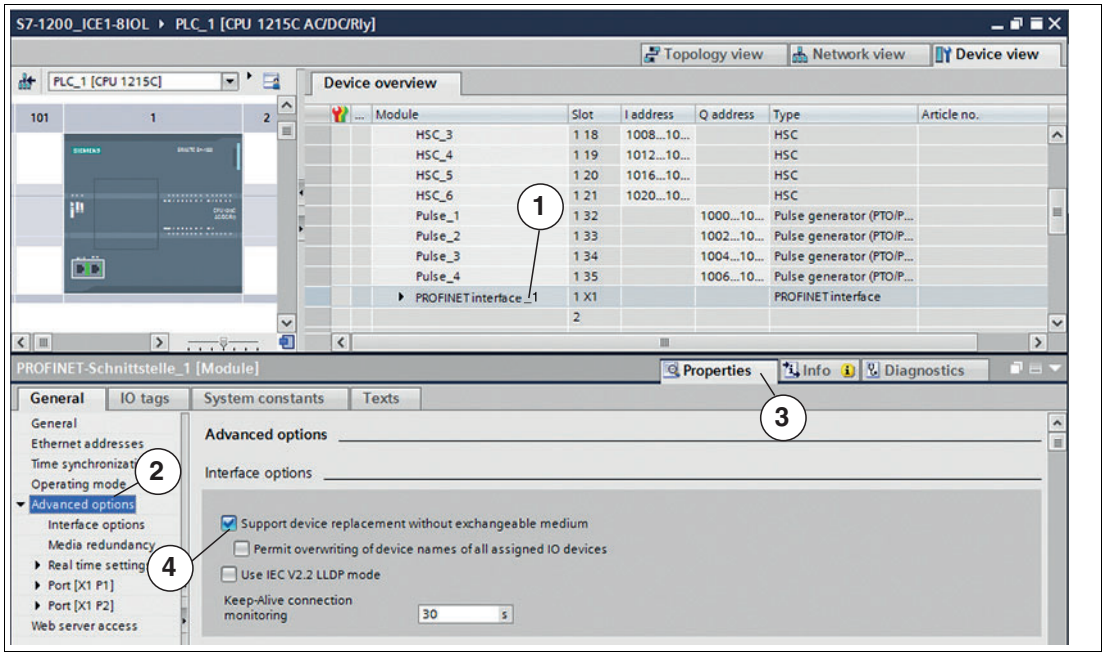


Figure 6.26

Note

A network topology is configured based on the connections between PROFINET ports on the individual devices. This can be reached via slot 0 of the PROFINET devices in use. Displaying all non-linked ports allows you to specify a suitable partner port in each case.

4. Define the network topology for the device replacement. To do so, select "Devices & networks" and "Topology view."
5. Use the mouse to drag a connection between the module and the PLC.

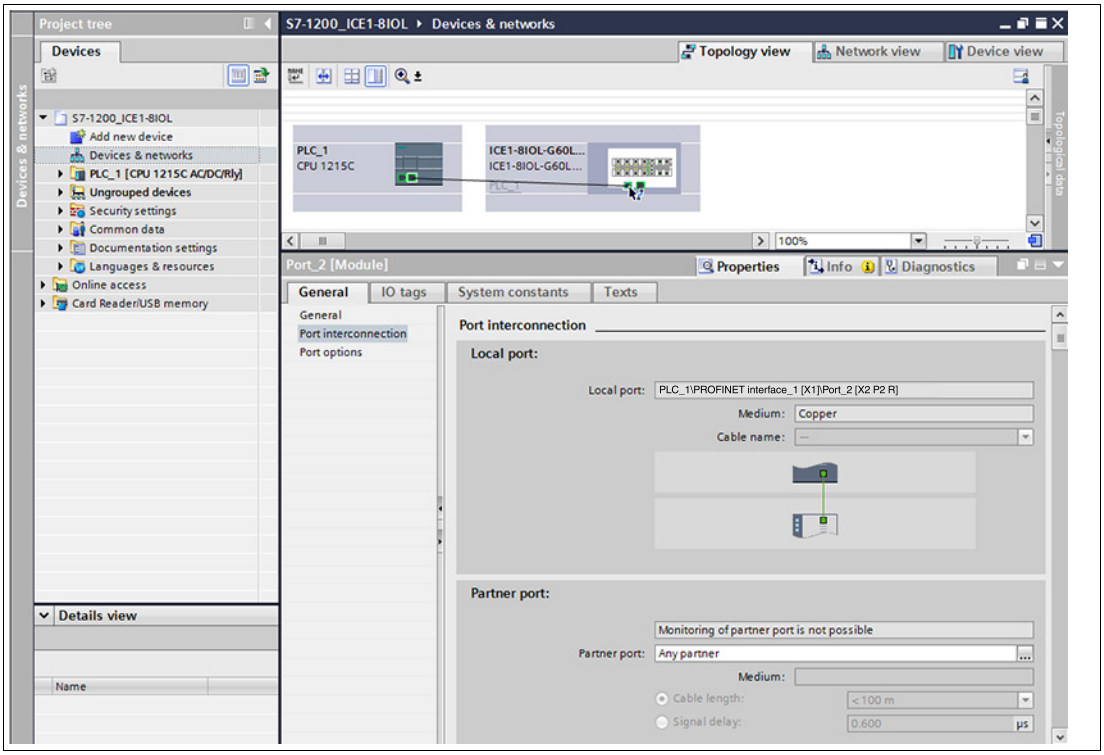


Figure 6.27

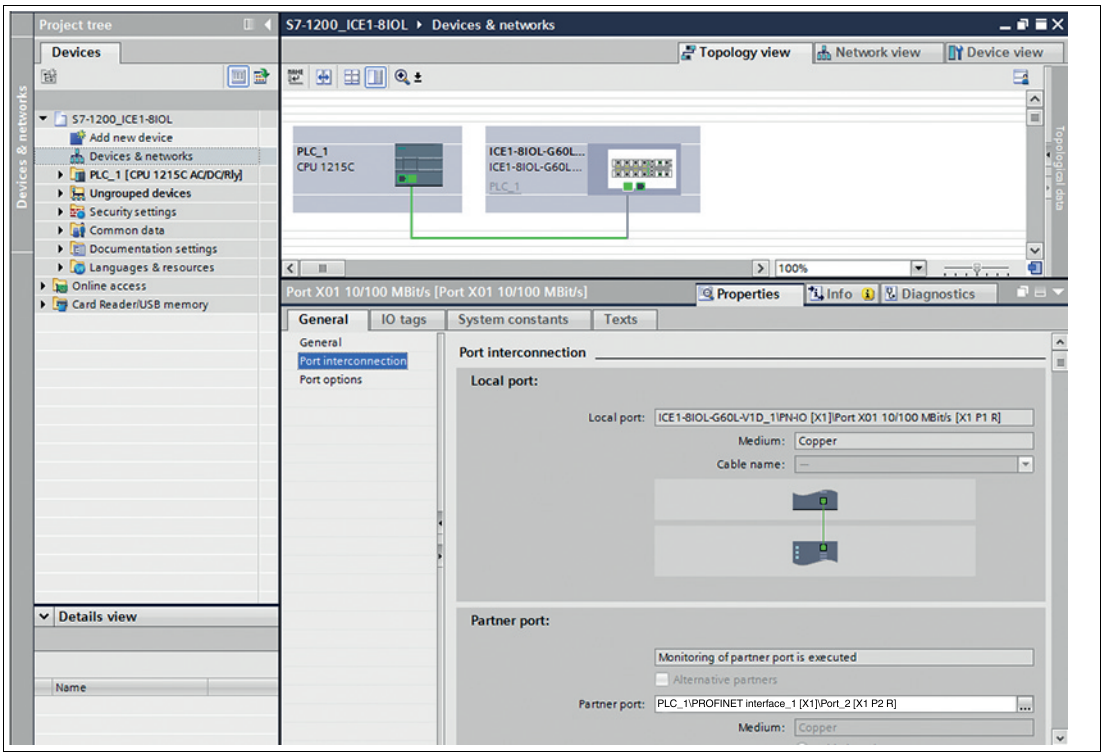


Figure 6.28

↳ The port interconnection was successful if the link is shown in the "Topology View" and on the "Partner Port."

6.2.9 Identification and Maintenance Functions (I&M)

The PROFINET module is capable of uniquely identifying devices installed in the system by means of an electronic nameplate. This device-specific data can be read acyclically at any time by the user. In addition, the installation date, location code, and other descriptions can be defined in the module on creation of the system.

Supported I&M Functions

- Module-specific I&M functions

  The module-specific I&M features 0 to 4 can be read or written via slot 0. The specified index is used for the mapping of data records.

I&M 0

Data object	Length [byte]	Access	Default value/description
MANUFACTURER_ID	2	Read	0x005D
ORDER_ID	20	Read	Order number of the module in ASCII
SERIAL_NUMBER	16	Read	Defined in the production process, in ASCII
HARDWARE_REVISION	2	Read	Hardware revision of the device
SOFTWARE_REVISION	4	Read	Software revision of the device
REVISION_COUNTER	2	Read	Counts each statically stored parameter change on the IO-Link master (e.g., device name or IP address)
PROFILE_ID	2	Read	0xF600 (generic device)
PROFILE_SPECIFIC_TYPE	2	Read	0x0003 (IO module)
IM_VERSION	2	Read	0x0101 (I&M version 1.1)
IM_SUPPORTED	2	Read	0x001E (I&M 1 ... 4 supported)

Table 6.1 I&M 0 (slot 0, index 0xAFF0)

I&M 1

Data object	Length [byte]	Access	Default value/description
TAG_FUNCTION	32	Read/write	0x20 et seq. (empty)
TAG_LOCATION	22	Read/write	0x20 et seq. (empty)

Table 6.2 I&M 1 (slot 0, index 0xAFF1)

I&M 2

Data object	Length [byte]	Access	Default value/description
INSTALLATION_DATE	16	Read/write	0x20 et seq. (empty) The supported data format is a visible character string with a fixed length of 16 bytes; "YYYY-MM-DD hh:mm" or "YYYY-MM-DD" filled with spaces

Table 6.3 I&M 2 (slot 0, index 0xAFF2)

I&M 3

Data object	Length [byte]	Access	Default value/description
DESCRIPTOR	54	Read/write	0x20 et seq. (empty)

Table 6.4 I&M 3 (slot 0, index 0xAFF3)

I&M 4

Data object	Length [byte]	Access	Default value/description
SIGNATURE	54	Read/write	0x20 et seq. (empty)

Table 6.5 I&M 4 (slot 0, index 0xAFF4)

I&M Functions of the IO-Link Master

The IO-Link master-specific I&M functions 0 and 99 can be read via slot 1. The specified index is used for the mapping of data records.

I&M 0

Data object	Length [byte]	Access	Default value/description
MANUFACTURER_ID	2	Read	0x005D
ORDER_ID	20	Read	Order number of the module in ASCII
SERIAL_NUMBER	16	Read	Defined in the production process, in ASCII
HARDWARE_REVISION	2	Read	Hardware revision of the device
SOFTWARE_REVISION	4	Read	Software revision of the device
REVISION_COUNTER	2	Read	Counts each statically stored parameter change on the IO-Link master (e.g., device name or IP address)
PROFILE_ID	2	Read	0xF600 (generic device)
PROFILE_SPECIFIC_TYPE	2	Read	0x0003 (IO module)
IM_VERSION	2	Read	0x0101 (I&M version 1.1)
IM_SUPPORTED	2	Read	0x001E (I&M 1 ... 4 supported)

Table 6.6 I&M 0 (slot 0, index 0xAFF0)

I&M 99

Data object	Length [byte]	Access	Default value/description
IOL_VERSION	1	Read	0x11 (IO-Link version 1.1)
IOL_PROFILE_VERSION	1	Read	0x10 (IO-Link profile version 1.0)
IOL_FEATURE_SUPPORT	4	Read	0x00000000
NUMBER_OF_PORTS	1	Read	0x08 (number of supported IO-Link connections)
REF_PORT_CONFIG	1	Read	0x00 (no connection configuration data supported)

2022-06

Data object	Length [byte]	Access	Default value/description
REF_IO_MAPPING	1	Read	0x00 (no I/O mapping data supported)
REF_IPAR_DIRECTORY	1	Read	0x00 (no IPar directory supported)
REF_IOL_M	1	Read	0x00 (no IOL-M parameters supported)
NUMBER_OF_CAPS	1	Read	0x01 (number of client access points)
INDEX_CAP1	1	Read	0xFF (client access point for IOL_CALL)

Table 6.7 I&M 99 (slot 1, index 0xB063)

I&M Functions of the IO-Link Device

The IO-Link device-specific I&M functions 16 and 23 can be read via slot 1, sub-slot 1. The specified index is used for the mapping of data records.

Only data that is not equal to zero is received when a connection to an IO-Link device can be established.

I&M 16 ... 23

Data object	Length [byte]	Access	Default value/description
VENDOR_ID	2	Read	0x0000 (IO-Link device vendor ID)
DEVICE_ID	4	Read	0x00000000 (IO-Link device ID)
FUNCTION_ID	2	Read	0x0000 (IO-Link device function ID)
RESERVED	10	Read	0x00 et seq.

Table 6.8 I&M 16 ... 23 (slot 1, sub-slot 1, index 0xB000...0xB007)

Reading and Writing I&M Data

In its standard library, SIEMENS offers system functions with which I&M data can be read and written. A data record contains a 6 byte block header and the current I&M data record. The data requested when reading or the data to be written only begins after the existing block header. When writing, the block header must also be taken into account.

The following table shows the structure of a data record.

Data object	Length [byte]	Data Type	Coding	Description
BlockType	2	Word	I&M 0: 0x0020 I&M 1: 0x0021 I&M 2: 0x0022 I&M 3: 0x0023 I&M 4: 0x0024 I&M 16...23: 0x0F00 I&M 99: 0x0F00	BlockHeader
BlockLength	2	Word	I&M 0: 0x0038 I&M 1: 0x0038 I&M 2: 0x0012 I&M 3: 0x0038 I&M 4: 0x0038 I&M 16...23: 0x0014 I&M 99: 0x000F	
BlockVersionHigh	1	Byte	0x01	
BlockVersionLow	1	Byte	0x00	
I&M data	I&M 0: 54 I&M 1: 54 I&M 2: 16 I&M 3: 54 I&M 4: 54 I&M 16...23: 18 I&M 99: 13	Byte		I&M record

Table 6.9 Data record with BlockHeader and I&M record

Reading I&M Records

I&M data can be read using the standard RDREC (SFB52) command block in the TIA portal. First, the hardware identifier of the CPU is read out under "PLC Variables > System Constants." The CPU should be displayed there as <Local> with the data type "Hw_SubModule." You specify the hardware identifier via the corresponding input parameter (ID). The I&M index (INDEX) must also be transmitted. The return parameters indicate the length of the received I&M data and contain a corresponding status or error message.

Writing I&M Records

I&M data can be written using the standard WDREC (SFB53) function block in the TIA portal. First, the hardware identifier of the CPU is read out under "PLC Variables > System Constants." The CPU should be displayed there as <Local> with the data type "Hw_SubModule." You specify the hardware identifier via the corresponding input parameter (ID). The I&M index (INDEX) and the data length (LEN) to be written must also be transmitted. The return parameters contain a status or an error message.

6.2.10 Prioritized Start-Up/Fast Start-Up (FSU)

The modules with Fast Start-Up (FSU) support optimized system power-up. This ensures a quick restart after a power supply is restored after an interruption.

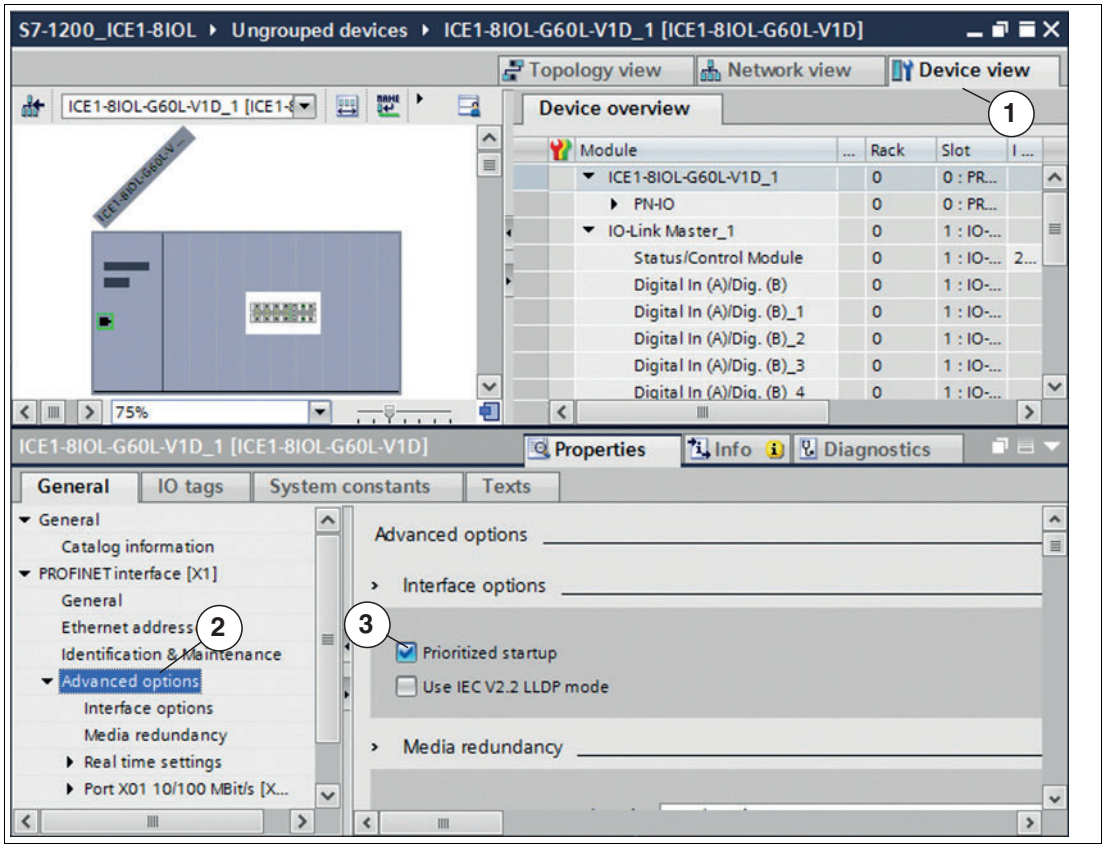


Figure 6.29

1. Select "Device View" (1) and the desired module (in this example, slot 1 for ICE1-8IOL-G60L-V1D_1).
2. Then, in the "General" tab, select the "Advanced Options" area (2).
3. Click on the "Prioritized Start-Up" option (3) to enable prioritized startup.

6.2.11 Resetting Modules to their Factory Settings

To reset the modules to the factory settings, you must search for accessible PROFINET nodes in the TIA Portal.

1. Open the dialog "Accessible devices" via the main menu "Online -> Accessible devices ...."

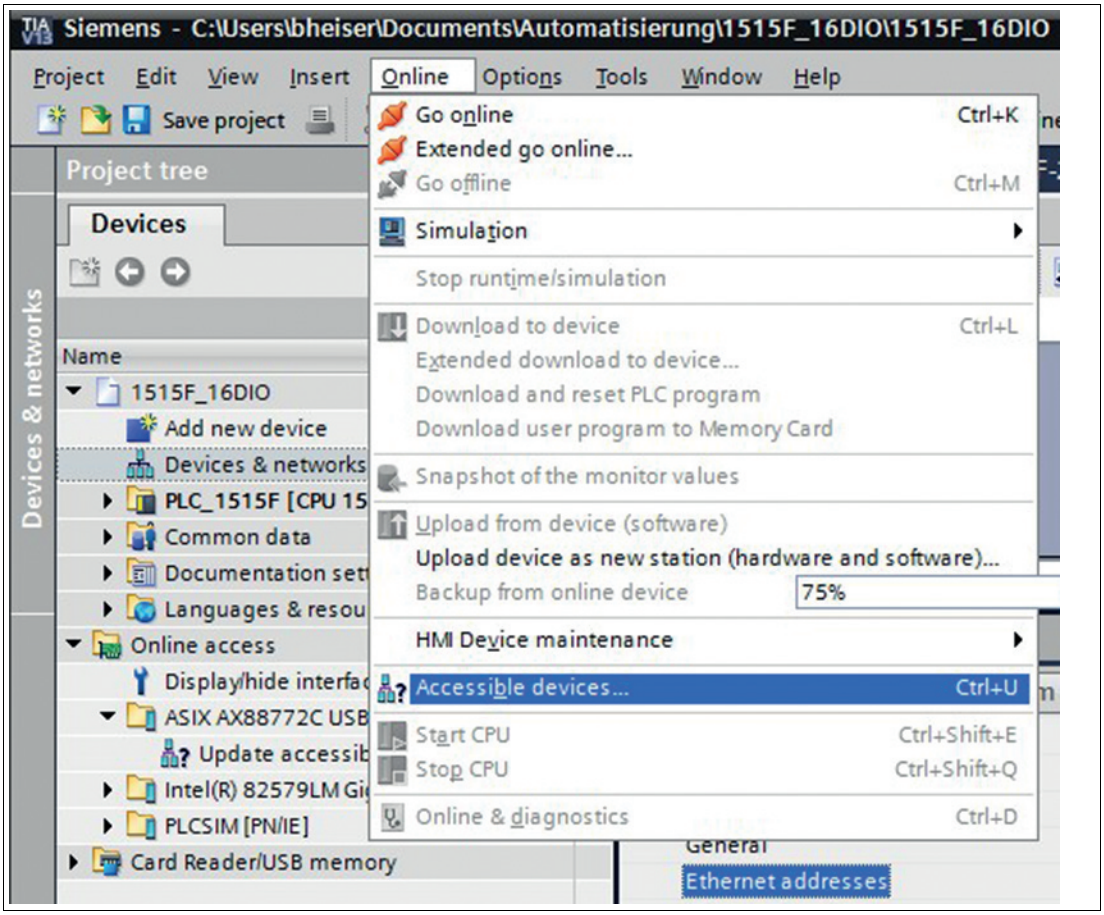


Figure 6.30

2. Select the module that you wish to reset to factory settings.

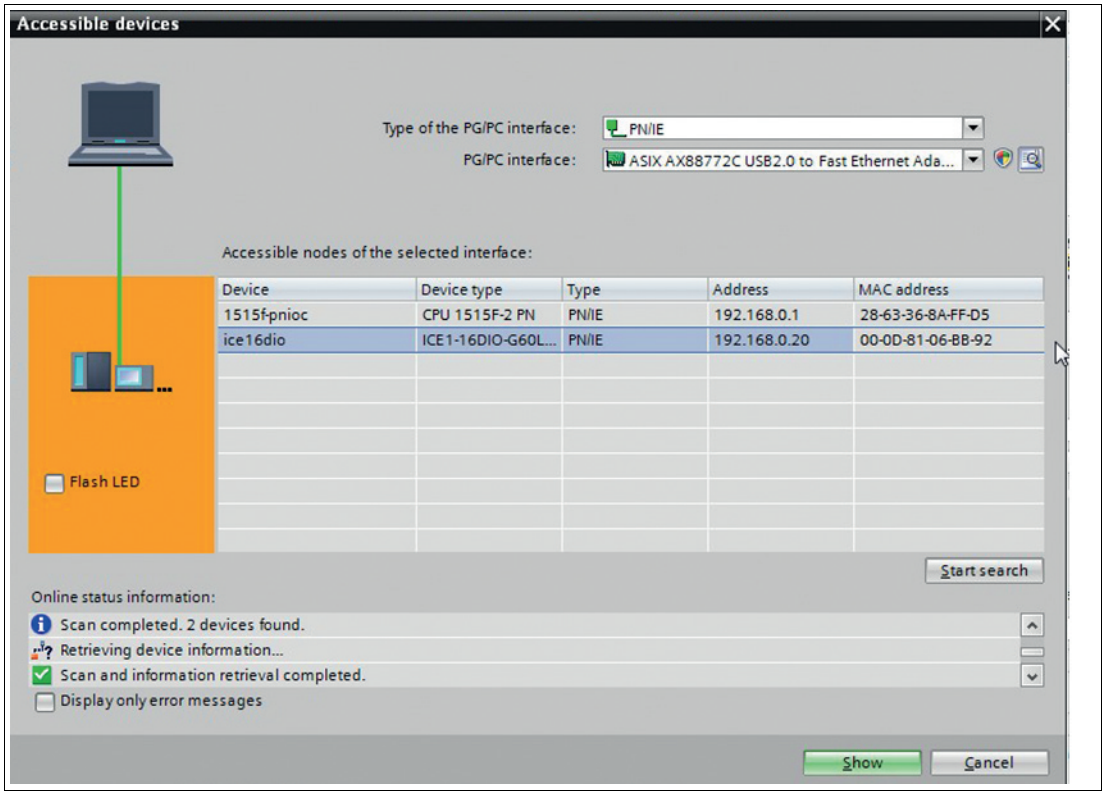


Figure 6.31

3. Initiate the reset process by pressing the "Reset" button and then confirming the safety prompt.

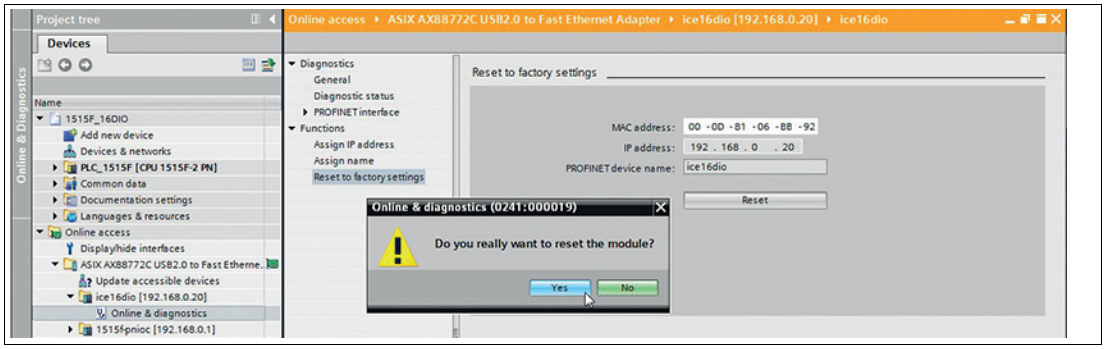


Figure 6.32

6.3 Bit Assignment

The IO-Link master uses a modular device model. Slot 1/sub-slot 1 contains the status/control module. This module provides 4 bytes of input data and 4 bytes of output data. By selecting an IO-Link master from the GSD file, the module is integrated automatically and cannot be changed. The IO-Link ports use the following sub-slots 2 through 9 in slot 1. Depending on the configuration, they may have a different operating mode and data length.

Process Data Status/Control Module, Slot 1/Sub-slot 1

Digital IO Mapping Mode 1 (Default Mapping)

If mapping mode 1 has been selected in the device configuration, the data of the status/control module is transferred as follows.

Input data of the status/control module

Byte	Byte 0, digital input status							
Bit	7	6	5	4	3	2	1	0
Connec-tion	X4	X4	X3	X3	X2	X2	X1	X1
Pin	**2**	4	**2**	4	**2**	4	**2**	4
Channel	4B	4A	3B	3A	2B	2A	1B	1A

Table 6.10 Byte 0, digital input status

Byte	Byte 1, digital input status							
Bit	7	6	5	4	3	2	1	0
Connec-tion	X8	X8	X7	X7	X6	X6	X5	X5
Pin	2	4	2	4	2	4	2	4
Channel	8B	8A	7B	7A	6B	6A	5B	5A

Table 6.11 Byte 1, digital input status

Byte	Byte 2, IOL-COM status							
Bit	7	6	5	4	3	2	1	0
Connec-tion	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.12 Byte 2, IOL-COM status

Byte	Byte 3, IOL-PD validity							
Bit	7	6	5	4	3	2	1	0
Connec-tion	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.13 Byte 3, IOL-PD validity

- The status of the digital outputs is returned in the digital input status (byte 1).
- **Channel**: Channel number of the PROFINET device model for diagnostic messages.
- **IOL-COM status**: The "IOL-COM status" indicates whether the connection has established communication with the IO-Link device.
- **IOL-PD validity**: "IOL-PD validity" indicates whether the IO-Link process data of the corresponding port is valid.

Output data of the status/control module

Byte	Byte 0, digital output status							
Bit	7	6	5	4	3	2	1	0
Connection	X4	X4	X3	X3	X2	X2	X1	X1
Pin	-	4	-	4	-	4	-	4
Channel	-	4A	-	3A	-	2A	-	1A

Table 6.14 Byte 0, digital output status

Byte	Byte 1, digital output status							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X8	X7	X7	X6	X6	X5	X5
Pin	2	4	2	4	2	4	2	4
Channel	8B	8A	7B	7A	6B	6A	5B	5A

Table 6.15 Byte 1, digital output status

Byte	Byte 2, COM mode							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.16 Byte 2, COM mode

Byte	Byte 3, reserved							
Bit	7	6	5	4	3	2	1	0
Connection	-	-	-	-	-	-	-	-
Pin	-	-	-	-	-	-	-	-
Channel	-	-	-	-	-	-	-	-

Table 6.17 Byte 3, reserved

- **Byte 0** (Pin 4, C/Q mode): The digital output at the corresponding port can be controlled via the process data.

  The IO-Link port must be configured as a digital output in the engineering tool.
- **Byte 2** (COM mode) can be used temporarily as long as the corresponding COM control bit is set. It switches one or more IO-Link connections previously configured as "IOL SIO" to IO-Link operating mode.

  This makes it possible to establish communication with the connected IO-Link device for parameterization.
  No process data is exchanged during this time.

Digital IO Mapping Mode 2 (Alternative Mapping)

If mapping mode 2 has been selected in the device configuration, the data of the status/control module is transferred as follows.

Input data of the status/control module

Byte	Byte 0, digital input status							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.18 Byte 0, digital input status

Byte	Byte 1, digital input status							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	**2**	**2**	**2**	**2**	2	2	2	2
Channel	8B	7B	6B	5B	4B	3B	2B	1B

Table 6.19 Byte 1, digital input status

Byte	Byte 2, IOL-COM status							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.20 Byte 2, IOL-COM status

Byte	Byte 3, IOL-PD validity							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.21 Byte 3, IOL-PD validity

- The status of the digital outputs is returned in the digital input status (byte 1).
- **Channel**: Channel number of the PROFINET device model for diagnostic messages.
- **IOL-COM status**: The "IOL-COM status" indicates whether the connection has established communication with the IO-Link device.
- **IOL-PD validity**: "IOL-PD validity" indicates whether the IO-Link process data of the corresponding port is valid.

Output data of the status/control module

Byte	Byte 0, digital output status							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.22 Byte 0, digital output status

Byte	Byte 1, digital output status							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	2	2	2	2	-	-	-	-
Channel	8B	7B	6B	5B	-	-	-	-

Table 6.23 Byte 1, digital output status

Byte	Byte 2, COM mode status							
Bit	7	6	5	4	3	2	1	0
Connection	X8	X7	X6	X5	X4	X3	X2	X1
Pin	4	4	4	4	4	4	4	4
Channel	8A	7A	6A	5A	4A	3A	2A	1A

Table 6.24 Byte 2, COM mode status

Byte	Byte 3, reserved							
Bit	7	6	5	4	3	2	1	0
Connection	-	-	-	-	-	-	-	-
Pin	-	-	-	-	-	-	-	-
Channel	-	-	-	-	-	-	-	-

Table 6.25 Byte 3, reserved

- **Byte 0** (Pin 4, C/Q mode): The digital output at the corresponding port can be controlled via the process data.

  The IO-Link connection must be configured as a digital output in the engineering tool.
- **Byte 2** (COM mode) can be used temporarily as long as the corresponding COM control bit is set. It switches one or more IO-Link connections previously configured as "IOL SIO" to IO-Link operating mode.

  This makes it possible to establish communication with the connected IO-Link device for parameterization.
  No process data is exchanged during this time.

IO-Link Connections Process Data, Slot 1/Sub-Slot 2 - Sub-Slot 9

The process data lengths of the IO-Link connections in COM mode depend on the configurations of IO-Link connections X1 - X8. Data lengths of 1 - 32 bytes of input data and/or 1 - 32 bytes of output data are configurable.

The data content can be taken from the descriptions of the IO-Link devices.

If no precise data length exists for the IO-Link device configuration, always select the next larger data length.

The mapping mode selected for the status/control module has no influence on the process data of the IO-Link connections.

7 The Integrated Web Server

The module has an integrated web server that provides functions for configuring modules, and displaying status and diagnostic information.

The web interface offers an overview of the module configuration and status. It can also be used to adjust specific settings, perform a restart, reset to factory settings, and update firmware.

Status Page

Enter `http://` in the address bar of the web browser, followed by the IP address, e.g., `http://192.168.1.1`.

If the module home page does not open, please check your browser and firewall settings.

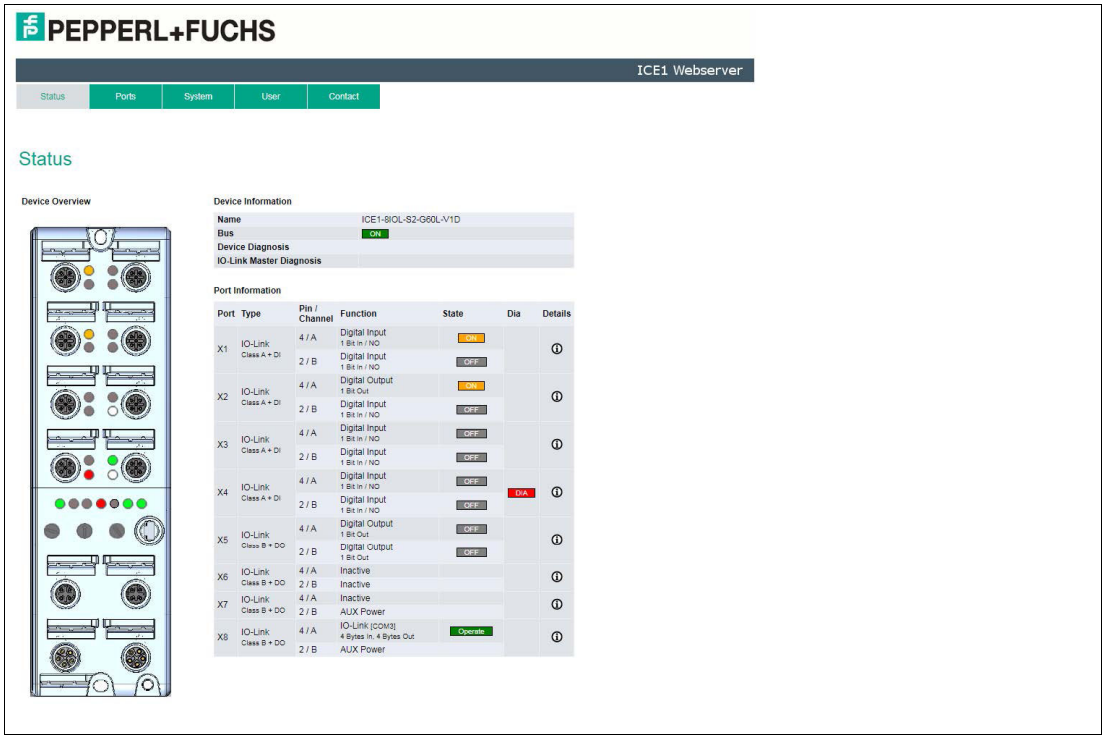


Figure 7.1

This page serves as a starting point for access to the integrated web server.

Device Overview

The left side shows a graphical representation of the module with all LEDs and the positions of the rotary coding switches

Device Information

The "Device Information" table contains some basic data on the module, e.g., the version, the state of the cyclic communication, and a diagnostic indicator. The diagnostic indicator shows whether a diagnosis is present in the module.

Port Information

The "Port Information" table indicates the configuration and status of all I/O ports of the module.

Ports (Connection Side)

Click the "Ports" tab in the menu bar of the start window. A new window opens with the details of the individual ports:

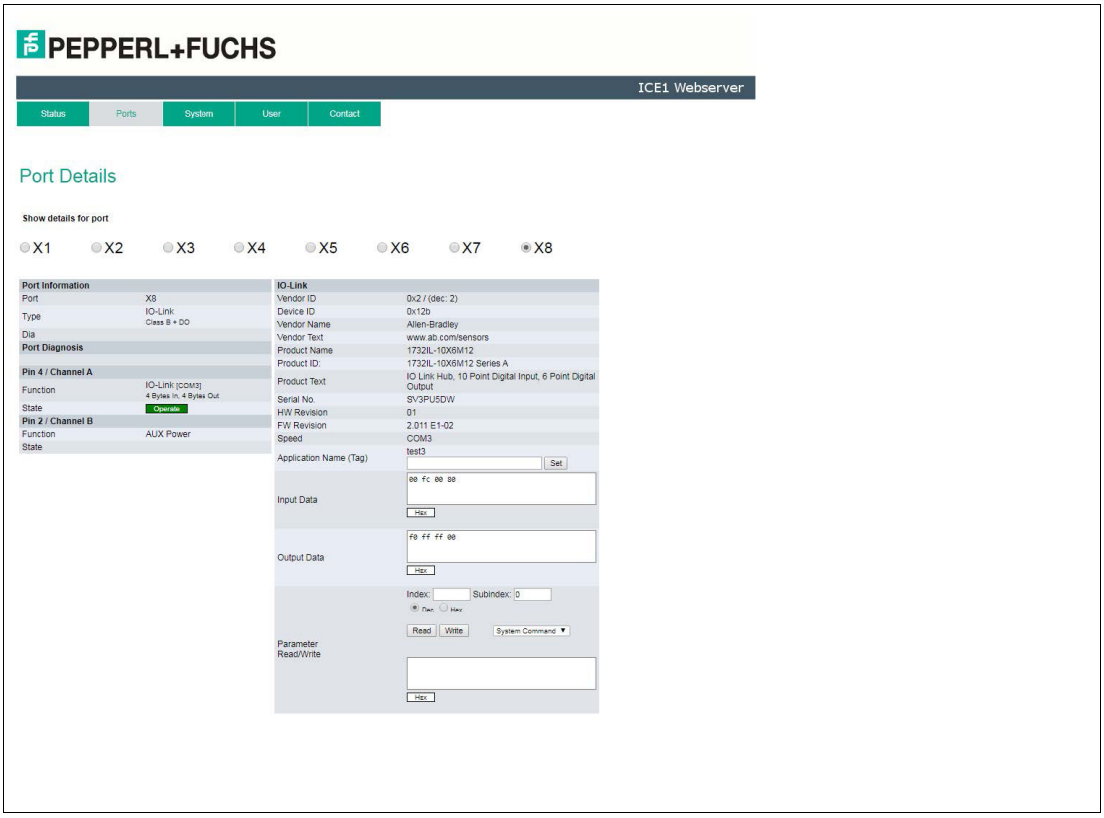


Figure 7.2

Detailed port information is displayed.

- Port Diagnosis shows incoming and outgoing diagnoses in plain text.
- Pin 2 and pin 4 contain information about the configuration and status of the port.
- Additional information about the connected sensor and its process data is shown under IO-Link.

System Page

Click the "System" tab in the menu bar of the start window. A new window opens with information on the system of the module:

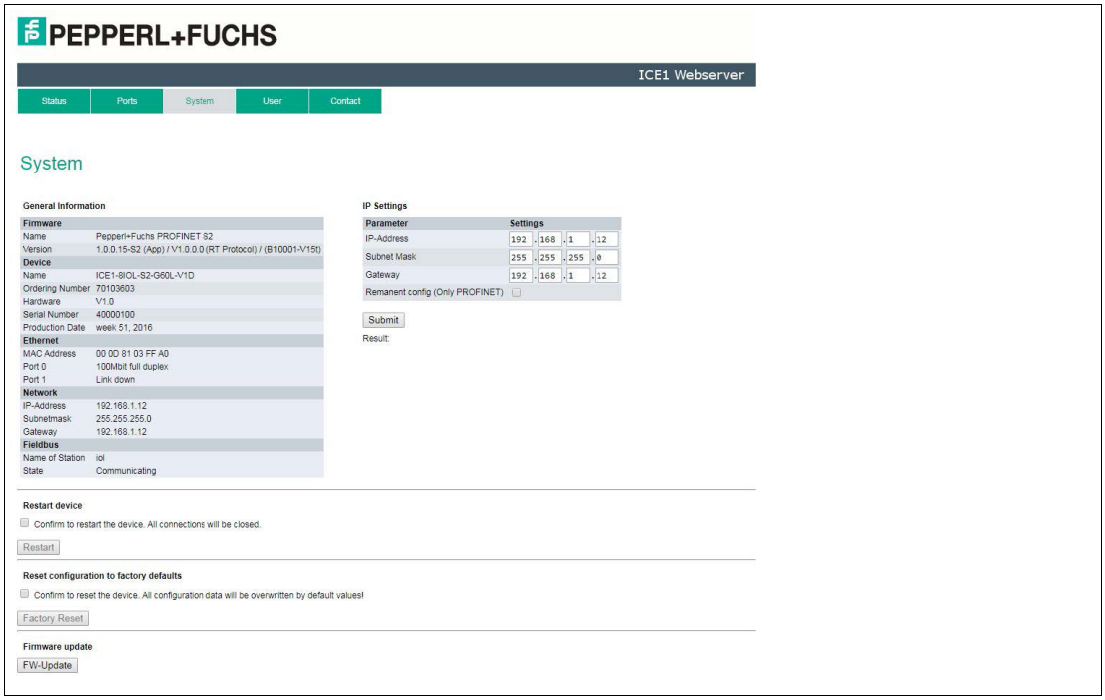


Figure 7.3

This page contains information about the following values and parameters:

- The firmware name and version is displayed under "Firmware".
- The "Device" section contains all the information about the module itself.
- Restart device
  - The module initializes a software reset.
- Reset configuration to factory defaults
  - The module restores the default factory settings.

Note

During a factory reset, the "BF/MS/RUN" LED will light up red three times. Once reset to the factory settings, the "BF/MS/RUN" LED will light up green three times. Once the LED has lit up green three times, restart the device and wait ten seconds.

- Firmware update

  The module initializes a firmware update.
  Select the provided *.ZIP container to update firmware. For firmware updates, please contact our support team. Follow the instructions that appear on the screen.

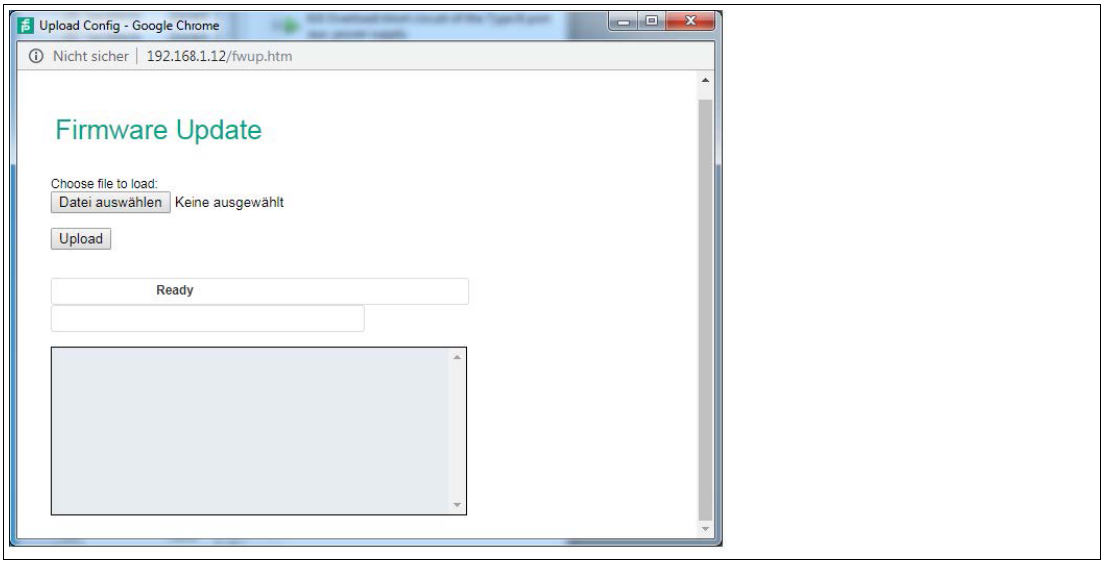


Figure 7.4

User Administration

Click on the "User" tab in the menu bar of the start window. A new window opens with the user administration settings for the module:

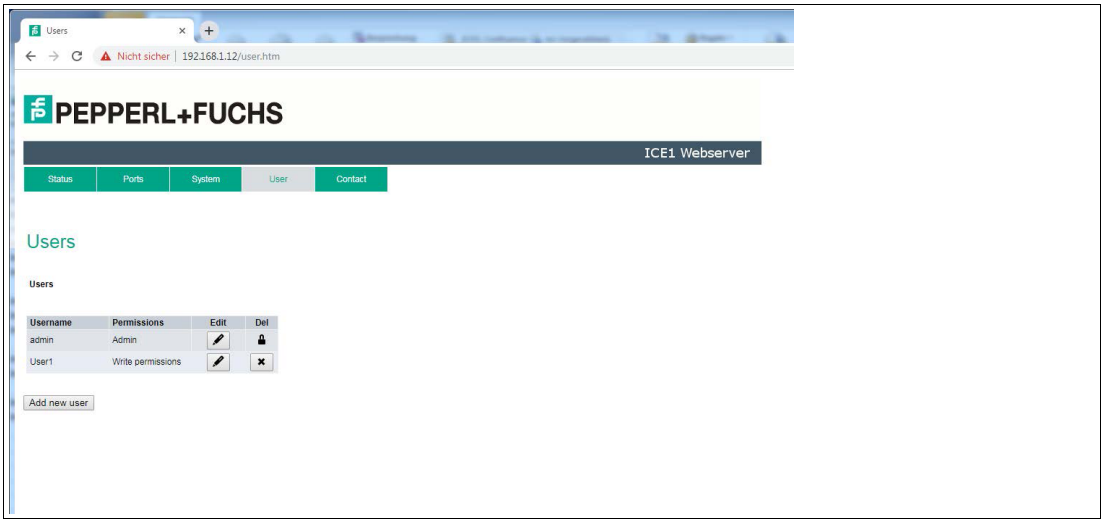


Figure 7.5

This page contains the settings relevant to managing the users of the module. New users can be added with **Admin** or **Write** access permissions.

Tip

For security reasons, change the default admin password once the device has been configured.

Default user login data:

- User: admin
- Password: private

Contact Page

Click on the "Contact" tab in the menu bar of the start window. A new window with the contact data of Pepperl+Fuchs opens:

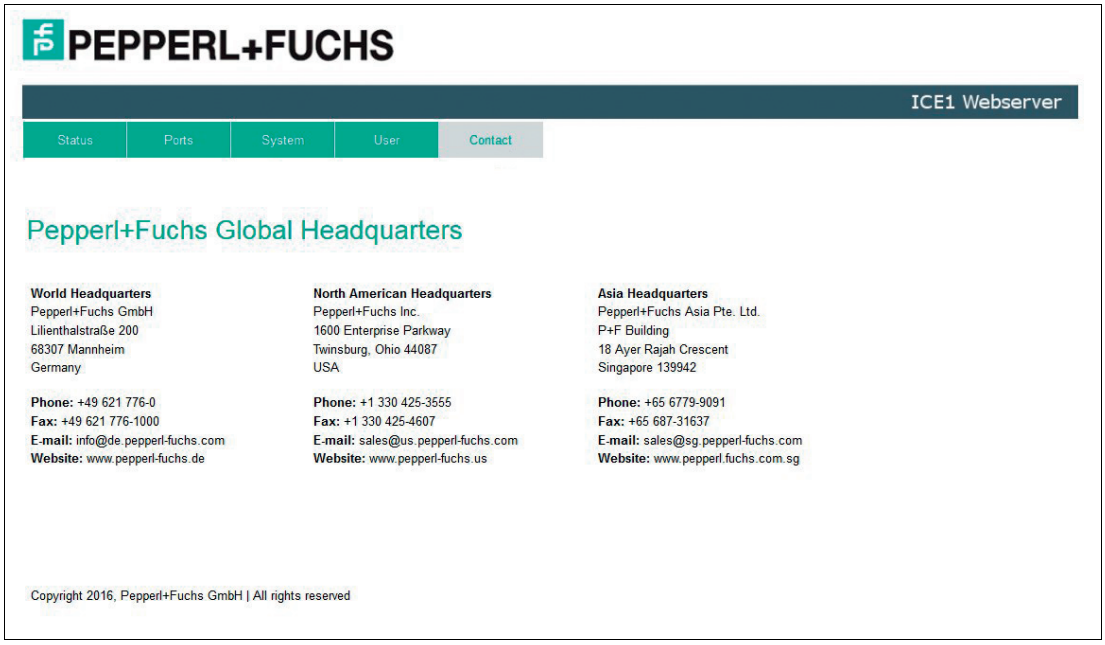


Figure 7.6

The address of the contact page is:

http://[IP address]/contact.htm

This page provides information about Pepperl+Fuchs Group contact details.

8 Troubleshooting

8.1 Diagnostics Indicator in the Integrated Web Server

The module shows the error diagnostics on the connection page of the integrated web server. For information on how to call up the connection page, see chapter 7.

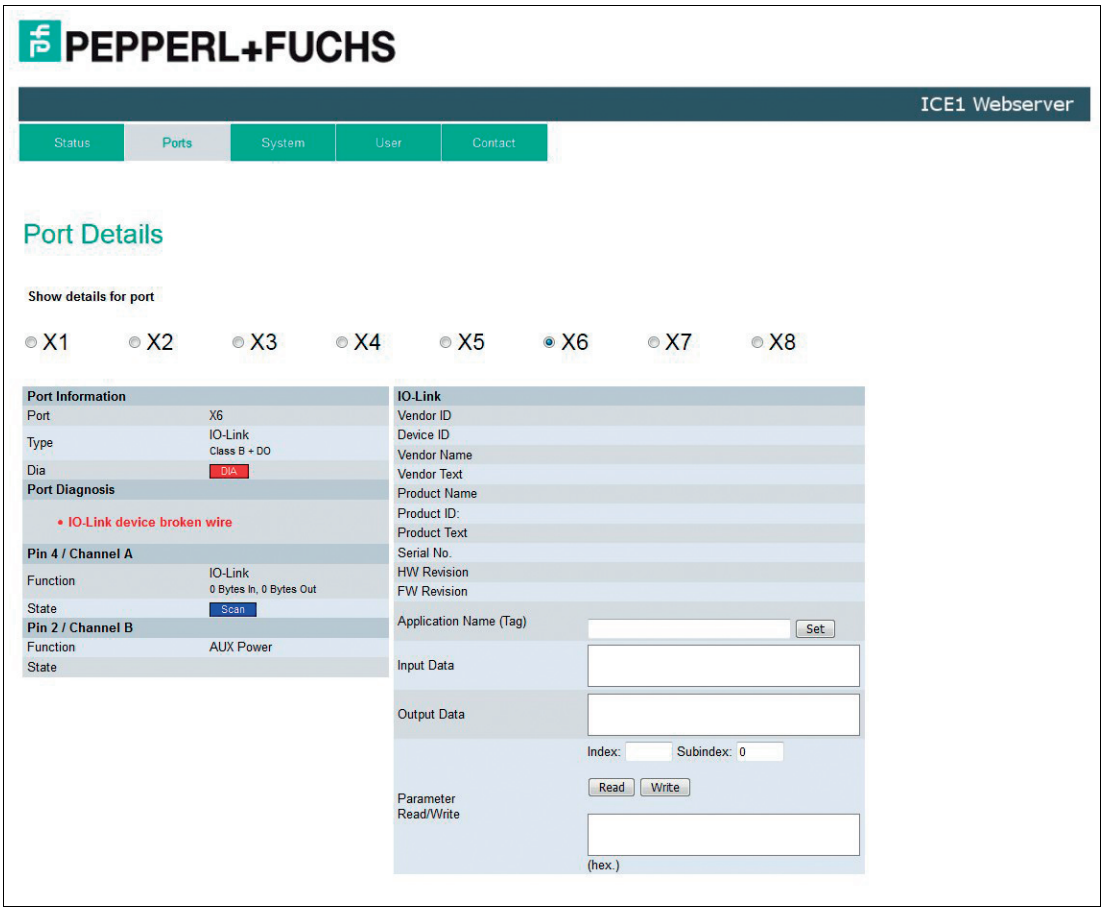


Figure 8.1

Diagnostic data is displayed in the "Port Diagnosis" area of the connection page, according to the connection.

8.2 Alarm Signals and Error Messages from Modules via PROFINET

Note

Alarm signals and error messages are only transmitted via PROFINET if the parameter for diagnosis is activated in the controller when the modules are configured.

If the modules detect a fault state, they trigger an alarm signal. The modules support diagnostic alarms. Diagnostic alarms are triggered by periphery faults, such as overloads, short circuits, and low voltage.

An alarm is triggered both by incoming events (e.g., sensor short circuits) and outgoing events.

The alarms are evaluated dependent on the PROFINET IO controller used.

Evaluating Alarms in the TIA portal

If a diagnostics alarm is triggered, the user program in the TIA portal is interrupted and a diagnostics block is called. The following blocks are used:

2022-06

Cause	OB call
Diagnostics alarm (short circuit, overload, wire break, low voltage on an I/O module)	OB82
Failure of a station or a rack	OB86

The initial information regarding the cause and type of fault is provided by the OB called and its start information. More detailed information regarding the error event can be obtained in the error OB by calling RALRM_SFB [SFB54] (read supplementary alarm information). For this purpose, SFB 54 must called in every error OB.

If the error OB called does not exist in the CPU, the CPU switches into the STOP operating state.

The Structure of the Diagnostics Data Records

Block version 0x0101 and the format identifier (USI, User Structure Identifier) 0x8000 are used to display the diagnostics data records.

The data values "ChannelNumber" and "ChannelError" contain the following values, depending on the error that has occurred:

Type of error	Source of fault	Channel number	Error code
Undervoltage/overvoltage of sensor/system power supply	Module	0x8000 (diagnosis not channel-specific)	0x0002
Auxiliary voltage/actuator voltage too low	Auxiliary voltage	0x8000 (diagnosis not channel-specific)	0x0103
Overload/short circuit of the sensor supply	IO port (pin 1)	0x01 to 0x08	0x01
Port driver temperature excess	IO port (pin 1)	0x01 to 0x08	0x0113
Overload/short circuit of the digital 500 mA outputs	IO port (pin 4)	0x01 to 0x08	0x010A
Overload/short circuit of the digital 2 A outputs	IO port (pin 2)	0x05 - 0x08	0x0109
Overload/short circuit of auxiliary power supply (U_{Aux}) at Class B port	IO port (pin 2)	0x05 - 0x08	0x0108
IO-Link C/Q Error	IO port (pin 4)	0x01 - 0x08	0x0006
IO-Link device diagnosis	IO-Link device	0x01 - 0x08	Dependent on the IO-Link device diagnosis Extended diagnosis: 0x9000

Display of diagnosis in the TIA Portal

1. Select the faulty I/O module in the hardware manager and navigate to its device view.
2. Select the affected channel/the submodule.
3. Open the online diagnostics by right-clicking with the mouse and select the menu item "Online & diagnostics > Channel diagnostics."

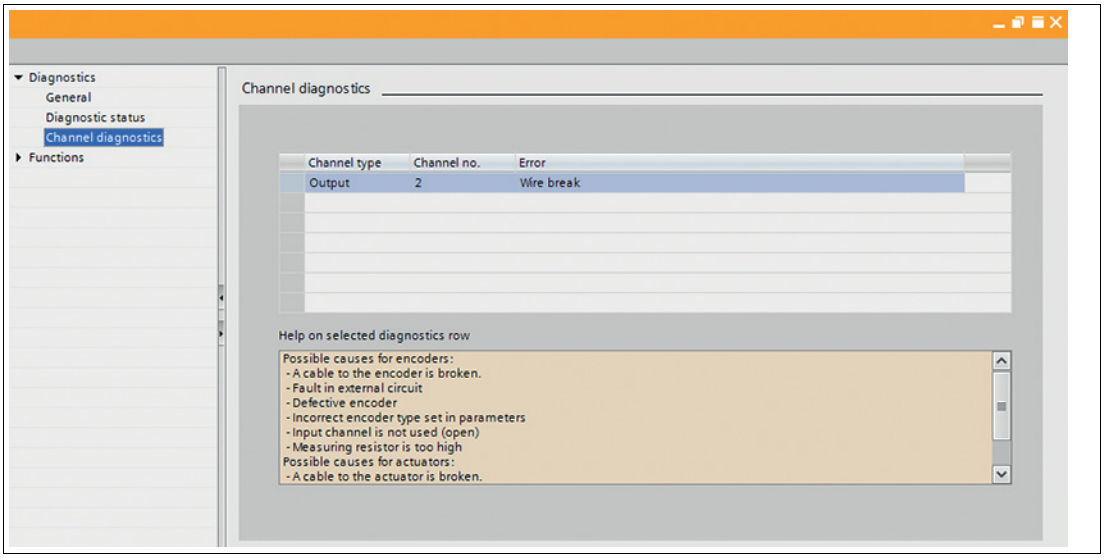


Figure 8.2

8.3 Alarm Signals and Error Messages via Ethernet IP

Errors in the System/Sensor Power Supply

The voltage value of the power supply for the system and the sensors is monitored globally.

An error message is generated if the voltage drops below approx. 18.6 V or rises above 30 V.

The green U_S LED is switched off.

The error message has no effect on the outputs.

Caution!

Power supply

It must be ensured that the supply voltage, measured at the most remote node, does not fall below 18 V_{DC}.

The following table shows the diagnostic bits used in the status data of the IO-Link master.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	MI-SCB	MI-SCA	MI-SCS	MI-LVA	**MI-LVS**

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-LVS**: Module information—low-voltage system/sensor power supply

Error in the Auxiliary Voltage/Actuator Power Supply

The voltage value of the power supply for the auxiliary voltage/actuator power supply is monitored globally.

2022-06

If the U_{AUX} diagnostic messaging is enabled, an error message is generated as soon as the voltage falls below approx. 18.6 V or rises above 30 V.

The red U_{AUX} LED lights up.

If the output channels are enabled, additional error messages, which are caused by the power failure, are generated at the IO-Link connections.

The U_{AUX} diagnostic message is disabled by default and must be enabled through parameterization.

The following table shows the used diagnostic bits in the status data of the IO-Link master:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	MI-SCB	MI-SCA	MI-SCS	**MI-LVA**	MI-LVS

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-LVS**: Module information—low-voltage system/sensor power supply

Overload/Short Circuit of the Sensor Supply Outputs of the IO-Link Connections

In the event of an overload or short circuit between pin 1 and pin 3 at connections X1 - X8, the following channel-specific diagnostic messages are generated:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	MI-SCB	MI-SCA	**MI-SCS**	MI-LVA	MI-LVS
Byte 6	**SCS-X8**	**SCS-X7**	**SCS-X6**	**SCS-X5**	**SCS-X4**	**SCS-X3**	**SCS-X2**	**SCS-X1**

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-LVS**: Module information—low-voltage system/sensor power supply
- **SCS-X1 ... SCS-X8**: Sensor short circuit at connections X1 to X8

Overload/Short Circuit of the Digital 500 mA Outputs

The digital outputs at the C/Q pin are protected against short circuit and overload. In case of a fault, the output is switched off automatically and cyclically switched on again automatically.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	MI-SCB	**MI-SCA**	MI-SCS	MI-LVA	MI-LVS
Byte 8	**CE-X8A**	**CE-X7A**	**CE-X6A**	**CE-X5A**	**CE-X4A**	**CE-X3A**	**CE-X2A**	**CE-X1A**

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-LVS**: Module information—low-voltage system/sensor power supply
- **CE-X1A ... CE-X8A**: Channel error, channel A (pin 4) of connections X1 to X8

Overload/Short Circuit of the Digital 2 A Outputs

There are four 2 A outputs at the B connections of the modules. A channel error is identified by comparing the target value set by a controller and the actual value of an output channel.

Target value	Actual value	Comment
Active	Active	OK, no diagnosis
Off	Off	OK, no diagnosis
Active	Off	Short circuit Channel display is red Channel error bit is set in the diagnosis. Channel is locked once the error has been resolved

If an output channel is enabled (rising edge of the channel status) or disabled (falling edge), the channel errors are filtered for the period of time that you have set with the "Surveillance Time-out" parameter in the module configuration. The value of this parameter can range from 0 to 255 ms; the factory setting is 80 ms. The filter is used to prevent premature error messages when a capacitive load is enabled or an inductive load is disabled and, in the event of other voltage peaks, when a status changes.

When the output channel is in the static state, i.e., while the channel is permanently switched on or switched off, the filter time between error detection and the diagnostic message is typically 5 - 10 ms.

The following table shows the used diagnostic bits in the status data of the IO-Link master:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	**MI-SCB**	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 9	**CE-X8B**	**CE-X7B**	**CE-X6B**	**CE-X5B**	0	0	0	0

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply

2022-06

- **MI-LVS**: Module information—low-voltage system/sensor power supply
- **CE-X5B ... CE-X8B**: Channel error, channel B (pin 2) of connections X1 to X8

Overload/Short Circuit of the Auxiliary Power Supply of the Type B Connection

In the event of an overload or short circuit between pin 2 and pin 5 at connections X5 - X8, the following group diagnostic message (not channel-specific) is generated in the status data of the IO-Link master:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	**MI-SCB**	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 9	**CE-X8B**	**CE-X7B**	**CE-X6B**	**CE-X5B**	0	0	0	0

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-LVS**: Module information—low-voltage system/sensor power supply
- **CE-X5B ... CE-X8B**: Channel error, channel B (pin 2) of connections X1 to X8

IO-Link Master Error

IO-Link C/Q Error

If an IO-Link device is disconnected in COM mode or an electrical fault occurs at the C/Q line (pin 4), e.g., due to a short circuit, the following diagnostic bits can be set in the IO-Link master status data:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	MI-SCB	**MI-SCA**	MI-SCS	MI-LVA	MI-LVS
Byte 8	**CE-X8A**	**CE-X7A**	**CE-X6A**	**CE-X5A**	**CE-X4A**	**CE-X3A**	**CE-X2A**	**CE-X1A**

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-LVS**: Module information—low-voltage system/sensor power supply
- **CE-X1A ... CE-X8A**: Channel error, channel A (pin 4) of connections X1 to X8

IO-Link Validation Error

If an IO-Link device is removed in COM mode and the validation is parameterized, or a validation error is detected, e.g., due to an incorrect vendor ID or device ID, the following diagnostic bits can be set in the IO-Link master status data:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	**MI-VAL**	MI-SCB	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 13	**VAL-X8**	**VAL-X7**	**VAL-X6**	**VAL-X5**	**VAL-X4**	**VAL-X3**	**VAL-X2**	**VAL-X1**

This includes:

- **MI-FMA**: Module information—force mode active
- **MI-VAL**: Module information—IO-Link validation error
- **MI-SCB**: Module information—actuator short circuit, channel B
- **MI-SCA**: Module information—actuator short circuit, channel A
- **MI-SCS**: Module information—sensor short circuit
- **MI-LVA**: Module information—low-voltage auxiliary power supply
- **MI-LVS**: Module information—low-voltage system/sensor power supply
- **VAL-X1A ... VAL-X8A**: IO-Link master validation error, channel A (pin 4, C/Q) of connections X1 to X8

IO-Link device diagnosis

The diagnosis of IO-Link devices contains errors, a warning, or a notification.

IO-Link Device Error

In the event that a device sends a fault diagnosis to the master, the following diagnostic bits can be set in the IO-Link master status data:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 5	0	0	0	0	0	IOL-DN	IOL-DW	**IOL-DE**
Byte 6	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 10	**DE-X8A**	**DE-X7A**	**DE-X6A**	**DE-X5A**	**DE-X4A**	**DE-X3A**	**DE-X2A**	**DE-X1A**
Byte 11	DW-X8A	DW-X7A	DW-X6A	DW-X5A	DW-X4A	DW-X3A	DW-X2A	DW-X1A
Byte 12	DN-X8A	DN-X7A	DN-X6A	DN-X5A	DN-X4A	DN-X3A	DN-X2A	DN-X1A
Byte 13	VAL-X8	VAL-X7	VAL-X6	VAL-X5	VAL-X4	VAL-X3	VAL-X2	VAL-X1

This includes:

- **IOL-DN**: Module information—IO-Link device notification
- **IOL-DW**: Module information—IO-Link device warning
- **IOL-DE**: Module information—IO-Link device fault
- **SCS-X1 ... SCS-X8**: Sensor short circuit at connections X1 to X8
- **DE-X1A ... DE-X8A**: IO-Link device error message, channel A (pin 4, C/Q) of connections X1 to X8
- **DW-X1A ... DW-X8A**: IO-Link device warning message, channel A (pin 4, C/Q) of connections X1 to X8
- **DN-X1A ... DN-X8A**: IO-Link device notification, channel A (pin 4, C/Q) of connections X1 to X8
- **VAL-X1A ... VAL-X8A**: IO-Link master validation error, channel A (pin 4, C/Q) of connections X1 to X8

IO-Link Device Warning

In the event that a device sends a warning to the master, the following diagnostic bits can be set in the IO-Link master status data:

2022-06

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 5	0	0	0	0	0	IOL-DN	**IOL-DW**	IOL-DE
Byte 11	**DW-X8A**	**DW-X7A**	**DW-X6A**	**DW-X5A**	**DW-X4A**	**DW-X3A**	**DW-X2A**	**DW-X1A**
Byte 12	DN-X8A	DN-X7A	DN-X6A	DN-X5A	DN-X4A	DN-X3A	DN-X2A	DN-X1A

This includes:

- **IOL-DN**: Module information—IO-Link device notification
- **IOL-DW**: Module information—IO-Link device warning
- **IOL-DE**: Module information—IO-Link device fault
- **DW-X1A ... DW-X8A**: IO-Link device warning message, channel A (pin 4, C/Q) of connections X1 to X8
- **DN-X1A ... DN-X8A**: IO-Link device notification, channel A (pin 4, C/Q) of connections X1 to X8

IO-Link Notification

In the event that a device sends a notification to the master, the following diagnostic bits can be set in the IO-Link master status data:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	0	MI-FMA	MI-VAL	MI-SCB	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 5	0	0	0	0	0	**IOL-DN**	IOL-DW	IOL-DE
Byte 6	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 7	0	0	0	0	0	0	0	0
Byte 8	CE-X8A	CE-X7A	CE-X6A	CE-X5A	CE-X4A	CE-X3A	CE-X2A	CE-X1A
Byte 9	CE-X8B	CE-X7B	CE-X6B	CE-X5B	0	0	0	0
Byte 10	DE-X8A	DE-X7A	DE-X6A	DE-X5A	DE-X4A	DE-X3A	DE-X2A	DE-X1A
Byte 11	DW-X8A	DW-X7A	DW-X6A	DW-X5A	DW-X4A	DW-X3A	DW-X2A	DW-X1A
Byte 12	**DN-X8A**	**DN-X7A**	**DN-X6A**	**DN-X5A**	**DN-X4A**	**DN-X3A**	**DN-X2A**	**DN-X1A**
Byte 13	VAL-X8	VAL-X7	VAL-X6	VAL-X5	VAL-X4	VAL-X3	VAL-X2	VAL-X1

Your automation, our passion.

Explosion Protection

- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
- Connectivity

Pepperl+Fuchs Quality
Download our latest policy here:

www.pepperl-fuchs.com/quality

PEPPERL+FUCHS

www.pepperl-fuchs.com

/ DOCT-5792E