ICE1-*-G60L-V1D, ICE1-*-G60L-C1-V1D

Fieldbus Modules with Multiprotocol Technology

Manual

PROFINET® EtherNet/IP™ EtherCAT®

Your automation, our passion.

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1 Safety

1.1 Introduction

1.1.1 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.

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

1.1.2 Manufacturer

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Internet: www.pepperl-fuchs.com

1.1.3 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.

1.1.4 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

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

2 Product Description

2.1 Use and Application

Module Description

The ICE1-*-G60L-*- 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. To do so, in addition to the fieldbus interface, different variants of the modules have a different number of ports for digital inputs and outputs.

The following module types are described in this manual:

- Ethernet IO module with fixed number of inputs/outputs

  8DI8DO modules

  - ICE1-8DI8DO-G60L-V1D: Ethernet IO module with 8 digital inputs (8DI) and 8 digital outputs (8DO)
  - ICE1-8DI8DO-G60L-C1-V1D: Ethernet IO module with 8 digital inputs (8DI), 8 digital outputs (8DO) and decentralized control function

  16DI modules

  - ICE1-16DI-G60L-V1D: Ethernet IO module with 16 digital inputs (16DI)
- Ethernet IO module with configurable inputs/outputs

  16DIO modules

  - ICE1-16DIO-G60L-V1D: Ethernet IO module with 16 digital inputs/outputs (16DIO), freely configurable
  - ICE1-16DIO-G60L-C1-V1D: Ethernet IO module with 16 digital inputs/outputs (16DIO), freely-configurable and decentralized control function

The modules have an integrated 2-port switch, have multiprotocol capability and can be configured for EtherNet/IP, PROFINET, or EtherCAT. 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 rapid extension is also possible.

The ICE1-*-G60L-* 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, or EtherCAT)

The Ethernet IO modules are multiprotocol modules and allow you to select one of many 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.

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. This does not apply to the 16DIO modules due to the configurable inputs/outputs.

- **Integrated web server**

  Network parameters such as IP address, subnet mask, and gateway can be adjusted via control switches (last byte of the IP address) or the integrated web server. The modules support the communication protocols BOOTP and DHCP for automated assignment of network parameters via the corresponding servers.

- **Integrated network switch**

  The integrated 2-port Ethernet switch of the modules allows you to set up a line topology for an EtherCAT® network 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 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 with output functionality offer 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 more quickly, for example.

- **Force Mode**

  "Force Mode" allows the simulation of process data at the 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.

- **Decentralized control function on C1 modules**

  ICE1-*-G60L-**C1**-V1D modules with decentralized control function (DCU) can control applications independently using an integrated programmable logic. They can therefore run timers, counters and other functions and can optionally exchange data with a higher-level controller. The program's residual storage is ideal for plug and play operation. This allows installation and maintenance of these modules to be quick and intuitive. Details on programming the decentralized control function can be found in the chapter "Decentralized Control Function."

- **Flex-Bit technology on 16DIO modules (IO mapping):**

  With Flex-Bit-technology, it is possible to change the IO mapping of process data. As a rule, each channel is statically assigned to a bit in the process data. This function allows the data direction of a channel to be determined, along with its process data bit assignment. By configuring the IO mapping, it is therefore possible to operate Ethernet IO modules in applications with bit mappings from other manufacturers.

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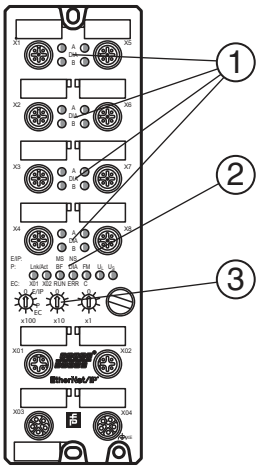
- **Automatic configuration of inputs/outputs on 16DIO modules via input/output profiles**

  The 16DIO modules can be used universally and offer a variety of input/output profiles as basic configuration. By selecting a predefined profile, you can very easily preconfigure a 16DIO module as, among other things, a 16DI, 16DO, or 8DI8DO module. This allows quick and easy replacement of existing modules within the plant.

2.2 Displays and Operating Elements



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).

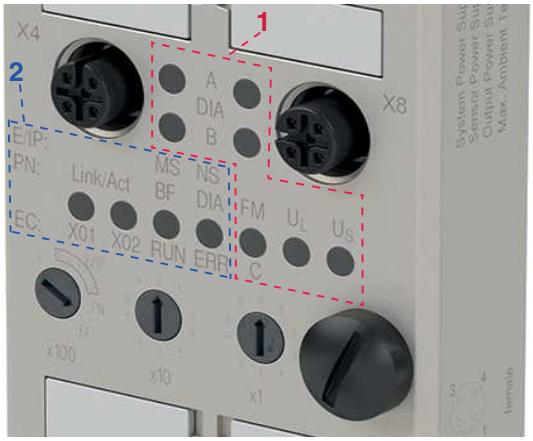


Figure 2.1

- E/IP: EtherNet/IP
- P: PROFINET
- EC: EtherCAT

Displays - General Part

Description for LED A, B, DIA, U_S, U_S, DCU/FM

LED	Function
LED A (for each of X1 - X8) DIA	White: channel A status is "on" Off: no error, not connected Red: peripheral error (sensor/actuator overload or short circuit)
LED B X1 - X8 B DIA	White: channel B status is "on" Off: no error, not connected Red: peripheral error (sensor/actuator overload or short circuit)
LED U_S	Green: voltage 19 V ≤ U_S ≤ 30 V Red: voltage U_S < 19 V or U_S > 30 V
LED U_L[1]	Green: voltage 19 V ≤ U_L ≤ 30 V Red: voltage U_L < 19 V or U_L > 30 V
LED C/FM Only ICE1-8DI8DO-G60L-C1-V1D And ICE1-16DIO-G60L-C1-V1D	Blue: DCU function is stopped Flashing blue: DCU function is working Off: DCU function not active; Force Mode disabled Flashing red: DCU function error Flashing blue/red: Force Mode enabled
LED FM For modules without decentralized control function (C1 modules)	Off: Force Mode disabled Flashing blue/red: Force Mode enabled

Table 2.1

1. Only 8DI8DO and 16DIO

EtherNet/IP Displays

E/IP area: relevant LEDs Lnk/Act, MS, NS

LED	Function
LED Lnk/Act	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 Off: module is turned off or does not have an IP address

Table 2.2

PROFINET Displays

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

LED	Function
LED Lnk/Act	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: no data exchange with IO device Off: no error
LED DIA	Red: watchdog timeout or diagnosis occurring, or system error Flashing red for 3 sec: DCP signal service triggered via the bus Off: no error

Table 2.3

EtherCAT Displays

EC area: relevant LEDs X01, X02 , RUN, ERR

LED	Function
LED X01	Green: connection to an Ethernet node Flashing yellow: data exchange with an IO device Off: no connection
LED X02	Green: connection to an Ethernet node Flashing yellow: data exchange with an IO device Off: no connection
LED RUN	Green: OPERATIONAL status 1 x flashing green: SAFE OPERATIONAL status Flashing green: PRE-OPERATIONAL status Flickering green: module is starting up and is not yet in INIT state, or module is in BOOTSTRAP state and is loading firmware. Off: INIT status
LED ERROR	Red: control error, e.g., PDI watchdog timeout Flickering: error during booting Flashing red: incorrect configuration; general configuration error 1 x flashing red: local error, undesired status change 2 x flashing red: watchdog error Off: no error

Operating Elements

Switch	Function
Rotary switch X100	Setting the fieldbus protocol Setting the IP address[1]
Rotary switch X10	Setting the IP address
Rotary switch X1	Setting the IP address

1. Only EtherNET/IP

Note

Details on setting the protocol and the IP address can be found in the chapter "Commissioning, Protocol Setting"

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

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

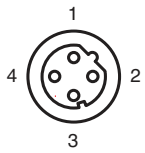


Figure 2.2 Schematic drawing of port X01, X02

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

Caution!

Risk of destruction!

Never route the power supply to the data cable.

Connection for Power Supply X03, X04

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

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 supply via U_L 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_L.

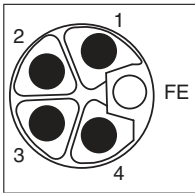


Figure 2.3 Schematic drawing of M12 L-encoding (plug); port X03 (IN)

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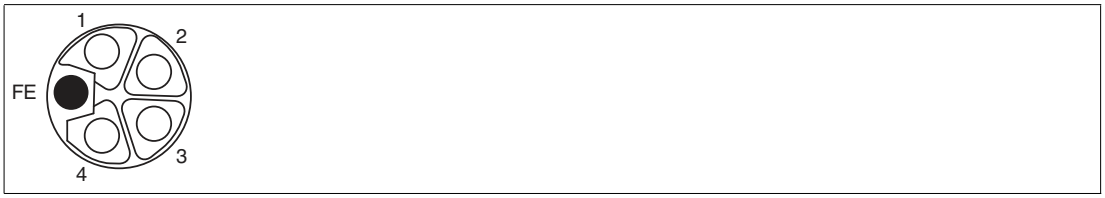

Figure 2.4 Schematic drawing of M12 L-encoding (socket); port X04 (OUT)

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

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.

Connection for Inputs/Outputs X1 ... X8

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

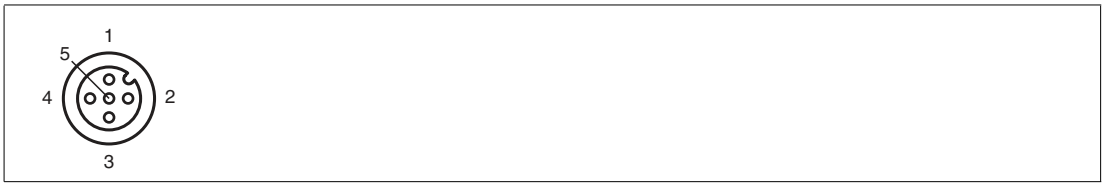

Figure 2.5 Schematic drawing of M12 socket, 5-pin, A-encoded, port X1 ... X8

Note

Depending on the module type, the pins of ports X1 ... X8 are occupied differently.

Note

For inductive loads of usage category DC13 (EN60947-5-1), the outputs are able to control currents of 1.6 A at a frequency of 1 Hz.

Modules ICE1-8DI8DO-G60L-V1D and ICE1-8DI8DO-G60L-C1-V1D

Port	Pin	Signal	Function
Inputs X1 ... X4	1	+24 VDC	Sensor/system supply
	2	IN B	Digital input B
	3	0 VDC	Ground/reference potential
	4	IN A	Digital input A
	5	FE (FE)	Functional ground

Port	Pin	Signal	Function
Outputs X5 ... X8	1	Not used	
	2	OUT B	Digital output B
	3	0 VDC	Ground/reference potential
	4	OUT A	Digital output A
	FE (5)	FE (FE)	Functional ground

Module ICE1-16DI-G60L-V1D

Port	Pin	Signal	Function
Inputs X1 ... X8	1	+24 VDC	Sensor/system supply
	2	In B	Digital input B
	3	0 VDC	Ground/reference potential
	4	In A	Digital input A
	FE (5)	FE (FE)	Functional ground

Modules ICE1-16DIO-G60L-V1D and ICE1-16DIO-G60L-C1-V1D

Port	Pin	Signal	Function
Outputs X1 ... X8	1	+24 VDC	Sensor/system supply
	2	IN B/OUT B	Can be configured as digital input B or output B
	3	0 VDC	Ground/reference potential
	4	IN A/OUT A	Can be configured as digital input A or output A
	FE (5)	FE (FE)	Functional ground

2.4 Dimensions

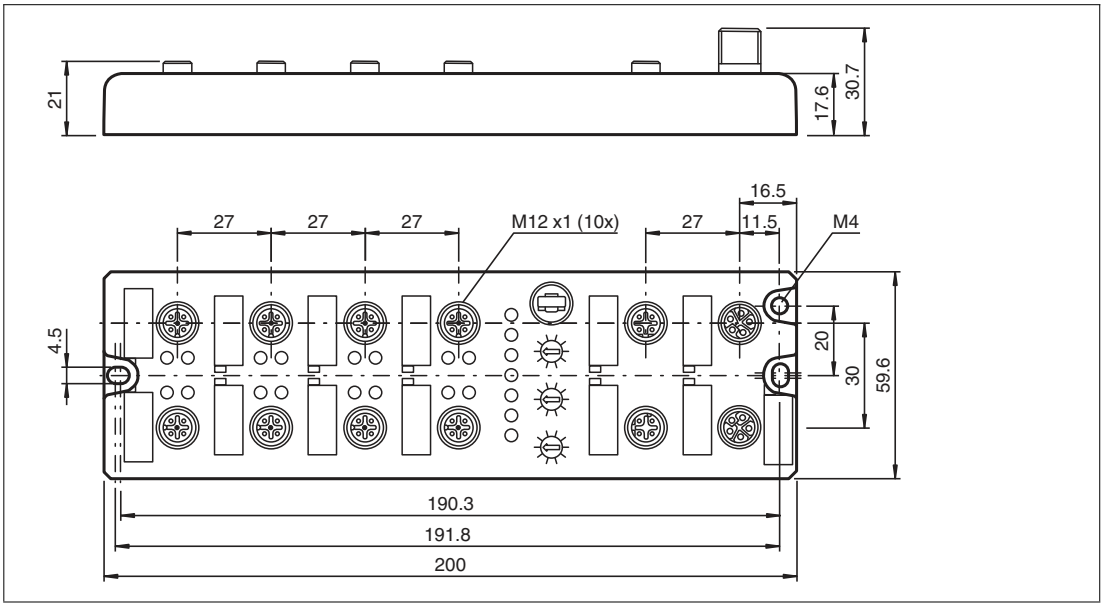

Figure 2.6 ICE1-8DI8DO-G60L-V1D
ICE1-8DI8DO-G60L-C1-V1D
ICE1-16DI-G60L-V1D
ICE1-16DIO-G60L-V1D
ICE1-16DIO-G60L-C1-V1D

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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_L 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_L.

Note

To dissipate interference currents and the EMC strength, 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

To program the controller, please consult the manufacturer information and use only the appropriate accessories.

Note

For UL application:

Only connect Ethernet IO modules using a UL-certified cable with suitable ratings (CYJV or PVVA).

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 cable with heat resistance up to at least 96 °C for the following Ethernet IO modules:

ICE1-8DI8DO-G60L-C1-V1D and ICE1-8DI8DO-G60L-V1D

ICE1-16DIO-G60L-V1D and ICE1-16DIO-G60L-C1-V1D

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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. For the other rotary switches, set the last two digits of the IP address when using EtherNet/IP.

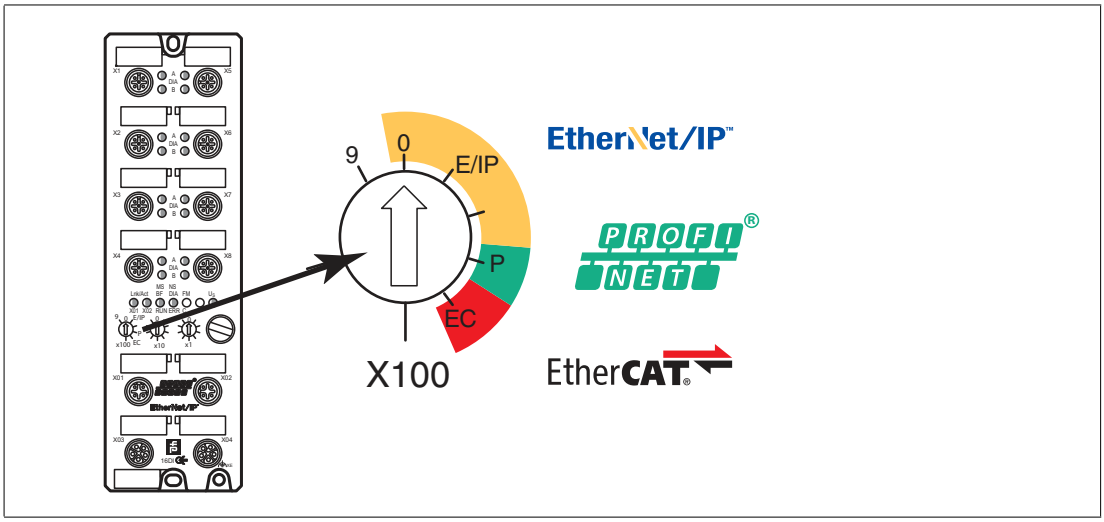

Figure 4.1 Rotary switch X100

Assigning the Protocol Using the Rotary Switches

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

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.

Alternatively, the required network parameters can be obtained via DHCP or BOOTP if the rotary switch is set to zero.

PROFINET

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

EtherCAT

If you are using EtherCAT as the protocol, set rotary switch X100 to the value "EC."

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.

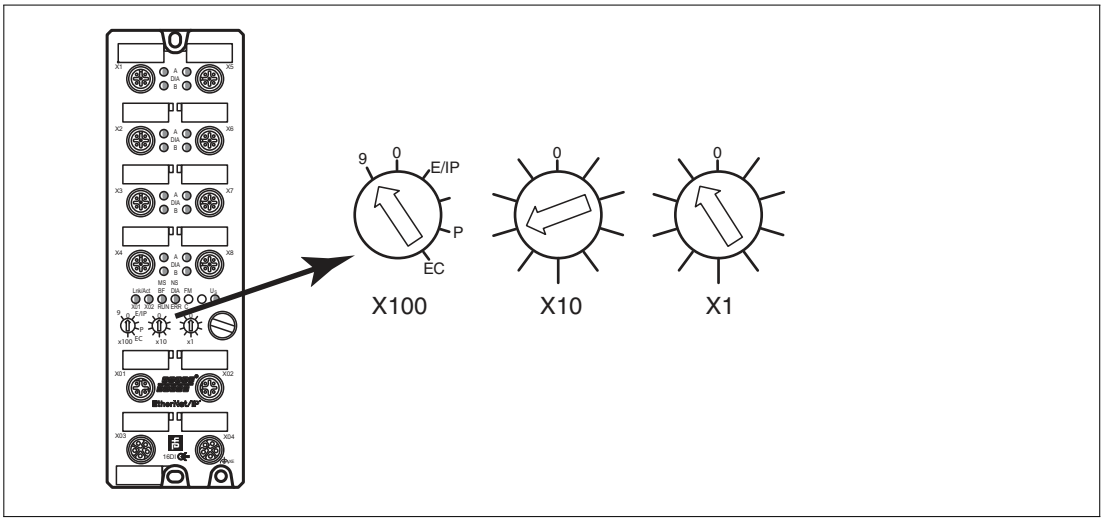

Figure 4.2 Restoring factory settings: X100 = 9, X10 = 7, X1 = 9

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.

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5 Commissioning for EtherNet/IP

5.1 Preparation

To configure a module in the controller, you need an EDS file. Each of the module variants requires its own 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 information about the device, 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 variant 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 right-hand side of the module.

Setting the Network Parameters

Using the three control switches on the front of the modules, you can set the operating mode for receiving network parameters such as the IP address, subnet mask, and gateway address.

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.
255 to 298 (Default: 299)	The network parameters are requested via DHCP and BOOTP but are not saved.

Rotary switch position	Function
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.

Table 5.1

5.2 Configuration

Implicit and Explicit Messaging

The Ethernet IO modules support implicit and explicit messaging for EtherNet/IP communication. IO process data is transmitted on a cyclical basis via assembly objects and an existing connection using implicit messaging.

Low-priority data, non-time-critical data, configuration and diagnostic data can be exchanged via non-cyclical messages using explicit messaging.

Connections and Assembly Object

The Ethernet IO modules support connection types Exclusive Owner, Input Only and Listen Only for exchanging IO process data and communication via implicit messaging.

- **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 (variants 16DIO and 8DI8DO). By selecting the corresponding instance ID for the assembly object, you determine whether the module adds diagnostic data to the standard process data.

The 16DIO-variant Ethernet modules are universally applicable and provide a variety of profiles for basic configuration. Using these, you can preconfigure a 16DIO module as a 16DI, 16DO or 8DI/8DO module, among other things, and replace a module where required, for example. Each I/O channel can be used as an input or output for the 16DI/DO profile. If an I/O channel is used as an input, the PLC programmer should not set the corresponding output bit.

By using the preconfigured alternate profiles, the risk of incorrect configuration is reduced through the use of profiles 16DI, 16DO or 8DI/8DO. In these profiles, the I/O channels are configured as "input" or "output."

Ethernet IO modules of type ICE1-8DI8DO-G60L-C1-V1D ICE1-16DIO-G60L-C1-V1D have the DCU function. For these, the process data is extended in both directions by 18 additional bytes.

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5.2.1 16DIO Modules, Connections and Assembly Objects

Note

The possible profiles for the Ethernet IO module with configurable inputs/outputs are listed below.

First for the ICE1-16DIO-G60L-V1D module and then for the ICE1-16DIO-G60L-C1-V1D module with DCU function.

ICE1-16DIO-G60L-V1D

ICE1-16DIO-G60L-V1D: Ethernet IO module with 16 digital inputs/outputs (16DIO), freely configurable

16-DI/DO Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DI/DO + DIA	Exclusive owner	Yes	Output: 100	2 byte
			Input: 101	7 byte
16 DI/DO	Exclusive owner	No	Output: 100	2 byte
			Input: 102	3 byte
16 DI/DO + DIA	Input only	Yes	Output: 193	0 byte
			Input: 101	7 byte
16 DI/DO	Input only	No	Output: 193	0 byte
			Input: 102	3 byte

Table 5.2

8-DI/DO Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DI/DO + DIA	Exclusive owner	Yes	Output: 103	1 byte
			Input: 104	6 byte
8 DI/DO	Exclusive owner	No	Output: 103	1 byte
			Input: 105	2 byte
8 DI/DO + DIA	Input only	Yes	Output: 193	0 byte
			Input: 104	6 byte
8 DI/DO	Input only	No	Output: 193	0 byte
			Input: 105	2 byte

Table 5.3

16-DI Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DI + DIA	Input only	Yes	Output: 193	0 byte
			Input: 101	7 byte
16 DI	Input only	No	Output: 193	0 byte
			Input: 102	3 byte

Table 5.4

8-DI Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DI + DIA	Input only	Yes	Output: 193	0 byte
			Input: 104	6 byte
8 DI	Input only	No	Output: 193	0 byte
			Input: 105	2 byte

Table 5.5

16-DO Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DO + DIA	Exclusive owner	Yes	Output: 100	2 byte
			Input: 106	5 byte
16 DO	Exclusive owner	No	Output: 100	2 byte
			Input: 107	1 byte

Table 5.6

8-DO Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DO + DIA	Exclusive owner	Yes	Output: 103	1 byte
			Input: 106	5 byte
8 DO	Exclusive owner	No	Output: 103	1 byte
			Input: 107	1 byte

Table 5.7

8-DI/8-DO Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DI/8 DO + DIA	Exclusive owner	Yes	Output: 103	1 byte
			Input: 104	6 byte
8 DI/8 DO	Exclusive owner	No	Output: 103	1 byte
			Input: 105	2 byte
8 DI/8 DO + DIA	Input only	Yes	Output: 193	0 byte
			Input: 104	6 byte
8 DI/8 DO	Input only	No	Output: 193	0 byte
			Input: 105	2 byte

Table 5.8

Generic Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
Generic 16 DI + DIA	Listen only	Yes	Output: 192	0 byte
			Input: 101	7 byte

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Connection	Type of connection	Diagnosis	Instance ID	Length
Generic 16 DI	Listen only	No	Output: 192	0 byte
			Input: 102	3 byte
Generic 8 DI + DIA	Listen only	Yes	Output: 192	0 byte
			Input: 104	6 byte
Generic 8 DI	Listen only	No	Output: 192	0 byte
			Input: 105	2 byte

Table 5.9

Even-Number DI/DO-Byte Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DI/DO + DIA	Exclusive owner	Yes	Output: 100	2 byte
			Input: 108	8 byte
16 DI/DO + DIA	Input	No	Output: 193	0 byte
			Input: 108	8 byte
Generic 16 DI + DIA	Listen only	Yes	Output: 192	0 byte
			Input: 104	6 byte

Table 5.10

ICE1-16DIO-G60L-C1-V1D (DCU Function)

Ethernet IO module with 16 digital inputs/outputs (16DIO), freely configurable and decentralized control function (DCU function).

16-DI/DO DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DI/DO + DIA + DCU	Exclusive owner	Yes	Output: 100	20 byte
			Input: 101	25 byte
16 DI/DO + DCU	Exclusive owner	No	Output: 100	20 byte
			Input: 102	21 byte
16 DI/DO + DIA + DCU	Input only	Yes	Output: 193	0 byte
			Input: 101	25 byte
16 DI/DO + DCU	Input only	No	Output: 193	0 byte
			Input: 102	21 byte

Table 5.11

8-DI/DO DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DI/DO + DIA + DCU	Exclusive owner	Yes	Output: 103	19 byte
			Input: 104	24 byte
8 DI/DO + DCU	Exclusive owner	No	Output: 103	19 byte
			Input: 105	20 byte

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DI/DO + DIA + DCU	Input only	Yes	Output: 193	0 byte
			Input: 104	24 byte
8 DI/DO + DCU	Input only	No	Output: 193	0 byte
			Input: 105	20 byte

Table 5.12

16-DI DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DI + DIA + DCU	Input only	Yes	Output: 193	0 byte
			Input: 101	25 byte
16 DI + DCU	Input only	No	Output: 193	0 byte
			Input: 102	21 byte

Table 5.13

8-DI DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DI + DIA + DCU	Input only	Yes	Output: 193	0 byte
			Input: 104	24 byte
8 DI + DCU	Input only	No	Output: 193	0 byte
			Input: 105	20 byte

Table 5.14

16-DO DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DO + DIA + DCU	Exclusive owner	Yes	Output: 100	20 byte
			Input: 106	23 byte
16 DO + DCU	Exclusive owner	No	Output: 100	20 byte
			Input: 107	19 byte

Table 5.15

8-DO DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DO + DIA + DCU	Exclusive owner	Yes	Output: 103	19 byte
			Input: 106	23 byte
8 DO + DCU	Exclusive owner	No	Output: 103	19 byte
			Input: 107	19 byte

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8-DI/8-DO DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
8 DI/8 DO + DIA + DCU	Exclusive owner	Yes	Output: 103	19 byte
			Input: 104	24 byte
8 DI/8 DO + DCU	Exclusive owner	No	Output: 103	19 byte
			Input: 105	20 byte
8 DI/8 DO + DIA + DCU	Input only	Yes	Output: 193	0 byte
			Input: 104	24 byte
8 DI/8 DO + DCU	Input only	No	Output: 193	0 byte
			Input: 105	20 byte

Table 5.17

Generic DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
Generic 16 DI + DIA + DCU	Listen only	Yes	Output: 192	0 byte
			Input: 101	25 byte
Generic 16 DI + DCU	Listen only	No	Output: 192	0 byte
			Input: 102	21 byte
Generic 8 DI + DIA + DCU	Listen only	Yes	Output: 192	0 byte
			Input: 104	24 byte
Generic 8 DI + DCU	Listen only	No	Output: 192	0 byte
			Input: 105	20 byte

Table 5.18

Even-Number DI/DO-Byte DCU Profiles

Connection	Type of connection	Diagnosis	Instance ID	Length
16 DI/DO + DIA + DCU	Exclusive owner	Yes	Output: 100	20 byte
			Input: 108	26 byte
16 DI/DO + DIA + DCU	Input	No	Output: 193	0 byte
			Input: 108	26 byte
Generic 16 DI + DIA + DCU	Listen only	Yes	Output: 192	0 byte
			Input: 104	26 byte

Table 5.19

5.2.2 16DI Modules, Connections and Assembly Objects

Note

The possible profiles for the Ethernet IO module ICE1-16DI-G60L-V1D with 16 inputs are listed below.

ICE1-16DI-G60L-V1D

Connection	Type of connection	Diagnosis	Instance ID	Length
16 bit in + diagnosis	Input only	Yes	Output: 193	0 byte
			Input: 101	4 byte
16 bit in	Input only	No	Output: 193	0 byte
			Input: 102	3 byte
16 bit in + diagnosis	Listen only	Yes	Output: 193	0 byte
			Input: 101	4 byte
16 bit in	Listen only	No	Output: 193	0 byte
			Input: 102	3 byte

Table 5.20

5.2.3 8DI/8DO Modules, Connections and Assembly Objects

Note

Listed below are the possible profiles for Ethernet IO modules with 8 inputs and 8 outputs.

ICE1-8DI8DO-G60L-V1D, ICE1-8DI8DO-G60L-C1-V1D

Connection	Type of connection	Diagnosis	Instance ID	Length
8 bit in/out + diagnosis	Exclusive owner	Yes	Output: 100	1 byte
			Input: 101	6 byte
8 Bit in/out	Exclusive owner	No	Output: 100	1 byte
			Input: 102	3 byte
8 bit in/out + diagnosis	Input only	Yes	Output: 193	0 byte
			Input: 101	6 byte
8 Bit in/out	Input only	No	Output: 193	0 byte
			Input: 102	3 byte
8 bit in/out + diagnosis	Listen only	Yes	Output: 192	0 byte
			Input: 101	6 byte
8 Bit in/out	Listen only	No	Output: 192	0 byte
			Input: 102	3 byte

Table 5.21

5.2.4 Configuration Parameters

Depending on the module type, different assembly objects are used to transfer configuration parameters for Ethernet IO modules. The connections and assembly objects can be found in the previous sections.

Each Ethernet IO module has a fixed number of configuration parameters. The size is determined via the respective configuration assembly instance

Length of configuration parameter:

- 16DIO modules: 65/33 words (130/66 bytes) depending on profile selected
- 16DI modules: 1 word (2 bytes)
- 8DI/8DO modules: 17 words (34 bytes)

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The following configuration parameters are available only for certain Ethernet IO module versions:

- 8DI8DO modules
  - Surveillance timeout: delay in output monitoring time on a channel
  - Fail-safe: initial state of a channel in the case of a fault
- 16DIO modules
  - Surveillance timeout: delay in output monitoring time on a channel
  - Fail-safe: initial state of a channel in the case of a fault
  - Process data direction
  - IO mapping: bit assignment for channels

QuickConnect Configuration

QuickConnect (QC) accelerates the start-up process of all Ethernet IO modules. Activating this parameter enables network communication to start up particularly quickly.

If you activate QuickConnect, it takes no longer than 350 ms for the module to accept a TCP connection after it is switched on. The controller subsequently establishes the connection. This allows the module to achieve a start-up time of approximately 400 to 500 ms.

To use QC, the network must be arranged in a star or linear topology and the module must have a static IP address. Ring topologies and DHCP/BOOTP are not supported. Please note that there is no automatic check for duplicate IP addresses within the same network.

If QuickConnect is activated, the following parameters are fixed for the Ethernet interface of the module:

- 100 Mbit/s transfer rate
- Full duplex connection
- Auto-negotiation and Auto-MDIX switched off

Note

A prerequisite for the use of QuickConnect is adherence to a strictly defined procedure. The Ethernet IO modules must be notified before switching off (inhibit instruction) and before switching on (uninhibit instruction).

A hard disconnection is not allowed during operation. Details of this procedure can be found in document ENET-AT001C-ENP from Rockwell Automation

The following options are available for using QuickConnect:

- Disabled (0) (default value)
- Enabled (1)

General Settings Configuration

Whether these general parameters are displayed depends on the type of Ethernet IO module used. Different parameters can be configured. Each bit in this bit field represents the state of a parameter.

The following options are available for use with each individual parameter:

- **Disabled (0)**
- **Enabled (1)**

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
For 16DI 0r 16DIO modules with DI profiles																
Word 0									RES	DOR	DCR	DCL	RDO	RUL	WIL	FML

	MSB								LSB							
For 16DIO modules with DIO profile, DO profile and 8DI/8DO profiles																
Word 32									RES	DOR	DRC	DCL	RDO	RUL	WIL	FML
For 8DI/8DO modules																
Word 16									RES		DRC	DCL	RDO	RUL	WIL	FML

Table 5.22

Legend

- **FML** (Force Mode Lock): allow (0)/block (1) use of Force Mode via the web server, default value: allow (0)
- **WIL** (Web Interface Lock): allow (0)/block (1) use of the web server, default value: allow (0)
- **RUL** (Report U_L Supply Voltage Fault): deactivate (0)/activate (1) diagnostic message when actuator supply is not present (U_L), default value: activate (1)
- **RDO** (Report DO Fault without U_L): deactivate (0)/activate (1) diagnostic message when actuator supply and output control is not present (U_L), default value: activate (1)
- **DCL** (DCU Lock) only for modules with DCU function: allow (0)/block (1) decentralized control function, default value: allow (0)
- **DCR** (DCU Run) only for modules with DCU function: deactivate (0)/start (1) DCU program, default value: (0)
- **DOR** (Digital Out Restart Mode) reset channel diagnosis when resetting digital output (0) or automatic restart after short circuit of digital output/return of actuator supply (1), default value: automatic restart (1)
- **RES** (Reserved): reserved parameter, default value: 0

Surveillance Timeout

The firmware of these modules enables you to set a delay time before the monitoring of the output currents starts, i.e., a surveillance timeout. You can set this for each individual output channel.

The delay time starts after the status of the output channel changes, i.e., when the channel is activated (after a rising edge) or deactivated (after a falling edge). After this time has elapsed, the monitoring of the output begins and the diagnosis begins reporting error states.

The “surveillance timeout” can be set between 0 ms and 255 ms. The default value is 80 ms. When the output channel is in a static state, i.e., when the channel is permanently switched on or off, the value is 100 ms.

Surveillance Timeout Values for 8DI/8DO Modules

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 0	Port X5, channel A (pin 4), possible values 0 … 255															
Word 1	Port X5, channel B (pin 2), possible values 0 … 255															
...																
Word 6	Port X8, channel A (pin 4), possible values 0 … 255															

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	MSB	LSB
Word 7	Port X8, channel B (pin 2), possible values 0 … 255	

Table 5.23

Surveillance Timeout Values for 16DIO Modules with DIO, DO and 8DI/8DO Profiles

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 0	Port X1, channel A (pin 4), possible values 0 … 255															
Word 1	Port X1, channel B (pin 2), possible values 0 … 255															
...																
Word 14	Port X8, channel A (pin 4), possible values 0 … 255															
Word 15	Port X8, channel B (pin 2), possible values 0 … 255															

Table 5.24

Fail-safe function

The firmware of these modules provides a fail-safe function for the outputs. When configuring the modules, you can define the status of the outputs after an interruption or loss of EtherNet/IP communication.

The following options are available:

- **Set low (0)** = deactivate the output channel (digital value = 0)
- **Set high (1)** = activate the output channel (digital value = 1)
- **Hold last (2)** = hold the last output state (digital value reflects last state)

Fail-safe values for 8DI/8DO modules

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 8	Port X5, channel A (pin 4), possible values 0 … 2															
Word 9	Port X5, channel B (pin 2), possible values 0 … 2															
...																
Word 14	Port X8, channel A (pin 4), possible values 0 … 2															
Word 15	Port X8, channel B (pin 2), possible values 0 … 2															

Table 5.25

Fail-safe values for 16DIO modules with DIO, DO and 8DI/8DO profiles

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 16	Port X1, channel A (pin 4), possible values 0 … 2															
Word 17	Port X1, channel B (pin 2), possible values 0 … 2															

	MSB	LSB
...		
Word 30	Port X8, channel A (pin 4), possible values 0 … 2	
Word 31	Port X8, channel B (pin 2), possible values 0 … 2	

Table 5.26

Process Data Direction Configuration (Only for 16DIO Modules)

These parameters are only supported by Ethernet IO modules on which IO mapping can be configured; these are

- ICE1-16DIO-G60L-V1D
- ICE1-16DIO-G60L-C1-V1D.

With "Process Data Direction," you can determine the data direction for each channel depending on the selected profile and IO mapping.

In a 16 DI/DO profile, for example, each channel can be configured as an input and output, a pure input or a pure output. This has the advantage that each channel can be used universally.

The following options are available:

- **Input 5/output (0)** = input and output channel
- **Input (1)** = input channel
- **Output (2)** = output channel

Process Data Direction for 16DIO Modules with DIO Profile

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 16	Port X1, channel A (pin 4), possible values 0 … 2, default value = 0															
Word 17	Port X1, channel B (pin 2), possible values 0 … 2, default value = 0															
...																
Word 47	Port X8, channel A (pin 4), possible values 0 … 2, default value = 0															
Word 48	Port X8, channel B (pin 2), possible values 0 … 2, default value = 0															

Table 5.27

Process Data Direction for 16DIO Modules with 16DI Profile

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 1	Port X1, channel A (pin 4), static value 1															
Word 2	Port X1, channel B (pin 2), static value 1															
...																
Word 15	Port X8, channel A (pin 4), static value 1															

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	MSB	LSB
Word 16	Port X8, channel B (pin 2), static value 1	

Table 5.28

Process Data Direction for 16DIO Modules with 16DO Profile

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 33	Port X1, channel A (pin 4), static value 2															
Word 34	Port X1, channel B (pin 2), static value 2															
...																
Word 47	Port X8, channel A (pin 4), static value 2															
Word 48	Port X8, channel B (pin 2), static value 2															

Table 5.29

Process Data Direction for 16DIO Modules with 8DI/8DO Profile

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 33	Port X1, channel A (pin 4), possible values 1 … 2, default value = 1															
Word 34	Port X1, channel B (pin 2), possible values 1 … 2, default value = 1															
...																
Word 47	Port X8, channel A (pin 4), possible values 1 … 2, default value = 2															
Word 48	Port X8, channel B (pin 2), possible values 1 … 2, default value = 2															

Table 5.30

IO Mapping Configuration (Only for 16DIO Modules)

Using IO mapping configuration, it is possible to alter the data structure of input/output data (I/O data). By default, each I/O channel is represented in order in the process data. Existing PLC programs may sometimes use a different channel assignment.

Using these parameters, all I/O channels can therefore be freely assigned to a bit in the I/O data. It is important to note that double assignments are not possible. If incorrect parameterization of the IO mapping is detected when transferring the configuration, the Ethernet IO module will report an error. Misconfiguration can be viewed via the status page of the web interface.

The permitted value range and the default value of the parameters depend on the selected profile. A channel can also be set inactive with the value 255.

For example, if a channel were configured with a value of 3, its status value would be transferred to the 3rd bit of process data. This applies to both data directions as long as they have been configured with the "Process Data Direction" for the channel. For further information about process data, see the chapter "Bit Assignment of Process Data."

IO Mapping for 16DIO Modules with 16DI/DO and 16DO Profiles

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 49	Port X1, channel A (pin 4), possible values 0 … 15, 255, default value = 0															
Word 50	Port X1, channel A (pin 2), possible values 0 … 15, 255, default value = 1															
...																
Word 63	Port X8, channel A (pin 4), possible values 0 … 15, 255, default value = 14															
Word 64	Port X8, channel B (pin 2), possible values 0 … 15, 255, default value = 15															

Table 5.31

IO Mapping for 16DIO Modules with 8DI/DO and 8DO Profiles

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 49	Port X1, channel A (pin 4), possible values 0 … 7, 255, default value = 0															
Word 50	Port X1, channel A (pin 2), possible values 0 … 7, 255, default value = 255															
...																
Word 63	Port X8, channel A (pin 4), possible values 0 … 7, 255, default value = 7															
Word 64	Port X8, channel B (pin 2), possible values 0 … 7, 255, default value = 255															

Table 5.32

IO Mapping for 16DIO Modules with 16DI Profiles

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 17	Port X1, channel A (pin 4), possible values 0 … 15, 255, default value = 0															
Word 18	Port X1, channel A (pin 2), possible values 0 … 15, 255, default value = 1															
...																
Word 31	Port X8, channel A (pin 4), possible values 0 … 15, 255, default value = 14															
Word 32	Port X8, channel B (pin 2), possible values 0 … 15, 255, default value = 15															

Table 5.33

IO Mapping for 16DIO Modules with 8DI Profiles

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 17	Port X1, channel A (pin 4), possible values 0 … 7, 255, default value = 0															
Word 18	Port X1, channel A (pin 2), possible values 0 … 7, 255, default value = 255															

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	MSB	LSB
...		
Word 31	Port X8, channel A (pin 4), possible values 0 … 7, 255, default value = 7	
Word 32	Port X8, channel B (pin 2), possible values 0 … 7, 255, default value = 255	

Table 5.34

IO Mapping for 16DIO Modules with 8DI/DO Profiles

	MSB								LSB							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 49	Port X1, channel A (pin 4), possible values 0 … 7, 255, default value = 0															
Word 50	Port X1, channel A (pin 2), possible values 0 … 7, 255, default value = 1															
...																
Word 63	Port X8, channel A (pin 4), possible values 0 … 7, 255, default value = 6															
Word 64	Port X8, channel B (pin 2), possible values 0 … 7, 255, default value = 7															

Table 5.35

5.2.5 Configuration Example

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. The configuration is based on the example of an ICE1-16DIO-G60L-V1D module. For other module versions, configuration is carried out with a few minor changes.

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. Add the desired Ethernet IO module to your EtherNet/IP communication interface by clicking on the right-hand mouse button and using the "New Module" command.

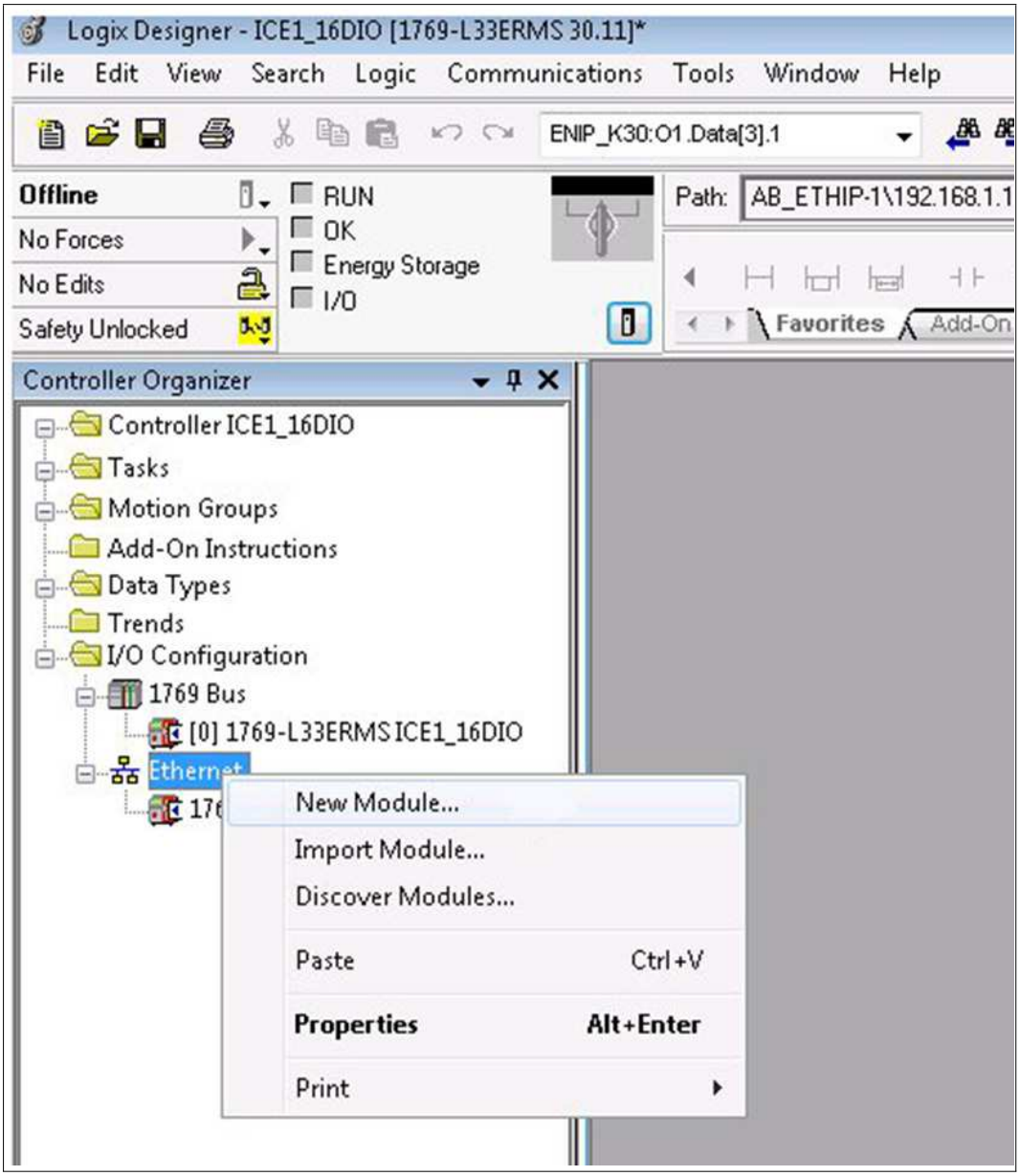

Figure 5.1

4. Select the Ethernet IO module you want to add and click the "Create" button.

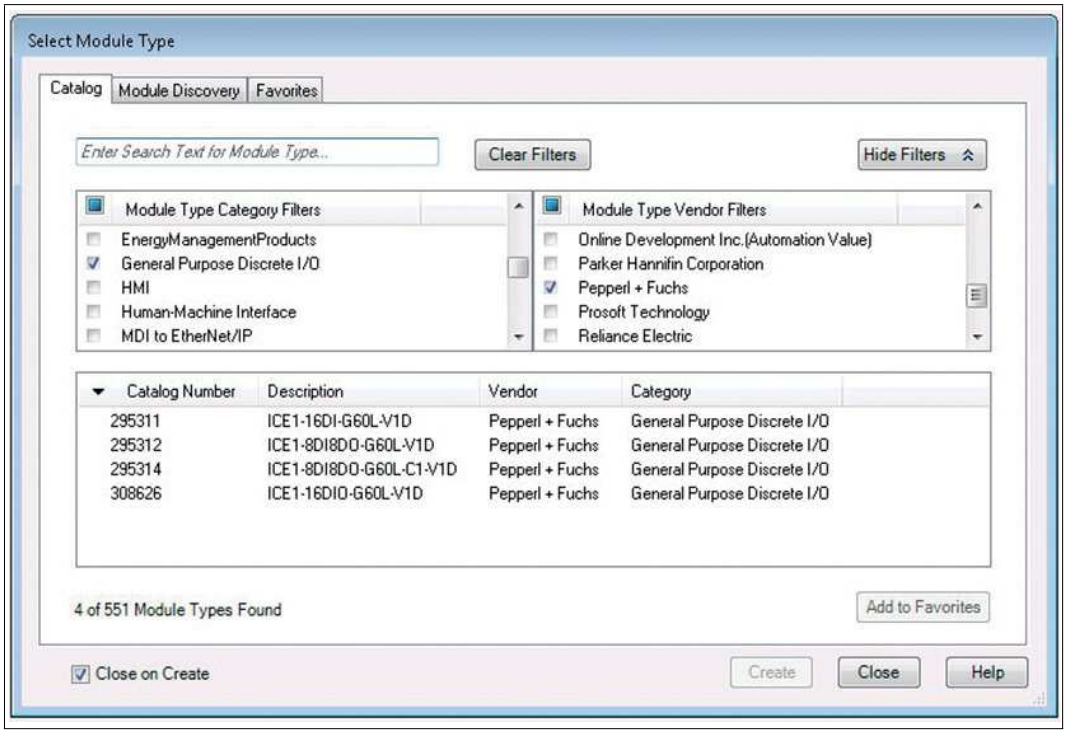

Figure 5.2

5. Enter a name for the Ethernet IO module and the correct IP address. The name "Name01" and IP address "192.168.100.10" have been used in this example.
6. Click on the “Change” button.

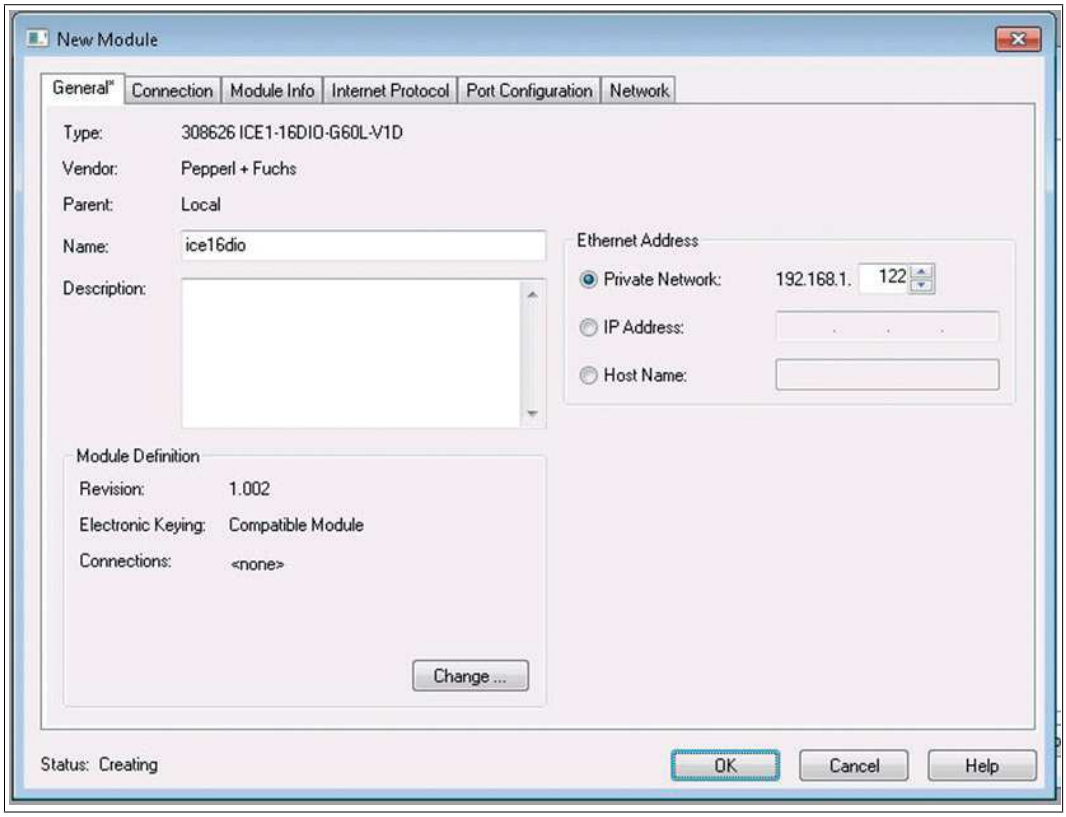

Figure 5.3

7. Change the settings for the module revision, electronic keying and connection type. Further details on the connection types can be found in the previous sections on connections and assembly objects.

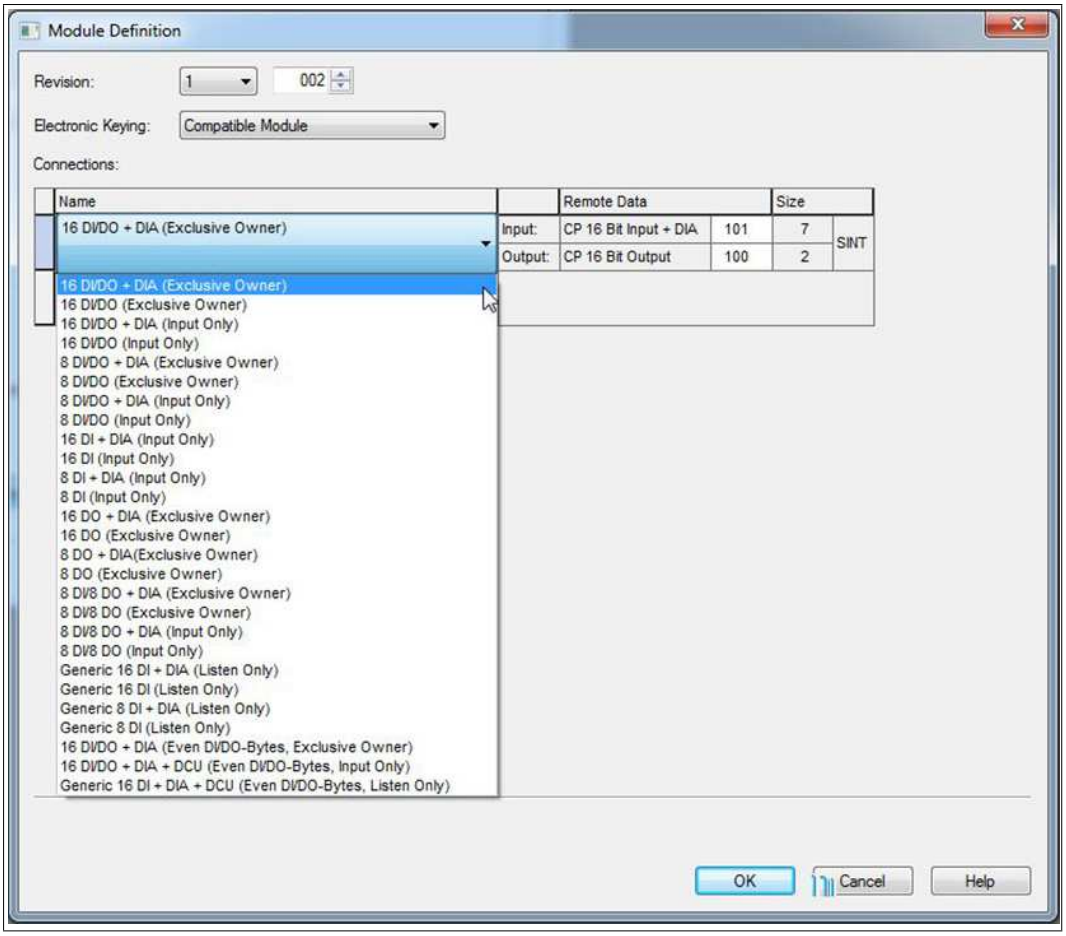

Figure 5.4

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

9. In the "Connections" tab of the 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.

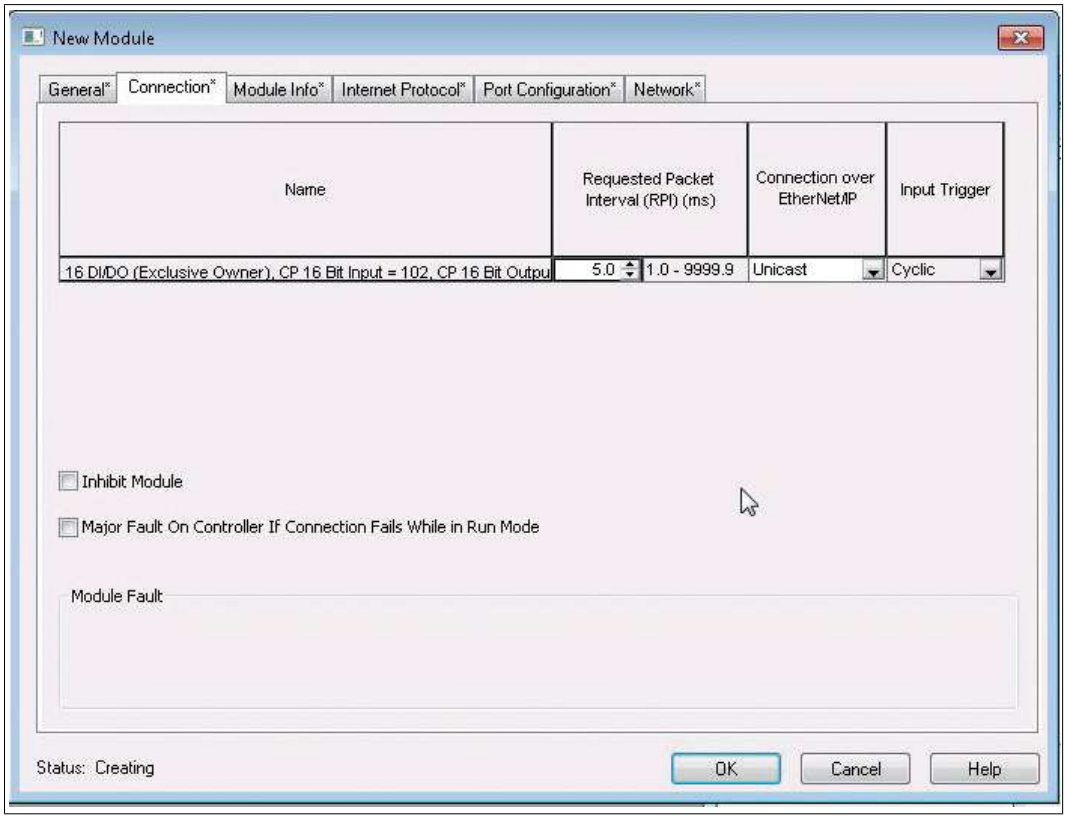

Figure 5.5

10. Confirm the entries with “OK”.
11. In the “Controller Organizer,” switch to the “Controller Tags” section. 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:

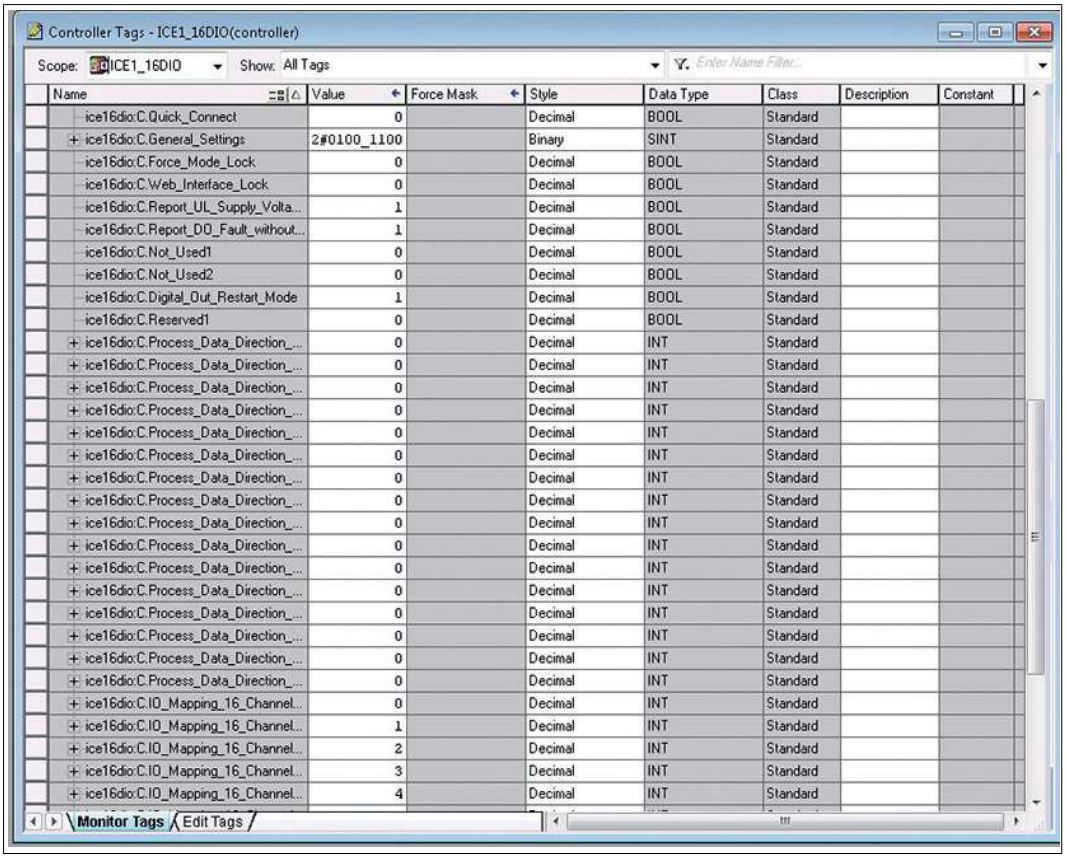

Figure 5.6

12. Configure the EtherNet/IP module and download the parameters to the controller.

Initial Settings for Connection Parameters

Configuration tools from other controller manufacturers may require additional parameters to be entered to establish a communication connection between your EtherNet/IP I/O scanner and the Ethernet IO modules. In such cases, the table below provides a list of useful parameters:

ICE1-16DIO-G60L-V1D/ICE1-16DIO-G60L-C1-V1D with 16DI/DO Profile and Diagnosis

Transport type	Exclusive owner
Trigger mode	Cyclic
Requested packet interval (RPI)	Minimum 1 ms
Sender to target device (O>T) connection parameters	
Real-time transfer format	32 bit Run/Idle header
Connection type	POINT2POINT
Assembly instance ID	100
Data type	USINT
Data size	1 byte
Data length	2 byte
Target device to sender (T>O) connection parameters	
Real-time transfer format	Pure, non-modal data connection
Connection type	MULTICAST
Assembly instance ID	101
Data type	USINT

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Data size	1 byte
Data length	7 byte

ICE1-16DI-G60L-V1D with Diagnosis

Transport type	Input only
Trigger mode	Cyclic
Requested packet interval (RPI)	Minimum 1 ms
Sender to target device (O>T) connection parameters	
Real-time transfer format	Heartbeat
Connection type	POINT2POINT
Assembly instance ID	193
Data type	USINT
Data size	1 byte
Data length	0 byte
Target device to sender (T>O) connection parameters	
Real-time transfer format	Pure, non-modal data connection
Connection type	MULTICAST
Assembly instance ID	101
Data type	USINT
Data size	1 byte
Data length	4 byte

ICE1-8DI8DO-G60L-V1D/ICE1-8DI8DO-G60L-C1-V1D with Diagnosis

Transport type	Exclusive owner
Trigger mode	Cyclic
Requested packet interval (RPI)	Minimum 1 ms
Sender to target device (O>T) connection parameters	
Real-time transfer format	32 bit Run/Idle header
Connection type	POINT2POINT
Assembly instance ID	100
Data type	USINT
Data size	1 byte
Data length	1 byte
Target device to sender (T>O) connection parameters	
Real-time transfer format	Pure, non-modal data connection
Connection type	MULTICAST
Assembly instance ID	101
Data type	USINT
Data size	1 byte
Data length	6 byte

5.3 Bit Assignment of Process Data

Input and Output Data

Actual values are specified for the input data and target values are specified for output data. Please note that the number of items of provider data (input data) is variable. It is dependent on whether you have selected that the diagnostics data should be transferred. The modules provide one byte for slot diagnostics or channel diagnostics—the **module information byte**. The diagnostics data supplements the standard process input data as additional bytes.

16DIO modules with decentralized control function

16DIO modules with decentralized control function (DCU) have an extended process data range with an additional 18 bytes in both directions. These are appended to the output data, module information byte or input data diagnoses. For further details on how to use the extended process data ranges, see the chapter "decentralized control function."

5.3.1 16DIO Modules, Bit Assignment of Process Data

Note

So that a diagnosis can be done within the module, the actual output statuses at the module—in addition to the actual input statuses—are reflected in the input data (output mirror).

16-bit output data, default IO mapping (assembly ID 100)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Table 5.36

16-bit input data with diagnosis, default IO mapping (assembly ID 101)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A
Byte 2	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 3	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 4	0	0	0	0	0	0	0	0
Byte 5	CE-X4B	CE-X4A	CE-X3B	CE-X3A	CE-X2B	CE-X2A	CE-X1B	CE-X1A
Byte 6	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

Table 5.37

16-bit input data with diagnostic and padding byte, default IO mapping (assembly ID 108)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A
Byte 2	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 3	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 4	0	0	0	0	0	0	0	0
Byte 5	CE-X4B	CE-X4A	CE-X3B	CE-X3A	CE-X2B	CE-X2A	CE-X1B	CE-X1A
Byte 6	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

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INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 7	0	0	0	0	0	0	0	0

Table 5.38

16-bit input data without diagnosis, default IO mapping (assembly ID 102)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A
Byte 2	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS

Table 5.39

8-bit output data, default IO mapping, not for 8DI/8DO (assembly ID 103)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X8-B	X7-A	X6-B	X5-A	X4-B	X3-A	X2-B	X1-A

Table 5.40

8-bit input data with diagnostic, default IO mapping, not for 8DI/8DO (assembly ID 104)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X8-B	X7-A	X6-B	X5-A	X4-B	X3-A	X2-B	X1-A
Byte 1	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 2	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 3	0	0	0	0	0	0	0	0
Byte 4	CE-X4B	CE-X4A	CE-X3B	CE-X3A	CE-X2B	CE-X2A	CE-X1B	CE-X1A
Byte 5	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

Table 5.41

8-bit input data without diagnostic, default IO mapping, not for 8DI/8DO (assembly ID 105)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X8-B	X7-A	X6-B	X5-A	X4-B	X3-A	X2-B	X1-A
Byte 1	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS

Table 5.42

8-bit output data, default IO mapping, only for 8DI/8DO (assembly ID 103)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Table 5.43

8-bit input data with diagnosis, default IO mapping, only for 8DI/8DO (assembly ID 104)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 2	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 3	0	0	0	0	0	0	0	0
Byte 4	CE-X4B	CE-X4A	CE-X3B	CE-X3A	CE-X2B	CE-X2A	CE-X1B	CE-X1A

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 5	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

Table 5.44

8-bit input data without diagnosis, default IO mapping, only for 8DI/8DO (assembly ID 105)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X8-B	X7-A	X6-B	X5-A	X4-B	X3-A	X2-B	X1-A
Byte 1	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS

Table 5.45

0-bit input data with diagnosis, default IO mapping (assembly ID 106)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 1	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 2	0	0	0	0	0	0	0	0
Byte 3	CE-X4B	CE-X4A	CE-X3B	CE-X3A	CE-X2B	CE-X2A	CE-X1B	CE-X1A
Byte 4	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

Table 5.46

0-bit input data without diagnosis, default IO mapping (assembly ID 107)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS

Table 5.47

Legend

- X1-A - X8-A: Status channel A (pin 4) of slots X1 to X8
- X1-B - X8-B: Status channel B (pin 2) of slots X1 to X8
- MI-LVS: Module information byte—low system/sensor supply voltage
- MI-LVA: Module information byte—low actuator supply voltage
- MI-SCS: Module information byte—sensor short circuit on an M12 slot
- MI-SCA: Module information byte—actuator short circuit on an M12 slot
- MI-IME: Module information byte—internal module error
- SCS-X1…SCS-X8: Sensor short circuit at slots X1 to X8
- CE-X1A…CE-X8A: Channel error, channel A (pin 4) on slot X1 to X8
- CE-X1B…CE-X8B: Channel error, channel B (pin 2) on slot X1 to X8

5.3.2 Modules with Decentralized Control Function, Bit Assignment of Process Data Extension

For Ethernet IO modules with decentralized control function (DCU), the process data range for input and output data has been extended by an additional 18 bytes. This process data extension is described below for the following Ethernet IO modules:

- ICE1-8DI8DO-G60L-C1-V1D
- ICE1-16DIO-G60L-C1-V1D.

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Input Data for DCU Extension

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	16 bit I/O DCU extension							
Byte n + 1								
Byte n + 2	INT I/O DCU extension							
Byte n + 3								
Byte n + 16	INT I/O DCU extension							
Byte n + 17								

Table 5.48

Legend

- 16-bit I/O DCU extension: bit states as input data for the decentralized control function (DCU function)
- INT I/O DCU extension: 8 word data types as input data for the decentralized control function (DCU function), e.g. transmission of program parameters.

Output Data for DCU Extension

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	16 bit I/O DCU extension							
Byte n + 1								
Byte n + 2	INT I/O DCU extension							
Byte n + 3								
Byte n + 16	INT I/O DCU extension							
Byte n + 17								

Table 5.49

Legend

- 16-bit I/O DCU: bit states as output data for the decentralized control function (DCU function)
- INT I/O DCU extension: 8 word data types as output data for the decentralized control function (DCU function), e.g. transmission of counter states.

5.3.3 16DI Modules, Bit Assignment of Process Data

Input Data with Diagnosis (Assembly ID 101)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

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

Table 5.50

Input data without diagnosis (assembly ID 101)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A
Byte 2	MI-IME	0	0	0	0	MI-SCS	0	MI-LVS

Table 5.51

16DI Legend

- X1-A - X8-A: input status channel A (pin 4) for slots X1 to X8
- X1-B - X8-B: input status channel B (pin 2) for slots X1 to X8
- MI-LVS: Module information byte—low system/sensor supply voltage
- MI-SCS: Module information byte—sensor short circuit on an M12 slot
- MI-IME: Module information byte—internal module error
- SCS-X1…SCS-X8: Sensor short circuit at slots X1 to X8

5.3.4 8DI/8DO Modules, Bit Assignment of Process Data

Note

So that a diagnosis can be done within the module, the actual output statuses at the module—in addition to the actual input statuses—are reflected in the input data (output mirror).

Input Data with Diagnosis (Assembly ID 101)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A
Byte 2	MI-IME	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 3	0	0	0	0	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 4	0	0	0	0	0	0	0	0
Byte 5	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

Table 5.52

Input data without diagnosis (assembly ID 102)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A
Byte 2	0	0	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS

Table 5.53

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Output data (assembly ID 100)

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Table 5.54

8DI8DO Legend

- X1-A - X4-A: Input status of channel A (pin 4) of slots X1 to X4
- X1-B - X4-B: Input status of channel B (pin 2) of slots X1 to X4
- X5-A - X8-A: Output status of channel A (pin 4) of slots X5 to X8
- X5-B - X8-B: Output status of channel B (pin 2) of slots X5 to X8
- MI-LVS: Module information byte—low system/sensor supply voltage
- MI-LVA: Module information byte—low actuator supply voltage
- MI-SCS: Module information byte—sensor short circuit on an M12 slot
- MI-SCA: Module information byte—actuator short circuit on an M12 slot
- MI-IME: Module information byte—internal module error
- SCS-X1…SCS-X4: Sensor short circuit on slots X1 to X4
- CE-X5A…CE-X8A: Channel error in channel A (pin 4) on slots X1 to X8
- CE-X5B…CE-X8B: Channel error in channel B (pin 2) on slots X1 to X8

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 V14 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.

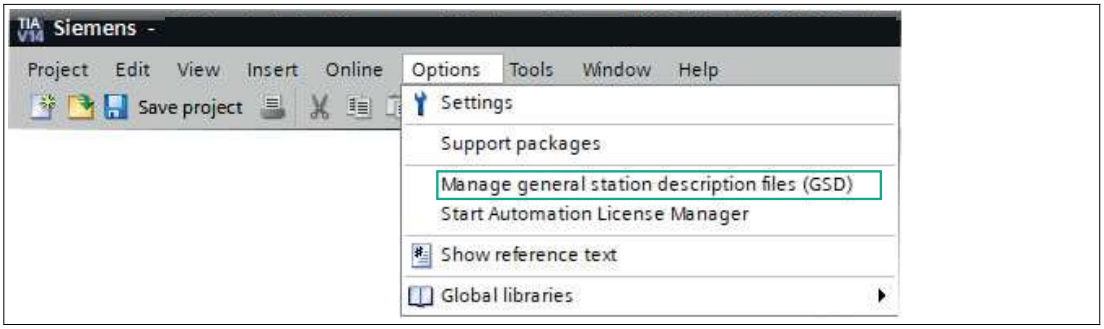

Figure 6.1

MAC IDs

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

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.

6.2 Configuration

The configuration and commissioning process for the modules described over the following pages was performed using TIA Portal V14 project planning software from SIEMENS. When using a control system from a different control system provider, please refer to the corresponding documentation.

The configuration is based on the example of an ICE1-16DIO-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

Integration of the PROFINET-IO Module into TIA

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 ICE1-16DIO-G60L-C1-V1D module.

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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.

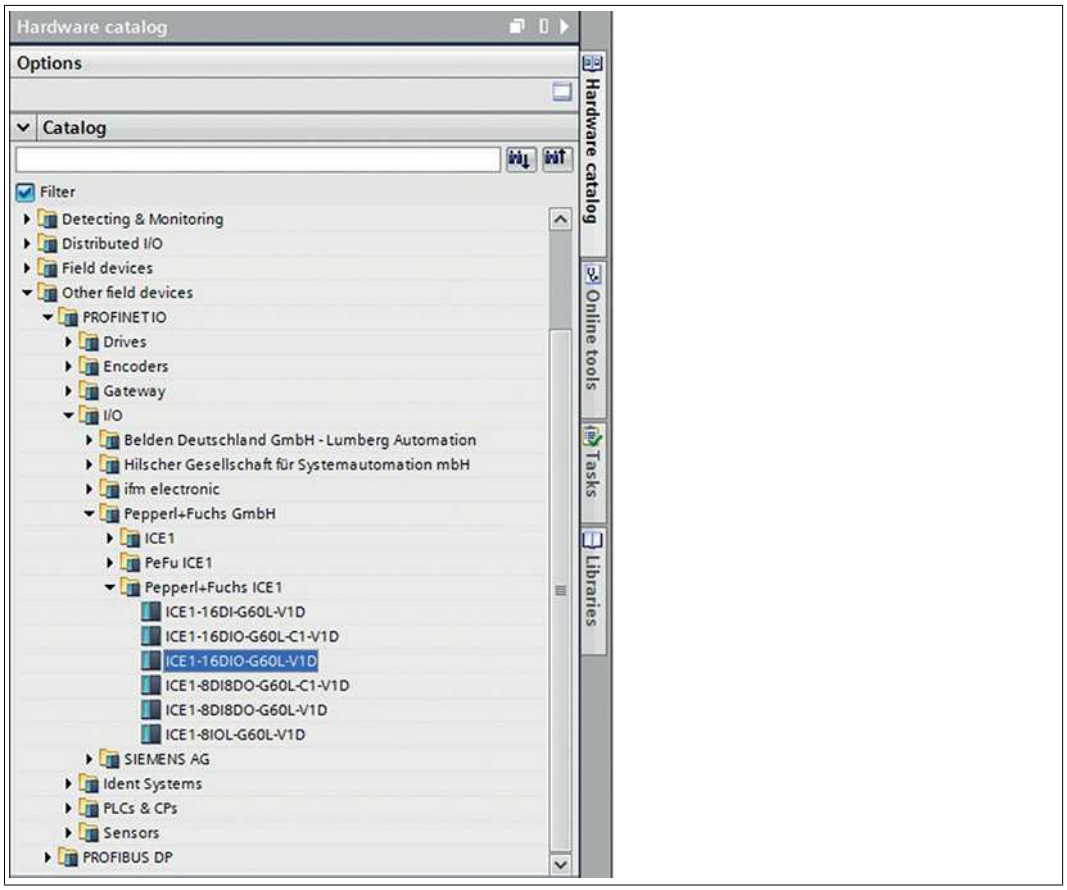

Figure 6.2

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

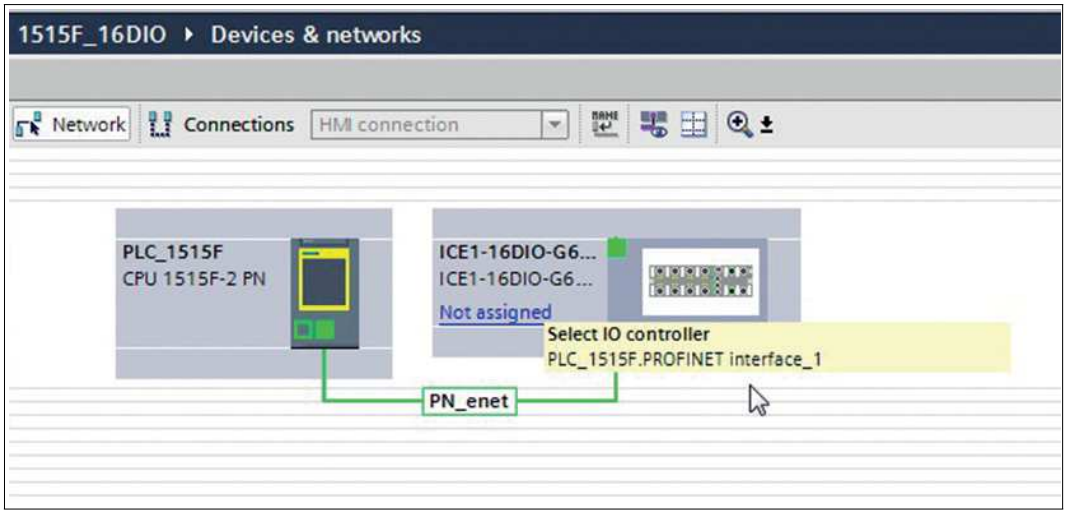

Figure 6.3

↳ A suitable element for the I/O function is automatically inserted into slot 1 of the rack.

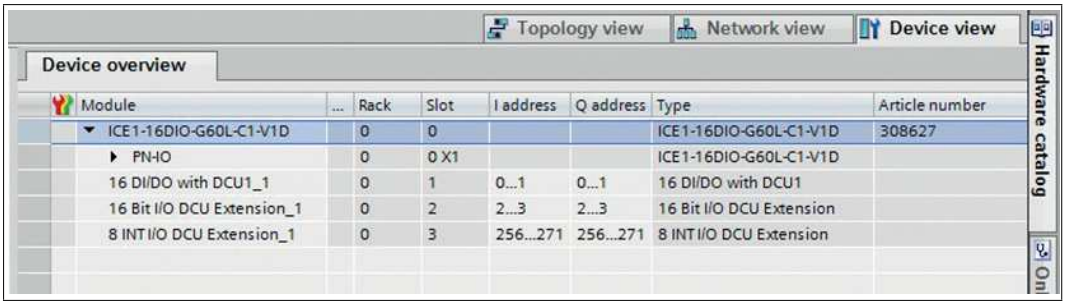

Figure 6.4

↳ You can change the input and output addresses specified in the device overview. The 16DIO modules have extended I/O functionality. With these modules, you can choose between different profiles (e.g., 16 DI/DO) and use different modules in slot 1 of the rack. This has the advantage that you can replace each existing digital I/O module with a 16DIO module. By selecting a suitable profile and using IO mapping in the module parameters, I/O addresses in this PLC program of this module can be replaced without any changes.
To change a profile, the module in slot 1 must be deleted and replaced with another. This is the same as adding a PROFINET module via the hardware catalog.

↳ The following module profiles are available for configuration of a 16DIO module:

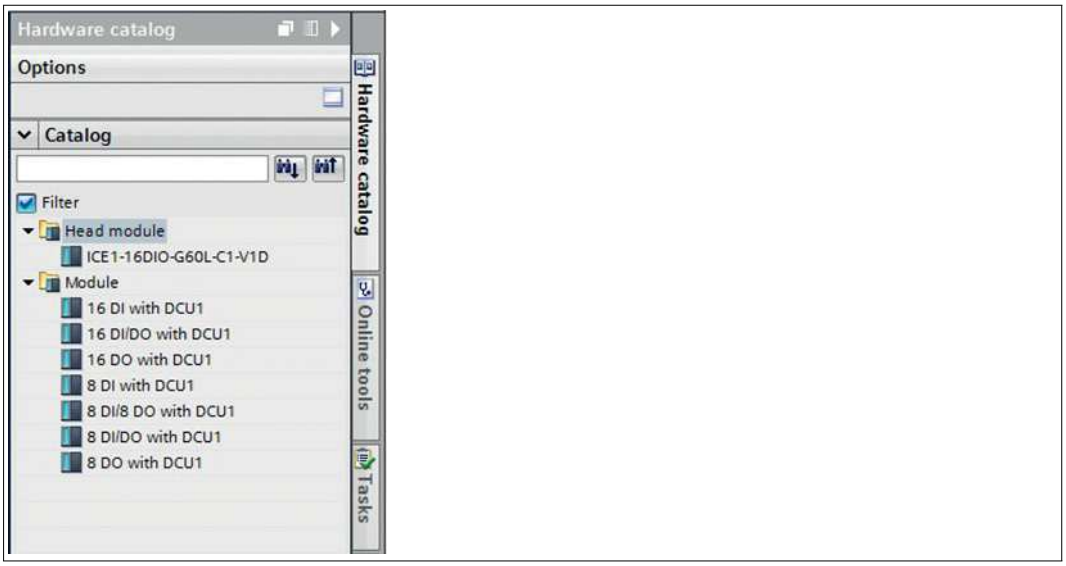

Figure 6.5

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 name is "ICE-16DIO-G60L-V1D."

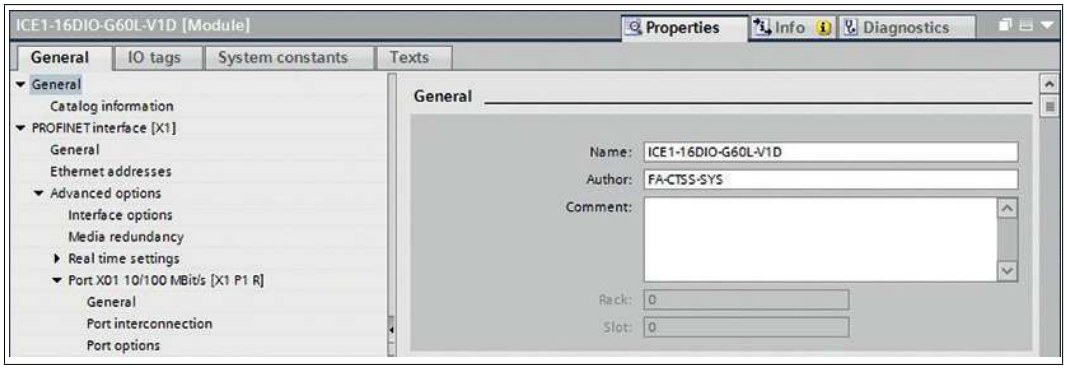

Figure 6.6

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.

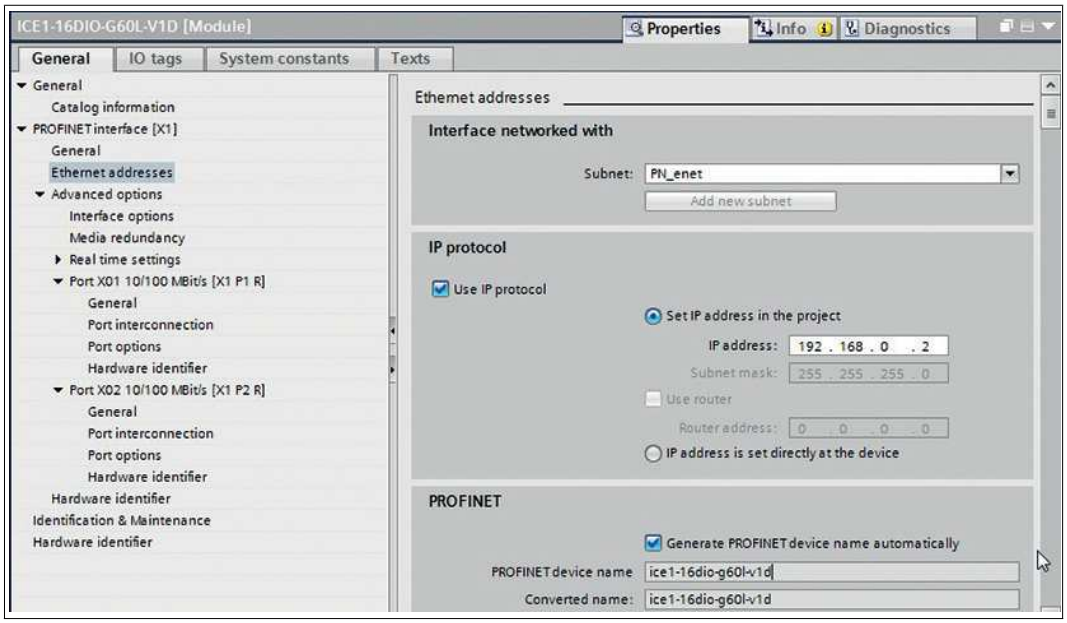

Figure 6.7

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.

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 node search displays all PROFINET devices that have been found.
On delivery, the Ethernet IO modules are assigned three MAC addresses. 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 ...".

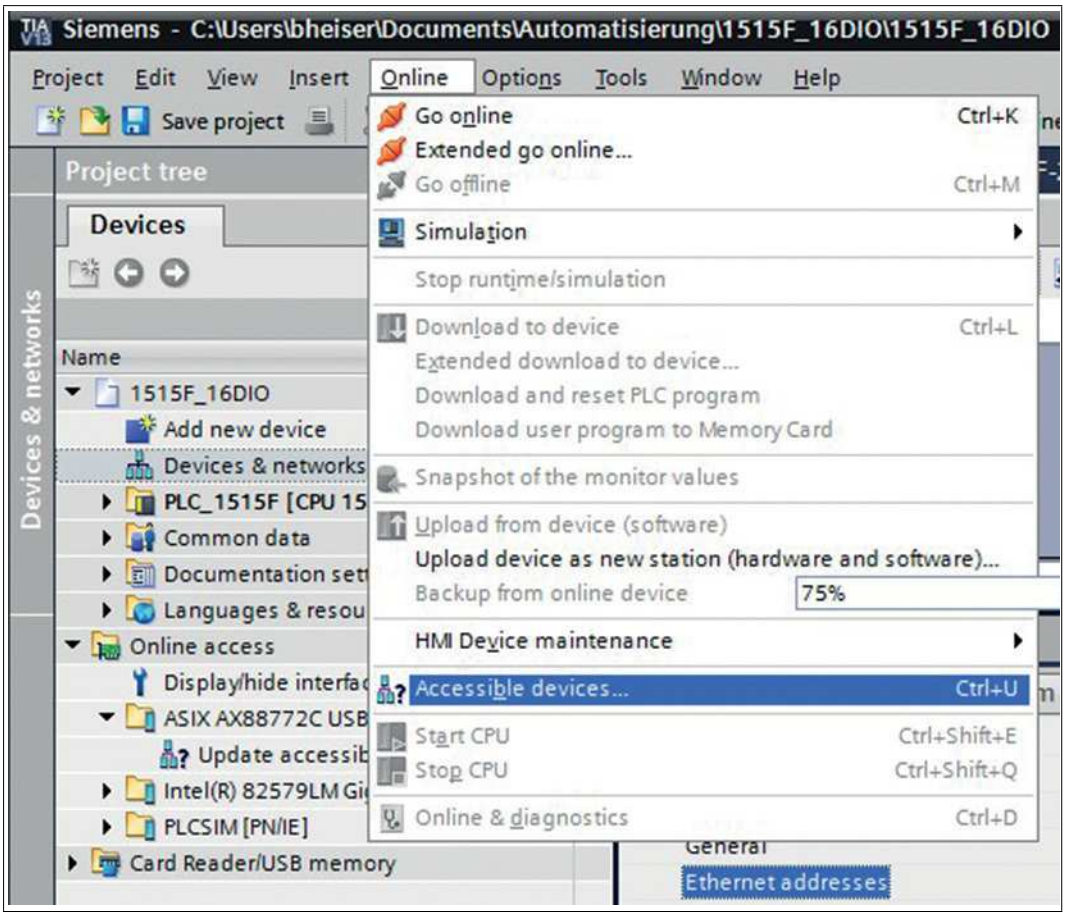

Figure 6.8

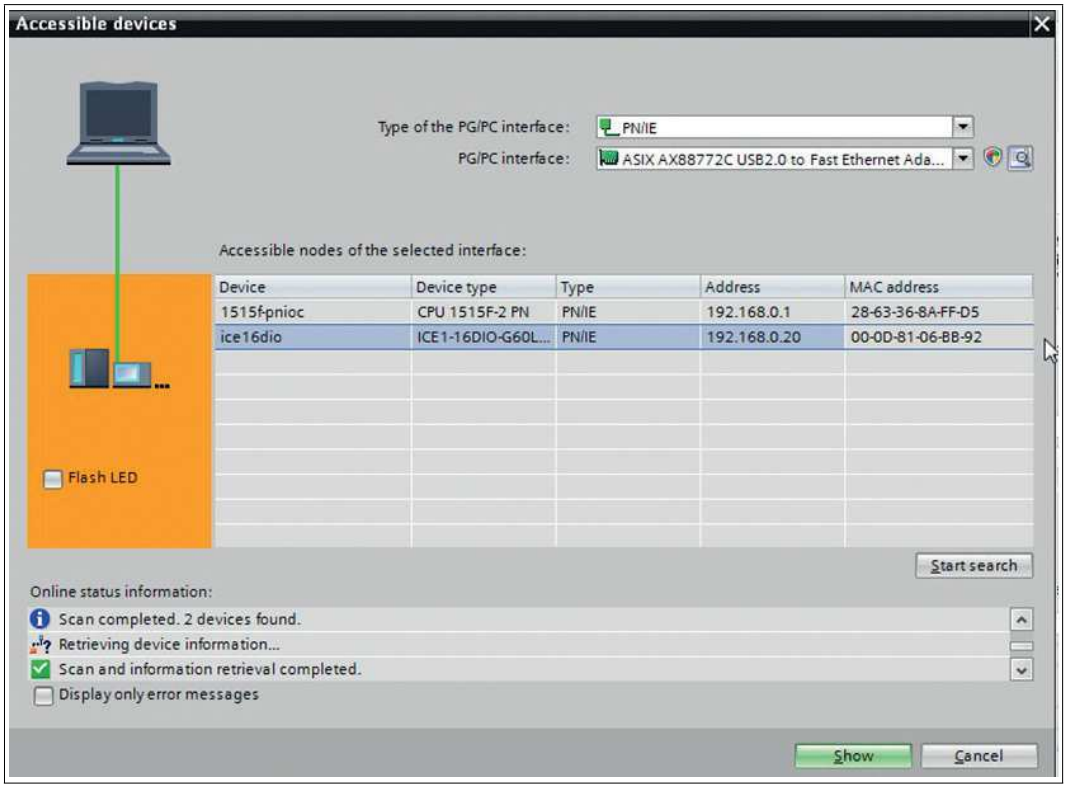

Figure 6.9

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.

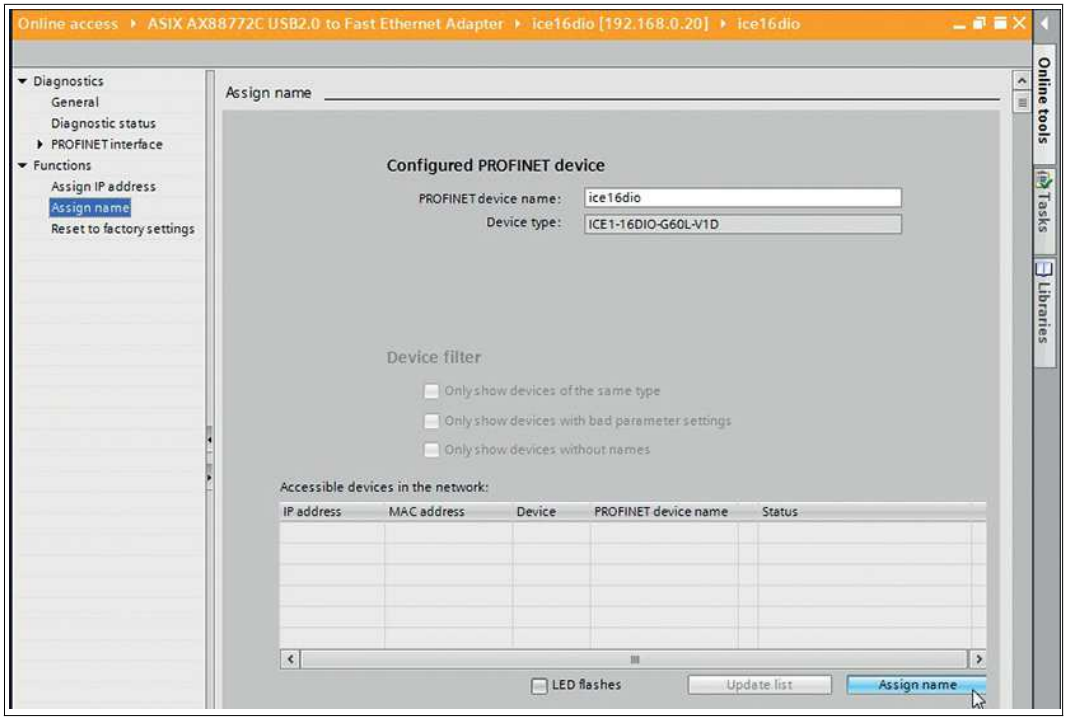

Figure 6.10

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

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

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).

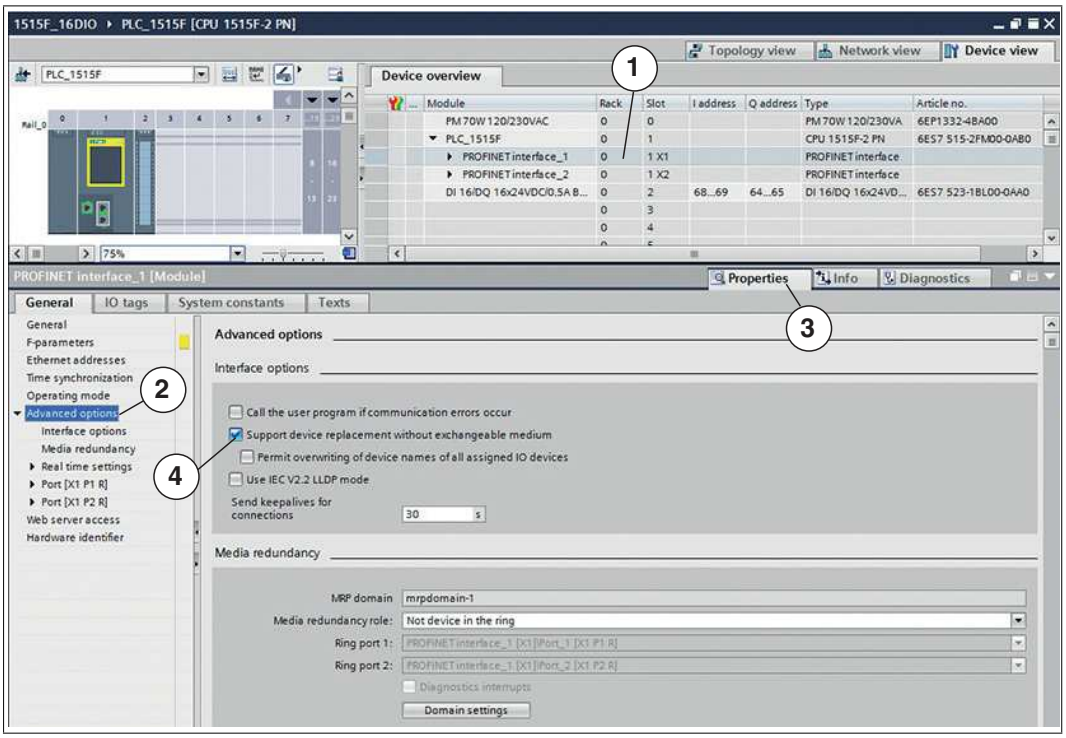

Figure 6.11

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" (1) and "Topology view" (2).
5. Use the mouse to drag a connection between the module and the PLC (3).

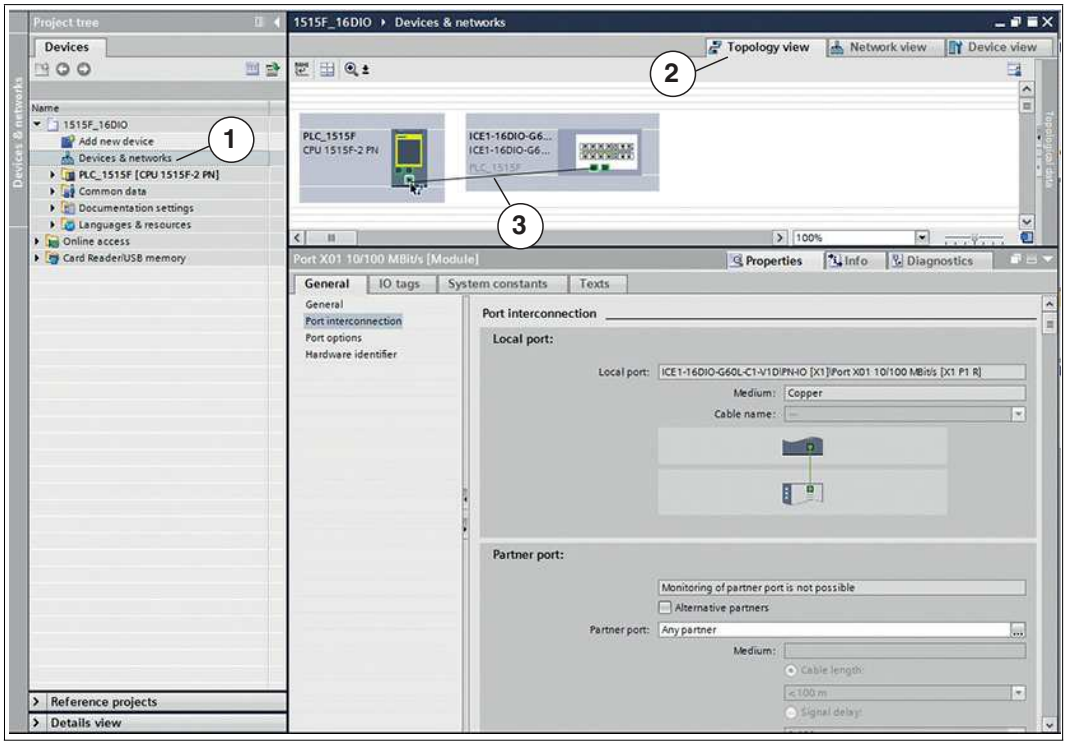

Figure 6.12

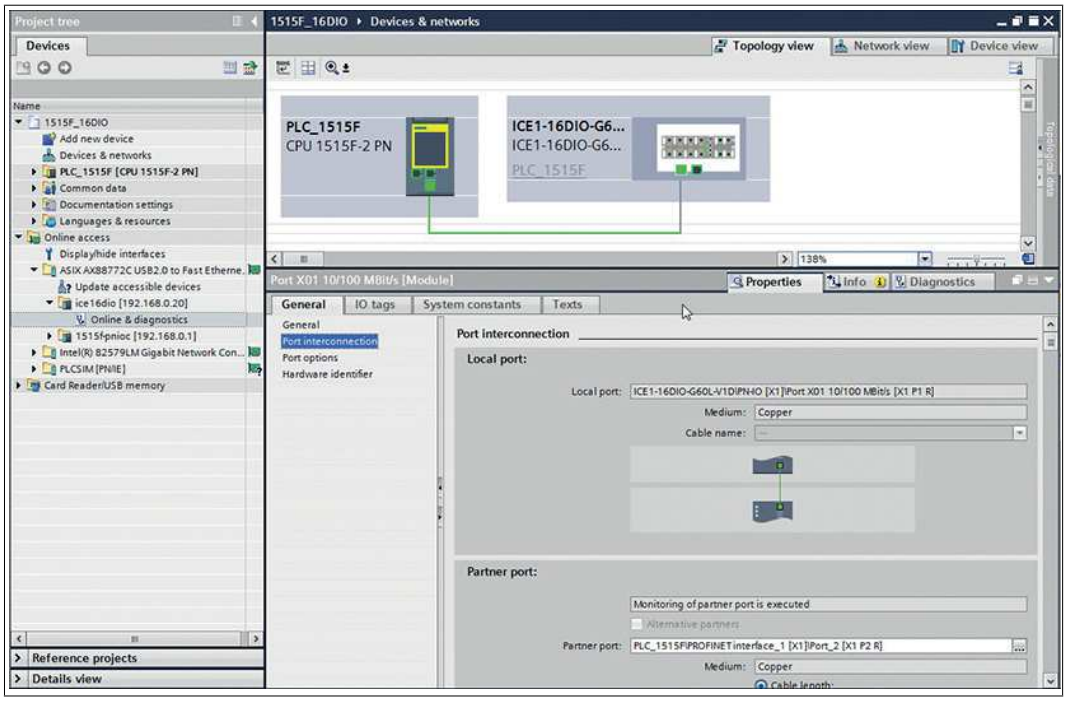

Figure 6.13

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

The Parameter Settings for the Modules

The parameter setting display depends on the module version in use and the version of the device description file. Each module has a unique set of parameters.
The parameter settings can be reached via the module device view:
- slot 0 (for 16DO and 8DI/8DO modules) and
- slot 1 (for 16DIO modules)

1. Select "Device View" (1) and the desired module (2) (in this example, slot 1 with a 16DIO module).
2. Then, in the "General" tab, select the "Module parameters" (3) area.

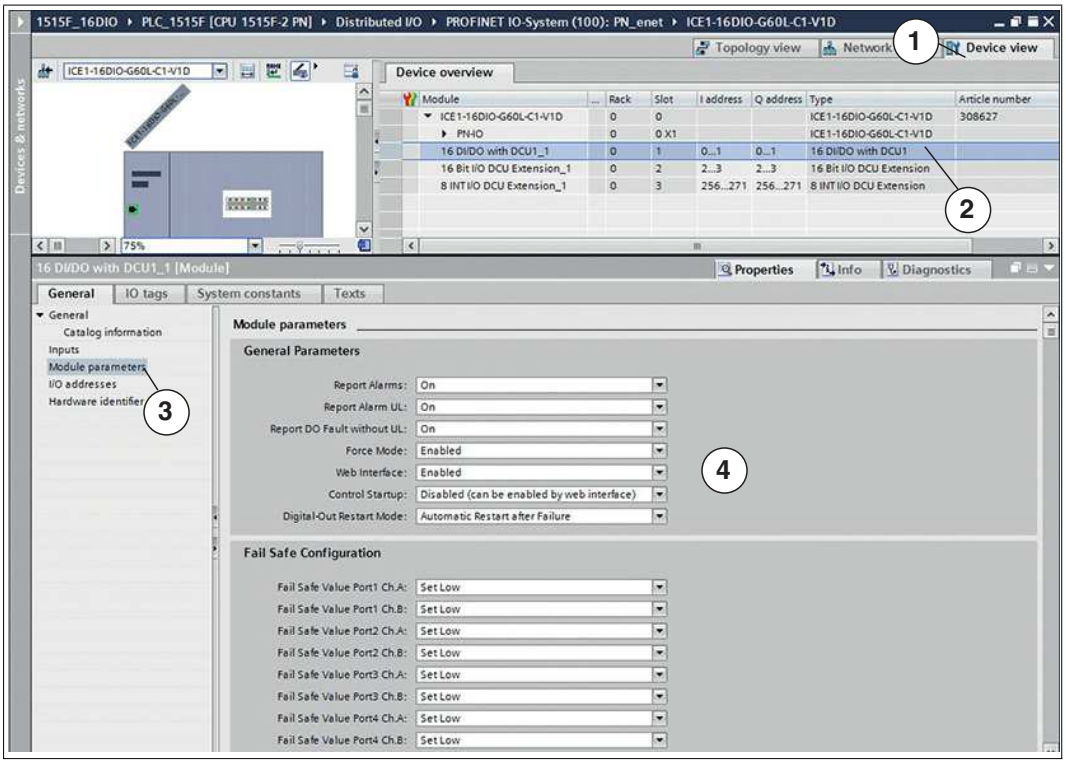

Figure 6.14

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

Parameter Overview

The parameter groups are briefly described below.

- **Report Alarms**

  Enable/disable global PROFINET alarm messages.

- **Report Alarm U_L**

  Enable/disable PROFINET alarm reporting on absence of supply to actuator (U_L). If the global PROFINET alarm messages are disabled, this alarm will not be reported.

- **Report Alarm DO without U_L**

  Enable/disable PROFINET alarm reporting on absence of supply to actuator (U_L) and activation of an output. If the global PROFINET alarm messages are disabled, this alarm will not be reported.

- **Force Mode**

  Allow/block use of Force Mode via the web server.

- **Web Interface**

  Allow/block use of the web server.

- **Decentralized control function DCU start-up** (only for C1 modules)

  Disable/block decentralized control function or start DCU program.

- **Digital-Out Restart Mode** (supported with 16DIO modules)

  Automatic restart after short circuit of digital output or reset of channel diagnosis when resetting the digital output.

Fail-Safe Configuration

These parameters are provided by module types with digital outputs. When configuring the modules, you can define the status of the outputs after an interruption or loss of communication.

The following options are available:

1. **Set Low** - Deactivate the output channel (digital value = 0)
2. **Set High** - Activate the output channel (digital value = 1)
3. **Hold Last** - Hold the last output state (digital value matches last state)

The "Surveillance Timeout" parameter

This parameter is supplied by modules types that produce digital outputs.

The firmware of these modules enables you to set a delay time before the monitoring of the output currents starts, i.e., a surveillance timeout. You can set this for each individual output channel.

The delay time starts after the status of the output channel changes, i.e., when the channel is activated (after a rising edge) or deactivated (after a falling edge). After this time has elapsed, the monitoring of the output begins and the diagnosis begins reporting error states.

The surveillance timeout can be set between 0 ms and 255 ms. The default value is 80 ms. When the output channel is in a static state, i.e., when the channel is permanently switched on or off, the value is 100 ms.

IO Mapping Configuration (Only for 16DIO Modules)

Using IO mapping configuration, it is possible to alter the data structure of I/O data. By default, each I/O channel is represented in order in the process data. Existing PLC programs may use a different channel assignment

Using these parameters, all I/O channels can therefore be freely assigned to a bit in the I/O data. It is important to note that double assignments are not possible. If incorrect parameterization of the IO mapping is detected when transferring the configuration, the module reports an error.

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.

1. Select "Device View" (1) and the desired module (in this example, slot 1 for a 16DIO module with 8DI/8DO profile).
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.

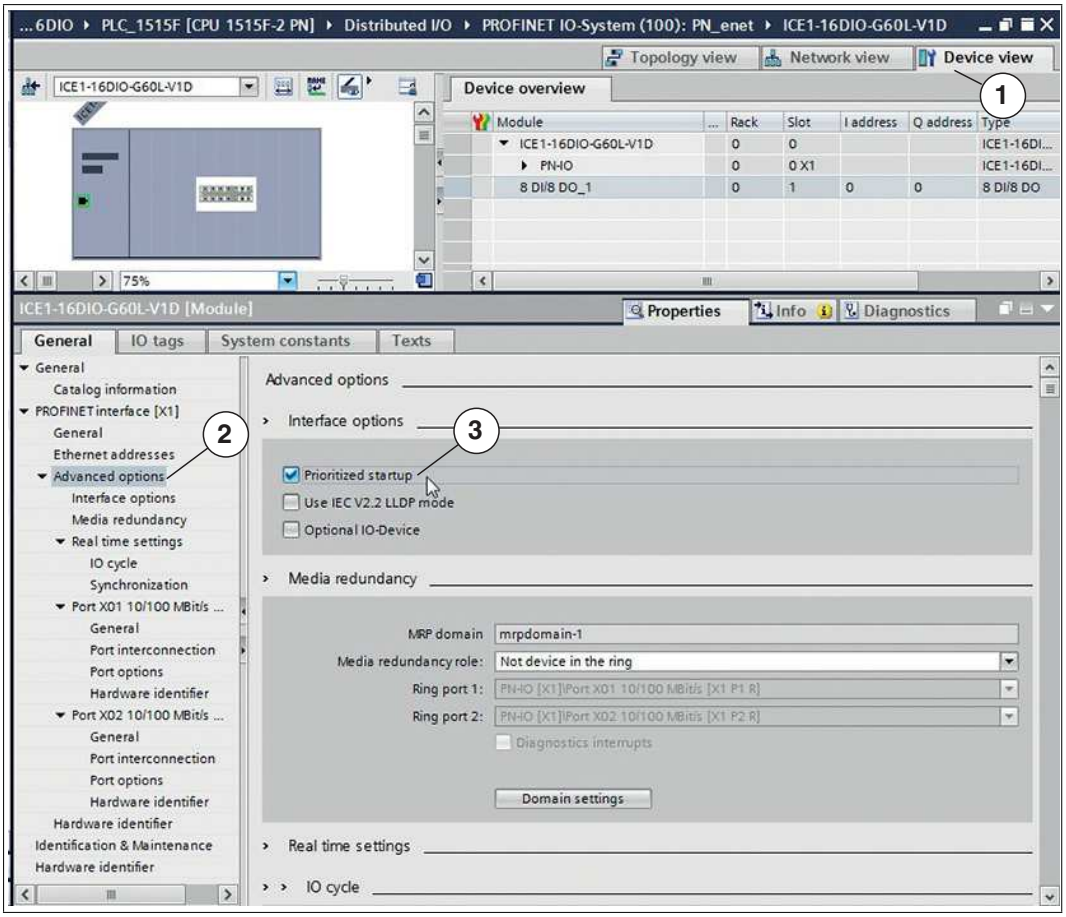
...6DIO ▸ PLC_1515F [CPU 1515F-2 PN] ▸ Distributed I/O ▸ PROFINET IO-System (100): PN_enet ▸ ICE1-16DIO-G60L-V1D
Topology view
Network view
Device view
1
ICE1-16DIO-G60L-V1D
Device overview
Module
Rack
Slot
I address
Q address
Type
ICE1-16DIO-G60L-V1D
0
0
ICE1-16DI...
PN-IO
0
0 X1
ICE1-16DI...
8 DI/8 DO_1
0
1
0
0
8 DI/8 DO
75%
ICE1-16DIO-G60L-V1D [Module]
Properties
Info
Diagnostics
General
IO tags
System constants
Texts
General
Catalog information
PROFINET interface [X1]
General
Ethernet addresses
Advanced options
Interface options
Media redundancy
Real time settings
IO cycle
Synchronization
Port X01 10/100 MBit/s ...
General
Port interconnection
Port options
Hardware identifier
Port X02 10/100 MBit/s ...
General
Port interconnection
Port options
Hardware identifier
Hardware identifier
Identification & Maintenance
Hardware identifier
2
Advanced options
Interface options
3
Prioritized startup
Use IEC V2.2 LLDP mode
Optional IO-Device
Media redundancy
MRP domain
mrpdomain-1
Media redundancy role:
Not device in the ring
Ring port 1:
PN-IO [X1]\Port X01 10/100 MBit/s [X1 P1 R]
Ring port 2:
PN-IO [X1]\Port X02 10/100 MBit/s [X1 P2 R]
Diagnostics interrupts
Domain settings
Real time settings
IO cycle

Figure 6.15

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 ...".

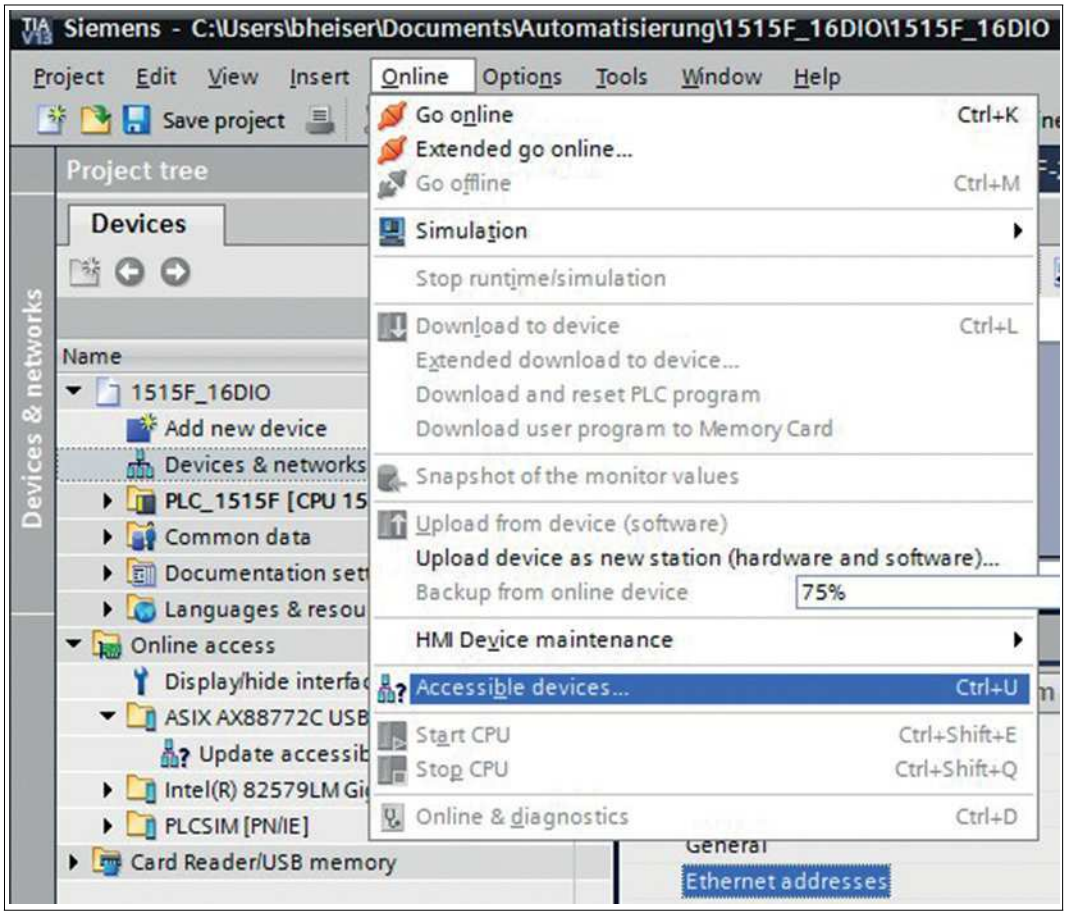

Figure 6.16

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

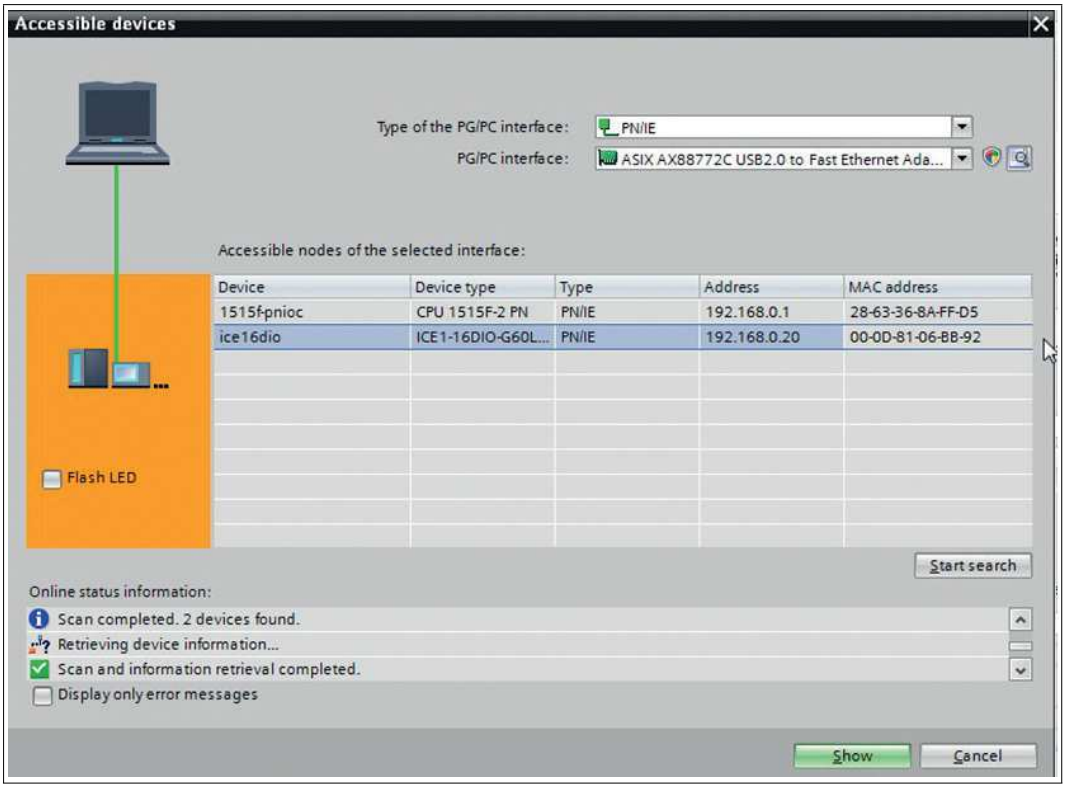

Figure 6.17

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

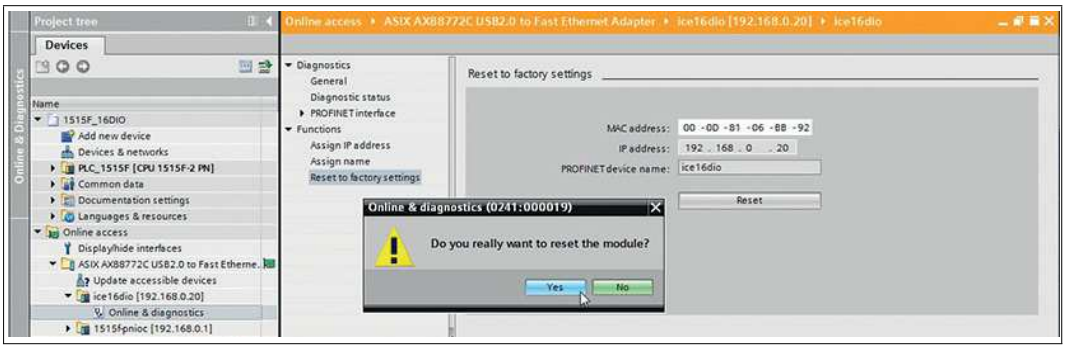

Figure 6.18

Media Redundancy Protocol (MRP)

You can create a redundant PROFINET communication with the modules without the need for additional switches by using a ring topology. An MRP redundancy manager closes the ring, detects individual failures and, in the case of a fault, sends the data packets via the redundant path.

The following requirements must be met in order to use MRP:

- All devices must support MRP.
- MRP must be activated on all devices.
- The devices can only be connected via the ring ports. This means an interconnected topology cannot be used.
- A maximum of 50 devices are permitted in the ring.
- All devices must be part of the same redundancy domain.
- One device must be configured as the redundancy manager.

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- All other devices must be configured as redundancy clients.
- Prioritized start-up (FSU) is not permitted.
- The watchdog time for all devices must be greater than the reconfiguration time (typically 200 ms, min. 90 ms for ICE1-* modules).
- We recommend using the automatic network setting on all devices.

The following images show a potential MRP ring configuration. The PLC is used as a redundancy manager and all other devices are used as clients. We recommend activating the diagnosis alarms to detect individual failures.

1. Select "Device View" (1) and the desired module in slot 0 (2).
2. Then, in the "General" tab, select the "Advanced Options -> Media Redundancy" (3). Set the "Media Redundancy Role" option to "Client" (4).

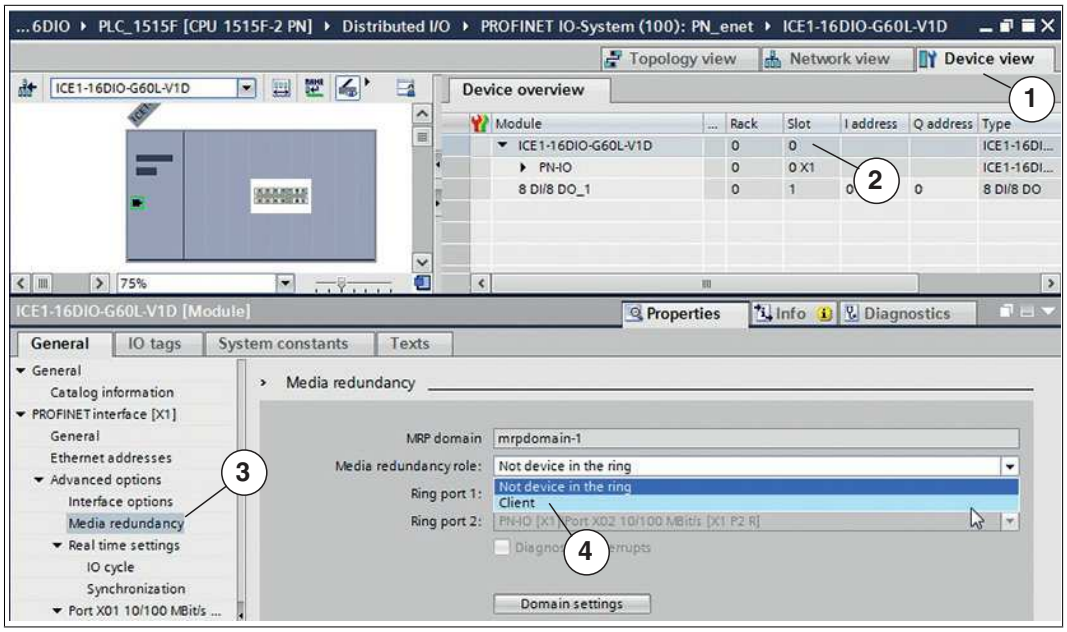

Figure 6.19

3. Check the "Watchdog Time." To do so, select the "Real-Time Settings" area in this module.
4. Re-set the "Watchdog Time" if necessary (to at least 90 ms, usually 200 ms).

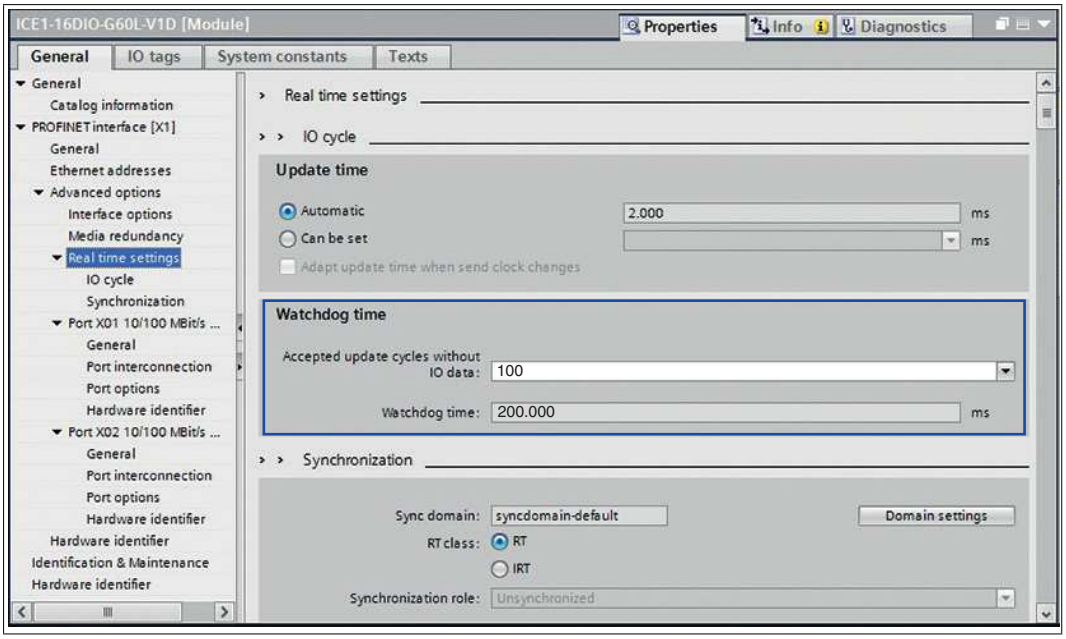

Figure 6.20

6.3 Assigning Process Data

This chapter describes how process data from the controller is assigned to the I/O channels in slot 1 of the modules.

The process data range extensions for 16DIO modules with distributed control function (DCU) are also described.

6.3.1 16DIO Modules, Bit Assignment of Process Data

The data structure of the process data in slot 1 depends on the IO mapping used. Ethernet IO modules with decentralized control function (DCU) have an expanded process data range in slot 2 and 3. This is therefore listed as optional. For further details on how to use the extended process data ranges, see the chapter "decentralized control function."

The following representations relate to the default settings of the respective profiles.

Input Data for 16DI/DO Profile (Default Profile)

This module provides two bytes of input data that depict the current status of the input and output channels.

Note

So that a diagnosis can be done within the module, the actual output statuses at the module—in addition to the actual input statuses—are reflected in the input data (output mirror).

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4 A	3B	3 A	2B	2 A	1B	1 A
Byte n+1	8B	8 A	7B	7 A	6B	6 A	5B	5 A

Table 6.1

The values refer to the following:

- 1A ... 8A: Actual status of input/output channel A (contact pin 4) for M12 connections 1 to 8.

- 1B ... 8B: Actual status of input/output channel B (contact pin 2) for M12 connections 1 to 8.

Output Data for 16DI/DO Profile (Default Profile)

This module requires two bytes of output data for controlling the digital outputs.

Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4 A	3B	3 A	2B	2 A	1B	1 A
Byte n+1	8B	8 A	7B	7 A	6B	6 A	5B	5 A

Table 6.2

The values refer to the following:

- 1A ... 8A: Target status of output channel A (contact pin 4) for M12 connections 1 to 8.
- 1B ... 8B: Target status of output channel B (contact pin 2) for M12 connections 1 to 8.

Input Data for 8DI/DO Profile

This module provides one byte of input data that depicts the current status of the input and output channels.

Note

So that a diagnosis can be done within the module, the actual output statuses at the module—in addition to the actual input statuses—are reflected in the input data (output mirror).

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	8 A	7 A	6 A	5 A	4 A	3 A	2 A	1 A

Table 6.3

The values refer to the following:

- 1A ... 8A: Actual status of input channel A (contact pin 4) for M12 connections 1 to 8.

Output Data for 8DI/DO Profile

This module requires one byte of output data for controlling the digital outputs.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	8 A	7 A	6 A	5 A	4 A	3 A	2 A	1 A

Table 6.4

The values refer to the following:

- 1A ... 8A: Target status of output channel A (contact pin 4) for M12 connections 1 to 8.

Input Data for 16DI Profile

This module provides two bytes of input data that depict the current status of the input channels.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4 A	3B	3 A	2B	2 A	1B	1 A
Byte n+1	8B	8 A	7B	7 A	6B	6 A	5B	5 A

Table 6.5

The values refer to the following:

- 1A ... 8A: Actual status of input channel A (contact pin 4) for M12 connections 1 to 8.

- 1B ... 8B: Actual status of input channel B (contact pin 2) for M12 connections 1 to 8.

Input Data for 8DI Profile

This module provides one byte of input data that depicts the current status of the input channels.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	8 A	7 A	6 A	5 A	4 A	3 A	2 A	1 A

Table 6.6

The values refer to the following:

- 1A ... 8A: Actual status of input channel A (contact pin 4) for M12 connections 1 to 8.

Output Data for 16DO Profile

This module requires two bytes of output data for controlling the digital outputs.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4B	3B	3 A	2B	2 A	1B	1 A
Byte n +1	8B	8 A	7B	7 A	6B	6 A	5B	5 A

Table 6.7

The values refer to the following:

- 1A ... 8A: Target status of output channel A (contact pin 4) for M12 connections 1 to 8.
- 1B ... 8B: Target status of output channel A (contact pin 2) for M12 connections 1 to 8.

Output Data for 8DO Profile

This module requires one byte of output data for controlling the digital outputs.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	8 A	7 A	6 A	5 A	4 A	3 A	2 A	1 A

Table 6.8

The values refer to the following:

- 1A ... 8A: Target status of output channel A (contact pin 4) for M12 connections 1 to 8.

Input Data for 8DI/8DO Profile

This module provides one byte of input data that depicts the current status of the input channels.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4 A	3B	3 A	2B	2 A	1B	1 A

Table 6.9

The values refer to the following:

- 1A ... 4A: Actual status of input channel A (contact pin 4) for M12 connections 1 to 4.
- 1B ... 4B: Actual status of input channel B (contact pin 2) for M12 connections 1 to 4.

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Output Data for 8DI/8DO Profile

This module requires one byte of output data for controlling the digital outputs.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	8B	8 A	7B	7 A	6B	6 A	5B	5 A

Table 6.10

The values refer to the following:

- 5A ... 8A: Target status of output channel A (contact pin 4) for M12 connections 5 to 8.
- 5B ... 8B: Target status of output channel B (contact pin 4) for M12 connections 5 to 8.

6.3.2 Modules with Decentralized Control Function, Bit Assignment of Process Data Extension

For Ethernet IO modules with decentralized control function (DCU), the process data range for input and output data has been extended. The extension provides 16-bit output data in slot 2 and 8-INT output data in slot 3.

This process data extension is described below for the following Ethernet IO modules:

- ICE1-8DI8DO-G60L-C1-V1D
- ICE1-16DIO-G60L-C1-V1D

Output Data for DCU Extension

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	16-bit I/O DCU extension: slot 2							
Byte n + 1								
Byte n	INT I/O DCU extension: slot 3							
Byte n + 1								
Byte n + 14	INT I/O DCU extension: slot 3							
Byte n + 15								

Table 6.11

The values refer to the following:

- 16-bit I/O DCU extension: bit states as output data for the decentralized control function (DCU function)
- INT I/O DCU extension: 8-word data types as output data for the decentralized control function (DCU function), e.g., for transmission of counter states.

Input Data for DCU Extension

INPUT	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	16-bit I/O DCU extension: slot 2							
Byte n + 1								
Byte n	INT I/O DCU extension: slot 3							
Byte n + 1								
Byte n + 14	INT I/O DCU extension: slot 3							
Byte n + 15								

Table 6.12

The values refer to the following:

- 16-bit I/O DCU extension: bit states as input data for the decentralized control function (DCU function)
- INT I/O DCU extension: 8-word data types as input data for the decentralized control function (DCU function), e.g., for transmission of program parameters.

6.3.3 16DI Modules, Bit Assignment of Process Data

Input Data

The module provides 2 bytes of status information for the digital inputs. The bits are assigned as follows:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4A	3B	3A	2B	2A	1B	1A
Byte n+1	8B	8A	7B	7A	6B	6A	5B	5A

Table 6.13

The values refer to the following:

- 1A ... 8A: Actual status of input channel A (contact pin 4) for M12 connections 1 to 8.
- 1B ... 8B: Actual status of input channel B (contact pin 2) for M12 connections 1 to 8.

6.3.4 8DI/8DO Modules, Bit Assignment of Process Data

Input Data

This module provides two bytes of input data that depict the current status of the input and output channels.

Note

So that a diagnosis can be done within the module, the actual output statuses at the module—in addition to the actual input statuses—are reflected in the input data (output mirror).

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4 A	3B	3 A	2B	2 A	1B	1 A
Byte n+1	8B	8 A	7B	7 A	6B	6 A	5B	5 A

Table 6.14

The values refer to the following:

- 1A ... 4A: Actual status of input channel A (contact pin 4) for M12 connections 1 to 4.
- 1B ... 4B: Actual status of input channel B (contact pin 2) for M12 connections 1 to 4.
- 5A ... 8A: Actual status of output channel A (contact pin 4) for M12 connections 5 to 8.
- 5B ... 8B: Actual status of output channel B (contact pin 2) for M12 connections 5 to 8.

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Output Data

This module requires two bytes of status information for controlling the digital outputs.

Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	8B	8 A	7B	7 A	6B	6 A	5B	5 A

Table 6.15

The values refer to the following:

- 5A ... 8A: Target status of output channel A (contact pin 4) for M12 connections 5 to 8.
- 5B ... 8B: Target status of output channel B (contact pin 2) for M12 connections 5 to 8.

7 Commissioning for EtherCAT

7.1 Preparation

Downloading and Installing the ESI File

An ESI file (EtherCAT Slave Information file) is required to configure a module in the controller. The ESI file supports all module variants.

You can find the relevant ESI file in the **Commissioning** 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 information about the device, 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 ESI file for the module variant used. For TwinCat®, you usually have to copy the ESI file to the installation folder, for example: `C:\TwinCAT\3.1\Config\Io\EtherCAT`. After installation, the modules are available in the hardware catalogs.

Reading MAC IDs

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

This MAC ID has no function for EtherCAT. For EoE (Ethernet over EtherCAT), the I/O module is assigned a virtual MAC ID.

7.2 Configuration

PDO Assignments

The module supports different PDO assignments for input and output data. There are assignments for bit or byte access with or without diagnostic data that are associated with the input data (TxPDO, I/O module to EtherCAT® controller).

You determine the data content by selecting the appropriate PDO.

The modules offer the following PDO assignments:

7.2.1 16DIO Modules, PDO Mapping

The 16DIO-variant Ethernet modules are universally applicable and provide a variety of profiles for basic configuration. With these, you can preconfigure a 16DIO module as a 16DI, 16DO or 8DI/8DO module and e.g. replace another if necessary. Each I/O channel can be used as an input or output for the 16DI/DO profile. If an I/O channel is used as an input, the PLC programmer should not set the corresponding output bit.

By using the preconfigured alternate profiles, the risk of incorrect configuration is reduced through the use of profiles 16DI, 16DO or 8DI/8DO. In these profiles, the I/O channels are configured as "input" or "output".

Ethernet IO modules of type ICE1-8DI8DO-G60L-C1-V1D ICE1-16DIO-G60L-C1-V1D have the DCU function. For these, the process data is extended in both directions by 4 additional bytes.

For this reason, each of the profiles supports flexible I/O bit mapping. Information on how to use flexible I/O bit mapping can be found in the following chapter, "Device Parameters" in the sections "Configuration of I/O direction (for 16DIO modules with/without DCU)" and "I/O mapping configuration (for 16DIO modules with/without DCU)"

Overview of the 16DIO Profiles in Byte Format

The following table provides an overview of the available I/O profiles and associated PDOs in byte format

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Profile	For-mat	PDO			PDO content			
		Type	Index	Size	Index	Size	Type	Name
16DI/DO	Byte	Input	0x1A00	2	0x6000:01	1.0	USINT	Physical inputs 0 ... 7
					0x6000:02	1.0	USINT	Physical inputs 8 ... 15
		Output	0x1600	2	0x6000:01	1.0	USINT	Physical outputs 0 ... 7
					0x6000:02	1.0	USINT	Physical outputs 8 ... 15
16DI	Byte	Input	0x1A00	2	0x6000:01	1.0	USINT	Physical inputs 0 ... 7
					0x6000:02	1.0	USINT	Physical inputs 8 ... 15
16DO	Byte	Output	0x1600	2	0x6200:01	1.0	USINT	Physical outputs 0 ... 7
					0x6200:02	1.0	USINT	Physical outputs 8 ... 15
8DI/DO	Byte	Input	0x1A10	1	0x6000:01	1.0	USINT	Physical inputs 0 ... 7
		Output	0x1610	1	0x6200:01	1.0	USINT	Physical outputs 0 ... 7
8DI	Byte	Input	0x1A10	1	0x6000:01	1.0	USINT	Physical inputs 0 ... 7
8DO	Byte	Output	0x1610	1	0x6200:01	1.0	USINT	Physical outputs 0 ... 7
8DI/8DO	Byte	Input	0x1A10	1	0x6000:01	1.0	USINT	Physical inputs 0 ... 7
		Output	0x1610	1	0x6200:01	1.0	USINT	Physical outputs 0 ... 7

Table 7.1

Overview of the 16DIO Profiles in Bit Format

Profile	For-mat	PDO			PDO content			
		Type	Index	Size	Index	Size	Type	Name
16DI/DO	Bit	Input	0x1A01	2	0x6020:01	0.1	BIT	Physical input 0
					...	...	...	...
					0x6020:10	0.1	BIT	Physical input 15
		Output	0x1601	2	0x6220:01	0.1	BIT	Physical output 0
					...	...	...	...
					0x6220:10	0.1	BIT	Physical output 15
16DI	Bit	Input	0x1A01	2	0x6020:01	0.1	BIT	Physical input 0
					...	...	...	...
					0x6020:10	0.1	BIT	Physical input 15
16DO	Bit	Output	0x1601	2	0x6220:01	0.1	BIT	Physical output 0
					...	...	...	...
					0x6220:10	0.1	BIT	Physical output 15
8DI/DO	Bit	Input	0x1A11	1	0x6020:01	0.1	BIT	Physical input 0
					...	...	...	...
					0x6020:08	0.1	BIT	Physical input 7
		Output	0x1611	1	0x6220:01	0.1	BIT	Physical output 0
					...	...	...	...
					0x6220:08	0.1	BIT	Physical output 7

Profile	For-mat	PDO			PDO content			
		Type	Index	Size	Index	Size	Type	Name
8DI	Bit	Input	0x1A11	1	0x6020:01	0.1	BIT	Physical input 0
					...	...	...	...
					0x6220:08	0.1	BIT	Physical input 7
8DO	Bit	Output	0x1611	1	0x6220:01	0.1	BIT	Physical output 0
					...	....	...	...
					0x6220:08	0.1	BIT	Physical output 7
8DI/8DO	Bit	Input	0x1A11	1	0x6020:01	0.1	BIT	Physical input 0
					...	...	...	...
					0x6020:08	0.1	BIT	Physical input 7
		Output	0x1611	1	0x6220:01	0.1	BIT	Physical output 0
					...	...	...	...
					0x6220:08	0.1	BIT	Physical output 7

Table 7.2

The following tables show the process data mapping for each profile with the standard I/O direction and the default mapping parameters.

Note

The following tables show the process data for each profile with default mapping parameters for the Ethernet IO modules ICE1-16DIO-G60L-V1D and ICE1-16DIO-G60L-C1-V1D with DCU function

- X1A ... X8A: data from channel A (pin 4) from slot X1 to X8
- X1B ... X8B: data from channel B (pin 2) from slot X1 to X8

PDOs 0x1A00/0x1600, 16DI/DO Profile with Data in Byte Format

Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A00		Output PDO: 0x1600	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:01	0	X1A	Physical inputs 0 ... 7	0	Physical outputs 0 ... 7	0
0x2304:02	1	X1B	Physical inputs 0 ... 7	1	Physical outputs 0 ... 7	1
0x2304:03	2	X2A	Physical inputs 0 ... 7	2	Physical outputs 0 ... 7	2
0x2304:04	3	X2B	Physical inputs 0 ... 7	3	Physical outputs 0 ... 7	3
0x2304:05	4	X3A	Physical inputs 0 ... 7	4	Physical outputs 0 ... 7	4
0x2304:06	5	X3B	Physical inputs 0 ... 7	5	Physical outputs 0 ... 7	5
0x2304:07	6	X4A	Physical inputs 0 ... 7	6	Physical outputs 0 ... 7	6
0x2304:08	7	X4B	Physical inputs 0 ... 7	7	Physical outputs 0 ... 7	7
0x2304:09	8	X5A	Physical inputs 8 ... 15	0	Physical outputs 8 ... 15	0
0x2304:0A	9	X5B	Physical inputs 8 ... 15	1	Physical outputs 8 ... 15	1
0x2304:0B	10	X6A	Physical inputs 8 ... 15	2	Physical outputs 8 ... 15	2
0x2304:0C	11	X6B	Physical inputs 8 ... 15	3	Physical outputs 8 ... 15	3

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Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A00		Output PDO: 0x1600	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:0D	12	X7A	Physical inputs 8 ... 15	4	Physical outputs 8 ... 15	4
0x2304:0E	13	X7B	Physical inputs 8 ... 15	5	Physical outputs 8 ... 15	5
0x2304:0F	14	X8A	Physical inputs 8 ... 15	6	Physical outputs 8 ... 15	6
0x2304:10	15	X8B	Physical inputs 8 ... 15	7	Physical outputs 8 ... 15	7

Table 7.3

PDO 0x1A0, 16DI Profile with Data in Byte Format

Process data for each I/O port: **Input**.

Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A00		Output PDO:	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:01	0	X1A	Physical inputs 0 ... 7	0	-	-
0x2304:02	1	X1B	Physical inputs 0 ... 7	1	-	-
0x2304:03	2	X2A	Physical inputs 0 ... 7	2	-	-
0x2304:04	3	X2B	Physical inputs 0 ... 7	3	-	-
0x2304:05	4	X3A	Physical inputs 0 ... 7	4	-	-
0x2304:06	5	X3B	Physical inputs 0 ... 7	5	-	-
0x2304:07	6	X4A	Physical inputs 0 ... 7	6	-	-
0x2304:08	7	X4B	Physical inputs 0 ... 7	7	-	-
0x2304:09	8	X5A	Physical inputs 8 ... 15	0	-	-
0x2304:0A	9	X5B	Physical inputs 8 ... 15	1	-	-
0x2304:0B	10	X6A	Physical inputs 8 ... 15	2	-	-
0x2304:0C	11	X6B	Physical inputs 8 ... 15	3	-	-
0x2304:0D	12	X7A	Physical inputs 8 ... 15	4	-	-
0x2304:0E	13	X7B	Physical inputs 8 ... 15	5	-	-
0x2304:0F	14	X8A	Physical inputs 8 ... 15	6	-	-
0x2304:10	15	X8B	Physical inputs 8 ... 15	7	-	-

Table 7.4

PDO 0x1600, 16DO Profile with Data in Byte Format

Process data for each I/O port: **Output**.

Mapping parameters (Default values, reference)			Process data			
			Input PDO:		Output PDO: 0x1600	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:01	0	X1A	-	-	Physical outputs 0 ... 7	0
0x2304:02	1	X1B	-	-	Physical outputs 0 ... 7	1
0x2304:03	2	X2A	-	-	Physical outputs 0 ... 7	2
0x2304:04	3	X2B	-	-	Physical outputs 0 ... 7	3
0x2304:05	4	X3A	-	-	Physical outputs 0 ... 7	4
0x2304:06	5	X3B	-	-	Physical outputs 0 ... 7	5
0x2304:07	6	X4A	-	-	Physical outputs 0 ... 7	6
0x2304:08	7	X4B	-	-	Physical outputs 0 ... 7	7
0x2304:09	8	X5A	-	-	Physical outputs 8 ... 15	0
0x2304:0A	9	X5B	-	-	Physical outputs 8 ... 15	1
0x2304:0B	10	X6A	-	-	Physical outputs 8 ... 15	2
0x2304:0C	11	X6B	-	-	Physical outputs 8 ... 15	3
0x2304:0D	12	X7A	-	-	Physical outputs 8 ... 15	4
0x2304:0E	13	X7B	-	-	Physical outputs 8 ... 15	5
0x2304:0F	14	X8A	-	-	Physical outputs 8 ... 15	6
0x2304:10	15	X8B	-	-	Physical outputs 8 ... 15	7

Table 7.5

PDOs 0x1A10/0x1610, 8DI/DO Profile with Data in Byte Format

Process data for each I/O port: **Input/output**.

Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A10		Output PDO: 0x1610	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:01	0	X1A	Physical inputs 0 ... 7	0	Physical outputs 0 ... 7	0
0x2304:02	Inactive	X1B	-	-	-	-
0x2304:03	1	X2A	Physical inputs 0 ... 7	1	Physical outputs 0 ... 7	1
0x2304:04	Inactive	X2B	-	-	-	-
0x2304:05	2	X3A	Physical inputs 0 ... 7	2	Physical outputs 0 ... 7	2
0x2304:06	Inactive	X3B	-	-	-	-
0x2304:07	3	X4A	Physical inputs 0 ... 7	3	Physical outputs 0 ... 7	3
0x2304:08	Inactive	X4B	-	-	-	-
0x2304:09	4	X5A	Physical inputs 0 ... 7	0	Physical outputs 0 ... 7	4
0x2304:0A	Inactive	X5B	-	-	-	-

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Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A10		Output PDO: 0x1610	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:0B	5	X6A	Physical inputs 0 ... 7	5	Physical outputs 0 ... 7	5
0x2304:0C	Inactive	X6B	-	-	-	-
0x2304:0D	6	X7A	Physical inputs 0 ... 7	6	Physical outputs 0 ... 7	6
0x2304:0E	Inactive	X7B	-	-	-	-
0x2304:0F	7	X8A	Physical inputs 0 ... 7	7	Physical outputs 0 ... 7	7
0x2304:10	Inactive	X8B	-	-	--	-

Table 7.6

PDO 0x1A10, 8DI Profile with Data in Byte Format

Process data for each I/O port: **Input**.

Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A10		Output PDO:	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:01	0	X1A	Physical inputs 0 ... 7	0	-	-
0x2304:02	Inactive	X1B	-	-	-	-
0x2304:03	1	X2A	Physical inputs 0 ... 7	1	-	-
0x2304:04	Inactive	X2B	-	-	-	-
0x2304:05	2	X3A	Physical inputs 0 ... 7	2	-	-
0x2304:06	Inactive	X3B	-	-	-	-
0x2304:07	3	X4A	Physical inputs 0 ... 7	3	-	-
0x2304:08	Inactive	X4B	-	-	-	-
0x2304:09	4	X5A	Physical inputs 0 ... 7	0	-	-
0x2304:0A	Inactive	X5B	-	-	-	-
0x2304:0B	5	X6A	Physical inputs 0 ... 7	5	-	-
0x2304:0C	Inactive	X6B	-	-	-	-
0x2304:0D	6	X7A	Physical inputs 0 ... 7	6	-	-
0x2304:0E	Inactive	X7B	-	-	-	-
0x2304:0F	7	X8A	Physical inputs 0 ... 7	7	-	-

Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A10		Output PDO:	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:10	Inactive	X8B	-	-	--	-

Table 7.7

PDO 0x1610, 8DO Profile with Data in Byte Format

Process data for each I/O port: **Output**.

Mapping parameters (Default values, reference)			Process data			
			Input PDO:		Output PDO: 0x1610	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:01	0	X1A	-	-	Physical outputs 0 ... 7	0
0x2304:02	Inactive	X1B	-	-	-	-
0x2304:03	1	X2A	-	-	Physical outputs 0 ... 7	1
0x2304:04	Inactive	X2B	-	-	-	-
0x2304:05	2	X3A	-	-	Physical outputs 0 ... 7	2
0x2304:06	Inactive	X3B	-	-	-	-
0x2304:07	3	X4A	-	-	Physical outputs 0 ... 7	3
0x2304:08	Inactive	X4B	-	-	-	-
0x2304:09	4	X5A	-	-	Physical outputs 0 ... 7	4
0x2304:0A	Inactive	X5B	-	-	-	-
0x2304:0B	5	X6A	-	-	Physical outputs 0 ... 7	5
0x2304:0C	Inactive	X6B	-	-	-	-
0x2304:0D	6	X7A	-	-	Physical outputs 0 ... 7	6
0x2304:0E	Inactive	X7B	-	-	-	-
0x2304:0F	7	X8A	-	-	Physical outputs 0 ... 7	7
0x2304:10	Inactive	X8B	-	-	--	-

Table 7.8

PDOs 0x1A10/0x1610, 8DI/8DO Profile with Data in Byte Format

Process data for each I/O port: **Input/output**.

Mapping parameters (Default values, reference)			Process data			
			Input PDO: 0x1A10		Output PDO: 0x1610	
Index: Byte	Value	Port	Byte name	Bit	Byte name	Bit
0x2304:01	0	X1A	Physical inputs 0 ... 7	0	-	-
0x2304:02	1	X1B	Physical inputs 0 ... 7	1	-	-
0x2304:03	2	X2A	Physical inputs 0 ... 7	2	-	-
0x2304:04	3	X2B	Physical inputs 0 ... 7	3	-	-
0x2304:05	4	X3A	Physical inputs 0 ... 7	4	-	-
0x2304:06	5	X3B	Physical inputs 0 ... 7	5	-	-
0x2304:07	6	X4A	Physical inputs 0 ... 7	6	-	-
0x2304:08	7	X4B	Physical inputs 0 ... 7	7	-	-
0x2304:09	8	X5A	-	-	Physical outputs 0 ... 7	0
0x2304:0A	9	X5B	-	-	Physical outputs 0 ... 7	1
0x2304:0B	10	X6A	-	-	Physical outputs 0 ... 7	2
0x2304:0C	11	X6B	-	-	Physical outputs 0 ... 7	3
0x2304:0D	12	X7A	-	-	Physical outputs 0 ... 7	4
0x2304:0E	13	X7B	-	-	Physical outputs 0 ... 7	5
0x2304:0F	14	X8A	-	-	Physical outputs 0 ... 7	6
0x2304:10	15	X8B	-	-	Physical outputs 0 ... 7	7

Table 7.9

PDOs 0x1A01/0x1601, 16DI/DO Profile with Data in Bit Format

Process data for each I/O port: **Input/output**.

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A01	Output PDO: 0x1601
Index: Byte	Value	Port	Bit	Bit
0x2304:01	0	X1A	Physical input 0	Physical output 0
0x2304:02	1	X1B	Physical input 1	Physical output 1
0x2304:03	2	X2A	Physical input 2	Physical output 2
0x2304:04	3	X2B	Physical input 3	Physical output 3
0x2304:05	4	X3A	Physical input 4	Physical output 4
0x2304:06	5	X3B	Physical input 5	Physical output 5
0x2304:07	6	X4A	Physical input 6	Physical output 6
0x2304:08	7	X4B	Physical input 7	Physical output 7
0x2304:09	8	X5A	Physical input 8	Physical output 8
0x2304:0A	9	X5B	Physical input 9	Physical output 9
0x2304:0B	10	X6A	Physical input 10	Physical output 10
0x2304:0C	11	X6B	Physical input 11	Physical output 11
0x2304:0D	12	X7A	Physical input 12	Physical output 12
0x2304:0E	13	X7B	Physical input 13	Physical output 13

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A01	Output PDO: 0x1601
Index: Byte	Value	Port	Bit	Bit
0x2304:0F	14	X8A	Physical input 14	Physical output 14
0x2304:10	15	X8B	Physical input 15	Physical output 15

Table 7.10

PDO 0x1A01, 16DI Profile with Data in Bit Format

Process data for each I/O port: **Input**.

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A01	Output PDO
Index: Byte	Value	Port	Bit	Bit
0x2304:01	0	X1A	Physical input 0	-
0x2304:02	1	X1B	Physical input 1	-
0x2304:03	2	X2A	Physical input 2	-
0x2304:04	3	X2B	Physical input 3	-
0x2304:05	4	X3A	Physical input 4	-
0x2304:06	5	X3B	Physical input 5	-
0x2304:07	6	X4A	Physical input 6	-
0x2304:08	7	X4B	Physical input 7	-
0x2304:09	8	X5A	Physical input 8	-
0x2304:0A	9	X5B	Physical input 9	-
0x2304:0B	10	X6A	Physical input 10	-
0x2304:0C	11	X6B	Physical input 11	-
0x2304:0D	12	X7A	Physical input 12	-
0x2304:0E	13	X7B	Physical input 13	-
0x2304:0F	14	X8A	Physical input 14	-
0x2304:10	15	X8B	Physical input 15	-

Table 7.11

PDO 0x1601, 16DO Profile with Data in Bit Format

Process data for each I/O port: **Output**.

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A01	Output PDO: 0x1601
Index: Byte	Value	Port	Bit	Bit
0x2304:01	0	X1A	-	Physical output 0
0x2304:02	1	X1B	-	Physical output 1
0x2304:03	2	X2A	-	Physical output 2
0x2304:04	3	X2B	-	Physical output 3

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Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A01	Output PDO: 0x1601
Index: Byte	Value	Port	Bit	Bit
0x2304:05	4	X3A	-	Physical output 4
0x2304:06	5	X3B	-	Physical output 5
0x2304:07	6	X4A	-	Physical output 6
0x2304:08	7	X4B	-	Physical output 7
0x2304:09	8	X5A	-	Physical output 8
0x2304:0A	9	X5B	-	Physical output 9
0x2304:0B	10	X6A	-	Physical output 10
0x2304:0C	11	X6B	-	Physical output 11
0x2304:0D	12	X7A	-	Physical output 12
0x2304:0E	13	X7B	-	Physical output 13
0x2304:0F	14	X8A	-	Physical output 14
0x2304:10	15	X8B	-	Physical output 15

Table 7.12

PDOs 0x1A11/0x1611, 8DI/DO Profile with Data in Bit Format

Process data for each I/O port: **Input/output**.

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A11	Output PDO: 0x1611
Index: Byte	Value	Port	Bit	Bit
0x2304:01	0	X1A	Physical input 0	Physical output 0
0x2304:02	Inactive	X1B	-	-
0x2304:03	1	X2A	Physical input 1	Physical output 1
0x2304:04	Inactive	X2B	-	-
0x2304:05	2	X3A	Physical input 2	Physical output 4
0x2304:06	Inactive	X3B	-	-
0x2304:07	3	X4A	Physical input 3	Physical output 3
0x2304:08	Inactive	X4B	-	-
0x2304:09	4	X5A	Physical input 4	Physical output 4
0x2304:0A	Inactive	X5B	-	-
0x2304:0B	5	X6A	Physical input 5	Physical output 5
0x2304:0C	Inactive	X6B	-	-
0x2304:0D	6	X7A	Physical input 6	Physical output 6
0x2304:0E	Inactive	X7B	-	-
0x2304:0F	7	X8A	Physical input 7	Physical output 7
0x2304:10	Inactive	X8B	-	-

Table 7.13

PDO 0x1A11, 8DI Profile with Data in Bit Format

Process data for each I/O port: **Input**.

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A11	Output PDO:
Index: Byte	Value	Port	Bit	Bit
0x2304:01	0	X1A	Physical input 0	-
0x2304:02	Inactive	X1B	-	-
0x2304:03	1	X2A	Physical input 1	-
0x2304:04	Inactive	X2B	-	-
0x2304:05	2	X3A	Physical input 2	-
0x2304:06	Inactive	X3B	-	-
0x2304:07	3	X4A	Physical input 3	-
0x2304:08	Inactive	X4B	-	-
0x2304:09	4	X5A	Physical input 4	-
0x2304:0A	Inactive	X5B	-	-
0x2304:0B	5	X6A	Physical input 5	-
0x2304:0C	Inactive	X6B	-	-
0x2304:0D	6	X7A	Physical input 6	-
0x2304:0E	Inactive	X7B	-	-
0x2304:0F	7	X8A	Physical input 7	-
0x2304:10	Inactive	X8B	-	-

Table 7.14

PDO 0x1611, 8DO Profile with Data in Bit Format

Process data for each I/O port: **Output**.

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A11	Output PDO: 0x1611
Index: Byte	Value	Port	Bit	Bit
0x2304:01	0	X1A	-	Physical output 0
0x2304:02	Inactive	X1B	-	-
0x2304:03	1	X2A	-	Physical output 1
0x2304:04	Inactive	X2B	-	-
0x2304:05	2	X3A	-	Physical output 4
0x2304:06	Inactive	X3B	-	-
0x2304:07	3	X4A	-	Physical output 3
0x2304:08	Inactive	X4B	-	-
0x2304:09	4	X5A	-	Physical output 4
0x2304:0A	Inactive	X5B	-	-
0x2304:0B	5	X6A	-	Physical output 5
0x2304:0C	Inactive	X6B	-	-

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Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A11	Output PDO: 0x1611
Index: Byte	Value	Port	Bit	Bit
0x2304:0D	6	X7A	-	Physical output 6
0x2304:0E	Inactive	X7B	-	-
0x2304:0F	7	X8A	-	Physical output 7
0x2304:10	Inactive	X8B	-	-

Table 7.15

PDOs 0x1A11/0x1611, 8DI/8DO Profile with Data in Bit Format

Process data for each I/O port: **Input/output**.

Mapping parameters (Default values, reference)			Process data	
			Input PDO: 0x1A01	Output PDO: 0x1611
Index: Byte	Value	Port	Bit	Bit
0x2304:01	0	X1A	Physical input 0	-
0x2304:02	1	X1B	Physical input 1	-
0x2304:03	2	X2A	Physical input 2	-
0x2304:04	3	X2B	Physical input 3	-
0x2304:05	4	X3A	Physical input 4	-
0x2304:06	5	X3B	Physical input 5	-
0x2304:07	6	X4A	Physical input 6	-
0x2304:08	7	X4B	Physical input 7	-
0x2304:09	8	X5A	-	Physical output 0
0x2304:0A	9	X5B	-	Physical output 1
0x2304:0B	10	X6A	-	Physical output 2
0x2304:0C	11	X6B	-	Physical output 3
0x2304:0D	12	X7A	-	Physical output 4
0x2304:0E	13	X7B	-	Physical output 5
0x2304:0F	14	X8A	-	Physical output 6
0x2304:10	15	X8B	-	Physical output 7

Table 7.16

PDO 0x1A04, Error Register

The PDOs 0x1A00, 0x1A01, 0x1A10 or 0x1A11 can be flexibly combined with the PDOs 0x1A04 (error register) and/or 0x1A05 (diagnosis register).

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A04	1	0x1001:01	1.0	USINT	Error register

Table 7.17

Content of the Error Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	0	0	0	No error
-	0	0	0	0	-	1	1	Output overload, MI-SCS
-	0	0	0	0	1	-	1	Voltage error, MI-LVS
1	0	0	0	0	-	-	1	Additional parameter error function, MI-PRM
1	0	0	0	0	-	-	1	Force Mode active, MI-FC
1	0	0	0	0	-	-	1	Additional device diagnosis function, MI-IME

Table 7.18

The symbol "-" can either be "0" or "1," if more than one error is active for each.

PDO 0x1A05, Diagnosis Register

The PDOs 0x1A00, 0x1A01, 0x1A10 or 0x1A11 can be flexibly combined with the PDOs 0x1A04 (error register) and/or 0x1A05 (diagnosis register).

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A05	1	0x2001:01	4.0	UDINT	Diagnosis register

Table 7.19

Content of the Diagnosis Register

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	MI-IME	MI-FC	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 2	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 3	CE-X4B	CE-X4A	CE-X3B	CE-X3A	CE-X2B	CE-X2A	CE-X1B	CE-X1A
Byte 4	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

Table 7.20

TwinCAT representation as UDINT: 0x Byte 4 - Byte 3 - Byte 2 - Byte 1

Legend

MI-LVS	Module information byte—voltage for system/sensor performance low
MI-LVA	Module information byte—voltage for actuator low
MI-SCS	Module information byte—sensor short circuit at an M12 slot
MI-SCA	Module information byte—actuator short circuit
MI-PRM	Module information byte—parameter error
MI-FC	Module information byte—Force Mode active
MI-IME	Module information byte—internal error
SCS-X1 ... SCS-X8	Sensor short circuit at slot X1 to X8

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CE-X5A ... CE-X8A	Channel error at output channel A (contact pin 4) of outputs X5 to X8.
CE-X5B ... CE-X8B	Channel error at output channel B (contact pin 2) of outputs X5 to X8.

7.2.2 Modules with Decentralized Control Function, Bit Assignment of Process Data Extension

Ethernet IO modules with decentralized control function (DCU) have additional specific process data objects. They expand the process data range for input and output data by 2 bytes each.

This process data extension is described below for the following Ethernet IO modules:

- ICE1-8DI8DO-G60L-C1-V1D
- ICE1-16DIO-G60L-C1-V1D

PDO 0x1A06, DCU Inputs (2 Bytes)

These 2 bytes can be used for the decentralized control function (DCU function) as additional input data (TxPDO, EtherCAT® slave on controller). You can disable file transfer in the process data/PDO assignment of the engineering tool.

PDO		PDO content			
Index	Size	Index	Size	Type	Name
0x1A06	2	0x6040:01	1.0	USINT	DCU inputs 0 - 7
		0x6040:02	1.0	USINT	DCU inputs 8 - 15

Table 7.21

PDO 0x1602, DCU Outputs (2 Bytes)

These 2 bytes can be used for the decentralized control function (DCU function) as additional output data (RxPDO, EtherCAT® controller on slave). You can disable file transfer in the process data/PDO assignment of the engineering tool.

PDO		PDO content			
Index	Size	Index	Size	Type	Name
0x1602	2	0x6040:01	1.0	USINT	DCU outputs 0 - 7
		0x6040:02	1.0	USINT	DCU outputs 8 - 15

Table 7.22

PDO 0x1A08, Additional DCU Inputs, (8 Signed Integer)

These 8 signed integer values can be used for the decentralized control function (e.g., as a counter) as additional input data (TxPDO, EtherCAT® slave on controller). You can disable file transfer in the process data/PDO assignment of the engineering tool.

PDO		PDO content			
Index	Size	Index	Size	Type	Name
0x1A08	2	0x6080:01	2.0	INT	DCU additional input 0
		0x6080:02	2.0	INT	DCU additional input 1
		0x6080:03	2.0	INT	DCU additional input 2
		0x6080:04	2.0	INT	DCU additional input 3
		0x6080:05	2.0	INT	DCU additional input 4
		0x6080:06	2.0	INT	DCU additional input 5
		0x6080:07	2.0	INT	DCU additional input 6
		0x6080:08	2.0	INT	DCU additional input 7

Table 7.23

PDO 0x1604, Additional DCU Outputs (8 Signed Integer)

These 8 signed integer values can be used for the decentralized control function (DCU function) as additional output data (RxPDO, EtherCAT® controller on slave). You can disable file transfer in the process data/PDO assignment of the engineering tool.

PDO		PDO content			
Index	Size	Index	Size	Type	Name
0x1604	2	0x6280:01	2.0	INT	DCU additional output 0
		0x6280:02	2.0	INT	DCU additional output 1
		0x6280:03	2.0	INT	DCU additional output 2
		0x6280:04	2.0	INT	DCU additional output 3
		0x6280:05	2.0	INT	DCU additional output 4
		0x6280:06	2.0	INT	DCU additional output 5
		0x6280:07	2.0	INT	DCU additional output 6
		0x6280:08	2.0	INT	DCU additional output 7

Table 7.24

7.2.3 16DI Modules, PDO Assignment

PDO for the ICE1-16DI-G60L-V1D

The PDOs 0x1A00 or 0x1A01 control the input data of the module

PDO 0x1A00, Input Data in Byte Format

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A00	2	0x6000:01	1.0	USINT	Input channel X1A ... X4B
		0x6000:02	1.0	USINT	Input channel X5A ... X8B

Table 7.25

Content of Input Channel X1A..X4B and Input Channel X5A..X8B

Index	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x6000:01	X4B	X4A	X3B	X3A	X2B	X2A	X1B	X1A
0x6000:02	X8B	X8A	X7B	X7A	X6B	X6A	X5B	X5A

Table 7.26

The values refer to the following:

- X1A ... X8A: Actual status of the input channel A (contact pin 4) of the inputs X1 to X8.
- X1B ... X8B: Actual status of the input channel B (contact pin 2) of the inputs X1 to X8.

PDO 0x1A01, Input Data in Bit Format

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A01	2	0x6020:01	0.1	BIT	Input channel X1A
		0x6020:02	0.1	BIT	Input channel X1B
		0x6020:03	0.1	BIT	Input channel X2A
		0x6020:04	0.1	BIT	Input channel X2B
		0x6020:05	0.1	BIT	Input channel X3A
		0x6020:06	0.1	BIT	Input channel X3B
		0x6020:07	0.1	BIT	Input channel X4A
		0x6020:08	0.1	BIT	Input channel X4B
		0x6020:09	0.1	BIT	Input channel X5A
		0x6020:0A	0.1	BIT	Input channel X5B
		0x6020:0B	0.1	BIT	Input channel X6A
		0x6020:0C	0.1	BIT	Input channel X6B
		0x6020:0D	0.1	BIT	Input channel X7A
		0x6020:0E	0.1	BIT	Input channel X7B
		0x6020:0F	0.1	BIT	Input channel X8A
		0x6020:10	0.1	BIT	Input channel X8B

Table 7.27

The PDOs 0x1A00 and 0x1A01 can be combined with the PDO 0x1A04 (error register) and/or the PDO 0x1A05 (diagnosis register).

PDO 0x1A04, Error Register

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A04	1	0x1001:01	1.0	USINT	Error register

Table 7.28

Content of the Error Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	0	0	0	No error
-	0	0	0	0	-	1	1	Output overload, MI-SCS
-	0	0	0	0	1	-	1	Voltage error, MI-LVS
1	0	0	0	0	-	-	1	Force Mode active, MI-FC
1	0	0	0	0	-	-	1	Additional device diagnosis function, MI-IME

Table 7.29

The symbol "-" can either be "0" or "1", if more than one error is active for each.

PDO 0x1A05, Diagnosis Register

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A05	1	0x2001:01	4.0	UDINT	Diagnosis register

Table 7.30

Content of the Diagnosis Register

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	MI-IME	MI-FC	0	0	0	MI-SCS	0	MI-LVS
Byte 2	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 3	0	0	0	0	0	0	0	0
Byte 4	0	0	0	0	0	0	1	0

Table 7.31

TwinCAT representation as UDINT: 0x Byte 4 - Byte 3 - Byte 2 - Byte 1

Legend

MI-LVS	Module information byte—voltage for system/sensor performance low
MI-SCS	Module information byte—sensor short circuit at an M12 slot
MI-FC	Module information byte—Force Mode active
MI-IME	Module information byte—internal error
SCS-X1 ... SCS-X8	Sensor short circuit at slot X1 to X8

7.2.4 8DI8DO Modules, PDO Assignment

PDO for the ICE1-8DI8DO-G60L-V1D and ICE1-8DI8DO-G60L-C1-V1D

The PDOs 0x1A00 or 0x1A01 control the input data of the modules.

The PDOs 0x1600 or 0x1601 control the outputs of the modules.

PDO 0x1A00, Input Data in Byte Format

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A00	1	0x6000:01	1.0	USINT	Input channel X1A ... X8B

Table 7.32

Content of port X1A ... X4B and port X5A ... X8B

Index	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x6000:01	X4B	X4A	X3B	X3A	X2B	X2A	X1B	X1A
0x6000:02	X8B	X8A	X7B	X7A	X6B	X6A	X5B	X5A

Table 7.33

The values refer to the following:

- X1A ... X8A: Actual status of the input channel A (contact pin 4) of the inputs X1 to X8.
- X1B ... X8B: Actual status of the input channel B (contact pin 2) of the inputs X1 to X8.

PDO 0x1A01, Input Data in Bit Format

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A01	2	0x6020:01	0.1	BIT	Input channel X1A
		0x6020:02	0.1	BIT	Input channel X1B
		0x6020:03	0.1	BIT	Input channel X2A
		0x6020:04	0.1	BIT	Input channel X2B
		0x6020:05	0.1	BIT	Input channel X3A
		0x6020:06	0.1	BIT	Input channel X3B
		0x6020:07	0.1	BIT	Input channel X4A
		0x6020:08	0.1	BIT	Input channel X4B
		0x6020:09	0.1	Bit	Input channel X5A
		0x6020:0A	0.1	Bit	Input channel X5B
		0x6020:0B	0.1	Bit	Input channel X6A
		0x6020:0C	0.1	Bit	Input channel X6B
		0x6020:0D	0.1	Bit	Input channel X7A
		0x6020:0E	0.1	Bit	Input channel X7B
		0x6020:0F	0.1	Bit	Input channel X8A
		0x6020:10	0.1	Bit	Input channel X8B

Table 7.34

The following PDOs are available for the input data (TxPDO of the module).

PDO 0x1A02, Output Status in Byte Format

If required, this object can provide real output statuses as input data to the controller (output mirror):

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A02	2	0x2200:01	1.0	USINT	Output channel X5A ... X8B

Table 7.35

Content of output channel X5A ... X8B

Index	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x2200:01	X8B	X8A	X7B	X7A	X6B	X6A	X5B	X5A

Table 7.36

The values refer to the following:

- X5A ... X8A: Actual status of output channel A (contact pin 4) of outputs X5 to X8.
- X5B ... X8B: Actual status of output channel B (contact pin 2) of outputs X5 to X8.

PDO 0x1A03, Output Status in Bit Format

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A03	2	0x2220:01	0.1	BIT	Output channel X5A
		0x2220:02	0.1	BIT	Output channel X5B
		0x2220:03	0.1	BIT	Output channel X6A
		0x2220:04	0.1	BIT	Output channel X6B
		0x2220:05	0.1	BIT	Output channel X7A
		0x2220:06	0.1	BIT	Output channel X7B
		0x2220:07	0.1	BIT	Output channel X8A
		0x2220:08	0.1	BIT	Output channel X8B

Table 7.37

The PDOs 0x1A01, 0x1A02 and 0x1A03 can be combined with the PDO 0x1A04 (error register) and/or the PDO 0x1A05 (diagnosis register).

PDO 0x1A04, Error Register

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A04	1	0x1001:01	1.0	USINT	Error register

Table 7.38

Content of the Error Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	0	0	0	0	0	0	No error
-	0	0	0	0	-	1	1	Output overload, MI-SCS
-	0	0	0	0	1	-	1	Voltage error, MI-LVS
1	0	0	0	0	-	-	1	Force Mode active, MI-FC

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Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Description
1	0	0	0	0	-	-	1	Additional device diagnosis function, MI-IME

Table 7.39

The symbol "-" can either be "0" or "1," if more than one error is active for each.

PDO 0x1A05, Diagnosis Register

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1A05	1	0x2001:01	4.0	UDINT	Diagnosis register

Table 7.40

Content of the Diagnosis Register

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	MI-IME	MI-FC	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 2	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 3	0	0	0	0	0	0	0	0
Byte 4	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6B	CE-X6A	CE-X5B	CE-X5A

Table 7.41

TwinCAT representation as UDINT: 0x Byte 4 - Byte 3 - Byte 2 - Byte 1

Legend

MI-LVS	Module information byte—voltage for system/sensor performance low
MI-LVA	Module information byte—voltage for actuator low
MI-SCS	Module information byte—sensor short circuit at an M12 slot
MI-SCA	Module information byte—actuator short circuit
MI-FC	Module information byte—Force Mode active
MI-IME	Module information byte—internal error
SCS-X1 ... SCS-X8	Sensor short circuit at slot X1 to X8
CE-X5A ... CE-X8A	Channel error at output channel A (contact pin 4) of outputs X5 to X8.
CE-X5B ... CE-X8B	Channel error at output channel B (contact pin 2) of outputs X5 to X8.

PDO 0x1600, Output Data in Byte Format

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1600	2	0x6200:01	1.0	USINT	Output channel X5A ... X8B

Table 7.42

Content of Output Channel X5A…X8B

Index	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x6200:01	X8B	X8A	X7B	X7A	X6B	X6A	X5B	X5A

Table 7.43

The values refer to the following:

- X5A ... X8A: Output data channel A (contact pin 4) of outputs X5 to X8.
- X5B ... X5B: Output data channel B (contact pin 2) of outputs X5 to X8.

PDO 0x1601, Output Data in Bit Format

PDO		Content			
Index	Size	Index	Size	Type	Name
0x1601	2	0x6220:01	0.1	BIT	Output channel X5A
		0x6220:02	0.1	BIT	Output channel X5B
		0x6220:03	0.1	BIT	Output channel X6A
		0x6220:04	0.1	BIT	Output channel X6B
		0x6220:05	0.1	BIT	Output channel X7A
		0x6220:06	0.1	BIT	Output channel X7B
		0x6220:07	0.1	BIT	Output channel X8A
		0x6220:08	0.1	BIT	Output channel X8B

Table 7.44

7.2.5 Device Parameters

The modules support different parameters. The parameters are sent to the module during commissioning of the controller.

The following parameters can be set:

Possible Parameter Options for the General Module Settings

Index (byte)	Parameter	Default	Available in module variant
0x2300:01	Web interface locked: 0 = false, 1 = true	0	All module variants
0x2300:02	Force Mode locked: 0 = false, 1 = true	1	All module variants
0x2300:03	Disable all emergency messages: 0 = false, 1 = true	0	All module variants
0x2300:04	Disable UL emergency messages: 0 = false, 1 = true	0	Module variants with outputs such as 16DO, 8DI/8DO, 16DIO
0x2300:05	Disable actuator emergency messages without U_L: 0 = false, 1 = true	0	Module variants with outputs such as 16DO, 8DI/8DO, 16DIO
0x2300:06	DCU Start: 0 = locked, 1 = disabled, 2 = run	1	Module variants with decentralized control function (DCU)
0x2300:07	Automatic restart of output after error: 0 = false, 1 = true	1	Only 16DIO module variants

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Fail-Safe Function (for Modules with Output Channels)

The firmware on the module provides a fail-safe function for the outputs for interruptions or loss of communication. When configuring modules, you can define the status of the outputs after an interruption or a loss of communication.

The following options are available:

Deactivate the output channel, value = 0

Activate the output channel, value = 1

Keep the last output status, value = 2

Caution!

Possible faults where 16DIO modules have been configured incorrectly

For the 16DIO module with the 8DI/DO and 8DI/8DO profiles, each of the 16 possible output channels can be parameterized, as the directional configuration of the I/O ports is flexible. Be aware of your specific I/O direction configuration when customizing the “Fail-Safe Function” parameter. This will help avoid faults with your application.

Possible Fail-Safe Values for 16DIO Modules and Profile(s) with Outputs

Index (byte)	Parameter
0x2301:01	Fail-safe function port X1, channel A (pin 4), value range 0 ... 2
0x2301:02	Fail-safe function port X5, channel B (pin 2), value range 0 ... 2
...	...
0x2301:0F	Fail-safe function port X8, channel A (pin 4), value range 0 ... 2
0x2301:10	Fail-safe function port X8, channel B (pin 2), value range 0 ... 2

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Possible Fail-Safe Values for 8DI/8DO Modules

Index (byte)	Parameter
0x2301:01	Fail-safe function port X5, channel A (pin 4), value range 0 ... 2
0x2301:02	Fail-safe function port X5, channel B (pin 2), value range 0 ... 2
...	...
0x2301:07	Fail-safe function port X8, channel A (pin 4), value range 0 ... 2
0x2301:08	Fail-safe function port X8, channel B (pin 2), value range 0 ... 2

Table 7.47

Surveillance Timeout (for Modules with Output Channels)

The module firmware allows you to set a delay time before monitoring of output currents begins. The delay time is also known as “Surveillance Timeout”. You can define this for each individual output channel.

The delay time starts after the status of the output channel changes, i.e., if this is activated after a rising edge or is disabled after a falling edge. After this time has elapsed, the monitoring of the output begins and the diagnosis begins reporting error states. The value of the monitoring time limit is 0 ms to 255 ms. The default value is 80 ms. If the output channel is in a static state, i.e., permanently switched on or switched off, the value is 100 ms.

Caution!

Possible faults where 16DIO modules have been configured incorrectly

For the 16DIO module with the 8DI/DO and 8DI/8DO profiles, each of the 16 possible output channels can be parameterized, as the directional configuration of the I/O ports is flexible. Be aware of your specific I/O direction configuration when customizing the “Surveillance Timeout” parameter. This will help avoid faults with your application.

Possible Surveillance Timeout Values for 16DIO Modules and Profile(s) with Outputs

Index (byte)	Parameter
0x2302:01	Surveillance timeout port X1, channel A (pin 4), value range 0 ... 255
0x2302:02	Surveillance timeout port X1, channel B (pin 2), value range 0 ... 255
...	...
0x2302:0F	Surveillance timeout port X8, channel A (pin 4), value range 0 ... 255
0x2302:10	Surveillance timeout port X8, channel B (pin 2), value range 0 ... 255

Table 7.48

Possible Surveillance Timeout Values for 8DI/8DO Modules

Index (byte)	Parameter
0x2302:01	Surveillance timeout port X5, channel A (pin 4), value range 0 ... 255
0x2302:02	Surveillance timeout port X5, channel B (pin 2), value range 0 ... 255
...	...
0x2302:07	Surveillance timeout port X8, channel A (pin 4), value range 0 ... 255
0x2302:08	Surveillance timeout port X8, channel B (pin 2), value range 0 ... 255

Table 7.49

Configuration of I/O Direction (for 16DIO Modules)

The "I/O direction" parameter allows the input/output channels (I/O channels) of the module to be configured.

The following settings are possible:

Input/output = 0

Input = 1

Output = 2

By configuring the I/O direction and using the appropriate I/O mapping configuration (see next section), you can adjust the module to match the most common standard I/O modules on the market. The appropriate settings are preconfigured for each profile (16DI/DO, 16DI, 16DO, 8DI/DO, 8DI, 8DO, 8DI/8DO). This means it is not necessary to adjust these parameters for most applications.

Possible Configuration of I/O Direction

Index (byte)	Parameter
0x2303:01	I/O direction configuration port X1A: Input/output = 0, input = 1, output = 2
0x2303:02	I/O direction configuration port X1A: Input/output = 0, input = 1, output = 2
...	...
0x2303:0F	I/O direction configuration port X1A: Input/output = 0, input = 1, output = 2
0x2303:10	I/O direction configuration port X1A: Input/output = 0, input = 1, output = 2

Table 7.50

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The following table provides an overview of the 16DIO profiles with preconfigured I/O direction. Certain channels have been set to inactive. Details of these settings see table "Standard I/O Mapping Configuration" on page 90 are in the following section.

Default Configuration of I/O Direction in 16DIO Profiles

Index	Port	16DI/DO	16DI	16DO	8DI/DO	8DI	8DO	8DI/8DO
0x2303:01	X1A	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:02	X1B	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:03	X2A	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:04	X2B	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:05	X3A	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:06	X3B	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:07	X4A	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:08	X4B	Input/output	Input	Output	Input/output	Input	Output	Input
0x2303:09	X5A	Input/output	Input	Output	Input/output	Input	Output	Output
0x2303:0A	X5B	Input/output	Input	Output	Input/output	Input	Output	Output
0x2303:0B	X6A	Input/output	Input	Output	Input/output	Input	Output	Output
0x2303:0C	X6B	Input/output	Input	Output	Input/output	Input	Output	Output
0x2303:0D	X7A	Input/output	Input	Output	Input/output	Input	Output	Output
0x2303:0E	X7B	Input/output	Input	Output	Input/output	Input	Output	Output
0x2303:0F	X8A	Input/output	Input	Output	Input/output	Input	Output	Output
0x2303:10	X8B	Input/output	Input	Output	Input/output	Input	Output	Output

Table 7.51

Caution!

Possible Malfunctions Caused By Misconfiguration of 16DIO modules

Choose the settings for “Configuration of I/O direction" and "I/O mapping configuration” carefully to avoid malfunctions.

I/O Mapping Configuration (for 16DIO Modules)

This parameter enables you to specify how the I/O channels are assigned to the associated process data.

- Each output control bit in the output data frame from the EtherCAT® controller can be assigned to your preferred output channel (X1A ... X8B). The available settings are 0 ... 7, 0 ...15, depending on the I/O profile, or 255 to set it inactive.

- Each physical input bit to be transfered to the EtherCAT® controller can be assigned to your preferred bit position in the input data frame. The available settings are 0 ... 7, 0 ... 15 (0 = X1A ... 15 = X8B), or 255 for the inactive setting.
- For I/O channels that are configured as "input/output," the mapping configuration applies to the input direction (producing data) and output direction (consuming data).

The appropriate settings are preconfigured for each profile (16DI/DO, 16DI, 16DO, 8DI/DO, 8DI, 8DO, 8DI/8DO). This means that it is not necessary to adjust these parameters for most applications.

Possible I/O Mapping Configuration

Index (byte?)	Parameter
0x2304:01	I/O mapping configuration port X1A: 0 ... 15 = process data channel 0 ... 15, 255 = inactive
0x2304:02	I/O mapping configuration port X1B: 0 ... 15 = process data channel 0 ... 15, 255 = inactive
...	...
0x2304:0F	I/O mapping configuration port X8A: 0 ... 15 = process data channel 0 ... 15, 255 = inactive
0x2304:10	I/O mapping configuration port X8B: 0 ... 15 = process data channel 0 ... 15, 255 = inactive

Table 7.52

The following table provides an overview of the relationship between the preconfigured I/O port channel (X1A... X8B) and the I/O process data channel (0 ... 15) for each profile.

Standard I/O Mapping Configuration

		I/O process data channel (0 ... 15), 255 = inactive/not available						
Index (byte)	Port	16DI/DO	16DI	16DO	8DI/DO	8DI	8DO	8DI/8DO
0x2304:01	X1A	0	0	0	0	0	0	0
0x2304:02	X1B	1	1	1	255	255	255	1
0x2304:03	X2A	2	2	2	1	1	1	2
0x2304:04	X2B	3	3	3	255	255	255	3
0x2304:05	X3A	4	4	4	2	2	2	4
0x2304:06	X3B	5	5	5	255	255	255	5
0x2304:07	X4A	6	6	6	3	3	3	6
0x2304:08	X4B	7	7	7	255	255	255	7
0x2304:09	X5A	8	8	8	4	4	4	0
0x2304:0A	X5B	9	9	9	255	255	255	1
0x2304:0B	X6A	10	10	10	5	5	5	2
0x2304:0C	X6B	11	11	11	255	255	255	3
0x2304:0D	X7A	12	12	12	6	6	6	4
0x2304:0E	X7B	13	13	13	255	255	255	5
0x2304:0F	X8A	14	14	14	7	7	7	6
0x2304:10	X8B	15	15	15	255	255	255	7

Table 7.53

Example of process data in the **byte** format:

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- 0x2304:0B (X6A) = 10 for the 16DI/DO profile means that input bit X6A is assigned to producing bit 10 (byte 1/bit 2) and that the output bit of consuming byte 1/bit 2 is used as output control information for port X6A.

Example of process data in the **bit** format:

- 0x2304:0B (X6A) = 10 for the 16DI/DO profile means that input bit X6A is assigned to producing bit 10 and that the output bit of consuming bit 10 is used as output control information for port X6A.

7.2.6 Configuration Example with TwinCAT® 3

The configuration and commissioning of the modules described below refers to the software TwinCAT® 3 from Beckhoff Automation GmbH.

The configuration is based on the example of an ICE1-16DIO-G60L-V1D module. For other module versions, configuration is carried out with a few minor changes.

If you have a control system from a different provider, please refer to the corresponding documentation from the provider.

Caution!

Personal injury and property damage

Before you adjust the inputs or outputs of the module, make sure that no personal injury or property damage can occur.

Integrating the PLC

1. Install the ESI file of the module family in TwinCat®. In TwinCAT® 3, the ESI file is normally inserted in the installation folder `C:\TwinCAT\3.1\Config\Io\EtherCAT`.

   ↳ After you restart TwinCAT®, the modules will be available in the hardware catalog.

2. Start TwinCat and open a new project.

   Note

   After creating the project, you must first take the following steps to establish communication with the PLC.

3. Select the "SYSTEM" option in "Solution Explorer" and click on the "Choose Target" button.

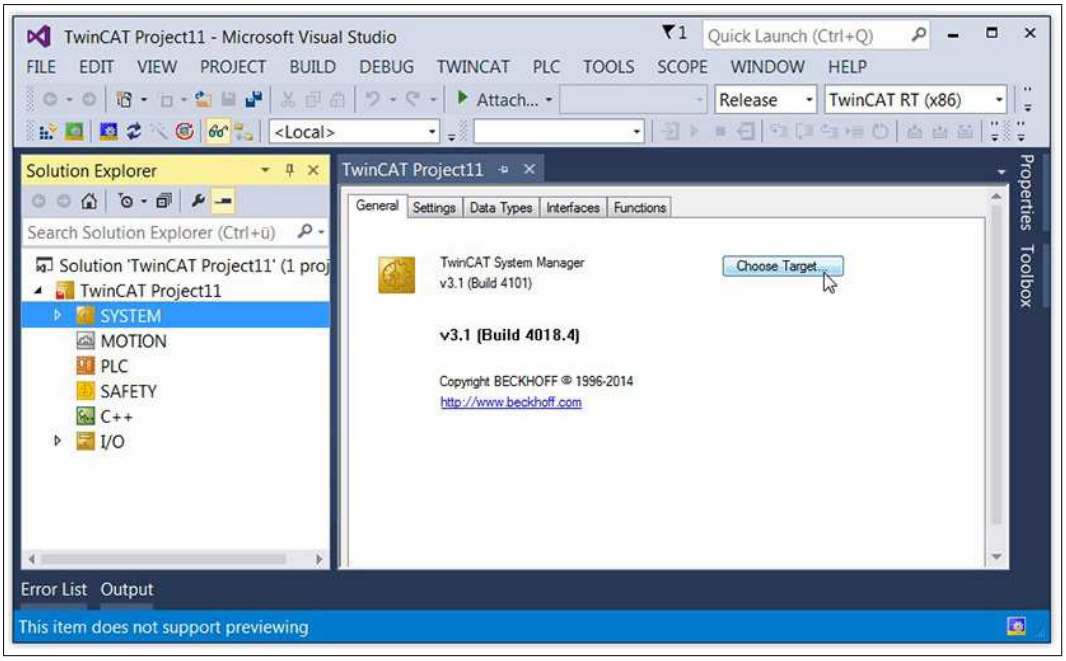

Figure 7.1

4. In the "Choose Target System" menu, click on the "Search (Ethernet)" button

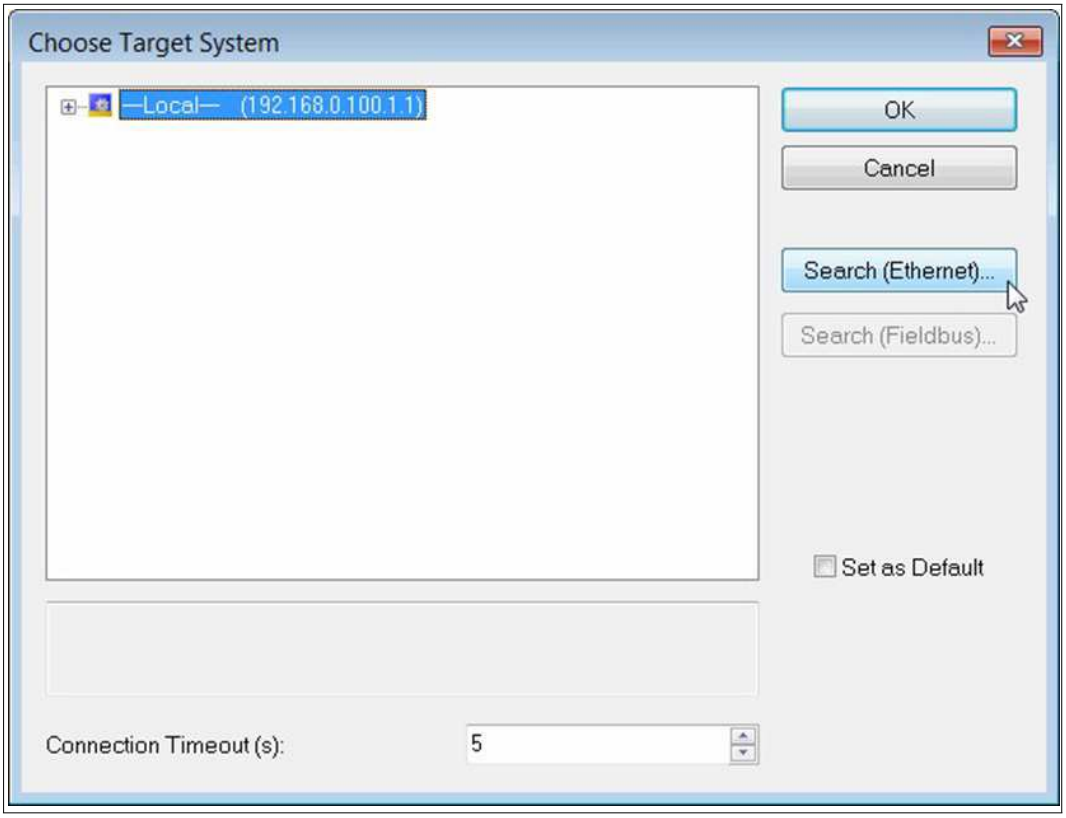

Figure 7.2

5. In the "Add Route Dialog" menu, click on the "Broadcast Search" button.

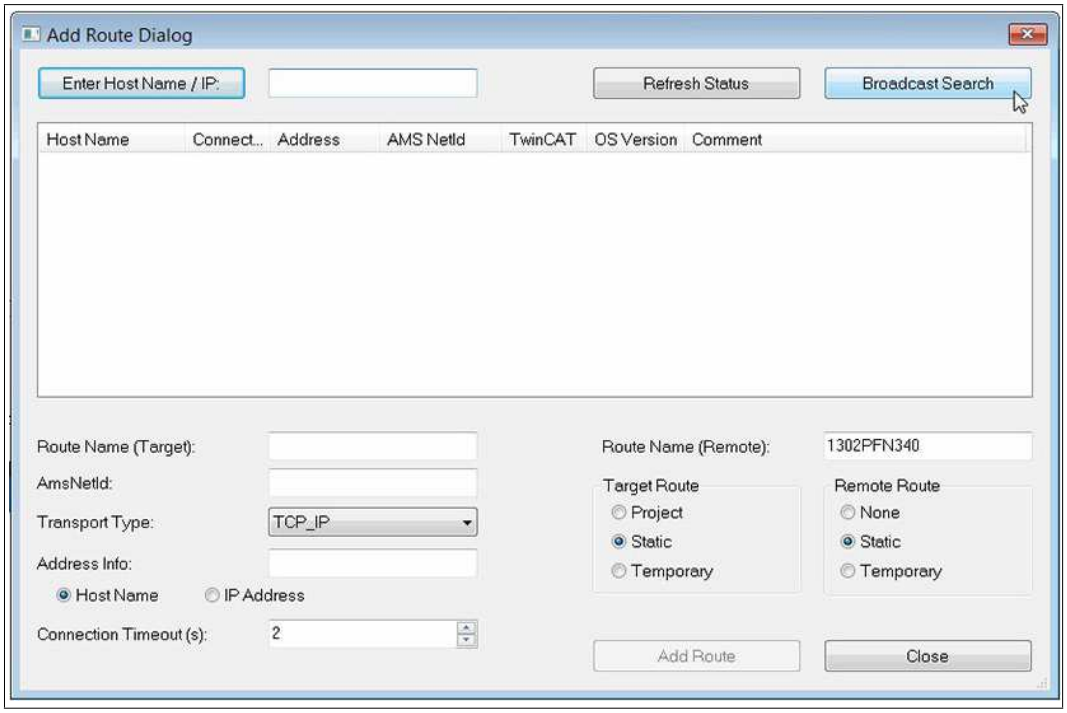

Figure 7.3

↳ TwinCAT® lists the found nodes in the menu.

6. Click on the desired device. In this example, "CX-19FDE4" for the PLC.

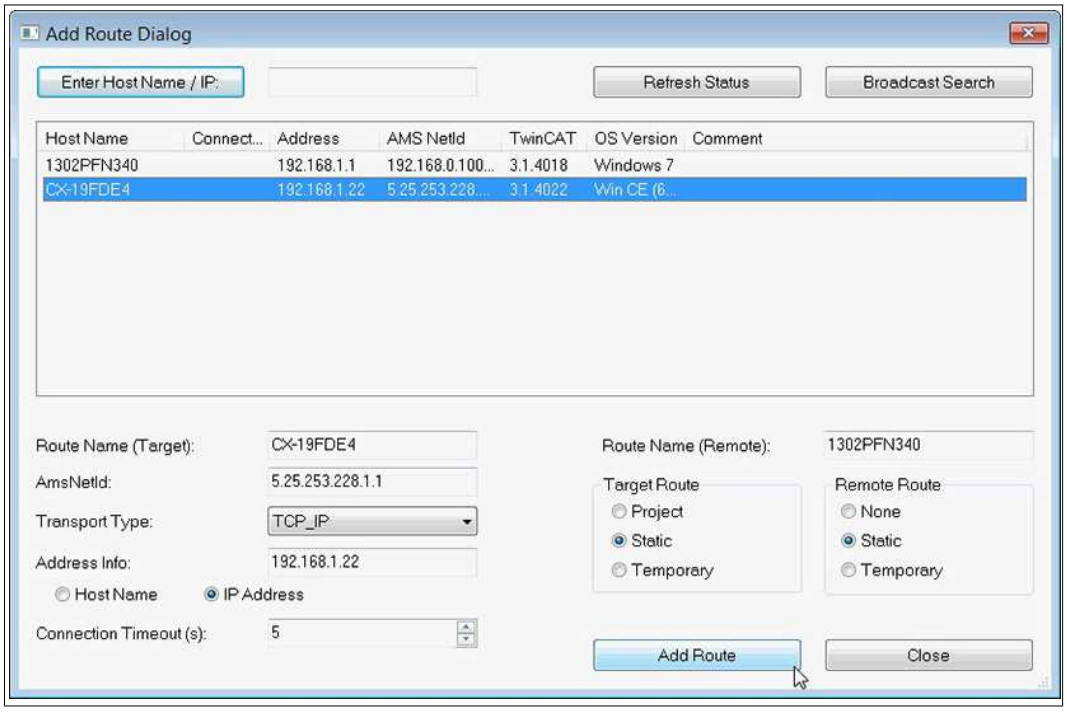

Figure 7.4

7. In the "Address Info" area, change the setting to "IP Address."
8. Then click on the “Add Route” button.

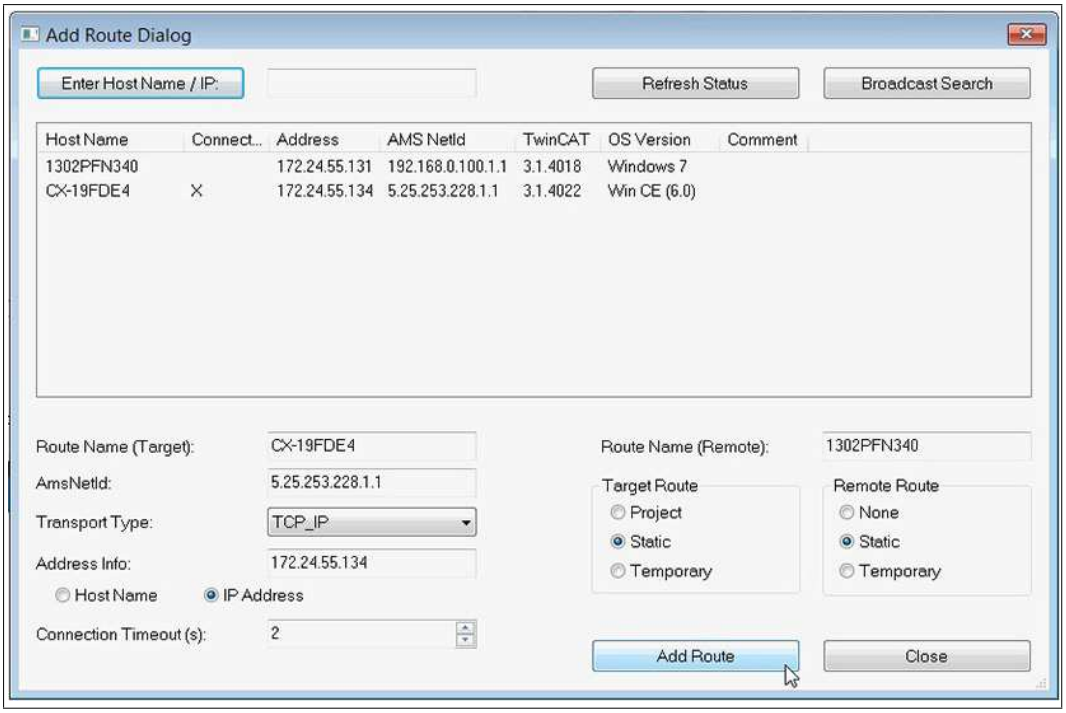

Figure 7.5

9. You will be prompted to create a password, but this is not necessary. Click on the "OK" button without entering data.

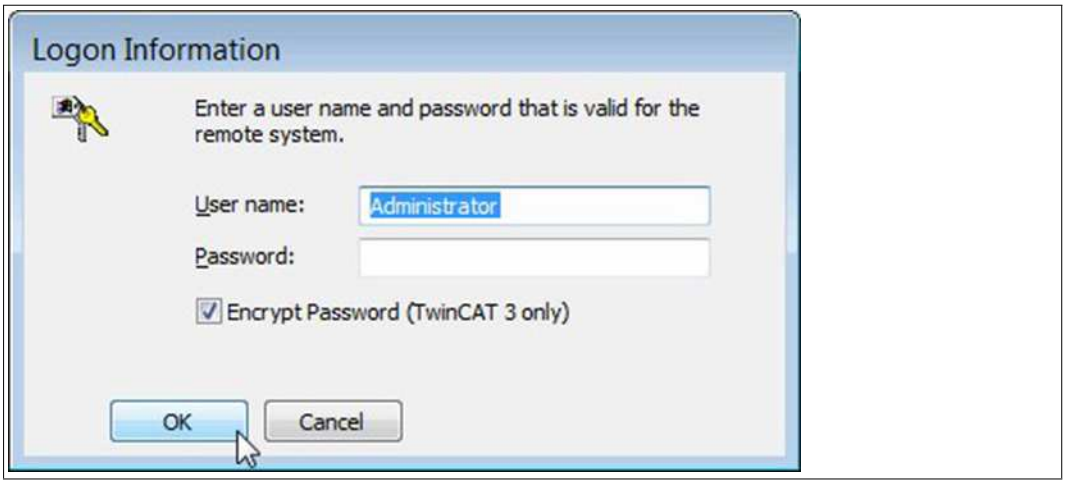

Figure 7.6

10. Click on the “Close” button in the "Add Route Dialog" menu.

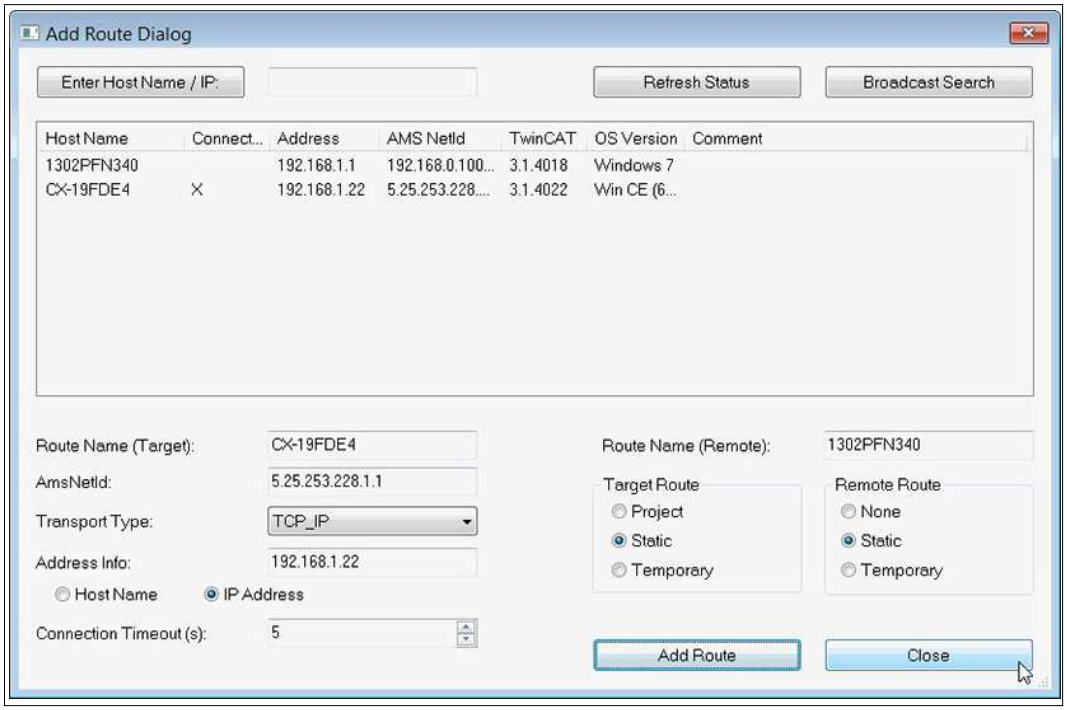

Figure 7.7

11. To save the connection to "CX-19FDE4" in the project, click on "CX-19FDE4" again within the "Choose Target System" dialog that is still open.

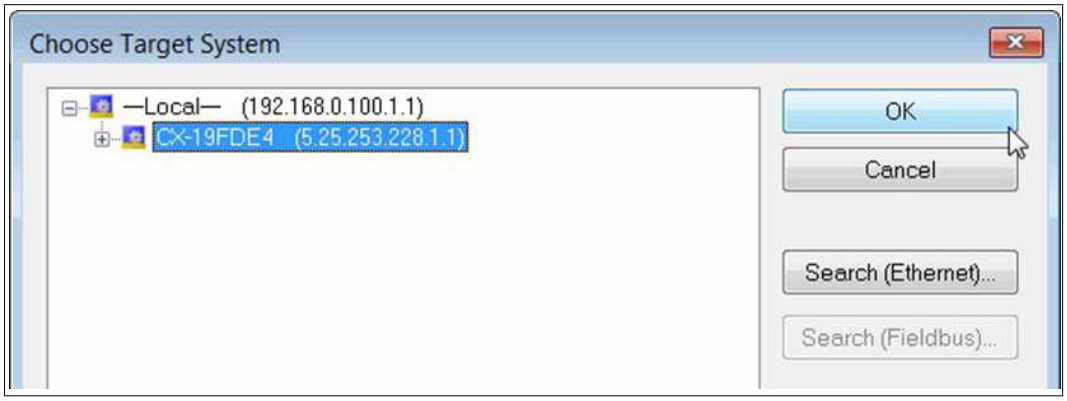

Figure 7.8

12. Click on the “OK” button to confirm the save.

    ↳ Now the status in TwinCAT will change from "Local" to "CX-19FDE4"

13. In the left-hand working area of “Solution Explorer”, switch to the option "I/O." .

14. Right-click on "Devices" and select the "Add New Item..." option.

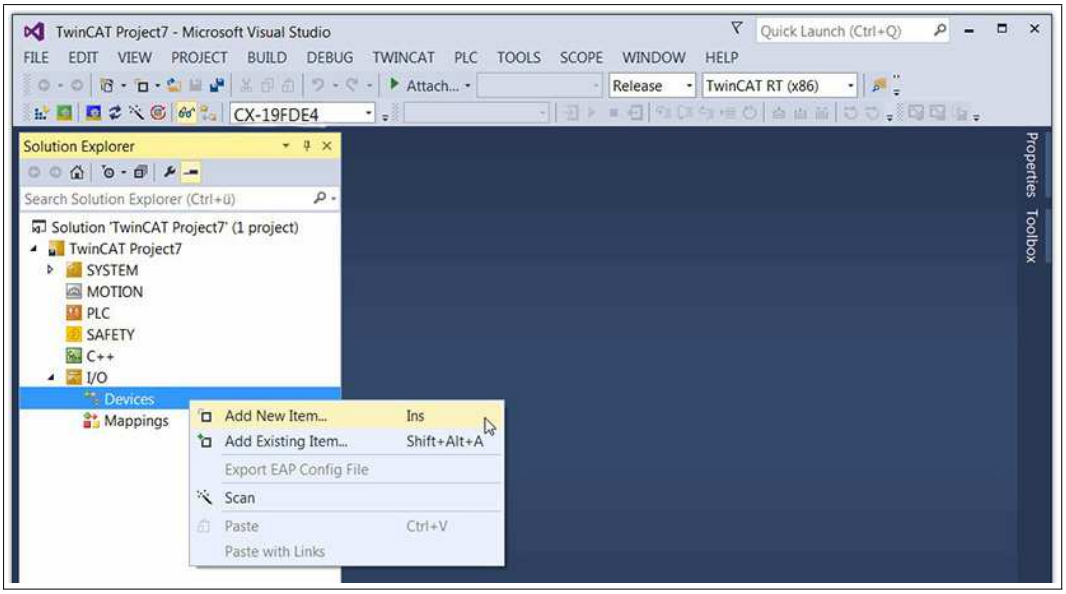

Figure 7.9

15. Then select "EtherCAT Master" and confirm with "OK."

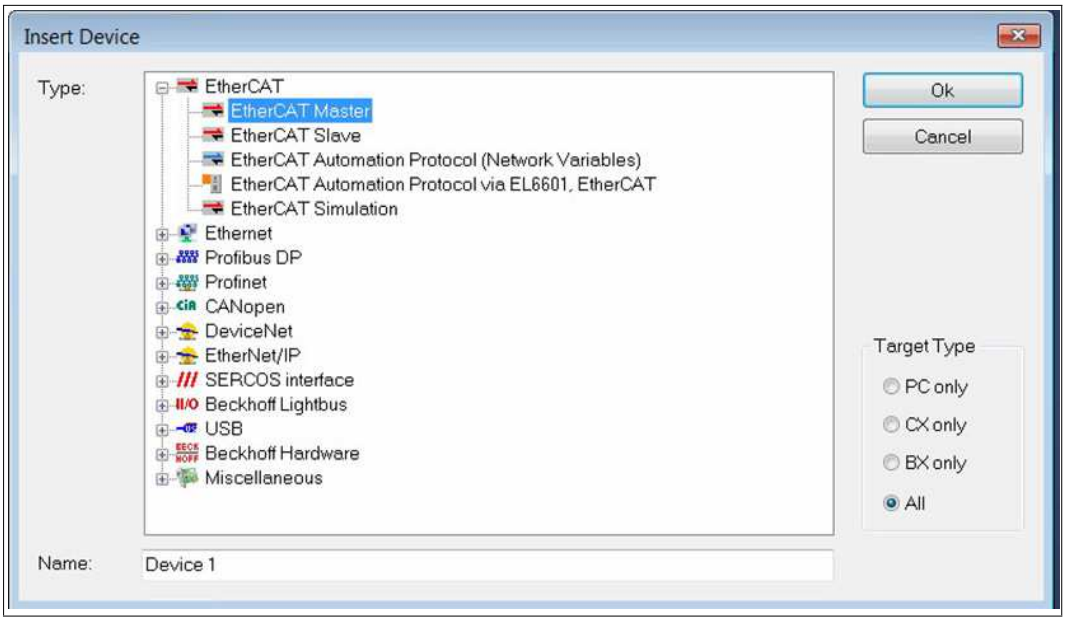

Figure 7.10

16. In the "Device Found At" dialog, select the port for your PLC. In this example, the port is "PCI\Tcl8254x1"

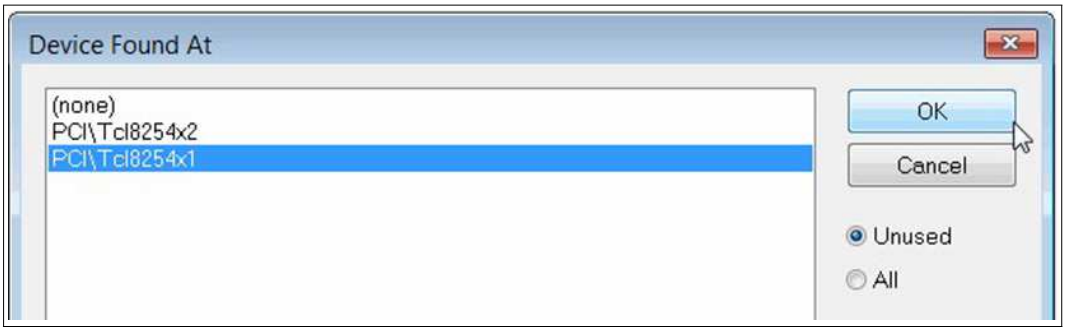

Figure 7.11

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17. Click on the "OK" button to confirm the selection. "
18. Open the configuration tab for the TwinCAT project by double-clicking on "Device 3."

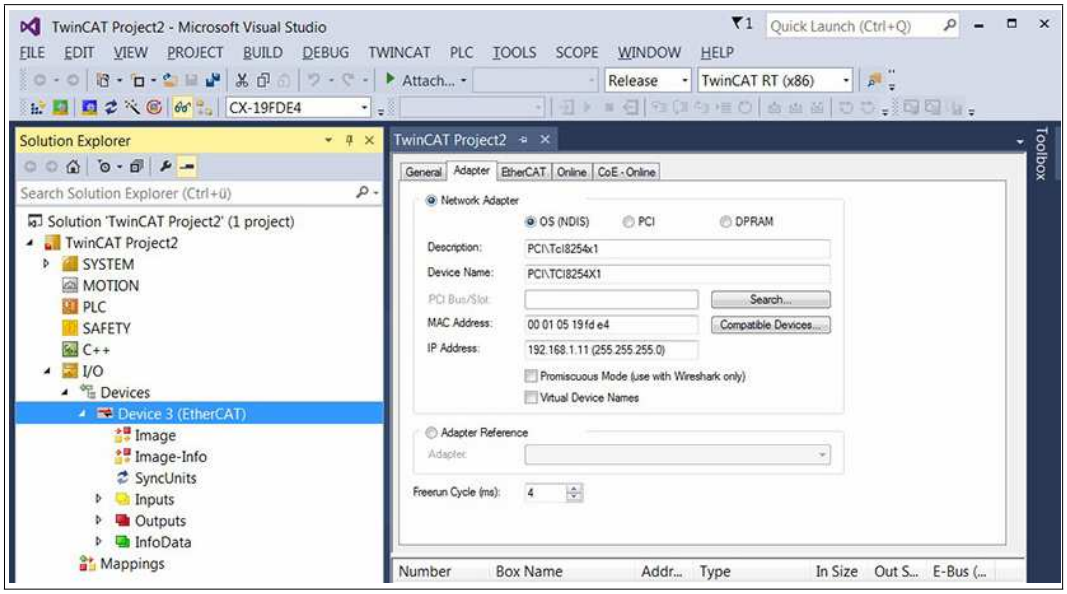


Figure 7.12

19. If you have not already done so, select the network adapter and install the driver for EtherCAT real-time communication.
20. Click on the "Adapter" tab and then on "Compatible Devices ..." to select and install the EtherCAT driver. Follow the further instructions within the software to install the driver.

Integrating the Ethernet IO Module

1. Select the device. To do so, navigate to "Device 1 (EtherCAT)," right-click on "Devices" and select the option "Add New Item...."

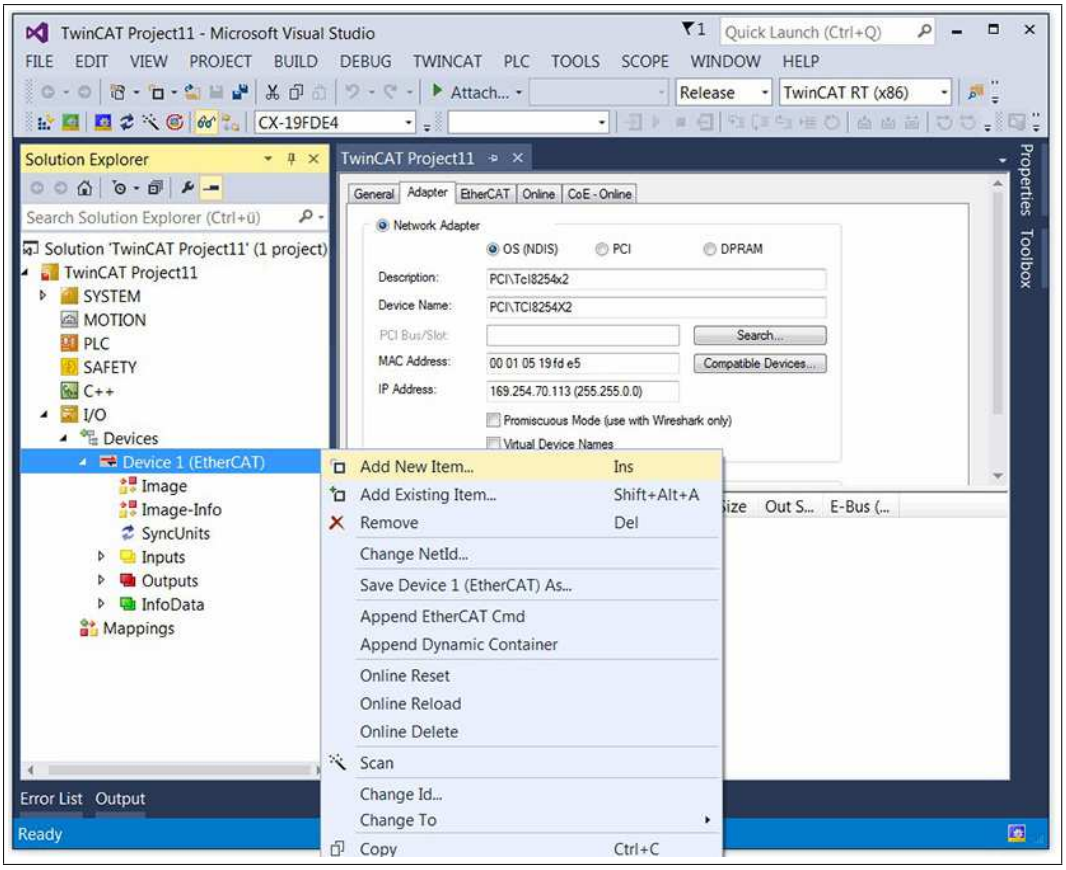


Figure 7.13

2. Select the desired module.

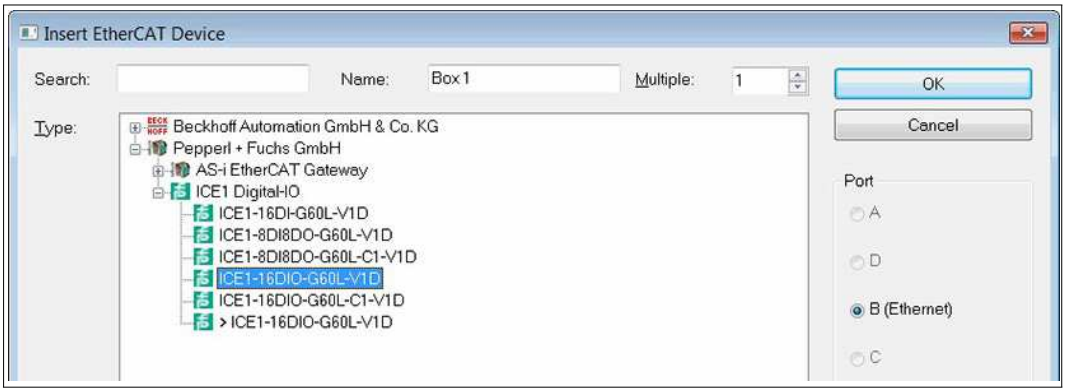


Figure 7.14

Note

Selecting a profile as follows is only possible on 16DIO modules such as ICE1-16DIO-G60L-V1D and ICE1-16DIO-G60L-C1-V1D. For other module variants, the next step is not carried out.

3. Select the I/O profile if you are using a 16DIO module.

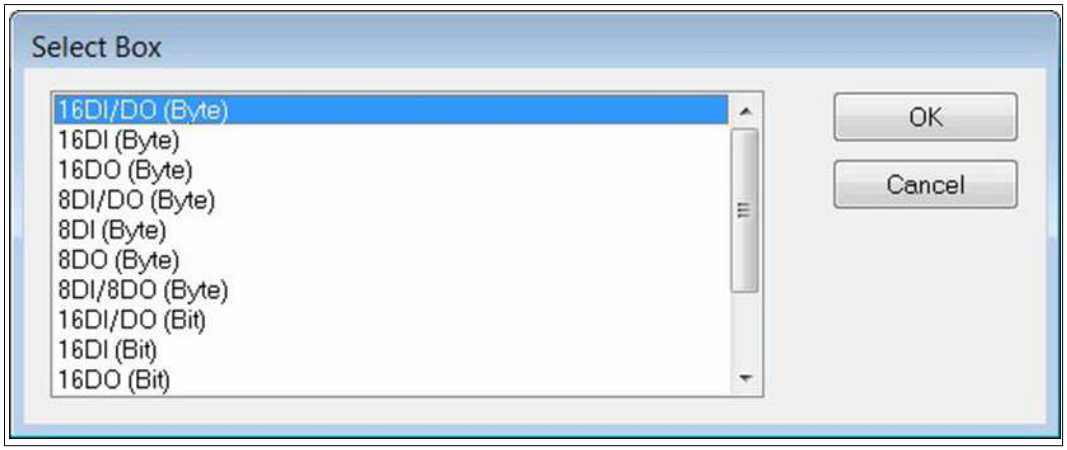


Figure 7.15

4. Click on the "OK" button to confirm the selection.

Note

The default standard PDOs will be used according to the profile selected. If necessary, you may change the I/O profile by carrying out the following steps.

If you wish to change the I/O profile or remove the default activation of the error or diagnostic register, you can do so using the "Slots" tab. On the “Process Data” tab, you can also determine settings for the error and diagnosis register.

5. Configure the "slots” if necessary. Navigate to the "Slots" tab to change the slot configuration.

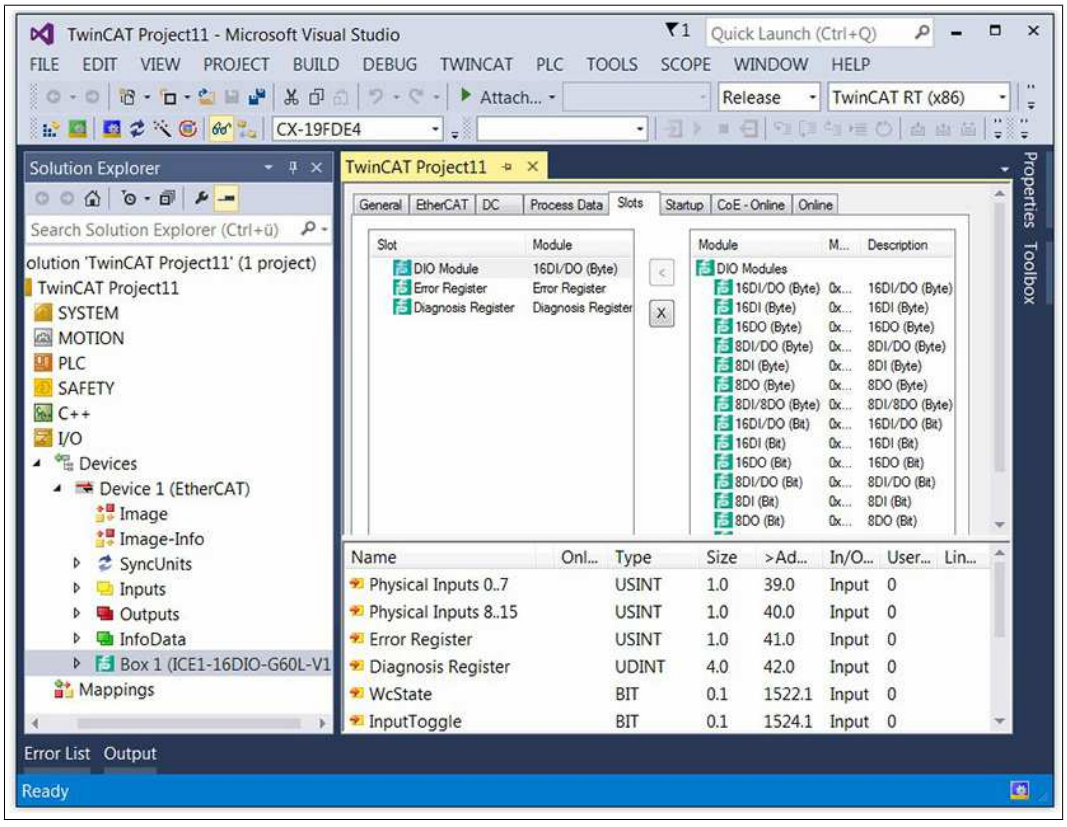


Figure 7.16

Caution!

Caution during parameter changes

If you change the I/O profile having changed the parameter settings on the “Start-Up” tab, the parameters on the “Start-Up” tab will remain as changed. If this is the case, delete the device from the configuration and then add it again. This will restore the default parameter settings and you will avoid unwanted parameter settings.

6. To configure the process data, go to the "Process Data” tab.

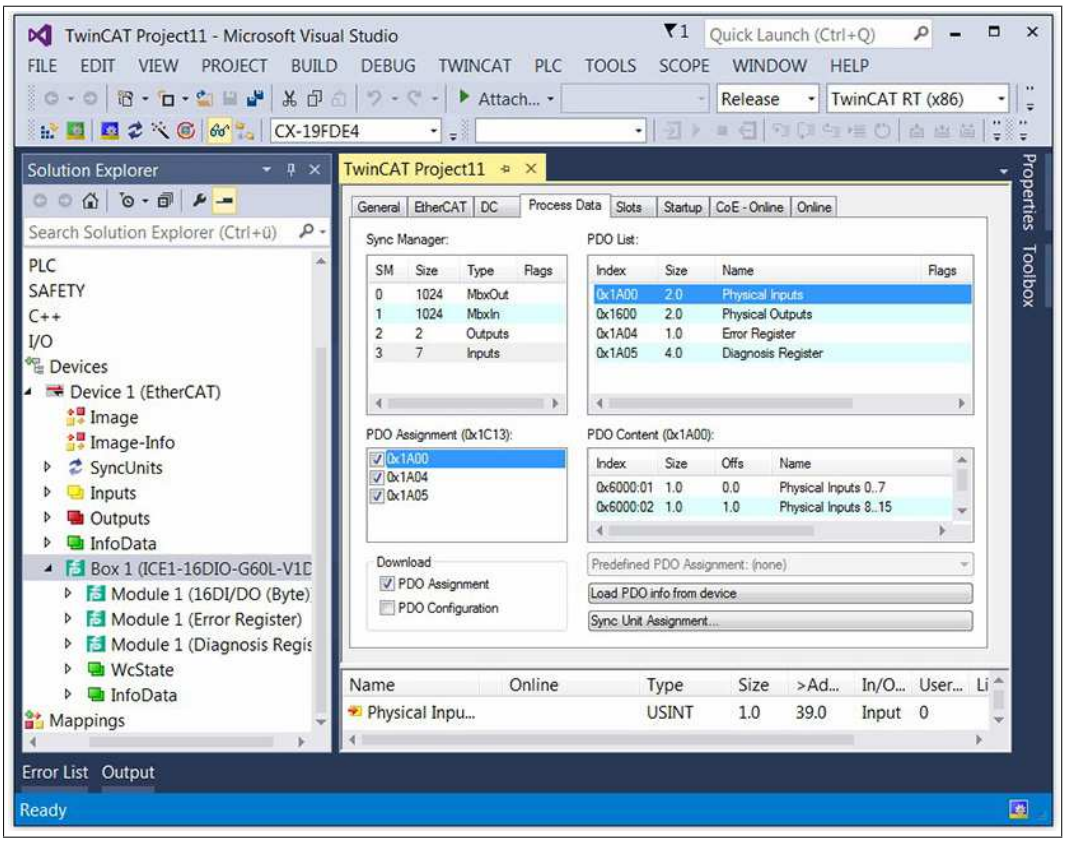


Figure 7.17

7. Select the input and output PDOs as described in the previous chapters on PDO assignment.
8. In the “Sync Manager” section, click on the "Inputs" option and select your input PDOs in the “PDO Assignment” area.
9. For example, you can disable the check boxes "0x1A04" and "0x1A05” if you do not wish for error and diagnosis information to be sent to the EtherCAT® controller.
10. In the “Sync Manager” section, click on the "Outputs" option and select your output PDOs in the “PDO Assignment” area if changes are necessary.

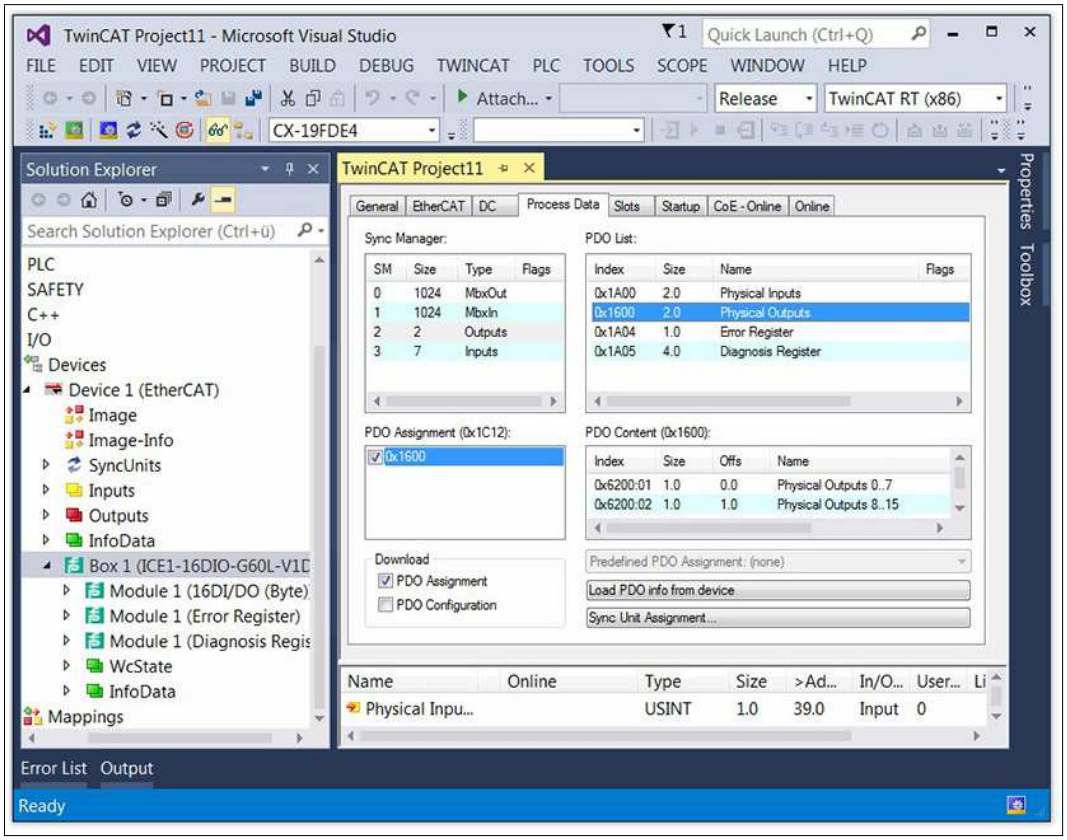


Figure 7.18

11. Navigate to the "Start-Up" tab and check the default device parameter settings.

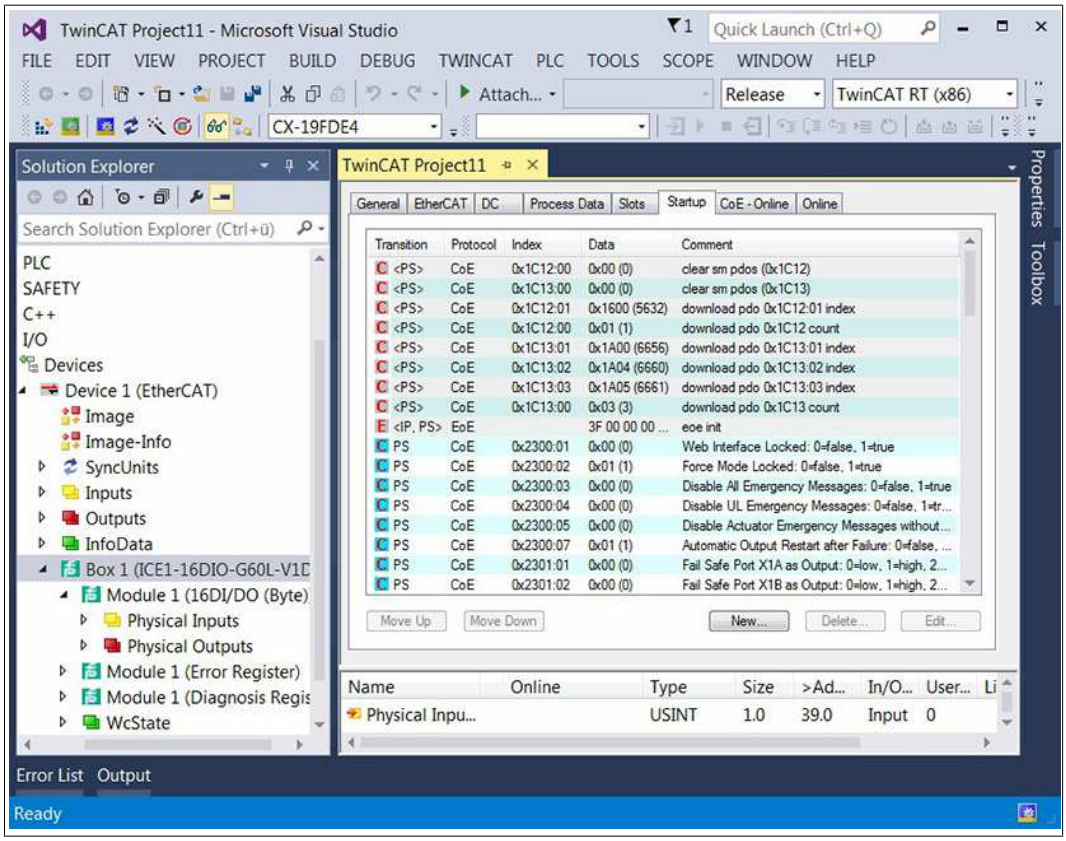


Figure 7.19

12. In order to change a parameter setting, double-click on a parameter, then the “Edit” dialog box will open. The new value can be entered in the data entry panel.

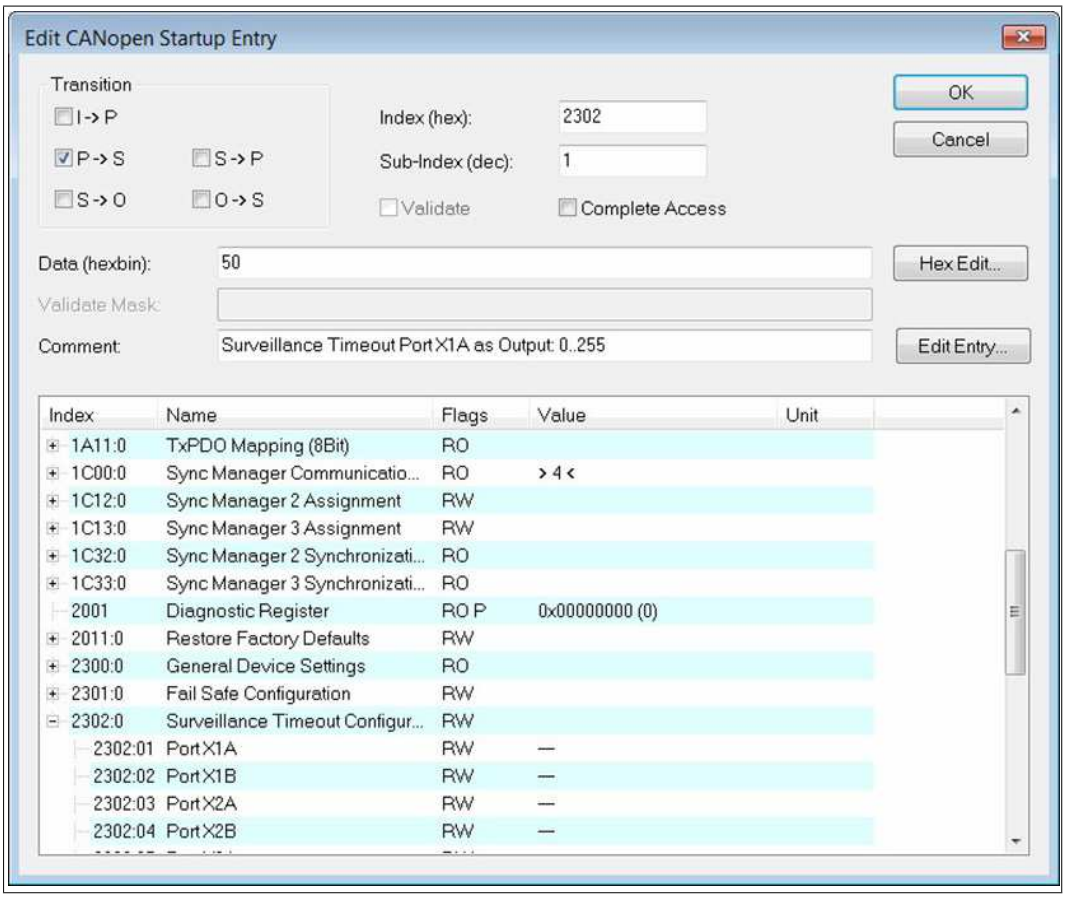


Figure 7.20

13. Click on the "OK" button to confirm the entries.

EoE IP Address

Note

An IP address must be set if the web server is to be used for the module in future. If web server services are not to be facilitated, you can also disable this option. The following steps describe how to do this.

1. Navigate to the "EtherCAT" tab.

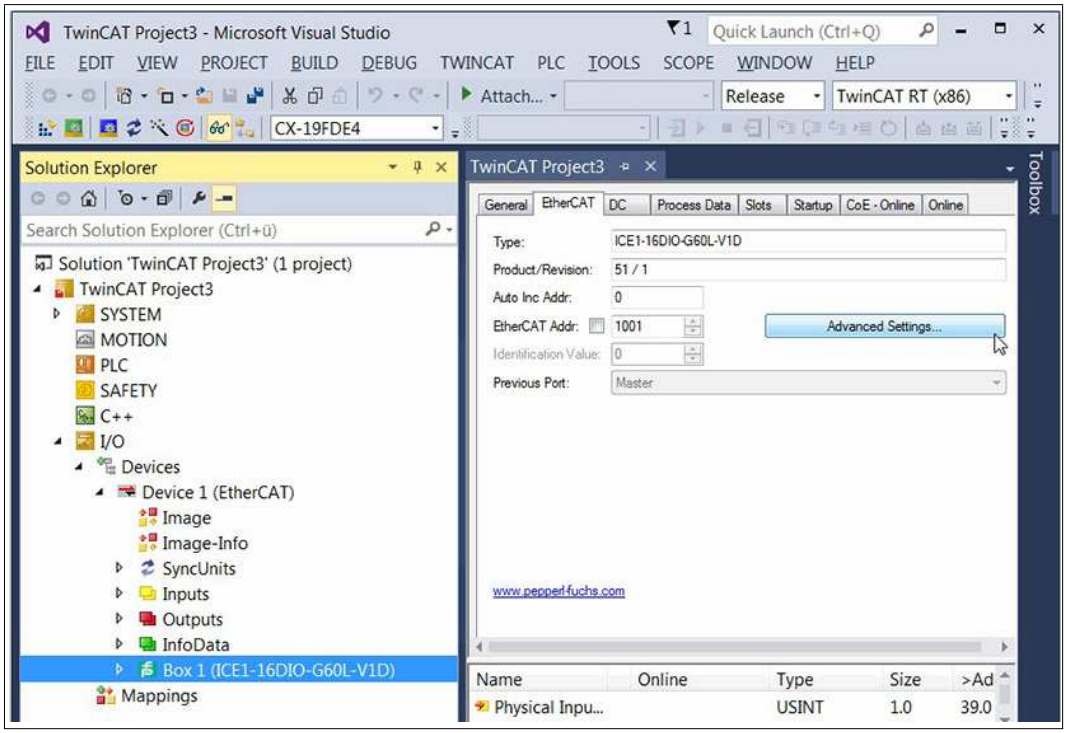


Figure 7.21

2. Click on the "Advanced Settings" button.
3. Navigate to the "EoE" entry under the "Mailbox" option.

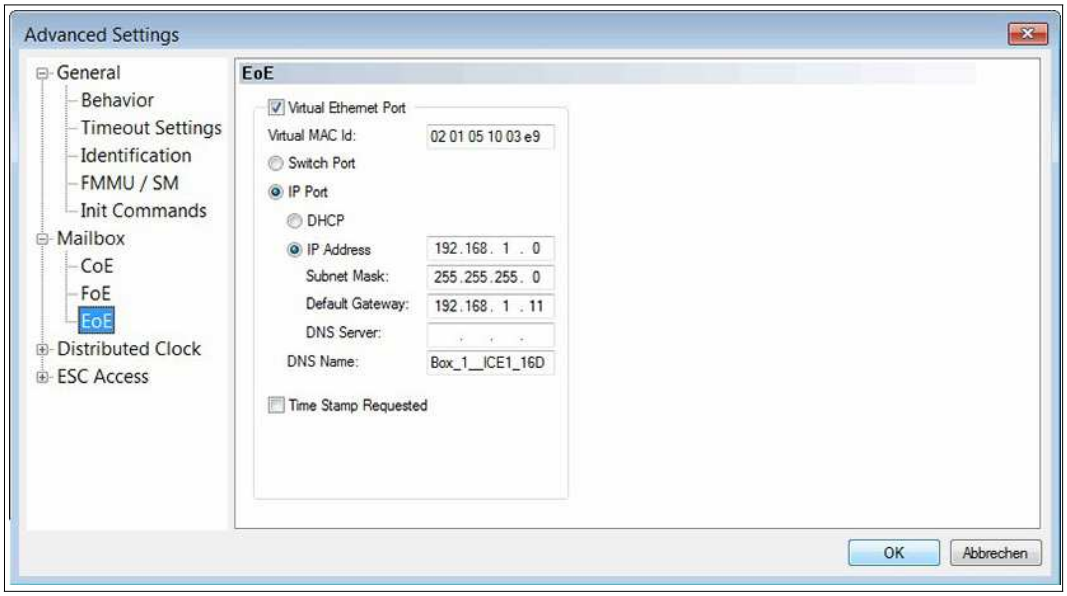


Figure 7.22

4. If no web server services are to be used, disable the "Virtual Ethernet Port" option by clicking on the tick.
5. To enable web server services, click on "IP Port" and "IP Address", then enter the IP settings according to those of the local network adapter.
6. Click on the "OK" button to confirm the changes.

Activating Configuration

1. If the module is connected to the EtherCAT network, select "TWINCAT" in the menu bar and then "Activate Configuration."

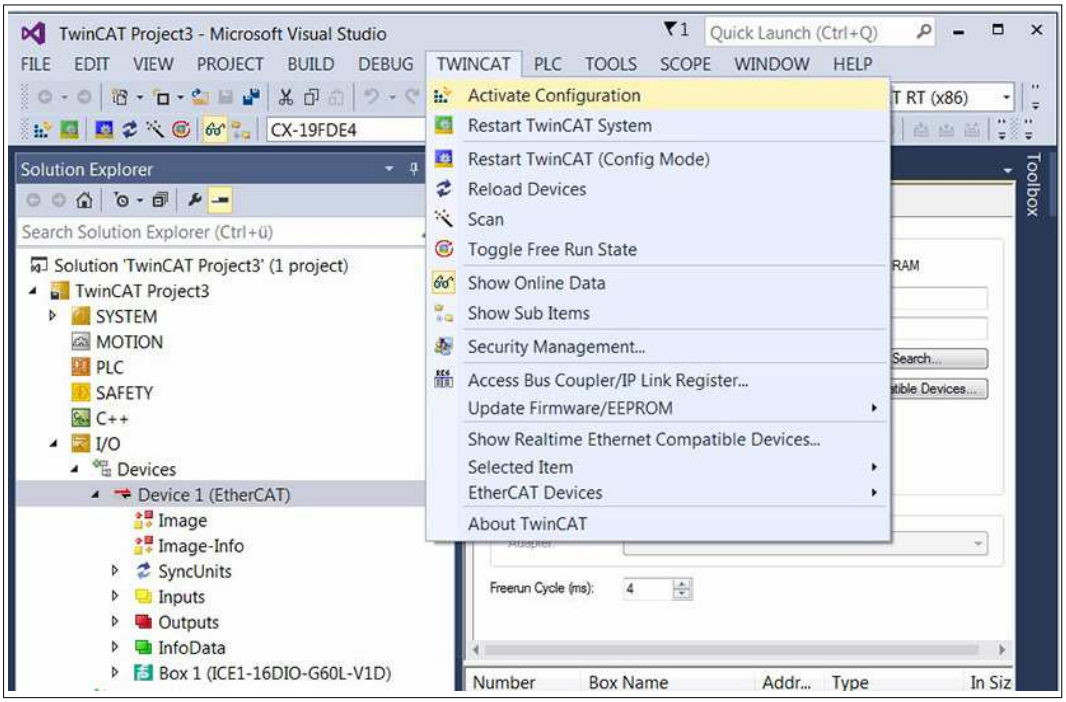


Figure 7.23

Caution!

Personal injury and property damage

Before you adjust the inputs or outputs of the module, make sure that no personal injury or property damage can occur.

2. Select "TWINCAT" in the menu bar again and then "Restart TwinCAT (Config Mode)."
3. Confirm the check box with “Yes”. The device then switches to the status "OP" and transfers I/O data.

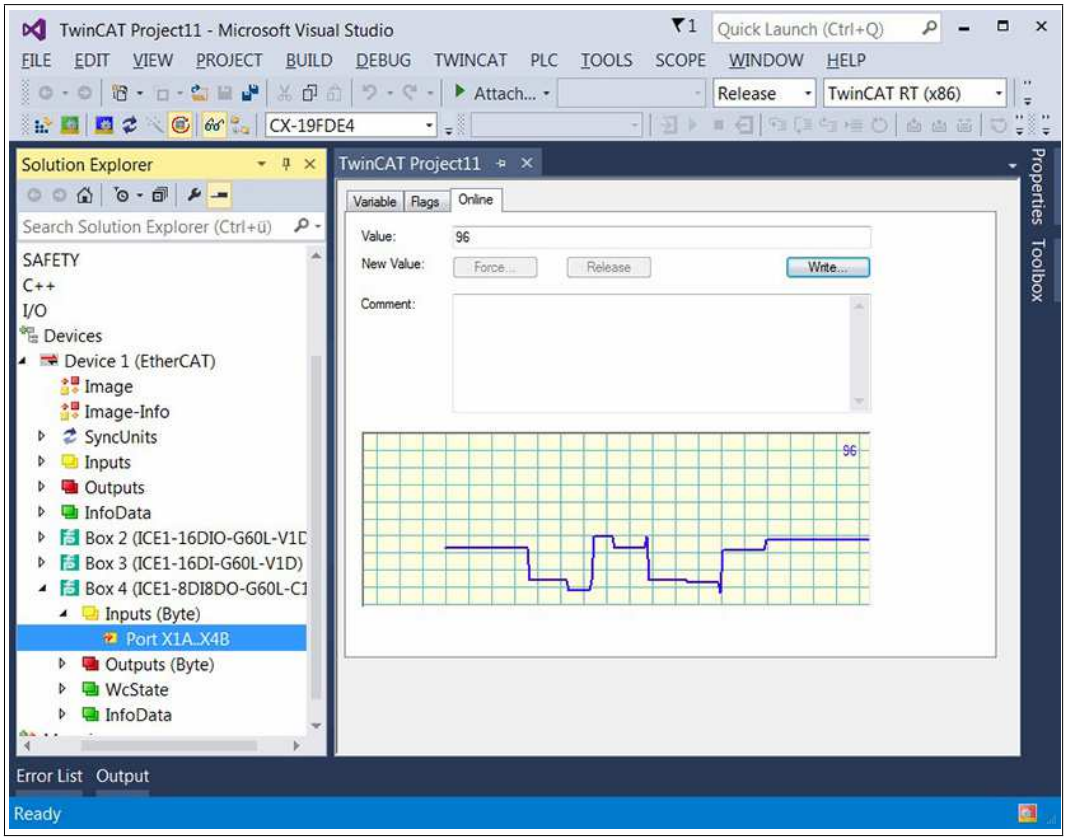
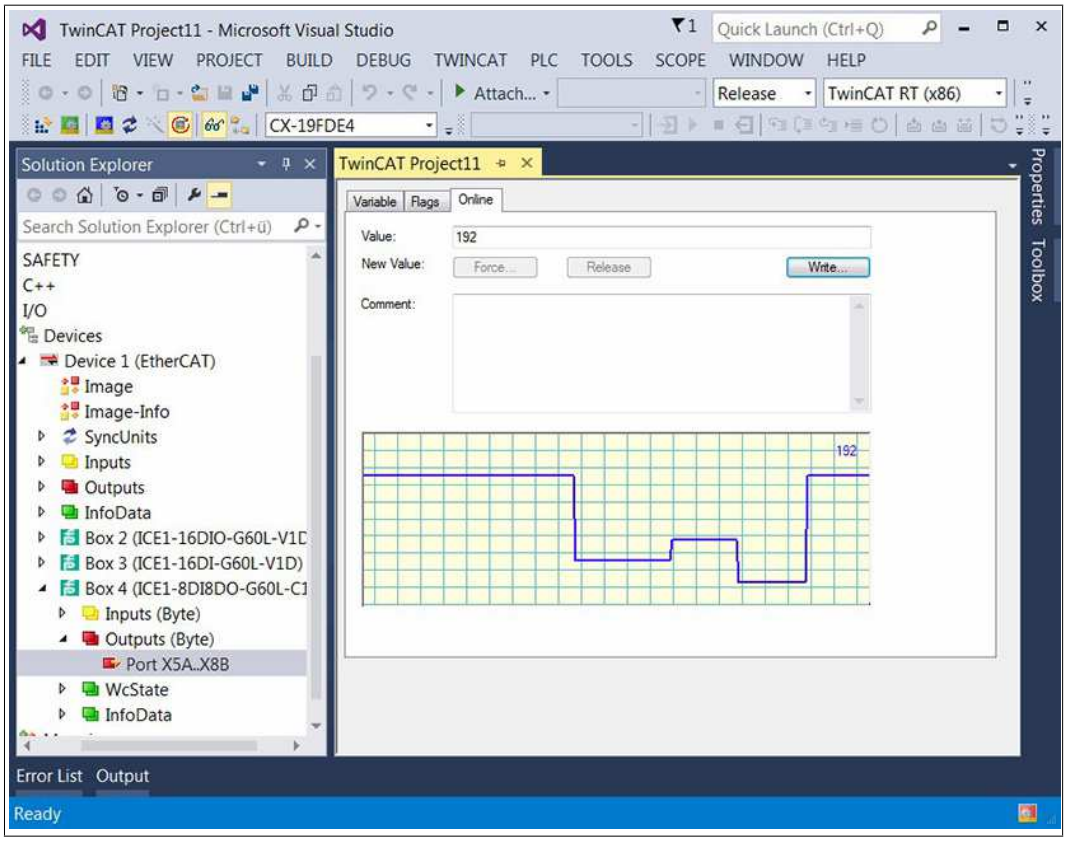


Figure 7.24

4. Click on the "Write" button to set a module output.



Note

Configuration of the PLC and module is now complete. You may now create your user program.

8 The Integrated Web Server

8.1 Overview and Module Addressing

The modules have an integrated web server that provides functions for configuring the modules and status and diagnostic information.

With the help of a standard web browser, you can access the available functions via an existing TCP/IP connection. To use the web server, the modules must have their own IP addresses. The modules have different default IP addresses depending on the protocol variant set.

Note

You have to assign a free IP address that is different to the factory setting to the modules before using the web server. For details, see the chapter "Displays and Controls," section "Operating Elements."

8.2 Menu Structure

Note

The web server can be used with different web browsers. The "Mozilla Firefox" and "Google Chrome" browsers can be used without any further changes to settings. When using “Microsoft® Internet Explorer,” it may be necessary to disable automatic configuration in the LAN settings.

Home Page (Status)

This page shows the current status of the entire module and the status of each individual channel. Upcoming diagnoses are reported in the same way as they are to the controller.

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

Depending on the selected protocol, the URL to open the home page will be different.

- **For EtherNet/IP and Profinet:**

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

- **For EtherCAT:**

  Enter `http://[IP address]/status.htm` in the address bar of your web browser, e.g., `http://192.168.1.1/status.htm`.

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

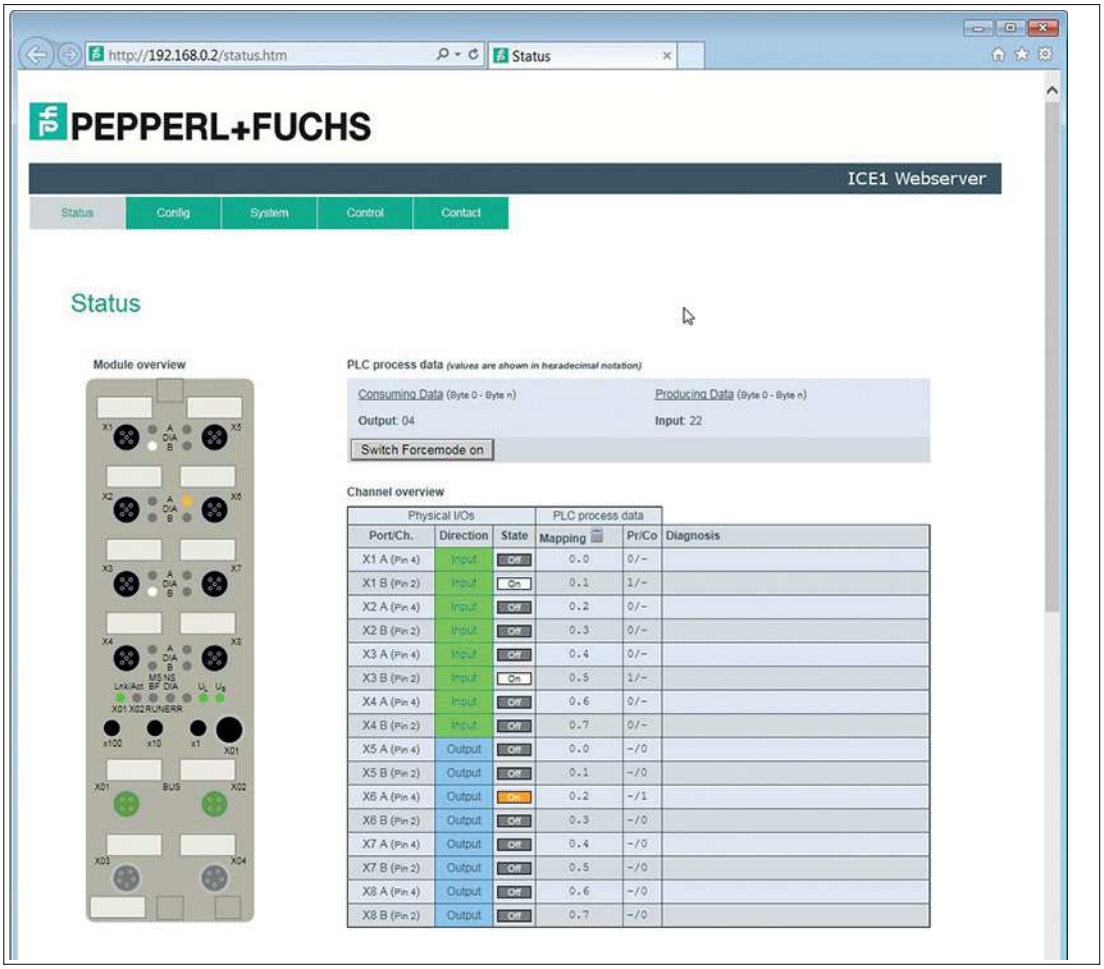


Figure 8.1

PLC process data and module overview

The "Consuming Data/Producing Data" process data, including "Diagnosis" diagnostic data, is displayed in tabular hexadecimal form in the "PLC process data" area, as well as graphically in the "Module Overview" area.

You can find details on diagnostic data encoding in the chapter for bit assignment of process data appropriate for the selected protocol.

Channel overview

The "Channel overview" table is divided into three different areas. These show the status of the physical input and output data of the channels as well as process data sent to and received from the controller. Channel errors are reported in the last column.

For each channel, the table shows the channel direction, current channel status, IO mapping configured via the controller and the currently mapped process data (Pr/Co). Pr/Co stands for "produced" and "consumed," both from the perspective of that module.

By clicking on the calculator icon, the input and output addresses from the controller can be assigned to provide an overview of the mapping values. Changes to the IO mapping on 16DIO modules are only possible via the controller.

Caution!

Serious injuries or property damage

Improper use of the "Force Mode" function can result in serious injury or property damage. Be careful when you use the "Force Mode" function. Please consider the consequences of using it.

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Force Mode

Force Mode can be helpful when commissioning the machine or during fault repair within the machine. The data for the input and output channels can be overwritten and set independently via the web server. It is therefore possible to set each output manually and simulate each input, regardless of the process data output from the controller or the actual status of the physical input.

You can activate "Force Mode" with the "Switch Force Mode on" button. It can be used across the board in offline mode without a connection to the controller, or in online mode with a connection to the controller. If you leave the status page or the web server, "Force Mode" automatically switches off.

This function is used for test purposes. The input and output data can be set from this website and the physical input data as well as the logical output data of the controller can be overwritten.

If "Force Mode" is activated via the web server in offline mode, it is not possible to connect to a controller.

To use "Force Mode" in online mode, the web interface and "Force Mode" must be activated in the controller parameterization.

If "Force Mode" is activated via the web server in online mode, it will automatically be switched off when "fail-safe" conditions occur (e.g. connection interruption, controller on STOP, internal module fault).

Note

User authentication is required to use “Force Mode”. Users can be created and changed on the system side. The default password for the "admin" user is "private.”

Click on the "Switch Force Mode on" button.

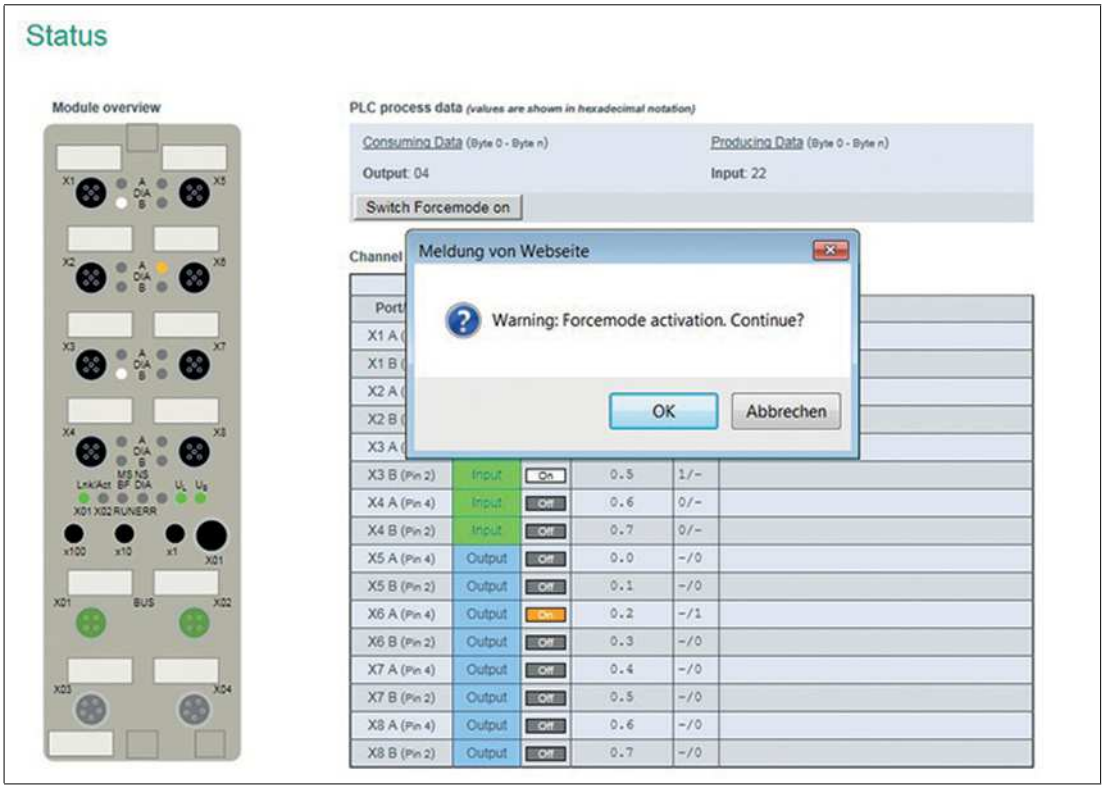

Figure 8.2

The following window appears for password entry

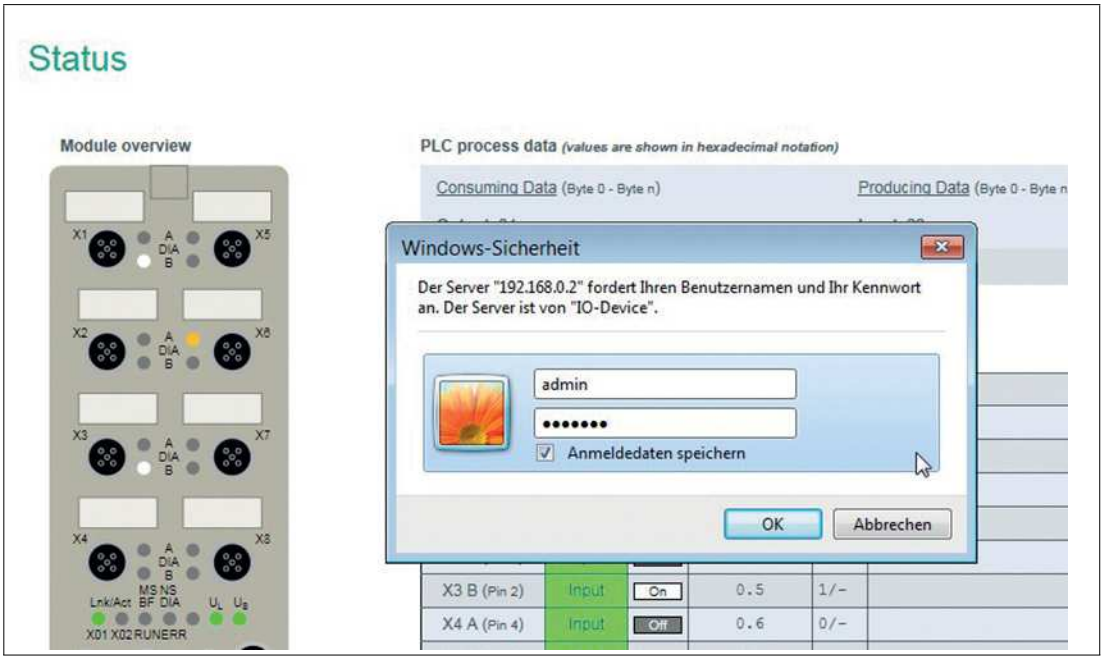

Figure 8.3

The user name is "admin." The password is "private."

If "Force Mode" has been successfully activated, the text "Force Mode enabled" appears in the display.

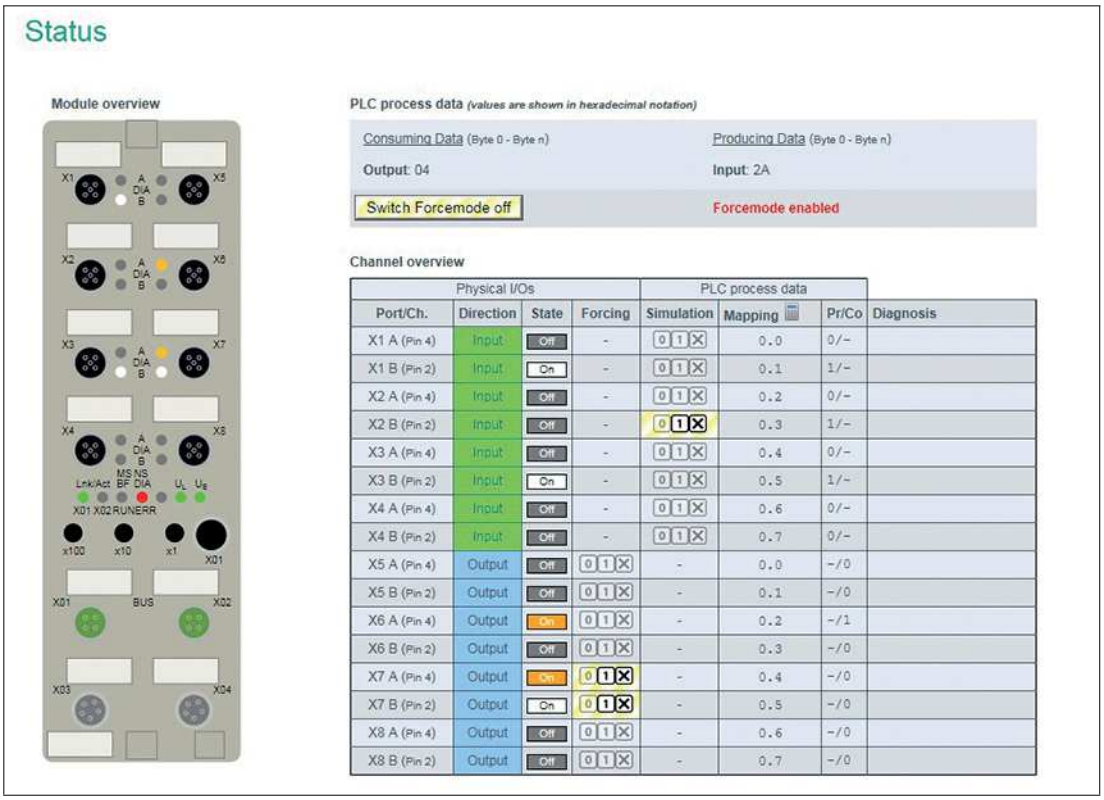

Figure 8.4

In the "Forcing" column, you can set the physical output data of the individual channels using the "0" and "1" buttons. The "X" button cancels Forcing for the respective channel.

In the same way, using the "Simulation" column, you can simulate the input data of individual channels before mapping into the process data.

To visualize the Force Mode manipulation in the web server, the behavior of the LEDs is displayed in the "Module Overview" area.

The Configuration Page (Config)

Click on the "Config" tab in the menu bar of the start window. This tab allows you to configure network parameters such as the IP address, reset the module to factory settings and initiate a firmware update.

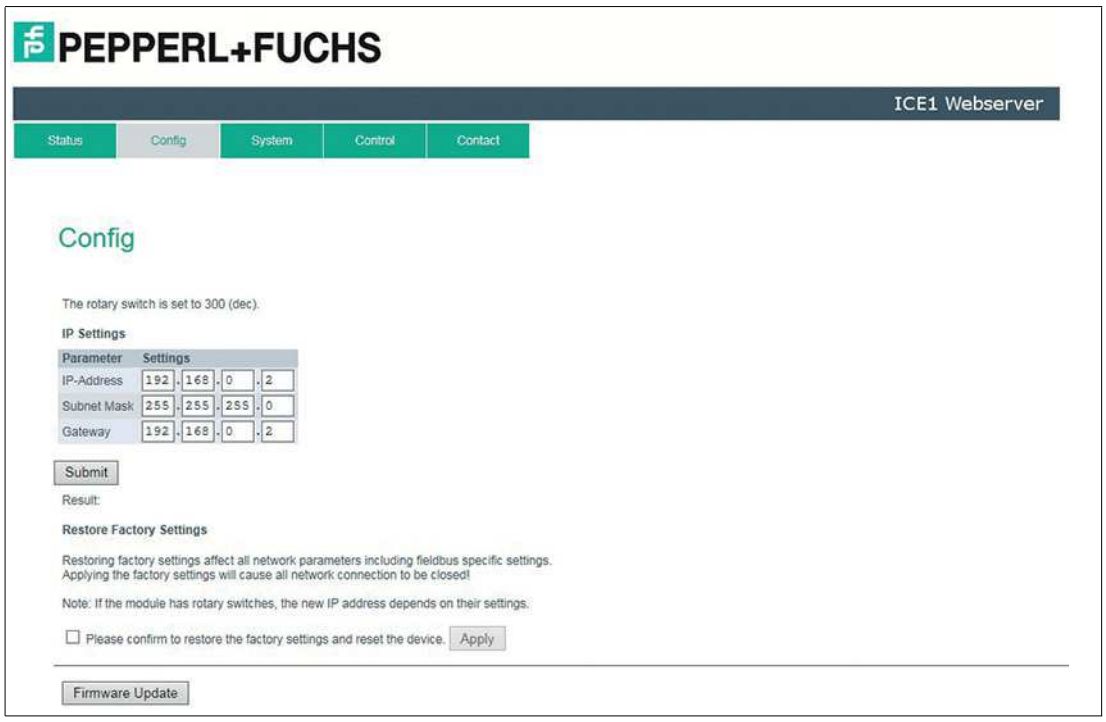

Figure 8.5

IP Settings

- IP address, readable and writable
- Subnet mask, readable and writable
- Gateway address, readable and writable

Clicking on the "Submit" button transfers the new parameters to the module. The new settings take effect on the module once the power supply has been switched off and back on.

Restore Factory Settings

In the "Restore Factory Settings" area, you can reset the module to factory settings.

Note

Please note that by restoring factory settings, the PROFINET name and IP address of the modules are also reset to their default settings. Access to the module web server and data exchange in the PROFINET network may no longer work after reset.

Firmware Update:

By clicking on the "Firmware Update" button, you can replace the current module firmware with a newer version.

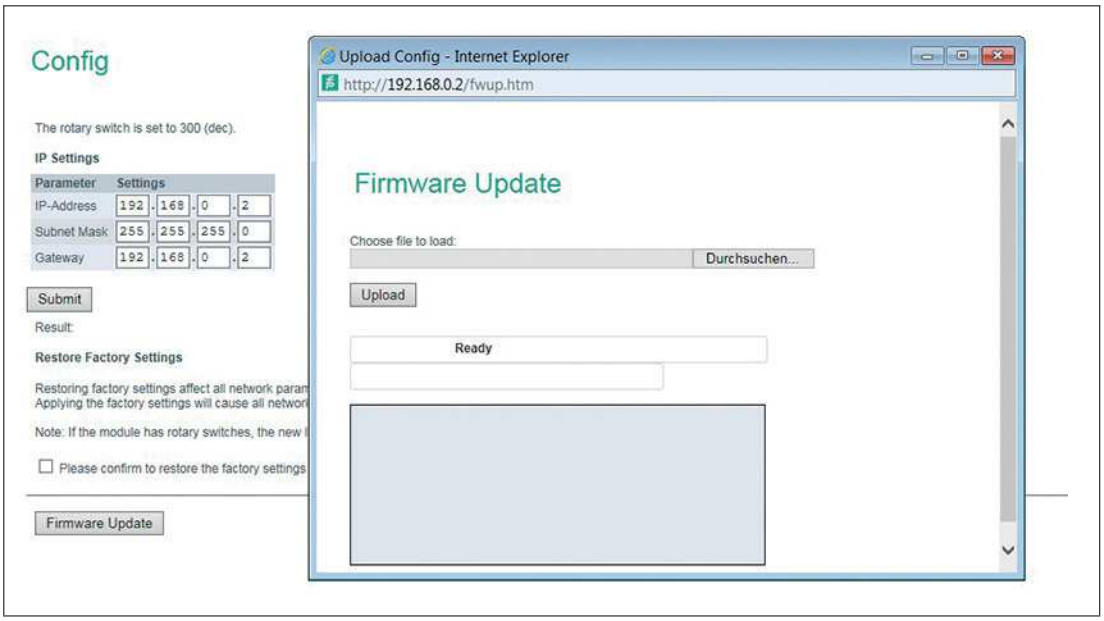

Figure 8.6

Note

A detailed description of the firmware update procedure can be found in the chapter "Firmware Update."

System Page

Click on the "System" tab in the menu bar of the start window. On this tab, you will find information on the connection status as well as module system information. You can also authorize users, create and change passwords.

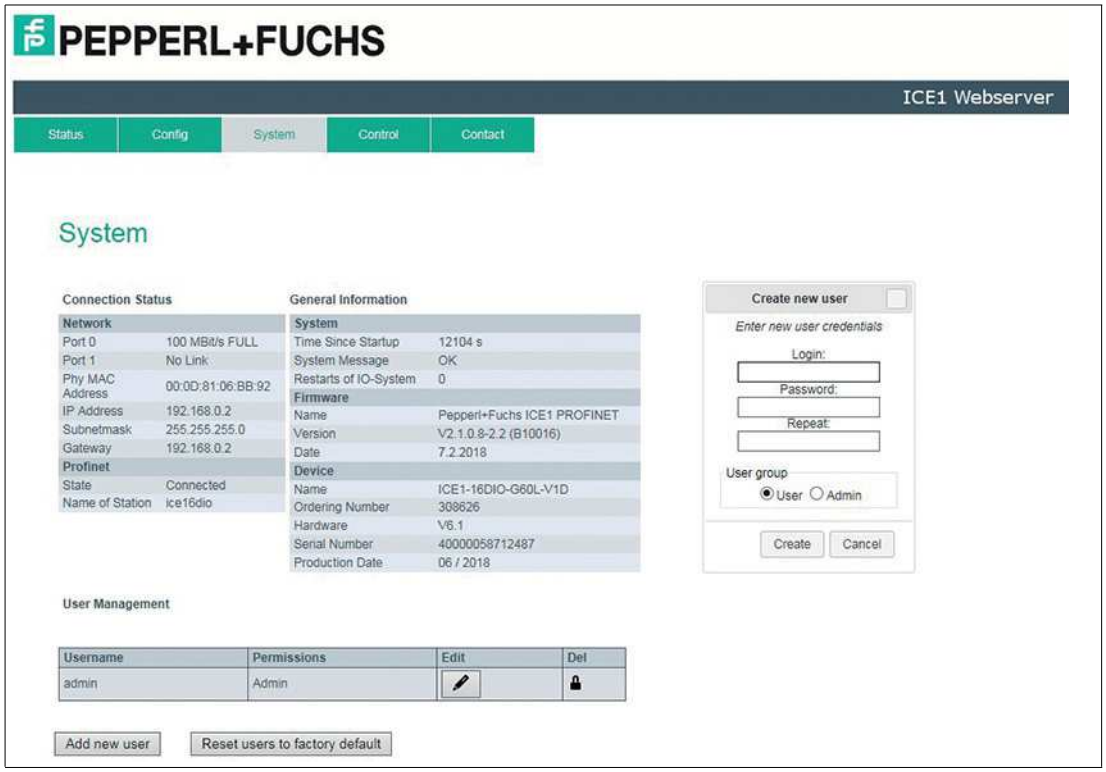

Figure 8.7

Connection Status

The "Connection Status" area shows the current status of each Ethernet port in terms of connection, transfer rate and transfer mode, along with the network parameters and PROFINET status of the module.

- Status of the LAN ports:
  - Duplex mode (full, half duplex)
  - Transfer rate (10 Mbit, 100 Mbit)
- Network address:
  - MAC ID

General Information

In the "General Information" area, you will find system-related information on runtime, firmware version, and module manufacturer information.

- Size and data direction of the assembly instances
- Status of the EtherNet/IP connection:
  - Stand-by
  - Wait-for-Connection
  - Operational
- Device status:
  - System runtime
  - System information
  - Number of restarts of the I/O system
- Firmware version and date

- Device information
- Revision:
  - Item number
  - Serial number
  - Week and year of production

User Management

In "User Management," you can change existing user passwords with the "Edit" button. In the "Create User" area, you can add more users with "Write" or "Admin" permissions. Only those with "Admin" access may create new users or change passwords.

Note

The status information on this tab is updated only when it is re-opened or refreshed in the web browser.

Control page (decentralized control function)

The decentralized control function (DCU) is only an optional extension on ICE1-*-G60L-**C1**-V1D modules. With this function, control and monitoring tasks can be run directly on the device via a decentralized control function. In doing so, the respective module can either send status information to a higher-level PLC (online operation) or operate independently without bus communication (offline operation).

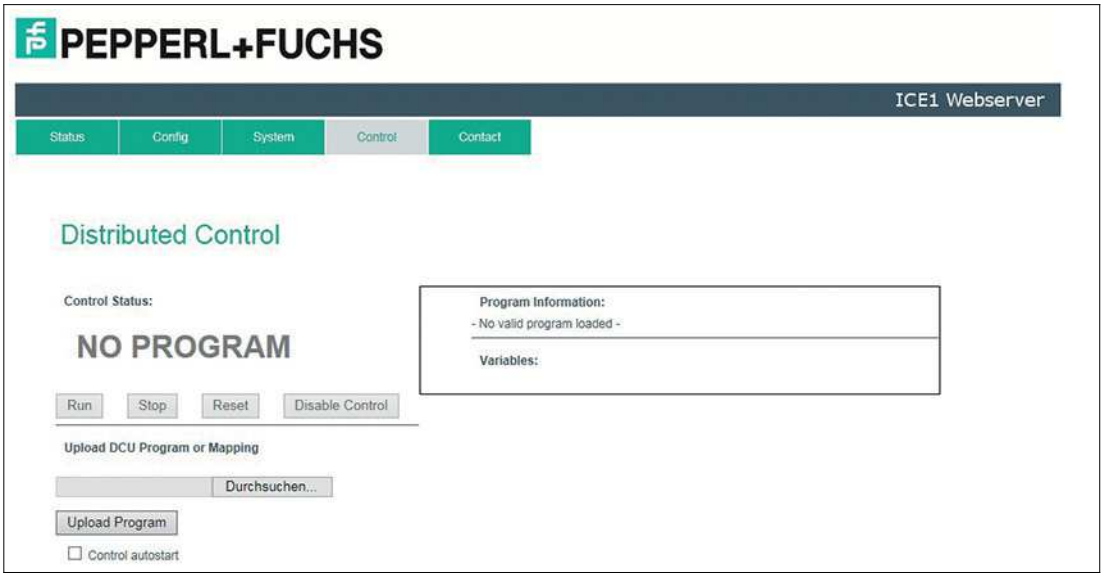

Figure 8.8

Modules without decentralized control function (DCU) do not show any usable information on this website.

Note

Details on using the functions on the control page can be found in the "Decentralized Control Function" chapter, in the sub-section "DCU Web Interface".

Contact Page

The “Contact” tab provides contact data for Pepperl+Fuchs GmbH.

8.3 Reading Out the Process and Diagnostic Data (JSON)

JSON Objects

You can read out the process and diagnostic data of the modules using the integrated web server. The web server provides the data in the standardized JSON format. The data is accessed via a web browser.

Note

Various web browsers can be used to call up JSON objects. How JSON objects are shown may differ depending on which web browser is used. In this manual they are shown in version 60.0.2 of Mozilla Firefox under Windows 10. When using Internet Explorer or Google Chrome, the information will be shown as raw data (see JSON response as raw data S.XY). However, the JSON objects themselves will not differ.

Calling up the JSON object

1. To call up the JSON object, open your web browser.
2. Enter the following command in the address bar:
3. **[IP address]/info.json**, e.g., 192.168.1.123/info.json

Structure of the JSON object

The diagram below shows the structure of the JSON object, using the ICE1-16DIO-G60L-C1-V1D module as an example:

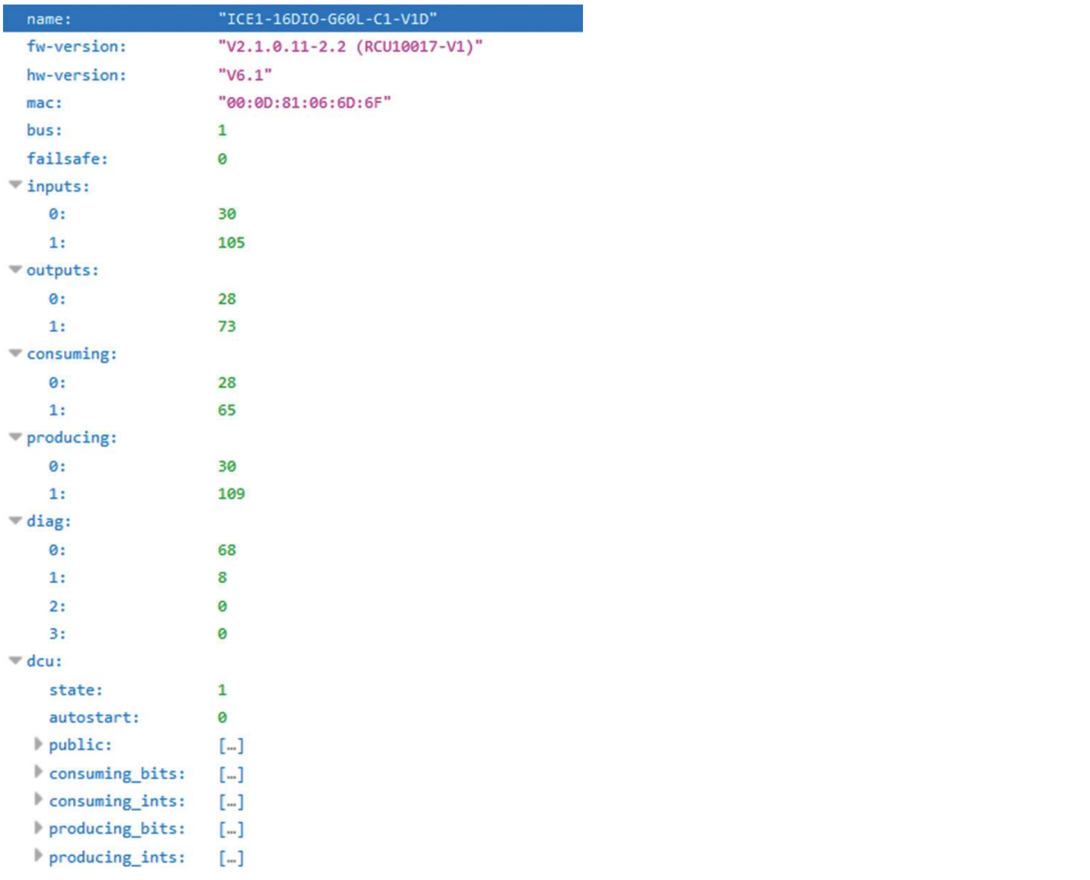

Figure 8.9

Note

For modules without the decentralized control function (DCU), the object ends after the entry for "diag:."

Example of JSON response as raw data

In addition to this structured representation of the JSON response, you can also access a representation of the raw data.

{"name": "ICE1-16DIO-G60L-C1-V1D","fw-version": "V2.1.0.11-2.2 (RC10017-V1)","hw-version": "V6.1","mac": "00:0D:81:06:6D:6F","bus": 1,"failsafe": 0,"inputs": [30,105],"outputs": [28,73],"consuming": [28,65],"producing": [30,109],"diag": [68,8,0,0],"dcu": {"state": 1,"autostart": 0,"public": [0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0],"consuming_bits": [0,0],"consuming_ints": [0,0,0,0,0,0,0,0],"producing_bits": [0,0],"producing_ints": [0,0,0,0,0,0,0,0]}}

The following table describes the contents of the individual entries. [n] = number of bytes:

Name	Data Type	Description
Name	String	Module name
fw-version	String	Firmware version
hw-version	String	Hardware version
mac	String	Module MAC ID

Name	Data Type	Description
bus	Number	0 = No connection to fieldbus 1 = Connected to fieldbus
failsafe	Number	0 = Outputs in normal mode 1 = Outputs in failsafe mode
inputs	Number[2]	Byte 0 = Actual status of input port X1 – X4 (channel A/B) Byte 1 = Actual status of input port X5 – X8 (channel A/B)
outputs	Number[2]	Byte 0 = Actual status of output port X1 – X4 (channel A/B) Byte 1 = Actual status of output port X5 – X8 (channel A/B)
consuming	Number[2]	Byte 0 = Data from PLC at port X1 – X4 (channel A/B) Byte 1 = Data from PLC at port X5 – X8 (channel A/B)
producing	Number[2]	Byte 0 = Data sent to PLC at port X1 – X4 (channel A/B) Byte 1 = Data sent to PLC at port X5 – X8 (channel A/B)
diag	Number[4]	Contains module diagnostic data Byte 0: • Bit 0 = Power supply error in the system/sensor (U_S) • Bit 1 = Power supply error in the actuator (U_L) • Bit 2 = Sensor overload • Bit 3 = Actuator overload • Bit 6 = Force mode active • Bit 7 = Internal module error (Invalid IO data) Byte 1 = Sensor overload at port X1 ... X8 Byte 2 = Actuator overload at port X1 ... X4 (channel A, B) Byte 3 = Actuator overload at port X5 ... X8 (channel A, B)
dcu	Object	Only available for DCU modules
dcu/state	Number	Current state of the DCU: • 0 = Locked • 1 = No program • 2 = Disabled • 3 = Stop • 4 = Run • 5 = Error
dcu/auto-start	Number	0 = Local autostart disabled 1 = Local autostart enabled
dcu/public	Number [32]	Contains the values of the DCU public variables (_P0 – _P31)
dcu/con-suming_bits	Number [2]	DCU 16-bit exchange data set by PLC
dcu/produc-ing_bit	Number [2]	DCU 16-bit exchange data set by a DCU program
dcu/con-suming_ints	Number [8]	DCU 16-byte data exchange words set by PLC
dcu/produc-ing_ints	Number [8]	DCU 16-byte data exchange words set by a DCU program

Table 8.1

Thus, the bit assignment of the data generally follows the following logic:

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

Table 8.2

The values refer to the following:

- X1-A ... X8-A: Actual status of input/output channel A (contact pin 4) for M12 connections 1 to 8.
- X1-B ... X8-B: Actual status of input/output channel B (contact pin 2) for M12 connections 1 to 8.

Note

The bit assignment of the diagnostic data from byte 1 (diag – Byte 1) is arranged according to a different logic, since a sensor short circuit can only result from an overload at pin 1. The table below shows the corresponding bit assignment.

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

Table 8.3

Description of the displayed byte values within the JSON object

The process data of the module is shown in decimal format in the JSON object. Consult the respective bit numbering for the precise meaning of the displayed values:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Bit numbering	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Byte 0	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 1	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Table 8.4

For this process data, the bit status (0 or 1) is multiplied by the corresponding bit numbering.

The following examples demonstrate this logic:

- Activated digital input at port X3-B: Byte 0 of the input data shows the value 32 as the port status in bit 5 (1 [bit status] x 32 [value])
- Activated digital output at port X8-A: Byte 1 of the output data shows the value 64 as the port status in bit 6 (1 [bit status] x 64 [value])

If multiple bits are set simultaneously, their values are totaled according to their byte assignment. The following example demonstrates this logic for the output data and input data.

Output data for byte 0 and byte 1:

- Port X3-A, port X2-B, and port X2-A are activated outputs, which means that bits 4, 3, and 2 in byte 0 are each 1 x bit numbering.

  The total value of byte 0 = 16 + 8 + 4 = 28
- Port X8-A, port X6-B, and port X5-A are activated outputs, which means that bits 6, 3, and 0 in byte 1 are each 1 x bit numbering.

  The total value of byte 1 = 64 + 8 + 1 = 73

Note

To enable internal module diagnosis, the actual output statuses at the module—in addition to the actual input statuses—are reflected in the input data (output mirror). To receive the pure input data, the values of the output data must therefore be subtracted from the total value of the input data in the JSON object. ().

Input data for byte 0 and byte 1:

- Input data for byte 0 = 30

  The pure input data is calculated by subtracting the output data of byte 0 = 28 from the displayed input data.

  Therefore, the pure input data from byte 0 = 30 - 28 = 2

  Based on the bit numbering for the ports, it can be concluded that Port X1-B is an activated input.

- Total value of the inputs for byte 1 = 105

  The pure input data is calculated by subtracting the output data of byte 0 = 73

  Therefore, the pure input data from byte 1 = 105 - 73 = 32

  Based on the bit numbering for the ports, it can be concluded that Port X7-B is an activated input.

Data under the "consuming" and "producing" headings only refers to pure communication between the module and a control panel. If the values of the input and output data differ from those displayed here, another source (for example, forcing via the web server) must also be involved in the communication. Which values are the result of another source can be ascertained by subtracting. In this case, the input data from the data in the "producing" section and the output data from the data in the "consuming" section can be subtracted according to their byte assignment.

9 Decentralized Control Function

9.1 Basic Information

Overview

The ICE1-*-G60L-**C1**-V1D variant Ethernet IO modules have a decentralized control (DCU) function. Using this, the modules can execute user programs that have been created with a small external tool called **LDMicro**. These user programs are created in a ladder logic and are called "DCU programs." This means that the user can add additional control logic, which is stored directly in the module and is independent of a higher-level control. This ranges from simple Boolean operations of the inputs and outputs through to autonomous programs. To a PLC, the module appears as a normal slave module with 8 bit output data and 16 bit input data.

Note

Inputs or outputs that are used by the DCU application can no longer be directly controlled by the PLC. However, the inputs or outputs can communicate with the PLC since the corresponding cyclic bits are read and written by the DCU program.

Cyclic Data and Parameters

Consuming Data (PLC to Ethernet IO Module)

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4A	3B	3A	2B	2A	1B	1A
Byte n +1	8B	8A	7B	7A	6B	6A	5B	5A

Table 9.1

Legend

- 1A … 8A: output status channel A (pin 4) of slots X1 to X8
- 1B … 8B: output status channel B (pin 4) of slots X1 to X8

Producing Data (Ethernet IO Module to PLC)

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4A	3B	3A	2B	2A	1B	1A
Byte n +1	8B	8A	7B	7A	6B	6A	5B	5A

Table 9.2

Legend

- 1A … 8A: current status of channel A (pin 4) of slots X1 to X8
- 1B … 8B: current status of channel B (pin 4) of slots X1 to X8

Note

Depending on the protocol set, the module may contain additional cyclic data bytes. Details can be found in the respective chapters on process data for the individual protocols.

Data Exchange

Note

The following information on data exchange between Ethernet IO module and PLC only applies to the ICE1-16DIO-G60L-C1-V1D modules.

2019-10

- The modules provide additional cyclic data explicitly for data exchange between the PLC and DCU program. The DCU program can accept commands and data from the PLC and responds with execution results.
- The width of the exchanged data is 16 bits plus 8 data words (as a signed 16-bit integer) in each direction.
- The data exchange bits can be written with the "YEn" bit variables in LDMicro.
- The data exchange bits can be read with the "XEn" bit variables in LDMicro.
- The symbols for the integer variables “EIn” and "EOn" allow the reading and writing of data exchange words.

PROFINET

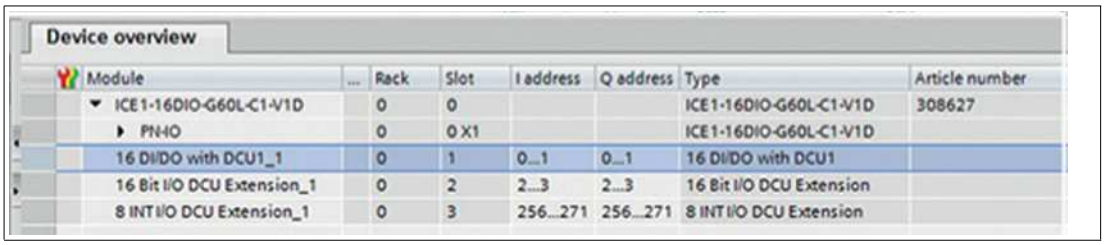

Figure 9.1 DCU data exchange area in the TIA Portal

In the PROFINET protocol, the data exchange area consists of 2 additional slots (2 and 3). Slot 2 contains the 16-bit exchange data and slot 3 the 16-byte exchange data words.

EtherNet/IP

The exchange data is made available within the cyclical Ethernet/IP data. The format of this data can changed depending on the assembly currently selected (16DIO, 16DI, 8DI/8DI etc.).

The following cyclic data applies to the standard 16DIO modules with DCU. For further information, please refer to the chapter "Commissioning for EtherNet/IP,” sub-section "Modules with Decentralized Control Function, Bit Assignment of Process Data Extension.”

Cyclic Producing Data

Byte	Function
0	Input data
1	Input data
2	General diagnosis
3	Sensor diagnosis
4	Reserved
5	Actuator diagnosis 1
6	Actuator diagnosis 2
7	DCU bit exchange byte 1
8	DCU bit exchange byte 2
9	DCU integer exchange 1 MSB
10	DCU integer exchange 1 LSB
11	DCU integer exchange 2 MSB
12	DCU integer exchange 2 LSB
...	...
24	DCU integer exchange 8 MSB
25	DCU integer exchange 8 LSB

Table 9.3

Cyclic Consuming Data

Byte	Function
0	Output data
1	Output data
2	DCU bit exchange byte 1
3	DCU bit exchange byte 2
4	DCU integer exchange 1 MSB
5	DCU integer exchange 1 LSB
6	DCU integer exchange 2 MSB
7	DCU integer exchange 2 LSB
...	...
20	DCU integer exchange 8 MSB
21	DCU integer exchange 8 LSB

Table 9.4

EtherCAT

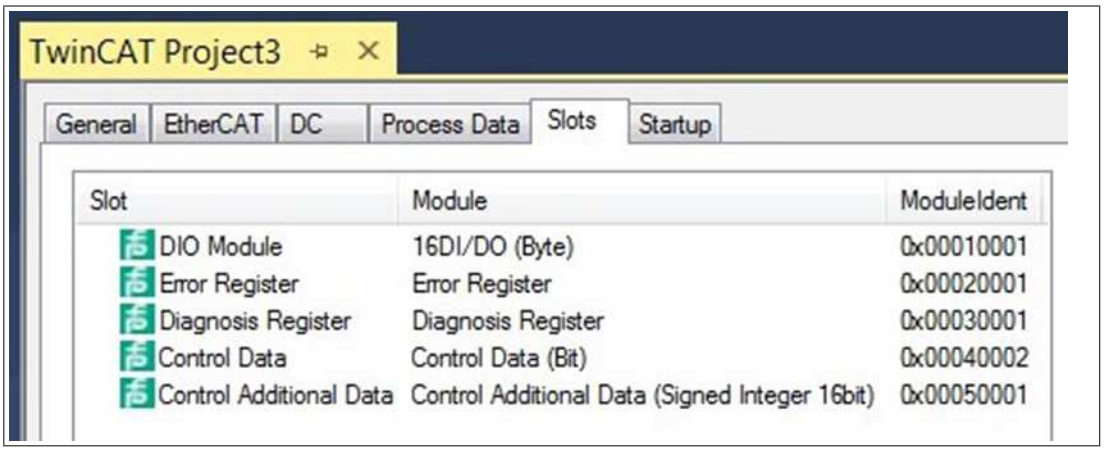

Figure 9.2 Control data exchange area in TwinCAT3

Name	Type	Size	>Ad...	In/O...	User...	Linked to
Physical Inputs 0..7	USINT	1.0	46.0	Input	0	
Physical Inputs 8..15	USINT	1.0	47.0	Input	0	
Error Register	USINT	1.0	48.0	Input	0	
Diagnosis Register	UDINT	4.0	49.0	Input	0	
Control Inputs 0..7	USINT	1.0	53.0	Input	0	
Control Inputs 8..15	USINT	1.0	54.0	Input	0	
Control Additional Input 0	INT	2.0	55.0	Input	0	
Control Additional Input 1	INT	2.0	57.0	Input	0	
Control Additional Input 2	INT	2.0	59.0	Input	0	
Control Additional Input 3	INT	2.0	61.0	Input	0	
Control Additional Input 4	INT	2.0	63.0	Input	0	
Control Additional Input 5	INT	2.0	65.0	Input	0	
Control Additional Input 6	INT	2.0	67.0	Input	0	
Control Additional Input 7	INT	2.0	69.0	Input	0	
WcState	BIT	0.1	1522.1	Input	0	

Figure 9.3 Control exchange variables in TwinCAT3

In EtherCAT, the two data exchange areas are organized as additional slots. The eight signed integer values are displayed directly as variables of type INT and size 2.

Module Parameters

The ICE1-*-G60L-**C1**-V1D modules have an additional PLC parameter that controls the startup behavior of the decentralized control function.

DCU Start Parameters

Disabled	The DCU application starts in the disabled state
Locked	The DCU application is disabled and cannot be started via the web interface.
Run	The DCU application starts in the RUN status and executes a valid, loaded DCU program.

DCU Start Parameters in the TIA Portal

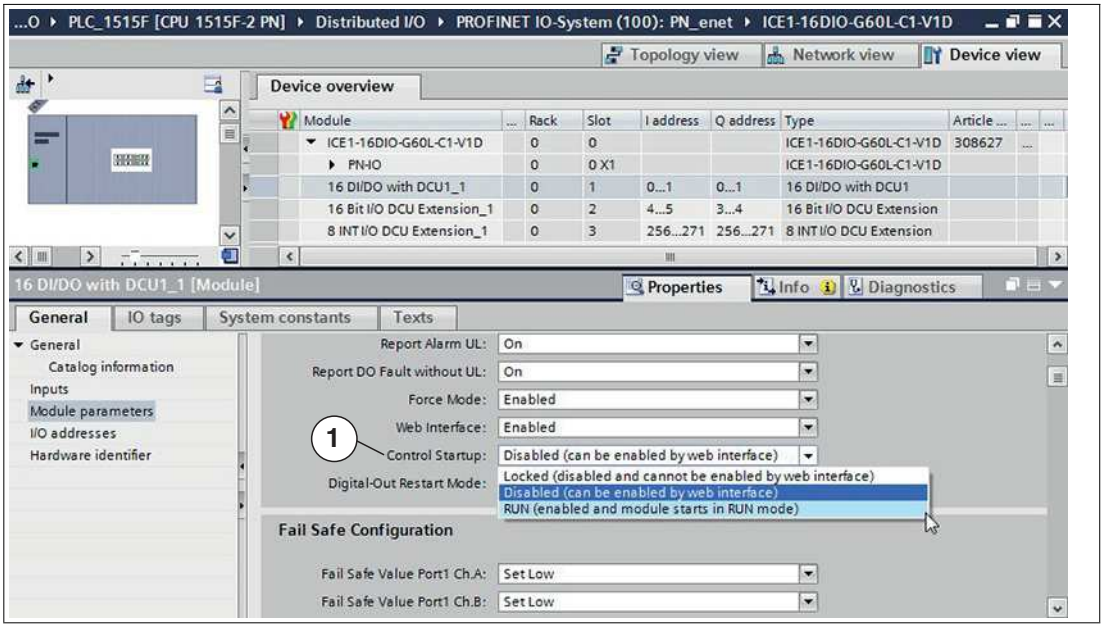

Figure 9.4

The DCU start parameters are activated/deactivated in "Control Startup" (1).

DCU Programming

DCU/LDMicro Framework Conditions

Max. rungs	99
Max. bits	99
Max. integers	99
Max. line count (compiled program)	4096
Min. µDCU cycle time	10 ms

9.2 LDMicro Programming Tool

LDMicro User Interface

Open source ladder logic programming tool:

Download LDMicro at: https://www.pepperl-fuchs.de or http://cq.cx/ladder.pl#dl

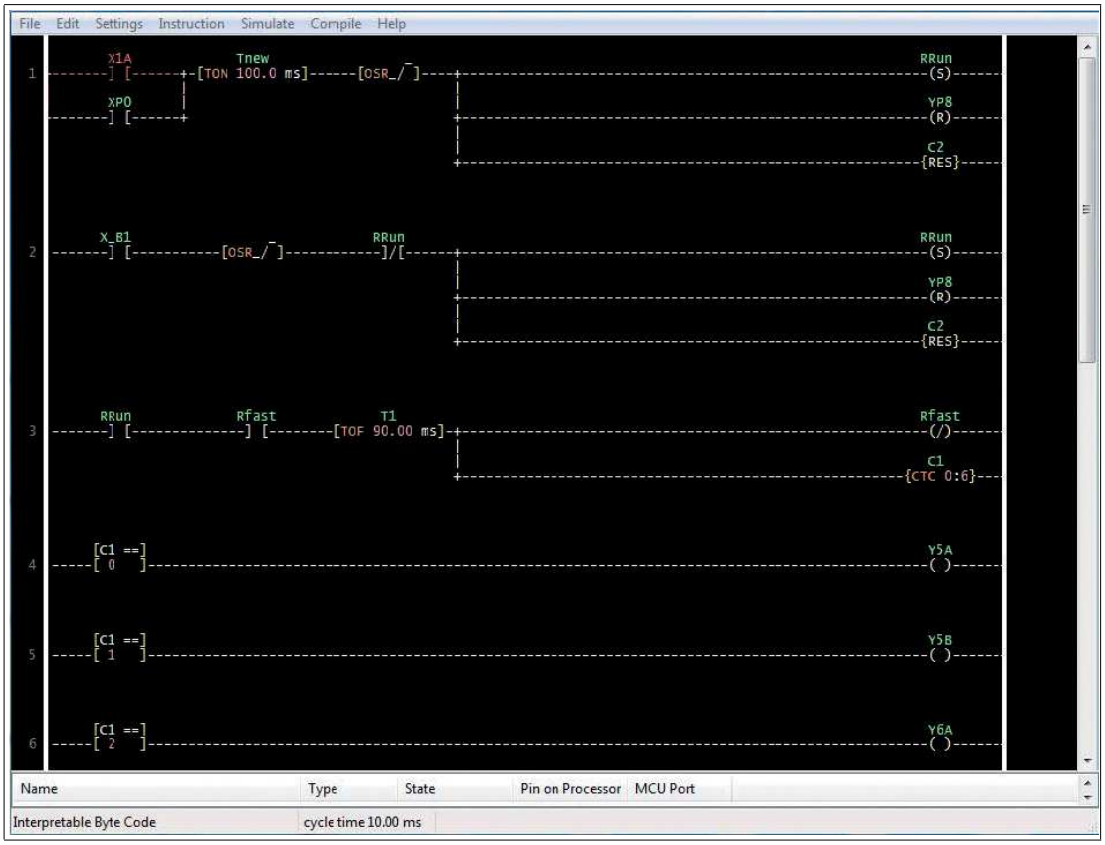

Figure 9.5

With LDMicro, the user can create programs in a ladder-diagram style in line with EN 61131-3. In a ladder-diagram style, all elements of the program are arranged on horizontal lines (rungs). The paths are always executed from left to right without an established rung order. This concept has its origin in hard-wired relay circuits.

LDMicro offers a wide variety of applications:

- Bit operations such as contacts, coils, setting/resetting
- Edge detection
- Time switches and enabling/disabling delays
- Incrementing/decrementing/circulating counter
- Arithmetic operations (16 bits, signed)

DCU programs that have been created with LDMicro can:

- Use all inputs and outputs on the module
- Respond to diagnostic events (short circuit, low voltage, etc.)
- Communicate with a connected PLC
- Release information about the network

File Types

Program files for LDMicro are named with .ld. These files can be loaded, edited and saved via the LDMicro application.

To compile a DCU program for the DCU application, first select the correct destination type under "**Settings -> Microcontroller -> Interpretable Bytecode**."

It is also possible to set the cycle time (Settings -> MCU parameters). A cycle time of 10 ms or more is recommended.

Then select **Compile -> Compile as ...** from the menu and choose a location and a name for where the compiled program should be saved. The result is a .int file.

Note

This file can now be uploaded to the DCU application via the web interface.

File Types

LDMicro recognizes the following types of data:

Bit	0 or 1
Int	16 bit integer (-32768 to +32767)
T	Timer
C	Counter

Conventions for Naming

LDMicro

There are three types of bits with a compulsory naming convention:

Type	Convention	Example
Input bit	Must begin with "X"	`X1A, X5P`
Output bit	Must begin with "Y"	`Y2B, Y3P`
Internal relay	Must begin with "R"	`R1, RRun, RStart`

µControl

Type	Convention	Example
Physical I/O input data	X followed by port number and channel	`X1A, X5B`
Physical I/O output data	Y followed by port number and channel	`Y2B, Y7A`
Cyclic data for PLC	Y followed by "P" and bit number	`YP5, YP15`
Cyclic data from the PLC	X followed by "P" and bit number	`XP0, XP6`
Special bits	"X" or "Y" followed by _ (underscore) and a name	`X_DIA, Y_STOP`
Integer values for I/Os	IN or OUT followed by byte number	`IN1, IN2, OUT1, OUT2`
Integer values for specific information	_ (underscore) followed by a name	`_SCS, _CE1`

Available Data

This data is available in the LDMicro program itself. Simply name a bit or integer variable in LDMicro according to the following list.

Basic input/output data

Symbol	Direction	Type	Description
Xn[A/B]	Input	Bit	Reads the digital input status of port n (1 ... 8). Channel A or B
Yn[A/B]	Output	Bit	Writes digital output status to port n (1 ... 8). Channel A or B
OUT[0/1]	Output	Int	Writes 8 output statuses as INT (0 = X1 ... X4, 1 = X5 ... X8)
IN[0/1]	Input	Int	Reads 8 input statuses as INT (0 = X1 ... X4, 1 = X5 ... X8

Data Exchange with PLC

Symbol	Direction	Type	Description
XPn	Input	Bit	Reads consuming bit from PLC (consumption data) n = 0 ... 15
YPn	Output	Bit	Writes producing bit for PLC (data creation) n = 0 ... 15
XCn[A/B]	Input	Bit	Reads consuming data from PLC for port n (1 ... 8). Channel A or B)
YPn[A/B]	Output	Bit	Writes producing data for PLC for port n (1 ... 8). Channel A or B
XEn*	Input	Bit	Reads data exchange bit n (0 ... 15)
YEn*	Output	Bit	Writes data exchange bit n (0 ... 15)
EIn*	Input	Int	Data exchange value from PLC n = 0 ... 7
EOn*	Input	Int	Data exchange value for PLC n = 0 ... 7

* Only available on 16DIO module.

Diagnosis Information

Symbol	Direction	Type	Description
X_DIA	Input	Bit	Diagnosis master bit
X_SCS	Input	Bit	Sensor diagnosis bit
X_SCA	Input	Bit	Actuator diagnosis bit
X_LVS	Input	Bit	Sensor supply voltage error
X_LVA	Input	Bit	Actuator supply voltage error
X_COMM	Input	Bit	Cyclic connection to PLC established
_SCS	Input	Int	Sensor short-circuit information per port
_CE1	Input	Int	Channel error LSB
_CE2	Input	Int	Channel error MSB

Control

Symbol	Direction	Type	Description
Y_STOP	Output	Bit	Causes the DCU application (DCU) to stop
Y_DIS	Output	Bit	Causes the DCU application (DCU) to lock itself

Special

Symbol	Direction	Type	Description
_Pn	Output	Int	Data for publishing. n = 0 - 31
_MSG	Output	Int	Shows message with the corresponding number on web GUI
X_Bn	Input	Bit	Virtual button on web GUI pressed n = button number 1 ... 10
X_First	Input	bit	Is only set on first program run after switch-on or reset.

Physical inputs and outputs

The symbols XnA and XnB allow the DCU program to read the corresponding physical input directly. A contact given this icon is interpreted as closed when the respective input pin is connected to + 24 V_{DC} (e.g. pin 1). The symbols XnA and XnB allow you to directly control a physical digital output. A coil named with this symbol would activate the corresponding output pin, which then supplies + 24 V_{DC}.

Physical inputs and outputs that are used in a DCU program are separated from the corresponding cyclic data to and from the PLC. However, this cyclic data can still be read and manipulated by the DCU program to communicate or exchange information with the PLC. Physical inputs and outputs that are NOT used can still be directly controlled by a PLC.

Direct Access to Cyclic Bits

The module provides the PLC with 16-bit cyclic input data (producing data), which is shown in the DCU program with the symbol YPn , whereby n is a bit within a range of 0 to 15. A coil with this name would control the corresponding cyclic bit in the data of the module. Only cyclic bits that are separated from physical inputs and outputs because they are used in a DCU program can be manipulated in this way.

The 8-bit cyclic output data from the PLC (consuming data) can also be read with a DCU program with the symbol XPn; n represents a bit within a range of 0 to 7. This allows the DCU application to respond to events that are triggered by the PLC.

Channel-related reading and manipulation of consuming and producing data through the channel

The symbols XCnA and XCnB read the consuming cyclic bit received from the PLC that controls the specified output channel. Even if the output channel is controlled by the DCU program and therefore not directly by the PLC, the program is able to react to the status of the bit.

The symbols YPnA and YPnB manipulate the producing data for the specified channel, which is sent to the PLC via the cyclic data. This allows a DCU program to simulate an input state to the PLC irrespective of the real channel state.

In doing so, the active process data mapping is observed.

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Channels 1 … 4

Physical port/channel	Port/channel 1/A	Port/channel 1/B	Port/channel 2/A	Port/channel 2/B	Port/channel 3/A	Port/channel 3/B	Port/channel 4/A	Port/channel 4/B
Reading the consuming bit	XC1A	XC1B	XC2A	XC2B	XC3A	XC3B	XC4A	XC4B
Manipulating the producing bit	YP1A	YP1B	YP2A	YP2B	YP3B	YP3B	YP4A	YP4B

Channels 5 … 8

Physical port/channel	Port/channel 5/A	Port/channel 5/B	Port/channel 6/A	Port/channel 6/B	Port/channel 7/A	Port/channel 7/B	Port/channel 8/A	Port/channel 8/B
Reading the consuming bit	XC5A	XC5B	XC6A	XC6B	XC7A	XC7B	XC8A	XC8B
Manipulating the producing bit	YP5A	YP5B	YP6A	YP6B	YP7B	YP7B	YP8A	YP8B

Data Exchange

Note

The following information on data exchange between Ethernet IO module and PLC only applies to the ICE1-16DIO-G60L-C1-V1D modules.

- The modules provide additional cyclic data explicitly for data exchange between the PLC and DCU program. The DCU program can accept commands and data from the PLC and responds with execution results.
- The width of the exchanged data is 16 bits plus 8 data words (as a signed 16-bit integer) in each direction.
- The data exchange bits can be written to LDMicro with the "YEn" bit variables.
- The data exchange bits can be read in LDMicro with the "XEn" bit variables.
- The data exchange bits are independent of the process data mapping in use.
- The symbols for the integer variables “EIn” and "EOn" allow the reading and writing of data exchange words.

9.3 DCU Web Interface

Distributed Control Web Interface

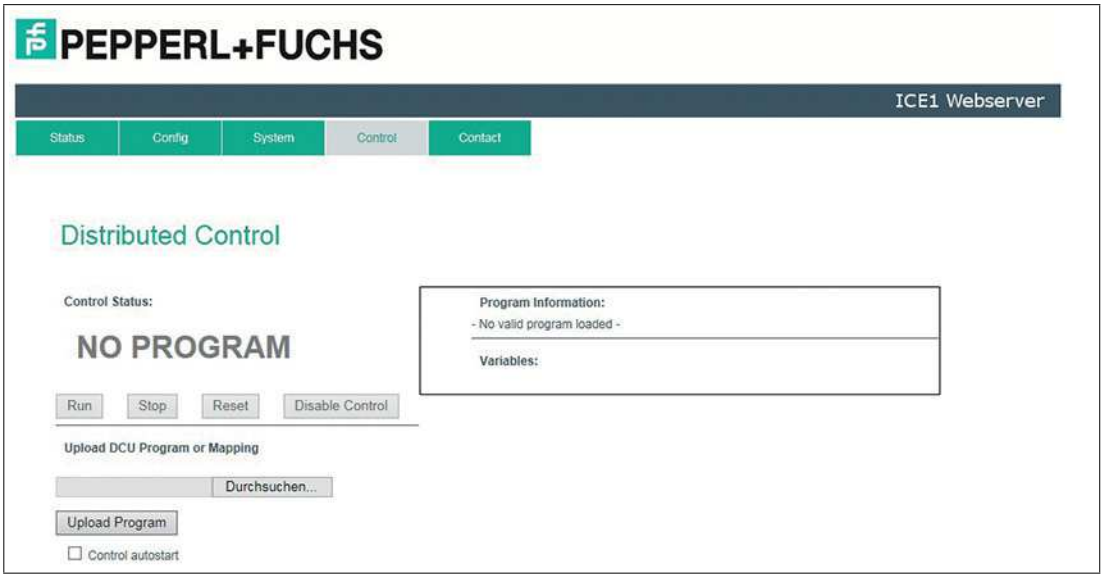

Figure 9.6 Control web interface without loaded program

The control web interface enables the user to upload programs to the DCU application and manage the control status.

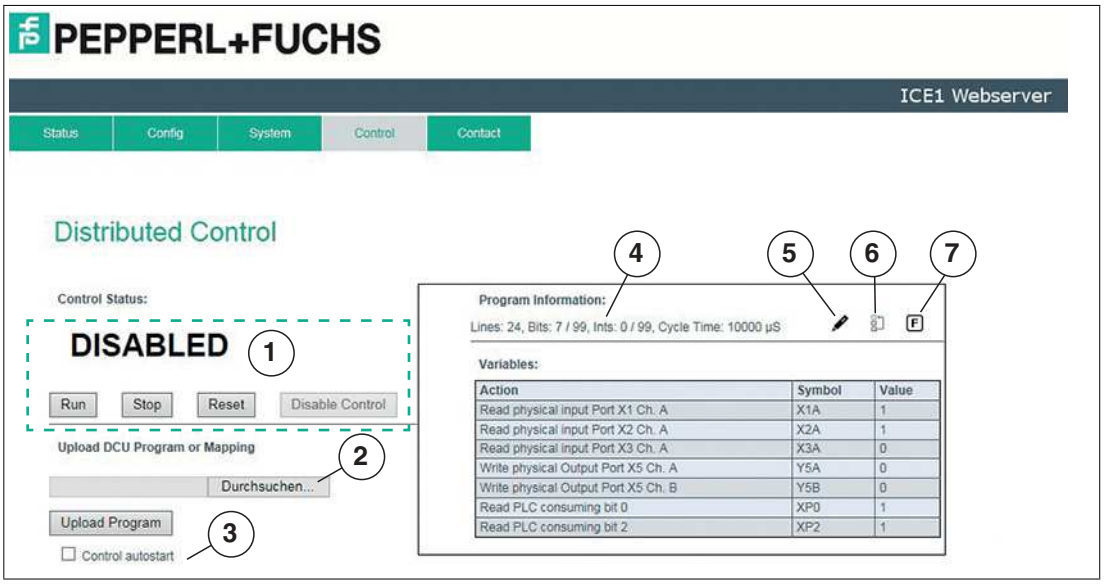

Figure 9.7 Control web interface with loaded program

1 Displays current DCU status and buttons to manage the decentralized control function

2 Uploading a program or mapping file

3 Auto-start box to automatically run a preloaded program immediately after switching on the power supply

4 The "Program Information" area shows basic information on the program, and a list of all module functions used by the decentralized control function

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5 Changes the number format in the "Value" column to integer variables.

6 Opens the mapping dialog to create a specific variable mapping.

7 Enables/disables variable forcing

User Name and Password

To change the control status or upload programs, you can use the "WRITE" or "ADMIN" user names.

Note

The default password for the "ADMIN" user is "private."

Control Status

The following control statuses are displayed:

Status	Description
NO PROGRAM	No program has been loaded or the uploaded file is not a valid program.
LOCKED	The DCU application is locked by the master configuration (PLC).
DISABLED	The DCU application is disabled. There is no program running and the DCU application has no control over the inputs and outputs.
STOP	The DCU application controls the inputs and outputs that are used in the loaded program, but the program is stopped. All other inputs and outputs can still be controlled by the master.
RUN	The DCU application controls the inputs and outputs that are used in the loaded program, and the program is executed. All other inputs and outputs can still be controlled by the master.

Uploading a Program to the DCU Application

Programs that are created and compiled with LDMicro can be uploaded directly into the DCU application. Select the program file (.int) and press the "Upload" button.

Program upload is NOT permitted if the DCU application is in RUN mode. WRITE or ADMIN user rights are required to upload a DCU program.

You can also upload a variable mapping file (.map).

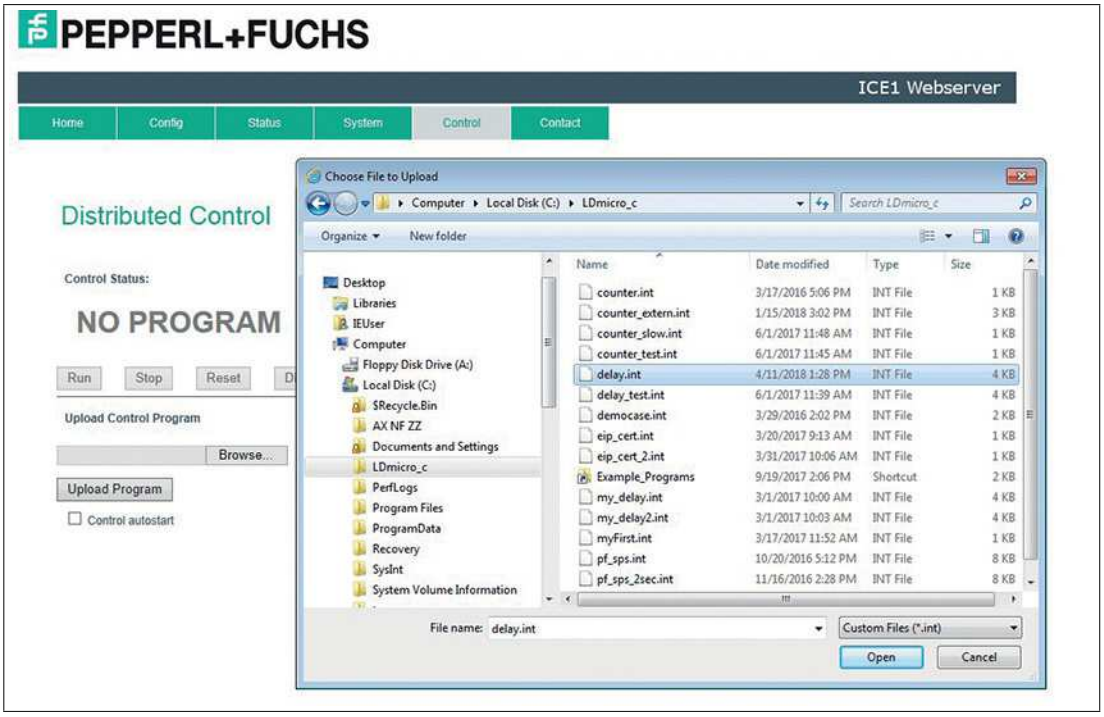


Figure 9.8

Program Information

The box on the right-hand side displays certain information about the program currently loaded. The I/O table shows all the physical inputs and outputs that are used by the PLC program. Only these I/Os are controlled by the DCU program. All other I/Os can be controlled by a fieldbus master (if available).

Auto Start

If the Auto Start check box is enabled, the DCU application starts automatically in RUN mode if the module is switched on and if a valid program is loaded.

Note

Only use "Control Autostart" if there is no connection to a PLC. Otherwise, the PLC will not recognize the module. To ensure that the control function is executed in conjunction with a PLC, the corresponding device parameters must be activated. For PROFINET, for example, this is called "Control Start-Up"

Specific Mapping

Typically, mapping between a variable and the respective module function is conducted implicitly based on the variable name (according to chapter "LDMicro Programming Tool," see table "Fundamental input/output data"). In the example, a variable named Y5B is automatically associated with the module function "Set physical output port 5 channel B." If this approach is used, no further mapping is required.

To improve the readability of the DCU program, it may be useful to identify variables according to their function in the application. For example, if an output is to activate a yellow LED, the variable can be Y_LEDyellow.

Such a variable name is not known to the module and therefore is not associated with a function. This variable is therefore not displayed in the variables list, but the assignment of this variable to a physical output can be carried out manually using variable mapping.

Creating the Mapping with the Mapping Dialog

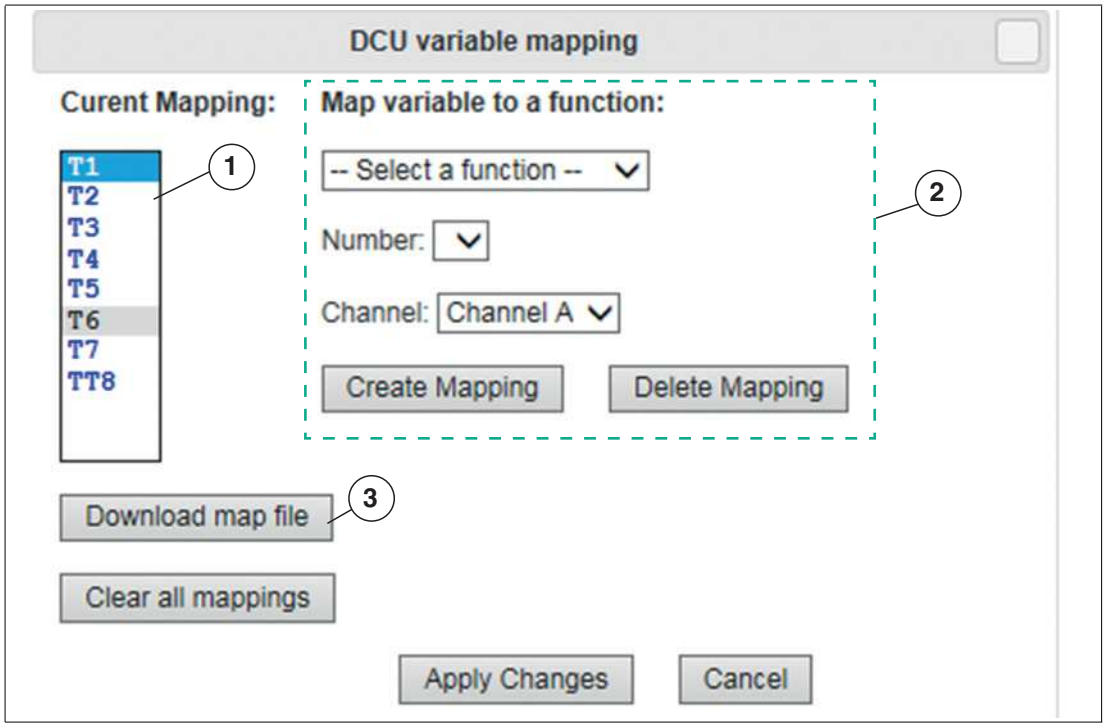


Figure 9.9

The mapping dialog shows a list of all variables in the current program (1), which cannot be mapped automatically by their names.

Each of these variables can be linked to a device function by selecting the variable. After that, the function drop-down list is filled with possible functions for this variable type.

Once a function is selected, it may be necessary to specify this further. For example, select a number or a port and channel (2).

By clicking on "Create Mapping", the variable is connected to this function.

The “Delete Mapping" button cancels an existing mapping.

Once all the required variables have been mapped, click on the "Apply Changes" button to send the changes to the module.

The variables list on the DCU page now shows the newly-assigned variables with the original function name in parentheses.

You can download the current mapping for backup, re-use or external editing purposes (3).

The "Clear all mappings" button deletes all existing mappings in the module.

Manually Creating a Mapping File

Variable mapping can also be generated simply by uploading a mapping file.

The file is structured as follows:

[CustomName];[Symbol]\r\n

Example:

XStart;X1A

YLED;Y5B

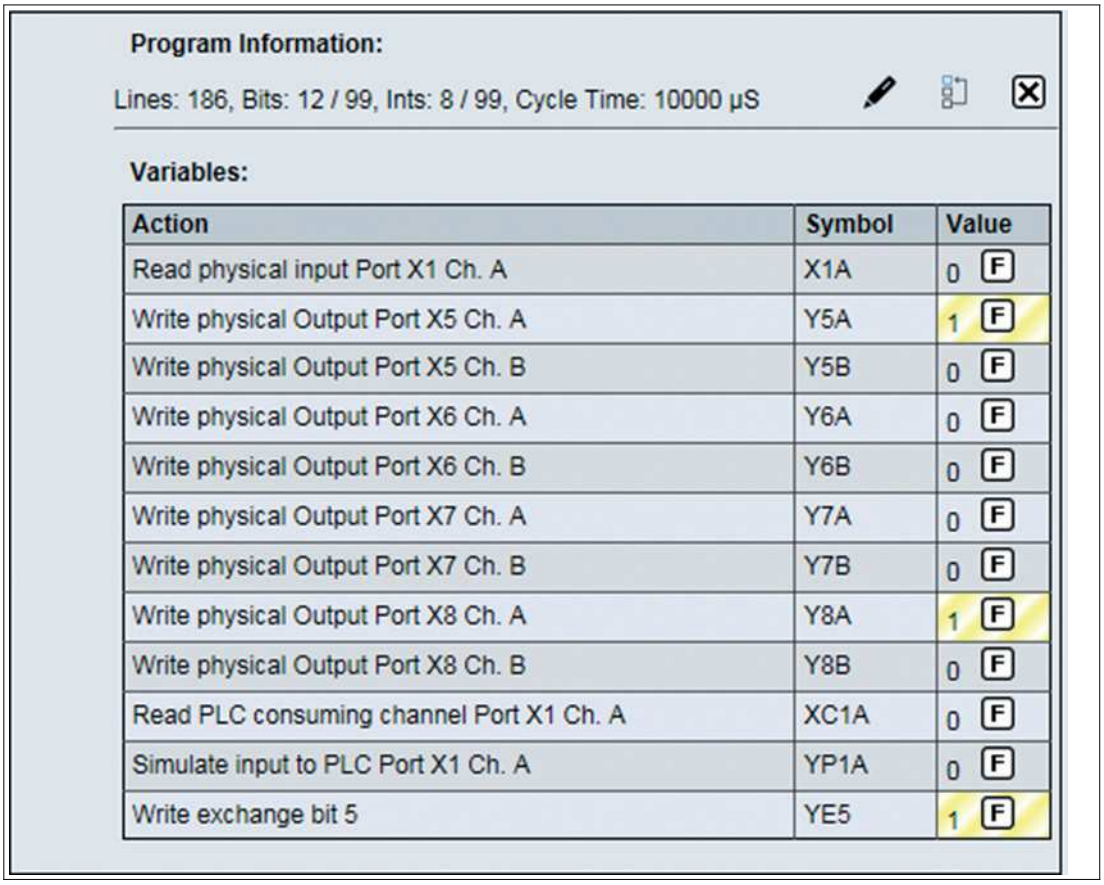
This file must have the ".map" extension.

Forcing Variables

Any variables in a DCU program that are mapped to a module function can be manipulated (forcing). This means that the value can be changed manually, directly from the web interface.

Input variables, i.e., variables that are filled with data from the module, can be manipulated to a certain value, which is then read by the DCU program. Input data for a DCU program can thus be manipulated, e.g., for test purposes.

Output variables, i.e., variables that are written by a DCU program to change the module state, can be set to a specific value. This is transmitted directly to the module function with which the variable is mapped. This enables the function to be manipulated directly. Output variables are only processed when the decentralized control function (DCU) is in the "RUN" state.



Action	Symbol	Value
Read physical input Port X1 Ch. A	X1A	0 F
Write physical Output Port X5 Ch. A	Y5A	1 F
Write physical Output Port X5 Ch. B	Y5B	0 F
Write physical Output Port X6 Ch. A	Y6A	0 F
Write physical Output Port X6 Ch. B	Y6B	0 F
Write physical Output Port X7 Ch. A	Y7A	0 F
Write physical Output Port X7 Ch. B	Y7B	0 F
Write physical Output Port X8 Ch. A	Y8A	1 F
Write physical Output Port X8 Ch. B	Y8B	0 F
Read PLC consuming channel Port X1 Ch. A	XC1A	0 F
Simulate input to PLC Port X1 Ch. A	YP1A	0 F
Write exchange bit 5	YE5	1 F

Figure 9.10 Variable list with active forcing

Starting/stopping and operating forcing

To start variable forcing, the user clicks on the "F" button in the program information. The buttons revolve around "X." Clicking on the button again ends variable forcing.

All variables in the list gain an additional "F" button in the "Value" column. Clicking on this button opens a small dialog, where the user can enter a forcing value for this variable. Bit variables only provide "0" and "1" buttons, since bit variables can only be set to 0 or 1.

A number can be entered for integer variables.

The button marked with an "X" immediately ends forcing for this variable. A forced variable in the list is highlighted in yellow.

Uploading a DCU Program and Mapping Batch

The DCU program and mapping files can also be uploaded via an HTTP POST request. An example of a Perl script is described below. This can be used directly for the batch upload.

POST Request to Upload Files

URI	/upload?cmd=store&fullpage=false	
Method	POST	
MIME type	multipart/form-data	
Form fields	path	dcu
	submit	upload
	file	[file to upload] (as application/octet-stream)
Filename	dc.int for program file dc.map for mapping file	

Use of the Perl Script

The following example of a batch file shows a Perl script (transfer.pl) for batch uploading files to the decentralized control function (DCU).

This line uploads a DCU program file (dc.int) to the module with the IP address 192.168.1.20:

perl -w .\transfer.pl -s dc.int -t dcu 192.168.1.20 -a IO-Device:admin:private

The procedure for a mapping file is the same:

perl -w .\transfer.pl -s dc.map -t dcu 192.168.1.20 -a IO-Device:admin:private

Note

The term "IO-Device" must remain unchanged.

You may need to adapt the user name and/or password to the real module configuration. Any user with at least "WRITE" permissions can be used.

10 Firmware Update:

Overview

If the modules require a firmware update, you can use the software provided by Pepperl+Fuchs on the Internet. Visit the product page for the respective module, ICE1-*-G60L-V1D, at **www.pepperl-fuchs.com** to download it.

You can update the module firmware using the embedded web server. To do this, you must first open the home page of the web server.

Depending on the selected protocol, the URL to open the home page will be different.

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

Note

The web server can be used with various web browsers. The "Mozilla Firefox" and "Google Chrome" browsers can be used without any further changes to settings. When using “Microsoft® Internet Explorer,” it may be necessary to disable automatic configuration in the LAN settings.

Firmware Update Process

Note

Do not interrupt the update process. Once the firmware update has been completed, you will be prompted to restart the module.

The firmware file must be downloaded and saved on the PC with the web server installed.

1. Go to the home page of the web server:
   - **For EtherNet/IP and Profinet:**

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

     Enter `http://[IP-Adresse]/status.htm` in the address bar of your web browser, e.g., `http://192.168.1.1/status.htm`.

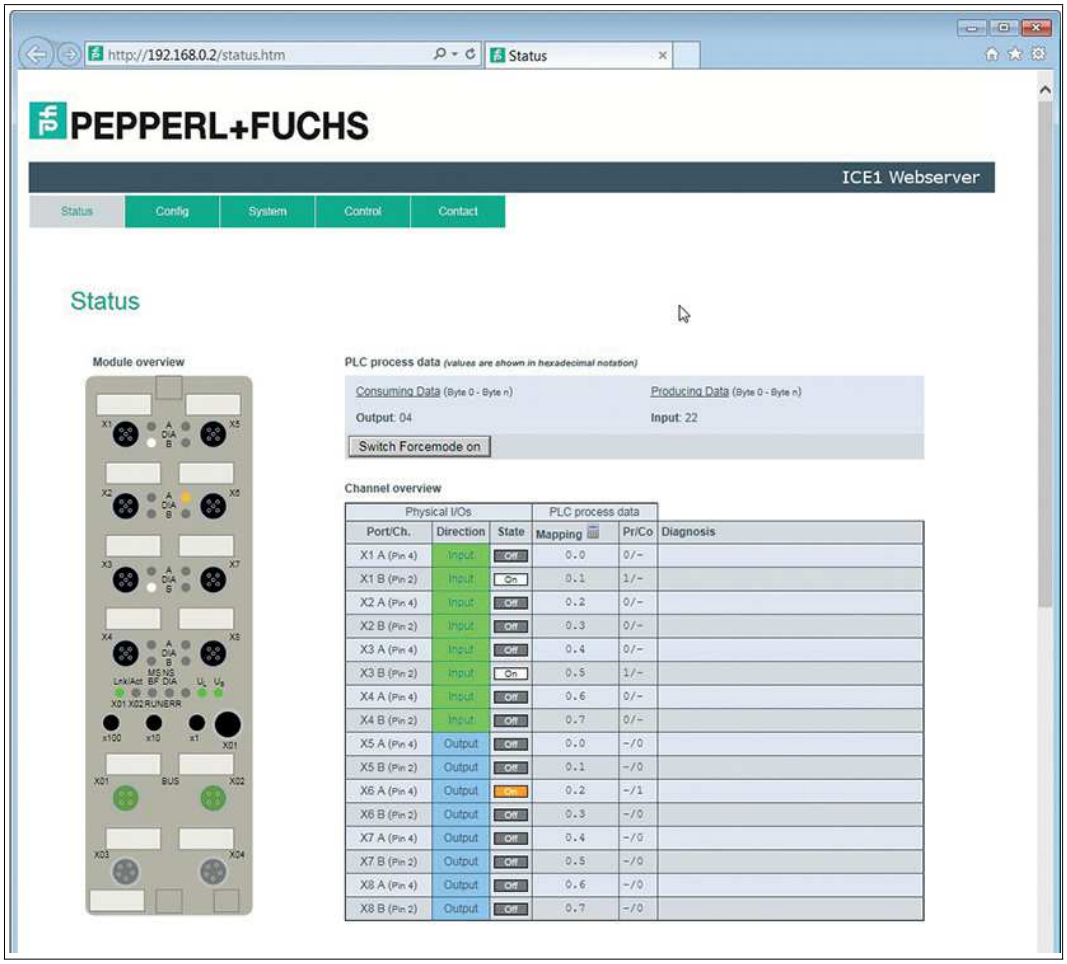


Figure 10.1

2. Click on the “Config” tab.
3. Click on the “Firmware Update” button.

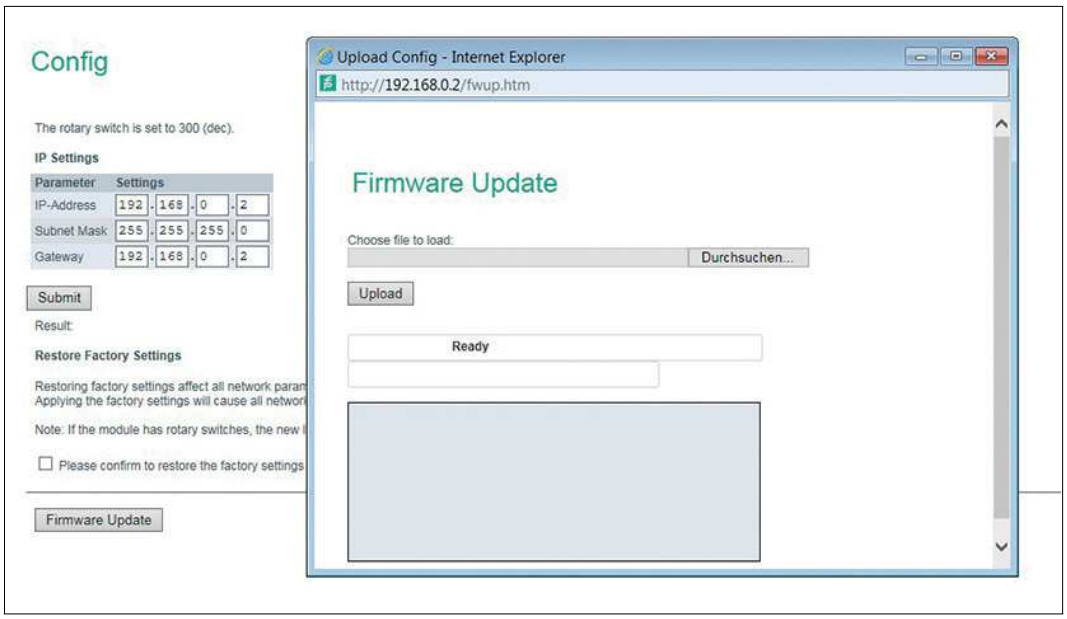


Figure 10.2

4. Click on the “Browse” button, select the appropriate ZIP file in your local directory and confirm the process with the "Upload" button.

   ↳ Transferring the firmware takes about 30 secs. There is a visual progress indicator.

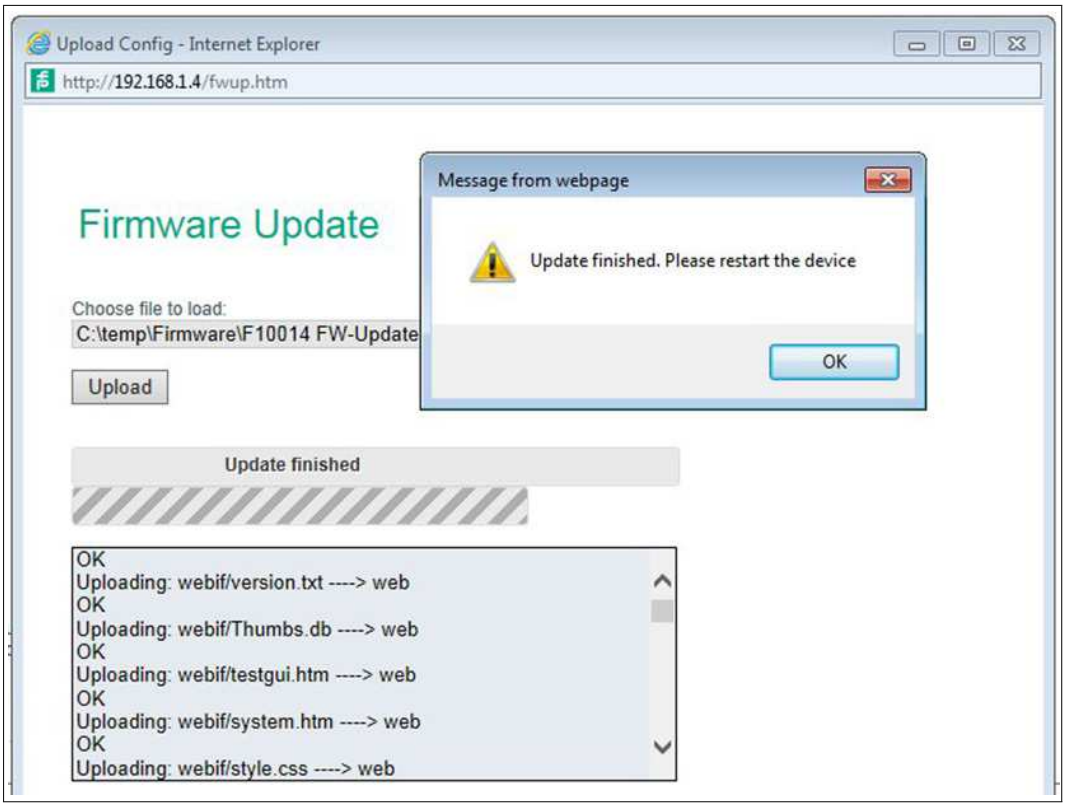


Figure 10.3

5. Restart the module. To do this, switch the power supply of the module off and on again.

   ↳ The module has now loaded the new firmware version.

6. You can check the new firmware version via the web server. Go to the home page of the web server again.

7. Click on the "System" tab in the menu bar of the start window. Here you can check the current firmware version.

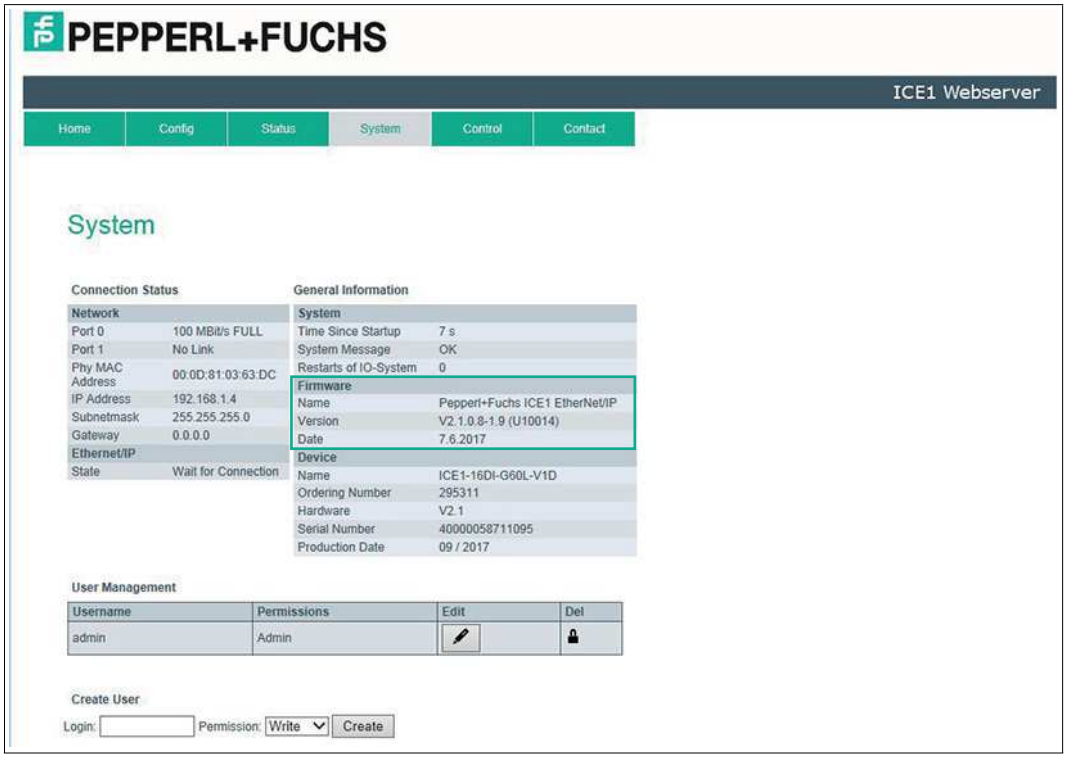

PEPPERL+FUCHS
ICE1 Webserver
Home
Config
Status
System
Control
Contact
System
Connection Status
Network
Port 0 100 MBit/s FULL
Port 1 No Link
Phy MAC Address 00:0D:81:03:63:DC
IP Address 192.168.1.4
Subnetmask 255.255.255.0
Gateway 0.0.0.0
Ethernet/IP
State Wait for Connection
General Information
System
Time Since Startup 7 s
System Message OK
Restarts of IO-System 0
Firmware
Name Pepperl+Fuchs ICE1 EtherNet/IP
Version V2.1.0.8-1.9 (U10014)
Date 7.6.2017
Device
Name ICE1-16DI-G60L-V1D
Ordering Number 295311
Hardware V2.1
Serial Number 40000058711095
Production Date 09 / 2017
User Management
Username
Permissions
Edit
Del
admin
Admin
Create User
Login:
Permission: Write
Create

Figure 10.4

11 Troubleshooting

11.1 General Diagnostic Processing

The modules offer extended diagnostic behavior especially for the output channels, to determine errors in the transfer. The firmware of the modules distinguishes between five different types of errors.

Channel Errors

A channel error is determined 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, none
Active	Off	• Short circuit • Channel display is red • Channel error bit is set in the diagnosis • Channel is locked after error repair
Off	Active	Feeding back a voltage Red and yellow/white channel indicators are switched on Channel error bit is set in the diagnosis Channel is not locked after error repair

Note

If both output channels of an M12 slot are activated when a channel error occurs, the controller locks both channels, even if only one channel is affected by the error. If only one channel is activated, the controller locks only this one. Locked channels are disabled and remain “off” if you do not reset them via the controller.

When activating (rising edge of the channel state) or deactivating (falling edge) an output channel, channel errors are filtered for the duration that you set via the parameter "Surveillance Timeout" in the module configuration. The value of this parameter covers a range of 0 to 255 ms; the factory setting is 80 ms.

The filter is used to prevent premature error messages when you switch on a capacitive load or switch off an inductive load, as well as other voltage peaks during a status change.

If a channel is static while it is permanently on or off, the controller uses a fixed duration of 5 ms for filtering the error messages.

Voltage Error at the M12 Slots

On each M12 input socket of the module, pin 1 delivers a monitored sensor voltage U_S. In the event of a sensor short circuit, a voltage error is reported. Both channel indicators of the M12 input socket light up red and the corresponding error bit "sensor short circuit" is set in the diagnostic bytes.

The error message is filtered by the parameter "Surveillance Timeout.”

Overload of the Current Drivers

The current drivers of the modules with output functionality (variant 16DIO, 8DI8DO) report an error if they identify an overload. This error is reported by setting the corresponding channel error bits in the diagnostic bytes.

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In the event of an overload, the status indicator of the active output channel lights up red. If both output channels of an M12 slot are active during an overload, both status indicators light up red.

The error message is filtered by the parameter "Surveillance Timeout."

Note

If both output channels of an M12 slot are activated when a channel error occurs, the controller locks both channels, even if only one channel is affected by the error. If only one channel is activated, the controller locks only this one. Locked channels are disabled and remain “off” if you do not reset them via the controller.

Reactivating a locked output channel after eliminating an error

1. Set the locked outputs to zero via the controller.
2. Activate the outputs set to zero.

↳ The outputs are activated again.

Actuator Supply Errors

The level of the voltage value is monitored globally and modularly at the connections for the power supply of the actuators. If the U_L actuator supply leaves the voltage value range of 18 V to 30 V, an error is reported.

The U_L indicator lights up red and the actuator low voltage bit is set in the module information byte. If output channels are activated, the voltage error is also indicated by setting the appropriate error bits of the M12 slots.

Note

Each output channel is locked if it is activated while a U_L supply voltage error is present. This means that the controller has to reset the output channel for correct operation when the status of the U_L supply voltage returns to normal. We recommend that all output channels are disabled via the controller as soon as the low voltage is detected. Otherwise, when the voltage value returns to normal, each active output channel will report a diagnosis because it is locked.

Errors in the System/Sensor Supply

The level of the voltage value of the system/sensor supply is also monitored globally. A voltage that is either below or above the voltage range of 18 V to 30 V generates an error message.

The U_S indicator lights up red and the sensor low voltage bit is set in the module information byte.

The error message has no effect on the outputs and is not filtered but instead reported immediately.

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.

11.2 Diagnostics Indicator in the Integrated Web Server

The modules show the channel status, module status, and fault diagnosis on the status page of the embedded web server in plain text.

For information on how to call up the status page, .

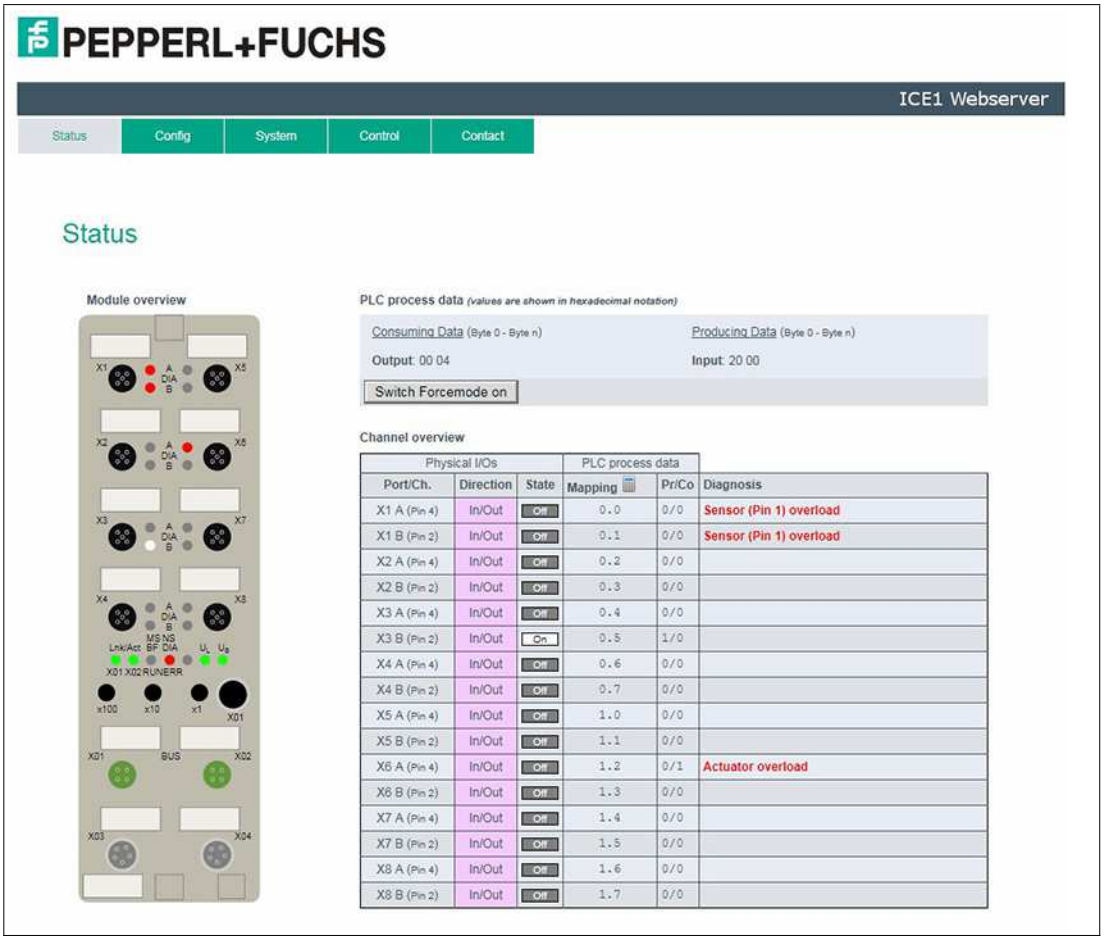

Figure 11.1

Depending on the module, up to 5 bytes of diagnostic data is displayed in the process data area on the status page. The diagnostic bytes are structured as follows in order from left to right:

11.3 Module Diagnostic Information via EtherNet/IP

Note

If the protocol for the module is set as "EtherNet/IP", diagnosis information occurs through process data when the appropriate assembly objects are used (see chapter “Commissioning for EtherNet/IP,” sub-chapter "Bit Assignment of Process Data").

11.4 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.

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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:

Cause	OB call
Peripheral fault (short circuit, overload, wire break, low voltage on an I/O module)	OB B2
Complete system failure	OB B6

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 SFB 54 RALRM (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.

A diagnostics data record can also be called via its data record number using the system function block SFB 52 "RDREC" in OB 1.

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	Reference	ChannelNumber	ChannelErrorType
Low sensor or actuator power supply voltage	Module	0x8000	0x0002
Sensor short circuit	M12 slot	0x0001 to 0x0008 M12 slot number	0x0102
Actuator short circuit	Channel A of an M12 slot	0x0001 to 0x0008 M12 slot number	0x0100
Actuator short circuit	Channel B of an M12 slot	0x0001 to 0x0008 M12 slot number	0x0101

If there is an accumulation of errors, the channel diagnosis section, including the "ChannelNumber," "ChannelProperties," and "ChannelErrorType" data values, is repeated for every error in the diagnostics data record.

To display diagnostics, select the faulty module in the distributed peripherals of the online TIA Portal, accessed via the project navigation. Click on the maintenance icon to open the online diagnosis for slot 1.

Switch to the "Channel Diagnostics dialog to display the pending module diagnostics

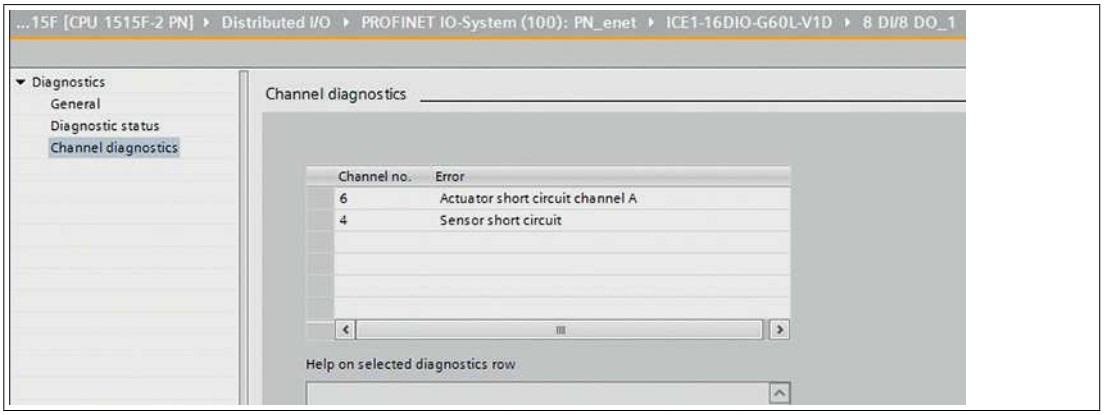

Figure 11.2

11.5 Alarm Signals and Error Messages from Modules via EtherCAT

If a recognized fault is detected during parameterization, the module sends error messages to the master. The coding of the first and second parts of the error messages is based on specifications CiA 301 and CiA 401. The third part of the error message is the known (manufacturer-defined) diagnosis register.

The error message is in an 8 byte format and is coded as follows:

Contents of an Error Message

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Error code		Error register CoE 0x1001	Diagnosis register				

Table 11.1

Contents of the Error Register (CoE Register 0x1001):

Error code Byte 1, byte 2	Error register (CoE 0x1001), byte 3							
	B7	B6	B5	B4	B3	B1	B0	Description of the fault (Bit 7–Bit 0)
0x0000	0	0	0	0	0	0	0	No error
0x2300	0	0	0	0	0	1	1	Output overload, MI-SCS or MI-SCA
0x3100	0	0	0	0	1	0	1	Voltage error, MI-LVS
0x3300	0	0	0	0	1	0	1	Voltage error at outputs, MI-LVA
0xF000	1	0	0	0	0	0	1	Additional "Forcing" function, MI-FC
0xFF00	1	0	0	0	0	0	1	Additional "device diagnosis" function, MI-IME

Content of the Diagnosis Register

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 4	MI-IME	MI-FC	0	0	MI-SCA	MI-SCS	MI-LVA	MI-LVS
Byte 5	SCS-X8	SCS-X7	SCS-X6	SCS-X5	SCS-X4	SCS-X3	SCS-X2	SCS-X1
Byte 6	CE-X4B	CE-X4A	CE-X2B	CE-X2A	CE-X2A	CE-X2A	CE-X1B	CE-X1A
Byte 7	CE-X8B	CE-X8A	CE-X7B	CE-X7A	CE-X6A	CE-X6A	CE-X5B	CE-X5A
Byte 8	0	0	0	0	0	0	0	0

Legend:

- **MI-LVS**: Module information byte—voltage for power/sensor supply low
- **MI-LVA**: Module information byte—voltage for actuator low
- **MI-SCS**: Module information byte—sensor short circuit on an M12 slot
- **MI-SCA**: Module information byte—actuator short circuit
- **MI-FC**: Module information byte—forcing active
- **MI-IME**: Module information byte—internal module error
- **CE-X1A ... CE-X8A**: Channel error, channel A (pin 4) of slots X1 to X8
- **CE-X1B ... CE-X8B**: Channel error, channel B (pin 2) of slots X1 to X8

The following example shows the error message received by a TwinCAT master regarding an actuator voltage power fault:

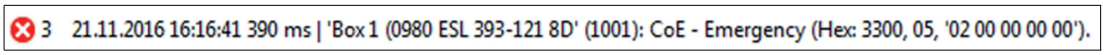

Figure 11.3

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