TURCK

Your Global Automation Partner

GEN...
Ethernet Gateway

Getting Started

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1 About these instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are written for specific qualified personaland must be read carefully by anyone entrusted with the installation, commissioning, operation, maintenance, disassembly or disposal of the device.

When using the device in Ex areas, the user must also have knowledge of explosion protection (IEC/EN 60079-14 etc.).

1.2 Explanation of symbols

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
	**NOTE** NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Other documents

Besides this document, the following material can be found on the Internet at www.turck.com:

- excom manual
- Integration manuals
- Data sheet
- EU Declaration of Conformity (current version)
- Approvals

1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to techdoc@turck.com.

2 Notes on the product

2.1 Product identification

These instructions apply to the following multiprotocol Ethernet gateways for excom:

- GEN-N (gateway firmware ≥ V1.6.0.0)
- GEN-3G (gateway firmware ≥ V1.6.0.0)

2.2 Turck service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database at **www.turck.com** offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

The contact data for Turck branches is provided at [▷ 70].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. Turck accepts no liability for damage caused by failure to observe these safety instructions.

3.1 General safety instructions

- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.

3.2 Intended use

The gateway must only be used in the excom I/O system with the appropriate module racks. The gateway forms the interface between the excom I/O system and the higher-level fieldbus system. The gateway supports the industrial Ethernet protocols PROFINET, EtherNet/IP and Modbus TCP.

A ring master enables gateways to be networked in a ring topology.

Any other use is not in accordance with the intended use. Turck accepts no liability for any resulting damage.

4 Commissioning

Requirements

- All the required modules must be fitted.
- The device must be connected to the power supply.
- The screws of the power supply modules must have been tightened.
- The gateway must be connected to a PC.
- The Turck Service Tool or TAS (Turck Automation Suite) must be installed on the PC.

As an alternative to the Turck Service Tool or TAS, an FDT frame (e.g. PACTware) can be used with an excom DTM or the web server.

The device is operational automatically once the power supply is switched on.

The status LEDs on the modules flash red when an unconfigured excom station is first commissioned. If no modules are inserted during initial commissioning, the status LED on the gateway flashes red.

4.1 Commissioning via the Turck Service Tool

4.1.1 Setting the IP address

The following example shows the setting of the IP address via the Turck Service Tool. The Turck Service Tool can be downloaded free of charge at www.turck.com.

The device is factory set to IP address 192.168.1.254.

NOTE
The PC and the gateway must be located in the same IP network.

- ▶ Connect the device to a PC via the Ethernet interface.
- ▶ Launch the Turck Service Tool.
- ▶ Click **Search** or press [F5].
- ⇨ The Turck Service Tool displays the connected devices.

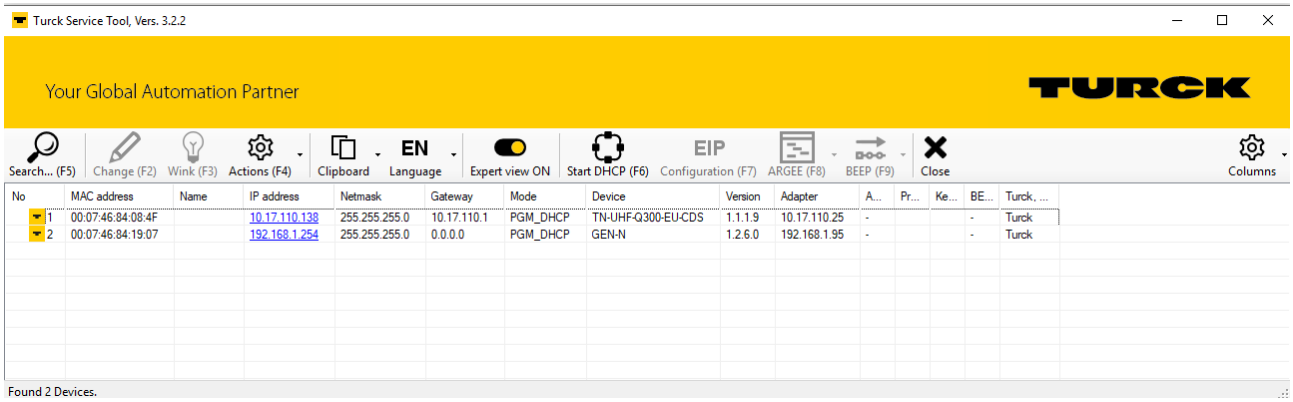

Fig. 1: Turck Service Tool

- Click the gateway (example: **GEN-N**).
- Click **Change** or press [F2].
- Set the IP address and if necessary the network mask and gateway.
- Accept the changes by clicking **Set in device**.

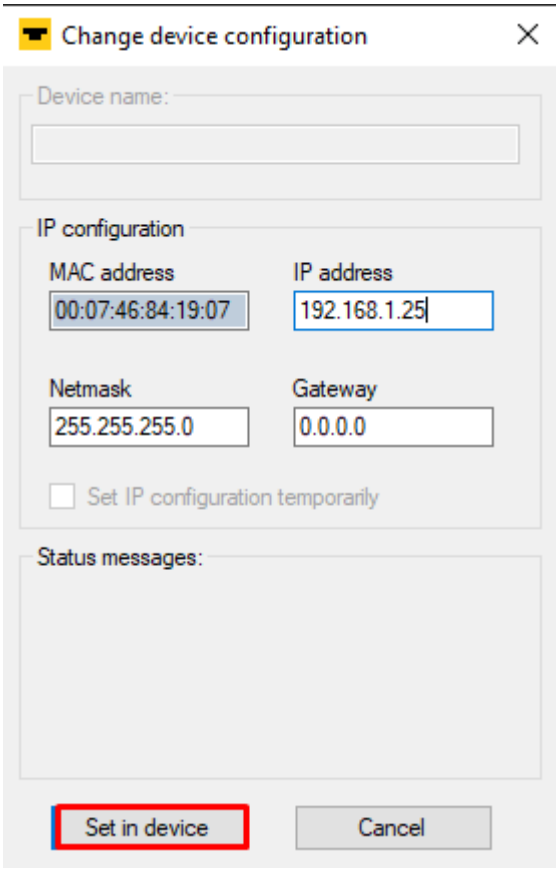

Fig. 2: Setting the IP address

4.1.2 Assigning a PROFINET device name

A PROFINET device name must be assigned in order to identify the excom system.

Observe the following requirements for assigning the PROFINET name:

- Numbers between 0…9
- Lower case letters from a…z
- Dashes "-" and dots "."
- Max. 63 characters in succession without permissible special characters "-" and "."
- Max. 127 characters
- Spaces not allowed
- "Port (0…999)" not allowed
- Starting with a number not allowed
- Number (sequences) similar to IP addresses not allowed (n.n.n.n (n = 0 to 9))
- Dashes "-" and dots "." at the beginning or end not allowed

The Turck Service Tool must be open and located in the same PROFINET network.

▶ Click on **Search** or press [F5].
⇨ The Turck Service Tool displays the connected devices.

▶ Select the device and click [F2] or the Change icon.
▶ Assign a device name.
▶ Click **Set in device**.

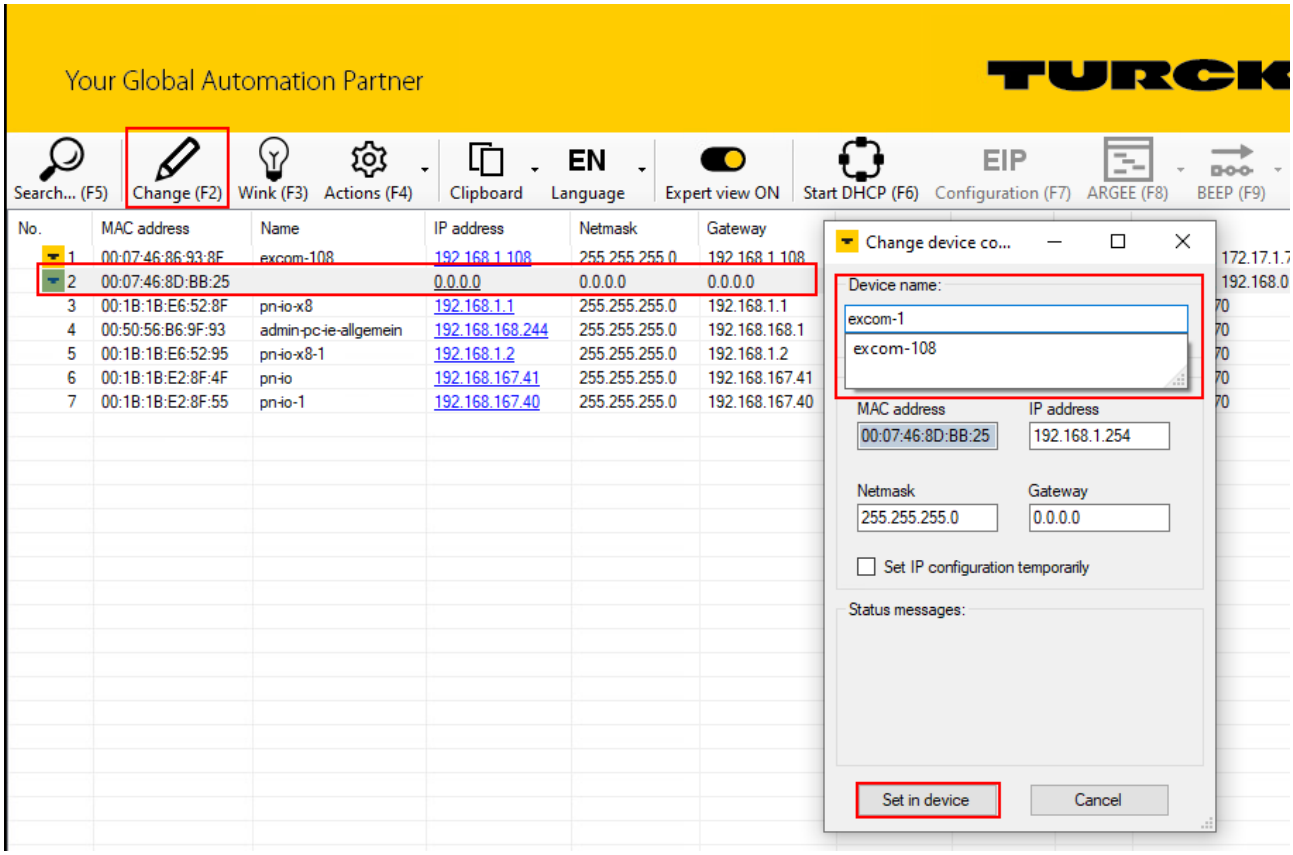

Fig. 3: Assigning a PROFINET device name

4.2 Commissioning via the TAS

4.2.1 Setting the IP address

The following example shows the setting of the IP address via the TAS. The TAS can be downloaded free of charge at www.turck.com.

The device is factory set to IP address 192.168.1.254.

- ▶ Connect the device to a PC via the Ethernet interface.
- ▶ Open the TAS.
- ▶ Under **Network**, click **Scan network**.
- ⇨ The TAS displays the connected devices. If the IP address is highlighted in orange, this is the default IP address.

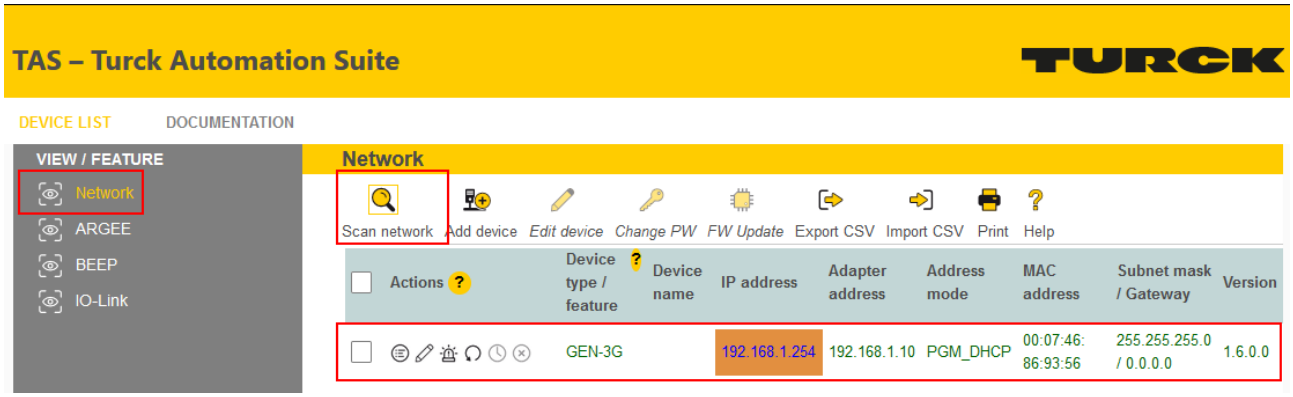

Fig. 4: Scanning the network

- ▶ Check the checkbox next to the gateway.
- ▶ Click the Edit icon in the menu bar.

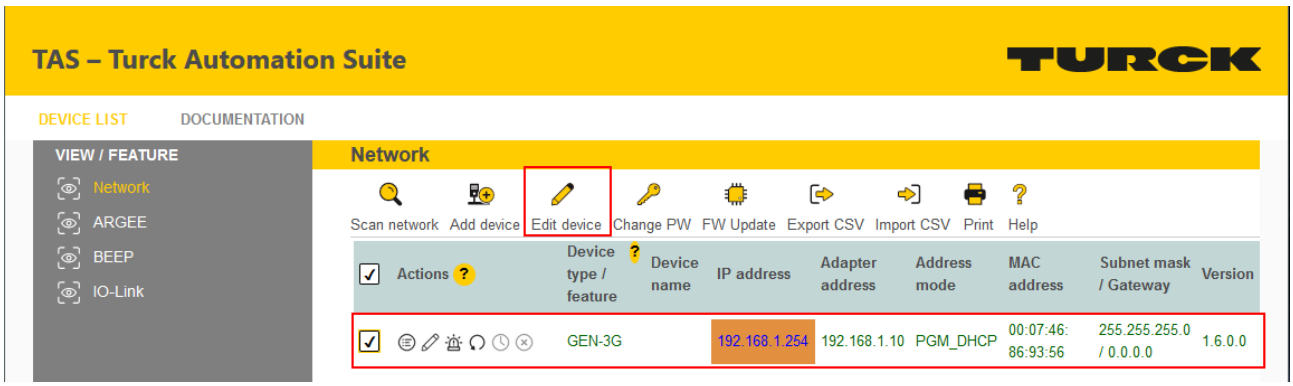

Fig. 5: Click the Edit icon

- Set the IP address, gateway and, if necessary, the network mask.
- Click **SET NETWORK DATA** to apply the changes.

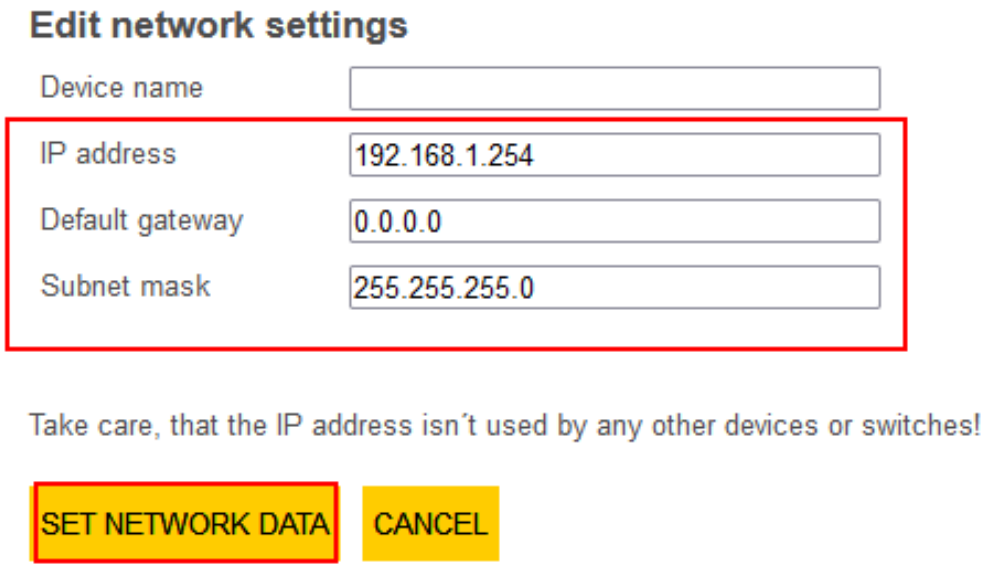

Fig. 6: Setting the IP address

4.2.2 Assigning a PROFINET device name

A PROFINET device name must be assigned in order to identify the excom system.

Observe the following requirements for assigning the PROFINET name:

- Numbers between 0…9
- Lower case letters from a…z
- Dashes "-" and dots "."
- Max. 63 characters in succession without permissible special characters "-" and "."
- Max. 127 characters
- Spaces not allowed
- "Port (0…999)" not allowed
- Starting with a number not allowed
- Number (sequences) similar to IP addresses not allowed (n.n.n.n (n = 0 to 9))
- Dashes "-" and dots "." at the beginning or end not allowed

To assign the PROFINET device name, the TAS must be open.

▶ Under **Network**, click **Scan network**.
⇨ The TAS displays the connected devices.

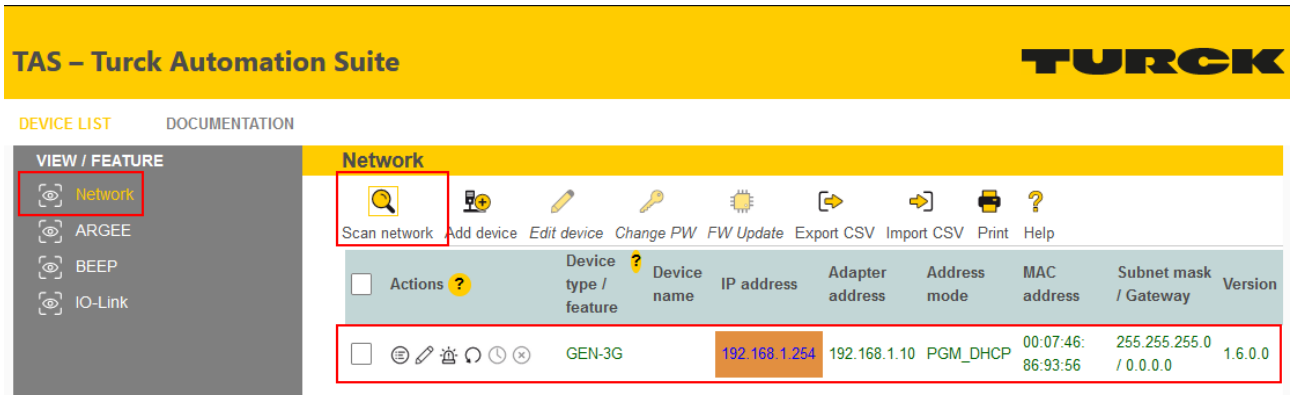

Fig. 7: Scanning the network

▶ Check the checkbox next to the gateway.
▶ Click the Edit icon in the menu bar.

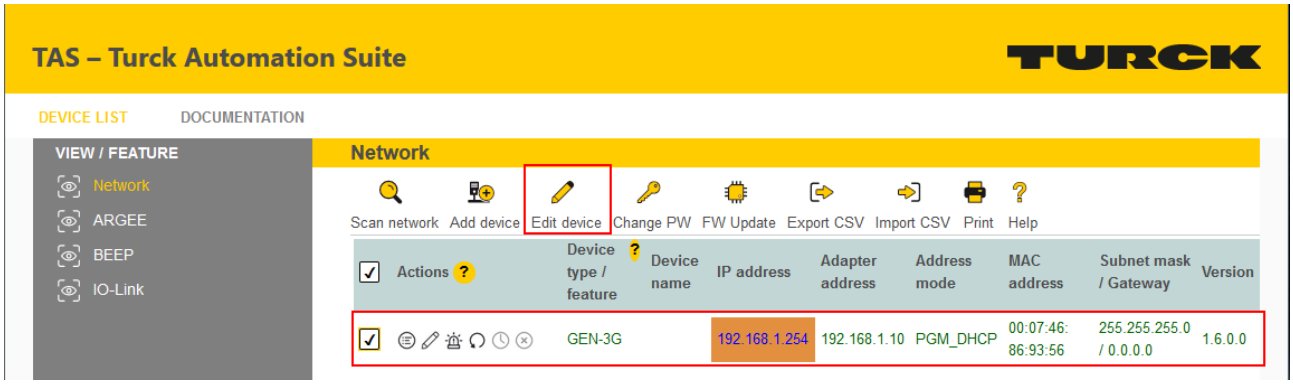

Fig. 8: Click the Edit icon

- Assign a PROFINET device name.
- Click **SET NETWORK DATA** to apply the changes.

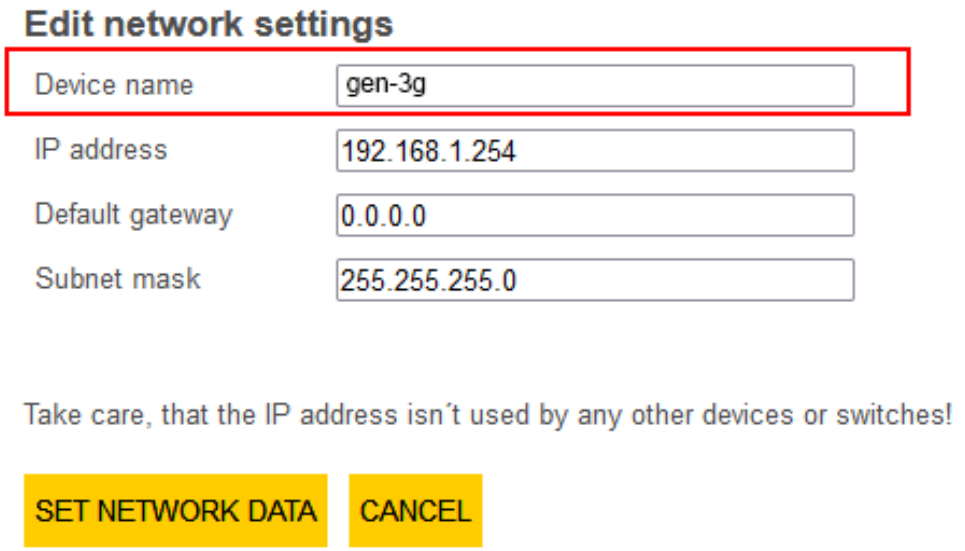

Fig. 9: Set a PROFINET device name

4.3 Commissioning via the web server

NOTE
The web server 2.0 is available from firmware version 1.6.0.0.

The currently used modules can be transferred with their basic configuration via the integrated web server and their parameters changed. In order to be able to open the web server with a PC, the device and the PC must be in the same IP network.

4.3.1 Opening a web server

The device is factory set to IP address 192.168.1.254. To open the web server via a web browser, enter **192.168.1.254** in the address bar of the web browser.

Alternatively, double-click on the IP address in the Turck Service Tool or the TAS.

4.3.2 Setting the login and password

A login is required in order to edit settings via the web server. The default password is “password”.

NOTE
To ensure greater security, Turck recommends changing the password after the first login.

- Enter the password in the Login field on the start page of the web server.
- Click **Login**.

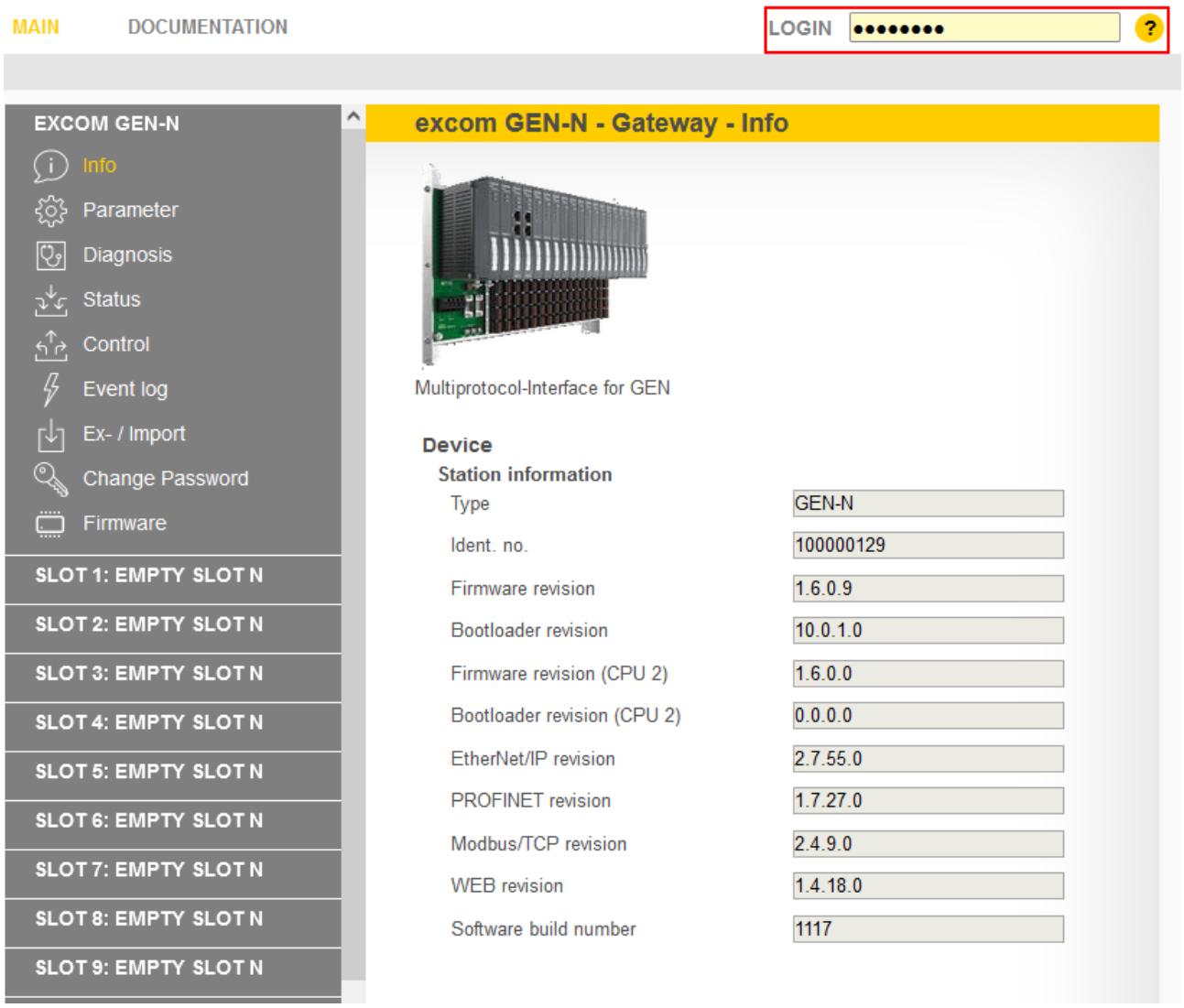

Fig. 10: Login field on the start page of the web server

- In the query window, click **Yes** to change the password.

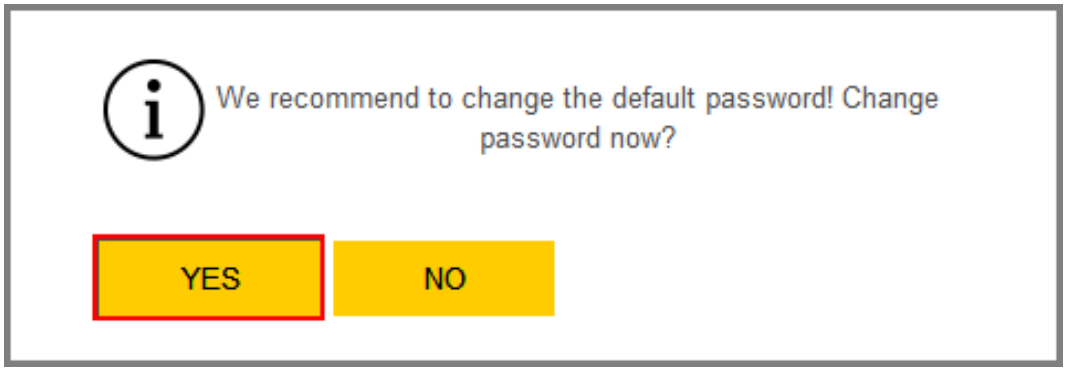

Fig. 11: Query window – Changing the password

Observe the following requirements for assigning the password:

- At least one upper case letter
- At least one lower case letter
- At least one number
- Between 6…15 characters

- Assign the new password.
- Confirm the password change by clicking **CHANGE PASSWORD**.
- Changing the password at a later date: Select **EXCOM GEN…** → **Change Password**.

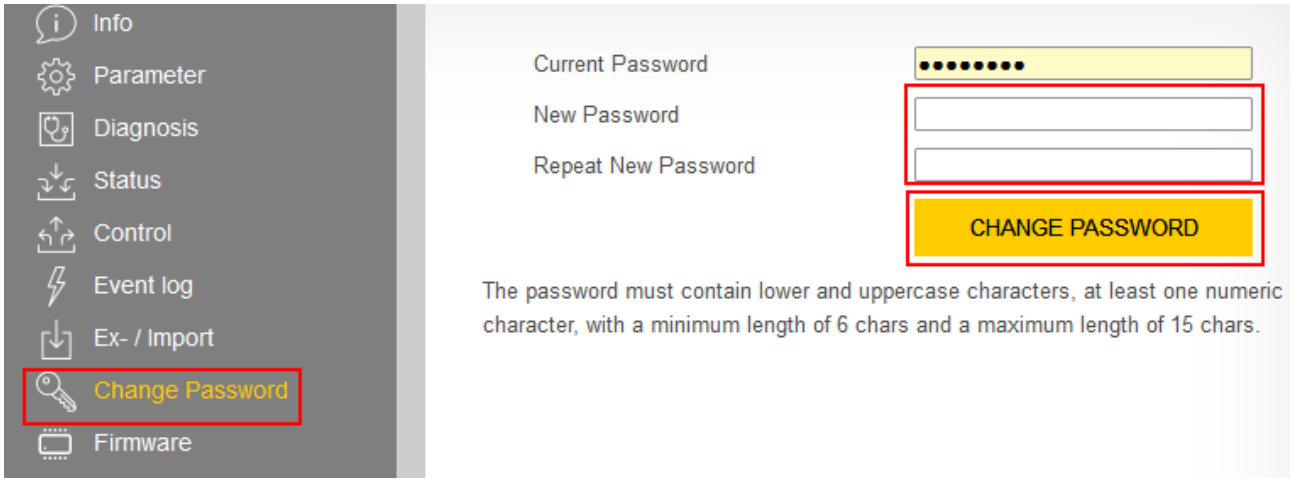

Fig. 12: Assigning the password

4.3.3 Setting the IP address

The device is factory set to IP address 192.168.1.254.

- ▶ Log into the web server.
- ▶ Select **EXCOM GEN-… → Parameters**.
- ▶ Under **Network → IP address**, adjust the IP address.
- ▶ Click **SET NETWORK CONFIGURATION**.
- ⇨ The new IP address is accepted. The web page is reloaded.

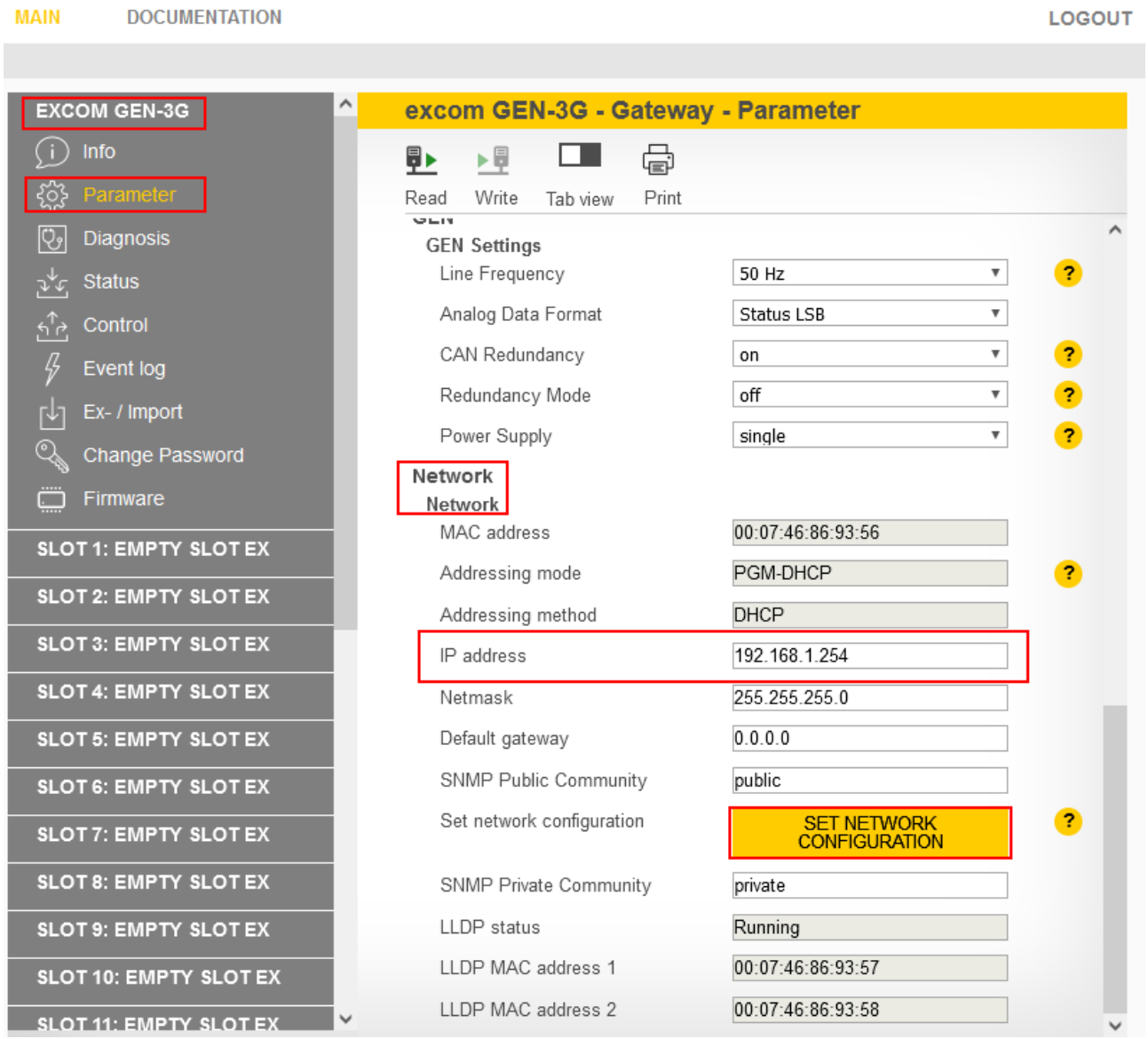

Fig. 13: Changing the IP address

4.3.4 Assigning a PROFINET device name

A PROFINET device name must be assigned in order to identify the excom system.

Observe the following requirements for assigning the PROFINET name:

- Numbers between 0…9
- Lower case letters from a…z
- Dashes "-" and dots "."
- Max. 63 characters in succession without permissible special characters "-" and "."
- Max. 127 characters
- Spaces not allowed
- "Port (0…999)" not allowed
- Starting with a number not allowed
- Number (sequences) similar to IP addresses not allowed (n.n.n.n (n = 0 to 9))
- Dashes "-" and dots "." at the beginning or end not allowed

You must have logged in as an administrator.

- ▶ Select **EXCOM GEN-…** → **Parameters**.
- ▶ Under **PROFINET configuration** → **Device name**, adapt the PROFINET device name.
- ▶ Write changes to the device via the Write icon.

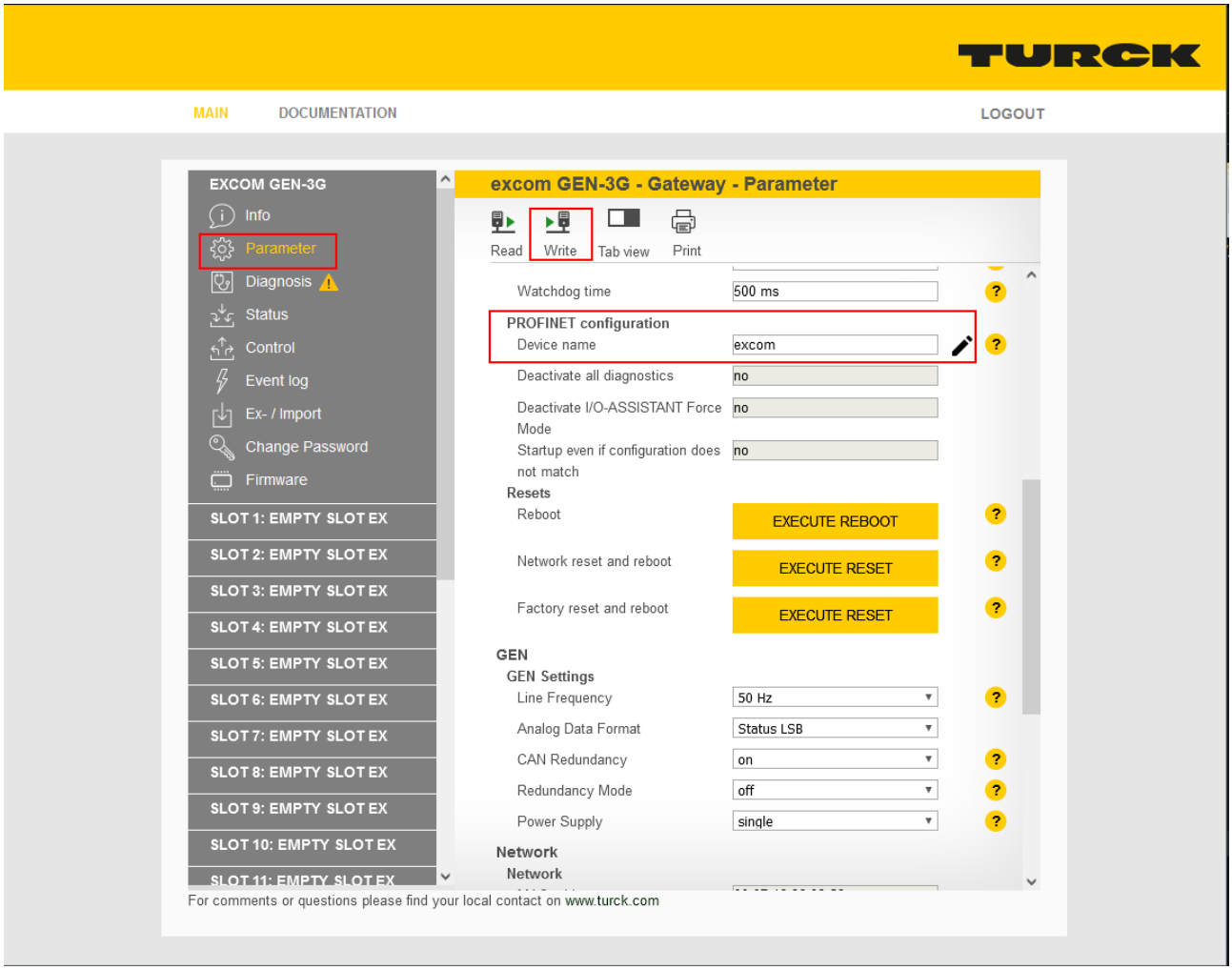

Fig. 14: Assigning a device name

⇨ The PROFINET device name is adopted.

4.3.5 Preparing the GEN… gateway for integration over Ethernet/IP

The gateway and the desired I/O modules are inserted into the module rack. The module rack is supplied with power.

- ▶ Open the web server.
- ▶ Log into the web server.
- ▶ Expand the Gateway in the left-hand sidebar.
- ▶ Under **Parameters**, click **UPDATE MODULE LIST**.

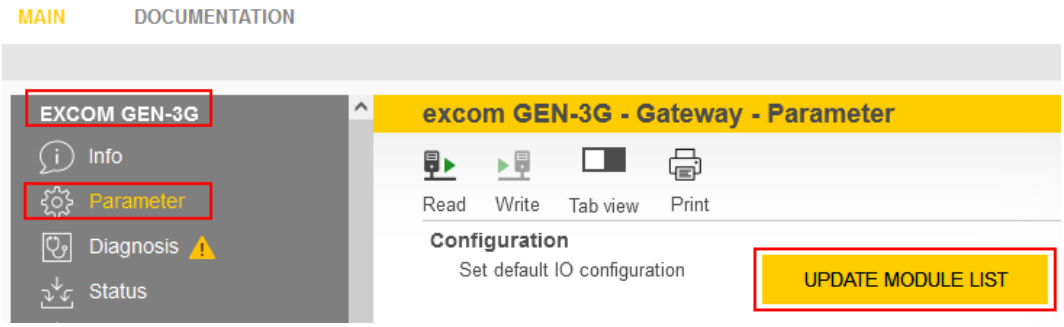

Fig. 15: Click UPDATE MODULE LIST

- ▶ Click **YES** to confirm the window querying whether you wish to load the default configuration.

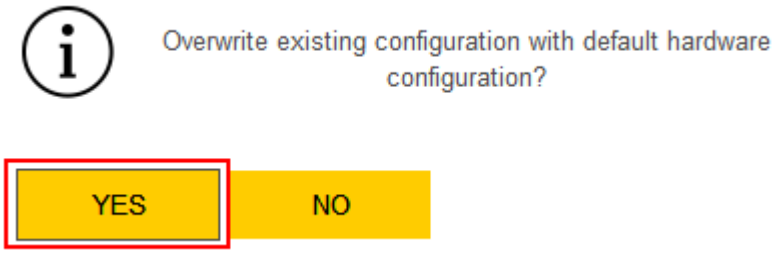

Fig. 16: Confirm the query window

- ⇨ The default configurations are loaded for all inserted I/O modules.

The inserted I/O modules can then be configured in the web server. To find all information about the EtherNet/IP mapping of all signals and diagnostics, proceed as follows:

- ▶ Click **DOCUMENTATION** in the main bar.
- ▶ Click **EtherNet/IP Memory Map** in the left-hand sidebar.
- ⇨ All information for the signals and diagnostics for processing in the control system is displayed.

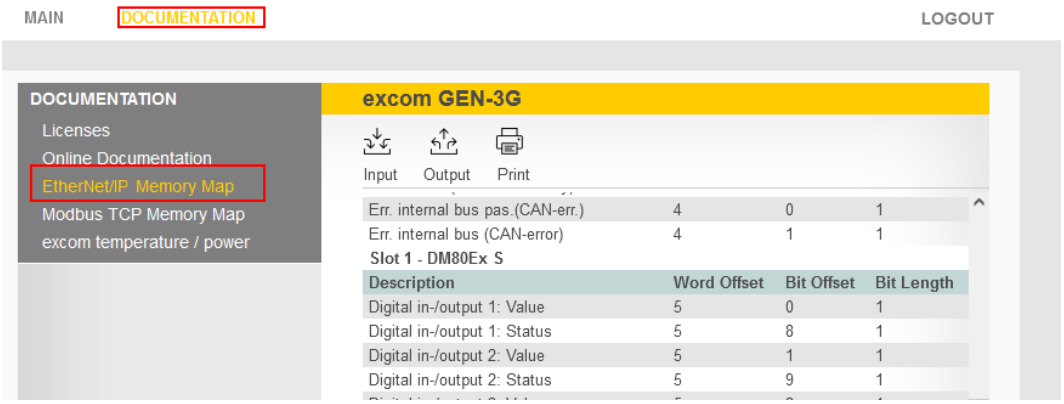

Fig. 17: Access information about Ethernet/IP

4.3.6 Preparing the GEN… gateway for integration over Modbus TCP

The gateway and the desired I/O modules are inserted into the module rack. The module rack is supplied with power.

- ▶ Open the web server.
- ▶ Log into the web server.
- ▶ Expand the Gateway in the left-hand sidebar.
- ▶ Under **Parameters**, click **UPDATE MODULE LIST**.

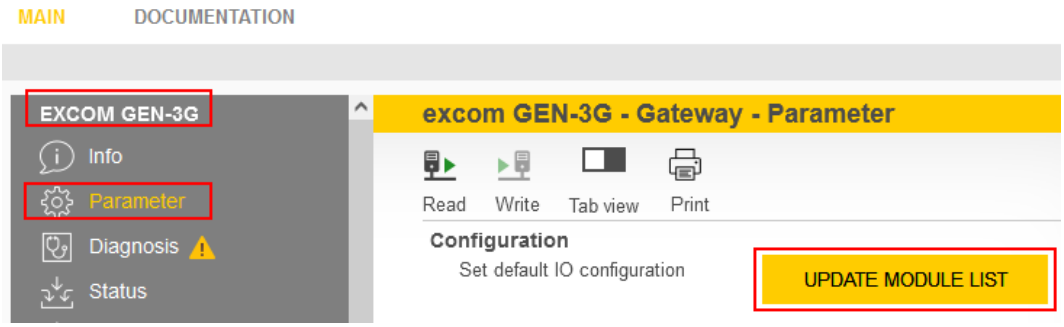

Fig. 18: Click UPDATE MODULE LIST

- ▶ Click **YES** to confirm the window querying whether you wish to load the default configuration.

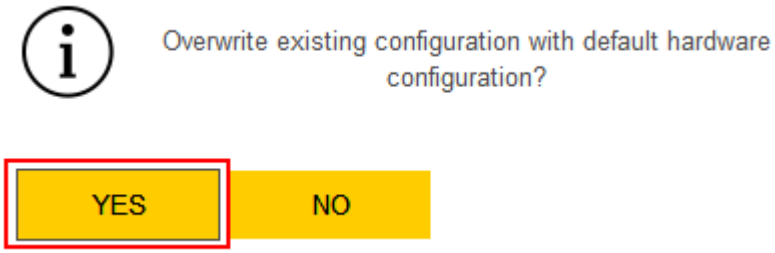

Fig. 19: Confirm the query window

- ⇨ The default configurations are loaded for all inserted I/O modules.

The inserted I/O modules can then be configured in the web server. To find all information about the Modbus TCP mapping of all signals and diagnostics, proceed as follows:

- ▶ Click **DOCUMENTATION** in the main bar.
- ▶ Click **Modbus TCP Memory Map** in the left-hand sidebar.
- ⇨ All information for the signals and diagnostics for processing in the control system is displayed.

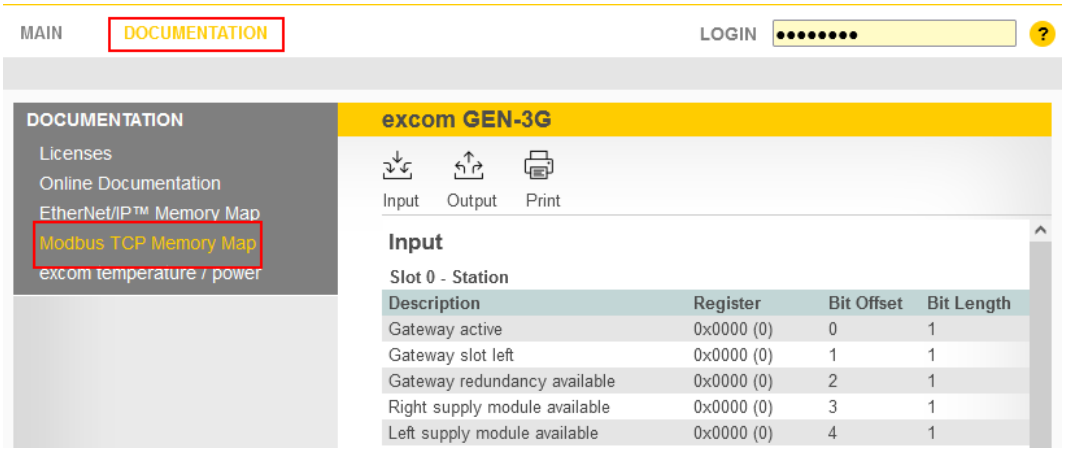

Fig. 20: Access information about Modbus TCP

5 Connecting excom to a Modbus master

The following example shows the integration of excom with CODESYS. The configuration and parameterization are carried out separately via the DTM or the web server.

Naming convention

Turck uses the terms "Modbus client" and "Modbus server" according to Modbus Organization. The following description uses the terms "Modbus TCP Master" and "Modbus TCP Slave" only because of the naming in CODESYS.

Hardware used

This example uses the following hardware components:

- Gateway GEN-N
- Ethernet cable with RJ45 connector
- PC

Software used

This example uses the following software:

- CODESYS version 3.5.12 (download free of charge from **www.turck.com**)

Requirements

- The programming software has been opened.
- A new project has been created.
- Codesys PLC has been started via CODESYS Control Win SysTray.

5.1 Modbus register access

The Modbus data model has four basic data types:

Data type	Object type	Access	Description
Discrete inputs	Bit	Read only	Data is provided by the I/O system.
Coils	Bit	Read/write	Data is changed and written by the application program. Data can also be read back.
Input register	16-bit (word)	Read only	Data is provided by the I/O system.
Holding registers	16-bit (word)	Read/write	Data is changed and written by an application program. Data can also be read back.

All data transferred via Modbus (bits and registers) must be stored in the application memory of the device. This data is accessed via defined Modbus Registersaccess addresses.

The excom gateway supports the following functions for accessing process data, parameters, diagnostics and other services:

Function code	Function	Description
1	Read coils	Read multiple output bits
2	Read discrete inputs	Read multiple input bits
3	Read holding registers	Read multiple output registers
4	Read input registers	Read multiple input registers
5	Write single coil	Write single output bits
6	Write single registers	Write single output registers
15	Write multiple coils	Write multiple output bits
16	Write multiple registers	Write multiple output registers
23	Read/write multiple registers	Read and write multiple registers

Multiple Modbus TCP connections are possible at the same time. Only the Exclusive owner connection can write and read data. The Exclusive owner connection is defined by the active fieldbus protocol after the power supply is switched on or via an appropriate entry in register 0x1140. Each I/O connection has complete read and write access to the configuration settings. Only the Exclusive owner connection has access to the I/O register.

After the Exclusive owner connection has timed out, the I/O data is set to the defined substitute value. Only read access is provided if Modbus is not the active fieldbus protocol. The following table explains the meaning of the registers:

Address	Access	Meaning
0x0000…0x01FF	Read only	Process data of the inputs (slots 0…24 are linked to form a data block)
0x0400…0x07FF	Read only	Diagnostics (gateway firmware ≥ V1.6.0.0)
0x0800…0x09FF	Read/write	Process data of the outputs (slots 0…24 are linked to form a data block)
0x1000…0x1006	Read only	Module ID
0x100C	Read only	Module status
0x1017	Read only	Register mapping revision (must always be 3 otherwise the register mapping is not compatible with this description)
0x1020	Read only	Watchdog, current time in ms
0x1120	Read/write	Watchdog, preset time in ms (default: 500 ms)
0x1130	Read/write	Modbus connection mode register
0x1131	Read/write	Modbus connection timeout in s (default: 300 s)
0x113C…0x113D	Read/write	Modbus parameter restore (reset the parameters to the default settings)
0x113E…0x113F	Read/write	Modbus parameter save (save non-volatile parameters)
0x1140	Read/write	Deactivate protocol Explicitly deactivates the selected Ethernet protocol: ■ Bit 0: Deactivate EtherNet/IP ■ Bit 1: Deactivate Modbus TCP ■ Bit 2: Deactivate PROFINET ■ Bit 15: Deactivate the web server
0x1141	Read only	Active protocol ■ Bit 0: EtherNet/IP active ■ Bit 1: Modbus TCP active ■ Bit 2: PROFINET active ■ Bit 15: Web server active
0x8000…0x8320	Read only	Process data of the inputs (max. 25 modules per station, 32 registers per module)
0x9000…0x9320	Read/write	Process data of the outputs (max. 25 modules per station, 32 registers per module)
0xA000…0xA320	Read only	Diagnostics
0xB000…0xB320	Read/write	Parameter

The gateway status word is in register 0x100C:

Gateway status word															
Byte 1								Byte 0							
res	FM	Par	MB Wdg	I/O cfg	I/O com	res	res	res	res	res	res	I/O cfg w	FS	res	I/O diag

Meaning of the gateway status bits

Designation	Meaning
res	Reserved
FM	Force mode in the DTM active
Par	I/O parameter error
MB Wdg	Modbus watchdog error
I/O cfg	Configuration error (missing or incorrectly fitted modules)
I/O cfg w	Warning: I/O configuration was changed
I/O com	No communication with the I/O module bus
FS	Warning – Fail-safe mode active
I/O diag	I/O diagnostics active

5.1.1 Example: Modbus registers

Proceed as follows to call up the assignment of the Modbus registers:

- ▶ Open the web server.
- ▶ Under **Documentation**, click **Modbus TCP Memory Map**.

Input registers: Slot 0 – Station

Description in the web server	Register	Bit offset	Bit length
Gateway active	0x0000 (0)	0	1
Gateway slot left	0x0000 (0)	1	1
Gateway redundancy available	0x0000 (0)	2	1
Right supply module available	0x0000 (0)	3	1
Left supply module available	0x0000 (0)	4	1

Input registers: Slot 1 – DM80-N S

Description in the web server	Register	Bit offset	Bit length
Digital in-/output 1: Value	0x0001 (1)	0	1
Digital in-/output 1: Status	0x0001 (1)	8	1
Digital in-/output 2: Value	0x0001 (1)	1	1
Digital in-/output 2: Status	0x0001 (1)	9	1
Digital in-/output 3: Value	0x0001 (1)	2	1
Digital in-/output 3: Status	0x0001 (1)	10	1
Digital in-/output 4: Value	0x0001 (1)	3	1
Digital in-/output 4: Status	0x0001 (1)	11	1
Digital in-/output 5: Value	0x0001 (1)	4	1
Digital in-/output 5: Status	0x0001 (1)	12	1
Digital in-/output 6: Value	0x0001 (1)	5	1
Digital in-/output 6: Status	0x0001 (1)	13	1
Digital in-/output 7: Value	0x0001 (1)	6	1
Digital in-/output 7: Status	0x0001 (1)	14	1
Digital in-/output 8: Value	0x0001 (1)	7	1
Digital in-/output 8: Status	0x0001 (1)	15	1

Input registers: Slot 3 – AIH40-N

Description in the web server	Register	Bit offset	Bit length
Analog input 1: Value	0x0002 (2)	0	15
Analog input 1: Status	0x0002 (2)	15	1
Analog input 2: Value	0x0003 (3)	0	15
Analog input 2: Status	0x0003 (3)	15	1
Analog input 3: Value	0x0004 (4)	0	15
Analog input 3: Status	0x0004 (4)	15	1
Analog input 4: Value	0x0005 (5)	0	15
Analog input 4: Status	0x0005 (5)	15	1

Input registers: Gateway status word

Description in the web server	Register	Bit offset	Bit length
Module Diagnostics Available	0x0006 (6)	0	1
Modulebus Failsafe Mode Enabled	0x0006 (6)	2	1
Station Configuration Changed	0x0006 (6)	3	1
Overcurrent Isys	0x0006 (6)	5	1
Overvoltage Field Supply UI	0x0006 (6)	6	1
Undervoltage Field Supply UI	0x0006 (6)	7	1
Overvoltage Field Supply Usys	0x0006 (6)	8	1
Undervoltage Field Supply Usys	0x0006 (6)	9	1
Modulebus Communication Lost	0x0006 (6)	10	1
Modulebus Configuration Error	0x0006 (6)	11	1
Modulebus Status Error	0x0006 (6)	12	1
Modulebus Parameter Error	0x0006 (6)	13	1
Force Mode Enabled	0x0006 (6)	14	1

Output registers: Slot 0 – Station

Description in the web server	Register	Bit offset	Bit length
Red switching	0x0800 (2048)	0	2

Output registers: Slot 1 – DM80-N S

Description in the web server	Register	Bit offset	Bit length
Digital in-/output 1: Value	0x0801 (2049)	0	1
Digital in-/output 2: Value	0x0801 (2049)	1	1
Digital in-/output 3: Value	0x0801 (2049)	2	1
Digital in-/output 4: Value	0x0801 (2049)	3	1
Digital in-/output 5: Value	0x0801 (2049)	4	1
Digital in-/output 6: Value	0x0801 (2049)	5	1
Digital in-/output 7: Value	0x0801 (2049)	6	1
Digital in-/output 8: Value	0x0801 (2049)	7	1

Output registers: Slot 2 – DO40-N

Description in the web server	Register	Bit offset	Bit length
Digital output 1: Value	0x0802 (2050)	0	1
Digital output 2: Value	0x0802 (2050)	1	1
Digital output 3: Value	0x0802 (2050)	2	1
Digital output 4: Value	0x0802 (2050)	3	1

Output registers: Slot 4 – AOH40-N

Description in the web server	Register	Bit offset	Bit length
Analog output 1: Value	0x0803 (2051)	0	15
Analog output 2: Value	0x0804 (2052)	0	15
Analog output 3: Value	0x0805 (2053)	0	15
Analog output 4: Value	0x0806 (2054)	0	15

5.2 Connecting the device with the controller

Prerequisites

- The programming software has been started.
- A new project has been created.
- The PLC has been added to the project.

Scanning the PLC

1. Double-click **Device**.
2. Click **Scan network…**.
3. Select the interface and confirm with **OK**.

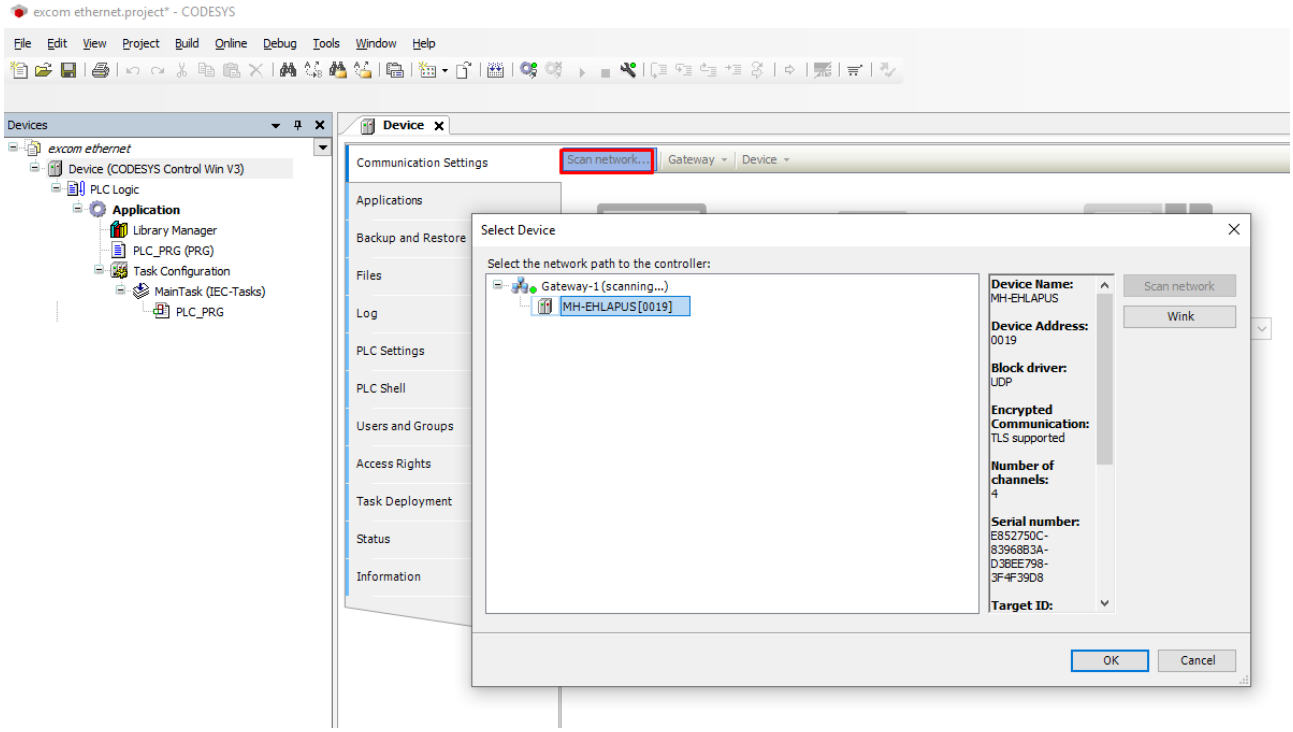

Fig. 21: Scanning the network

Adding an Ethernet adapter

- ▶ Right-click **Device** in the project tree.
- ▶ Select **Add device**.
- ▶ Select the Ethernet port.
- ▶ Click **Add device**.
- ⇨ The Ethernet port appears as **Ethernet** in the project tree.

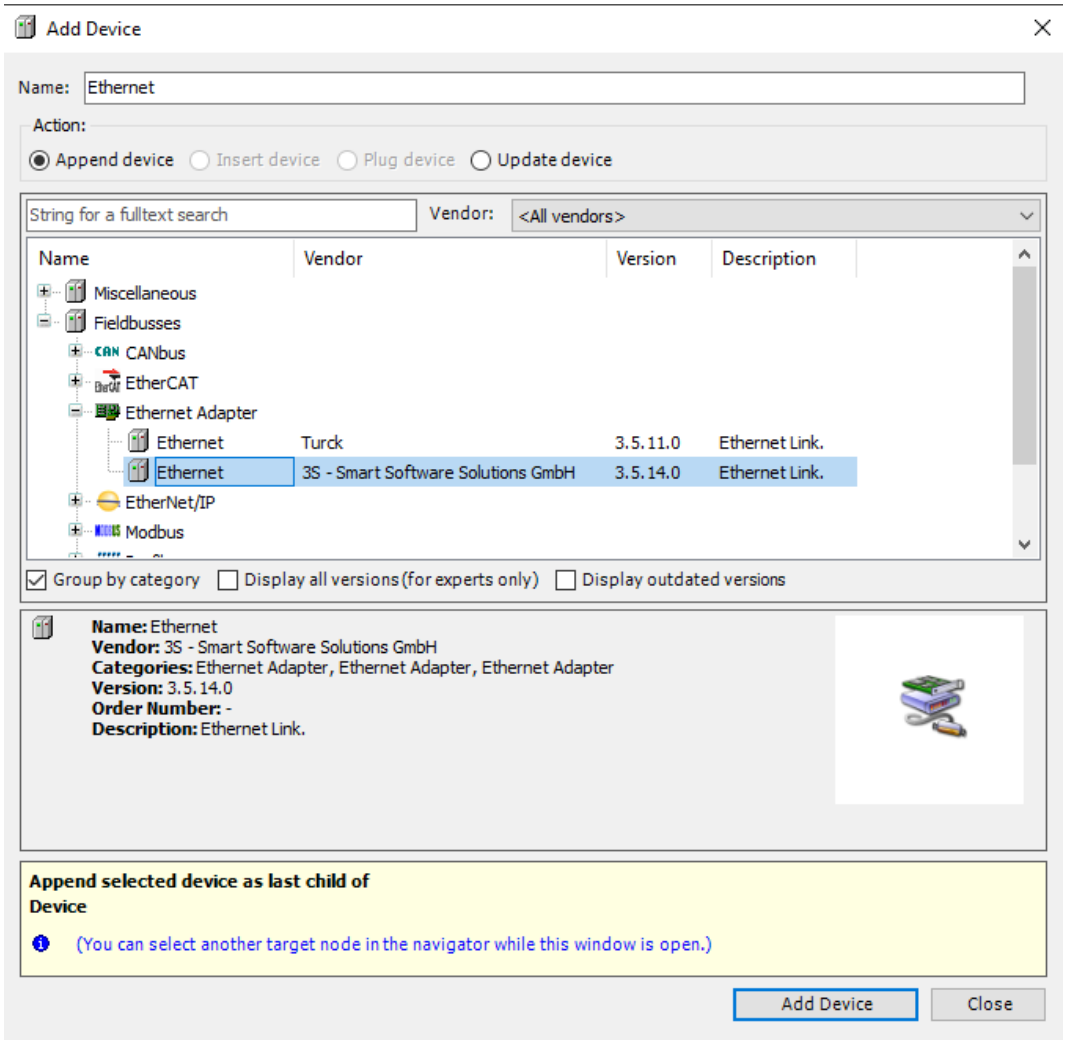

Fig. 22: Adding an Ethernet adapter

Setting the IP address

- Double-click Ethernet adapter (here: double-click **Ethernet (Ethernet)**.
- Set the IP address: (in this case: 192.168.1.1).

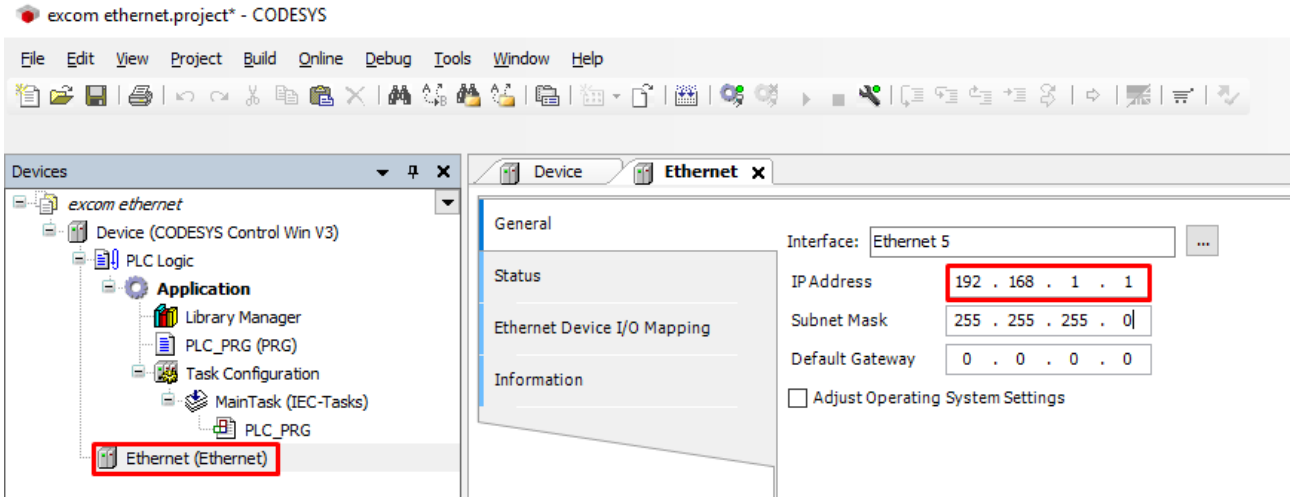

Fig. 23: Setting the IP address

Adding a Modbus master

- ▶ Right-click **Ethernet** in the project tree.
- ▶ Select **Append device**.
- ▶ Double-click the **Modbus TCP Master**.
- ⇨ The Modbus TCP master appears as **Modbus_TCP_Master** in the project tree.

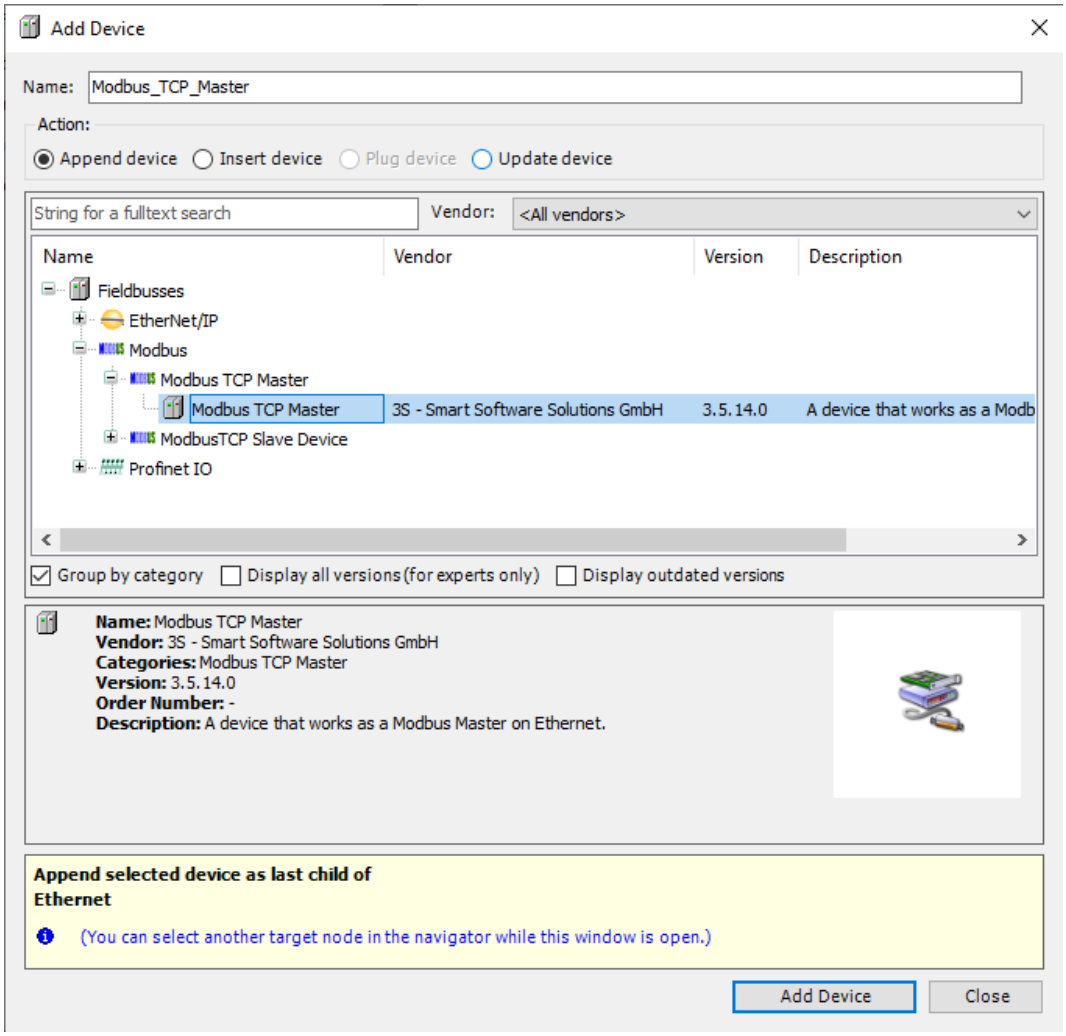

Fig. 24: Adding a Modbus master

Adding a Modbus slave

- ▶ Right-click **Modbus TCP Master** in the project tree.
- ▶ Select **Append device**.
- ▶ Double-click **Modbus TCP slave**.
- ⇨ The Modbus slave appears as **Modbus_TCP_Slave** in the project tree.

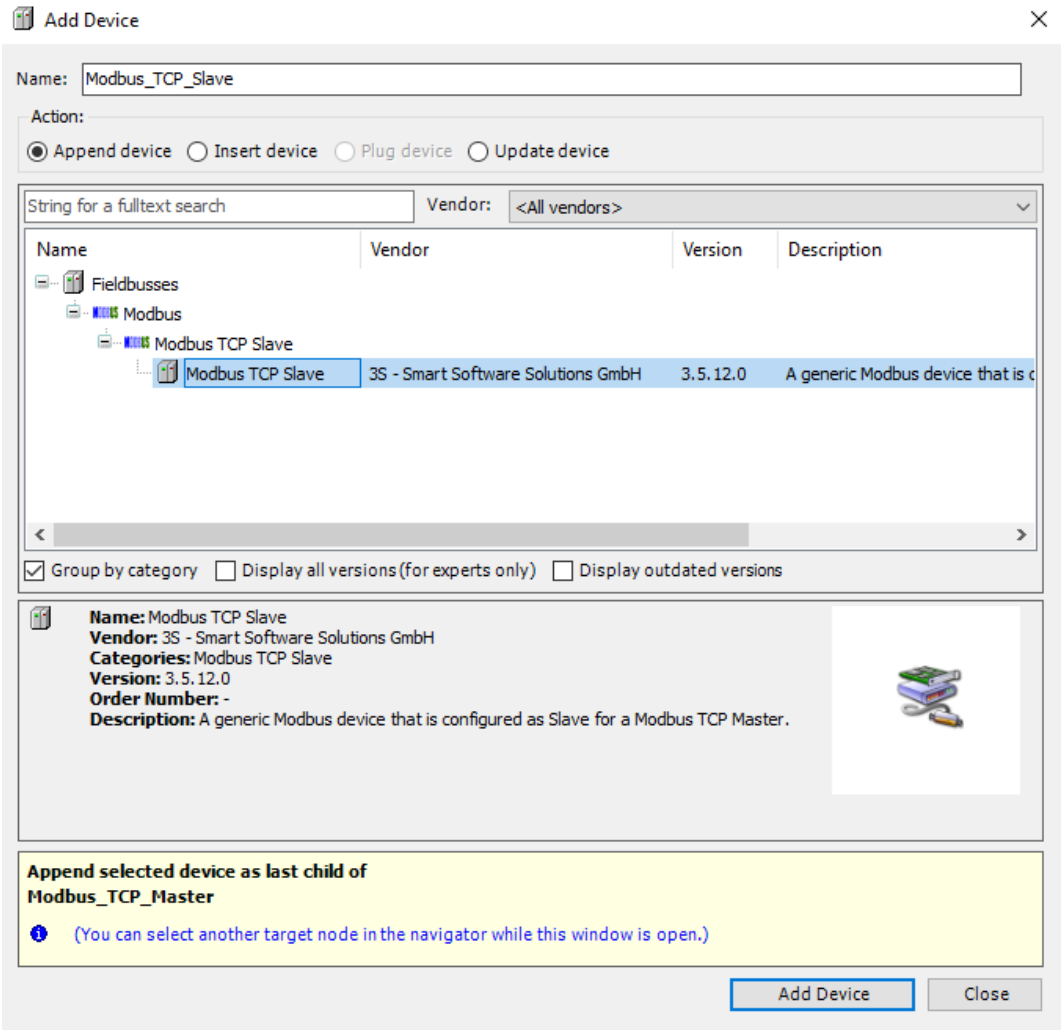

Fig. 25: Adding a Modbus slave

Renaming a Modbus slave

- Click Modbus slave in the project tree.
- Press [F2].
- Adjust the name of the slave in the project tree of the application.

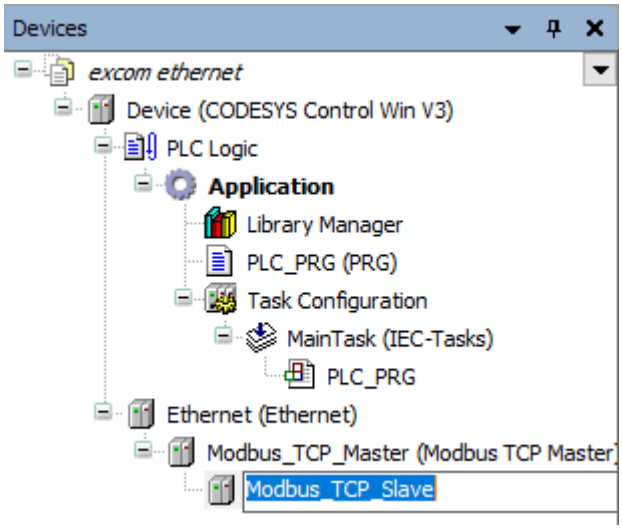

Fig. 26: Renaming a Modbus slave

5.3 Setting up a Modbus slave

Setting the IP address

- Double-click the Modbus slave.
- Set the IP address.

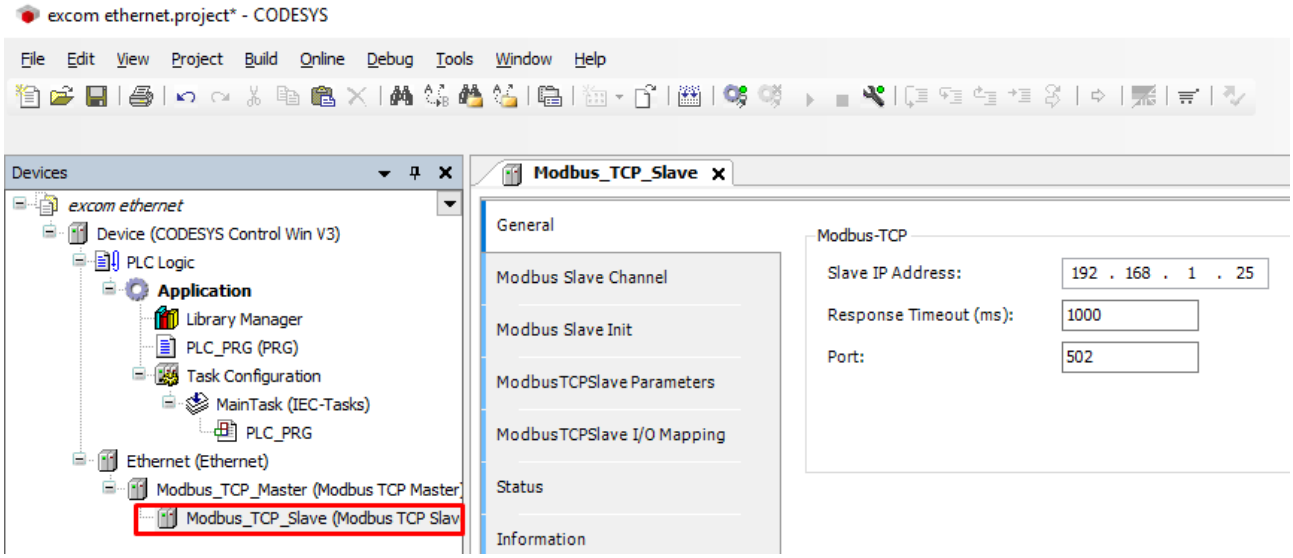

Fig. 27: Setting the Modbus slave IP address

The Modbus register mapping can be viewed via the web server. The mapping of the input and output data must be known. [▶ 25].

The communication between Modbus TCP master and Modbus slaves is performed using defined function calls (Modbus communication channels). These channels are set up with the relevant Modbus slaves in the **Modbus Slave Channel** tab via the **Add channel** button.

The Modbus communication channels are defined by:

Access type	Modbus function code that defines the type and method of function calls (bitwise, word-wise, read or write)
READ registers and WRITE registers Offset	Start address of the registers of the Modbus slave registers to be read or written. Refer to the Modbus mapping of the excom system for the relevant information (see web server or manual).

The signal in the following figure creates the entire input register (**Read input registers**) of a DM80 module via **READ register** with offset 0x0005.

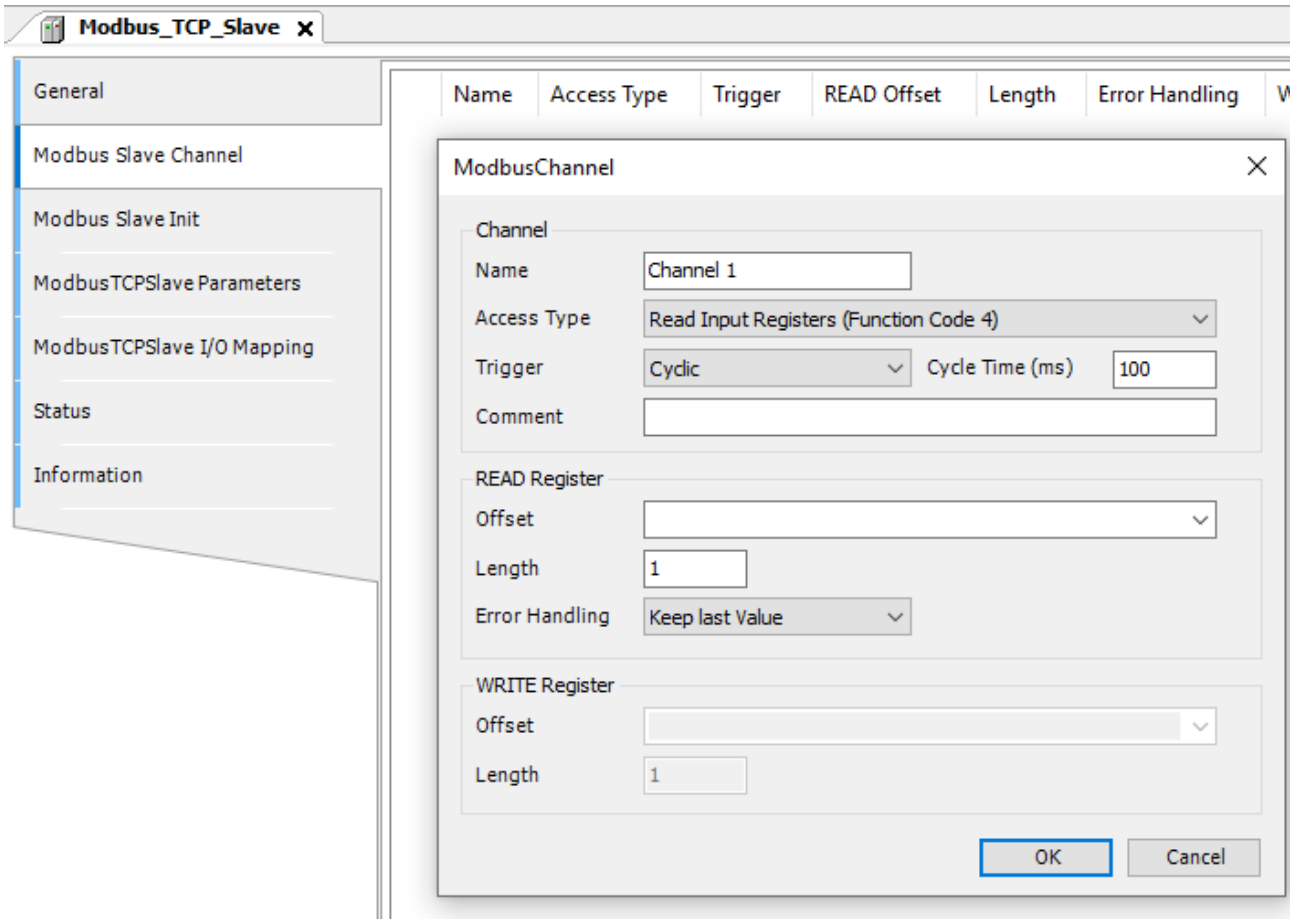

Fig. 28: Reading input data via **READ register**

The I/O mapping is created under **ModbusTCPSlave I/O image**. The status of process values is only displayed in the I/O mapping if a program accesses the process values or if the function **Enabled 2 (always in bus cycle task)** is activated in the **ModbusTCPSlave I/O image**.

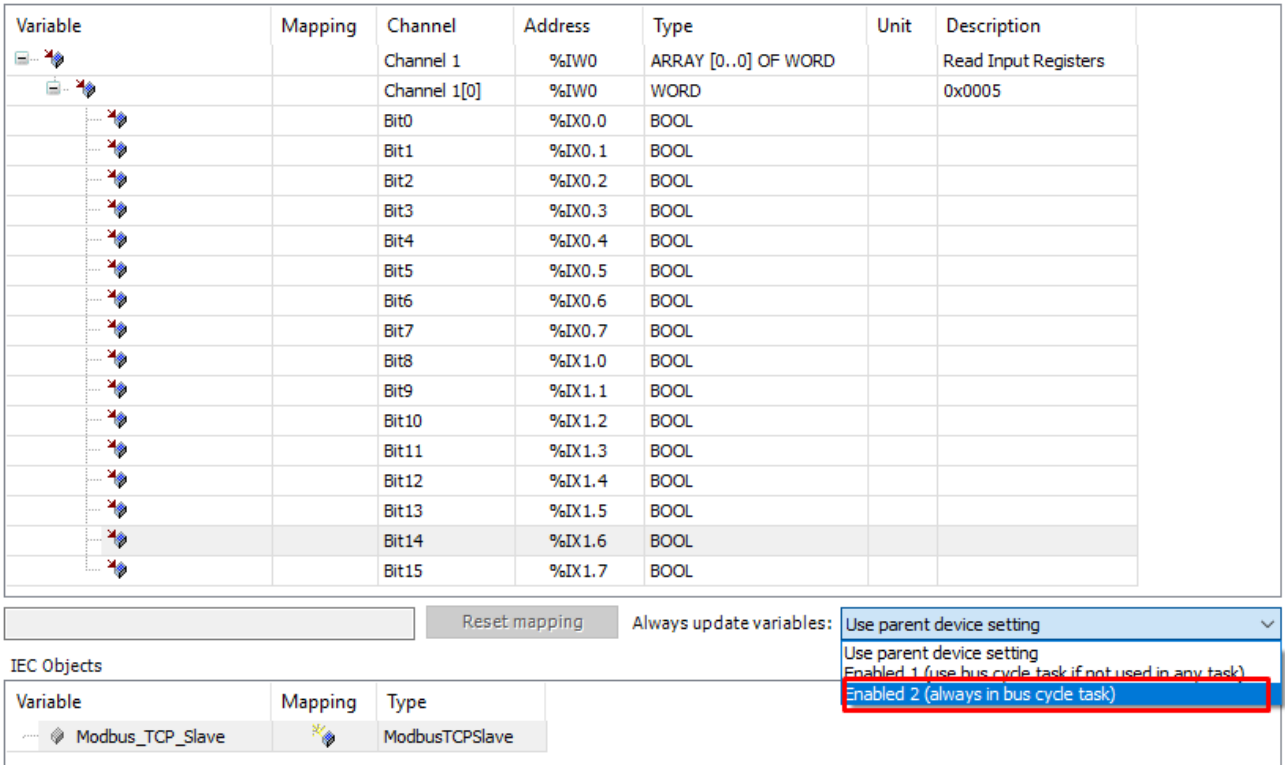

Fig. 29: Updating variables

Loading and starting CODESYS projects

NOTE
The WIN V3-PLC must be started.

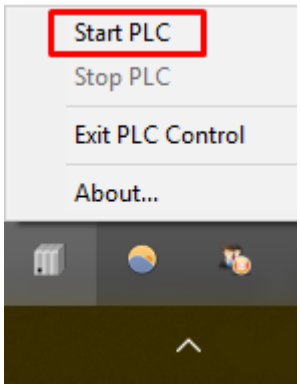

Fig. 30: Starting the WIN V3-PLC

- ▶ Compile the project via **Create** → **Compile** or press [F11].

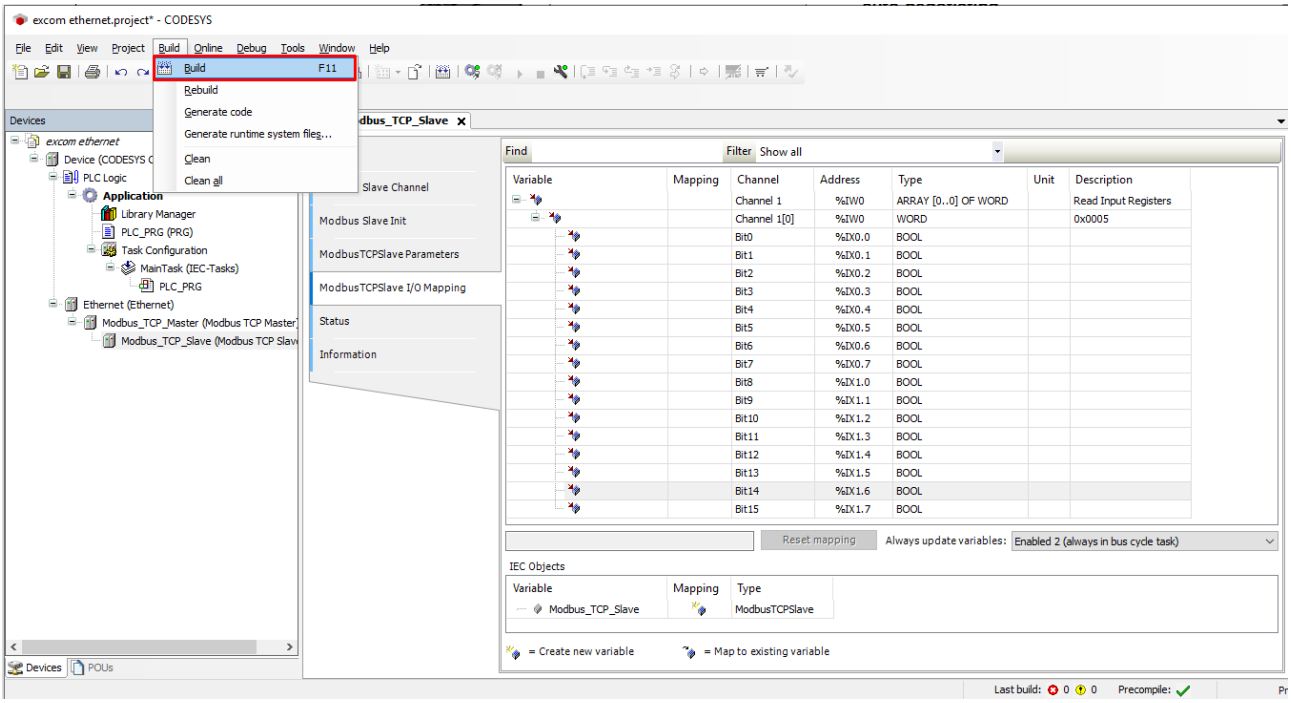

Fig. 31: Compiling the project

▶ Go online via **Online** → **Login** or offline via **Logout**.

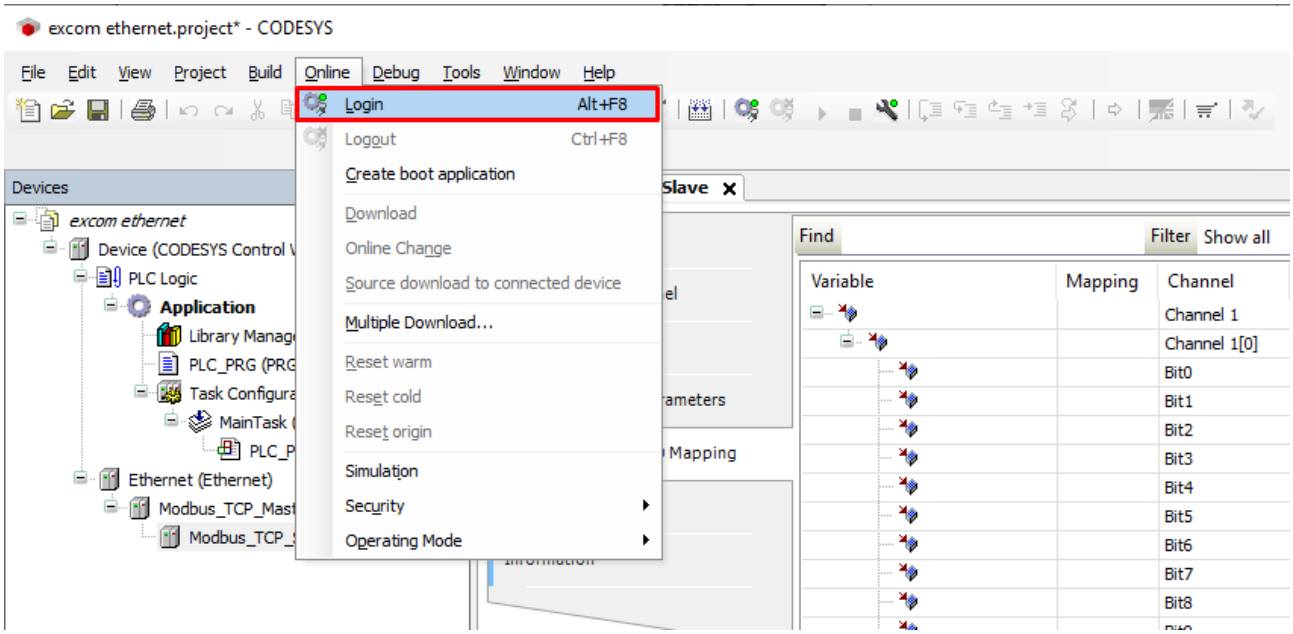

Fig. 32: Online – logging in

▶ Start the program via **Debug** → **Start**.

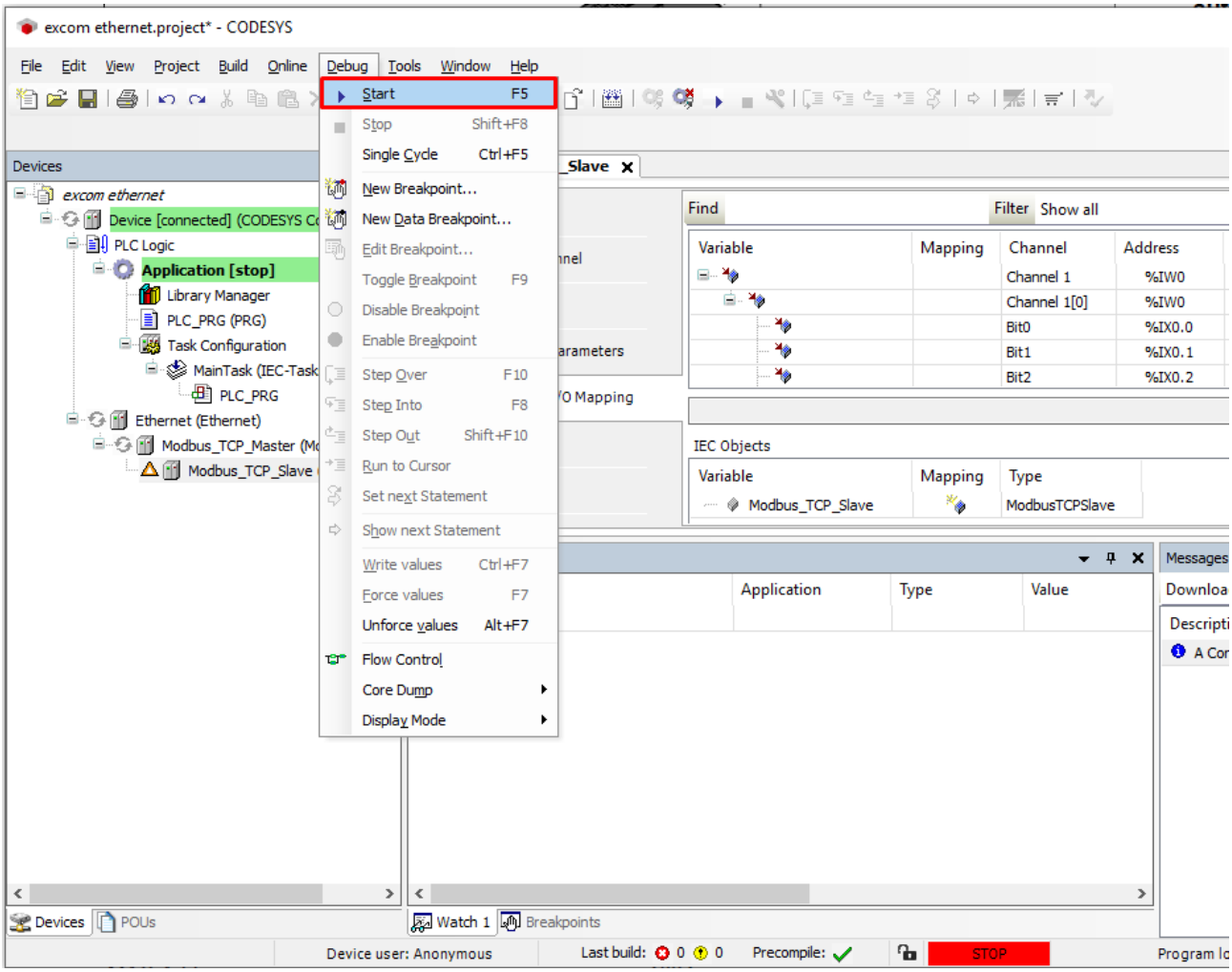

Fig. 33: Starting the program

6 Connecting excom to a PROFINET master

The following example shows the integration of excom with CODESYS. The configuration and parameterization is carried out via the configuration tool and the GSDML file.

Hardware used

This example uses the following hardware components:

- Gateway GEN-N
- Ethernet cable with RJ45 connector
- PC

Software used

This example uses the following software:

- CODESYS version 3.5.12 (download free of charge from www.turck.com)
- GSDML file version 2.3 (download free of charge from www.turck.com)

Requirements

- The PROFINET name is set.
- The programming software has been opened.
- A new project has been created.
- Codesys PLC has been started via CODESYS Control Win SysTray.

6.1 Installing a GSDML file

The GSDML file is available free of charge for download from www.turck.com.

▶ Include the GSDML file: Click **Tools** → **Device Repository**.
▶ Install a GSDML file: Specify the storage location of the GSDML file and click **Install**.
⇨ The device is included in the hardware catalog.

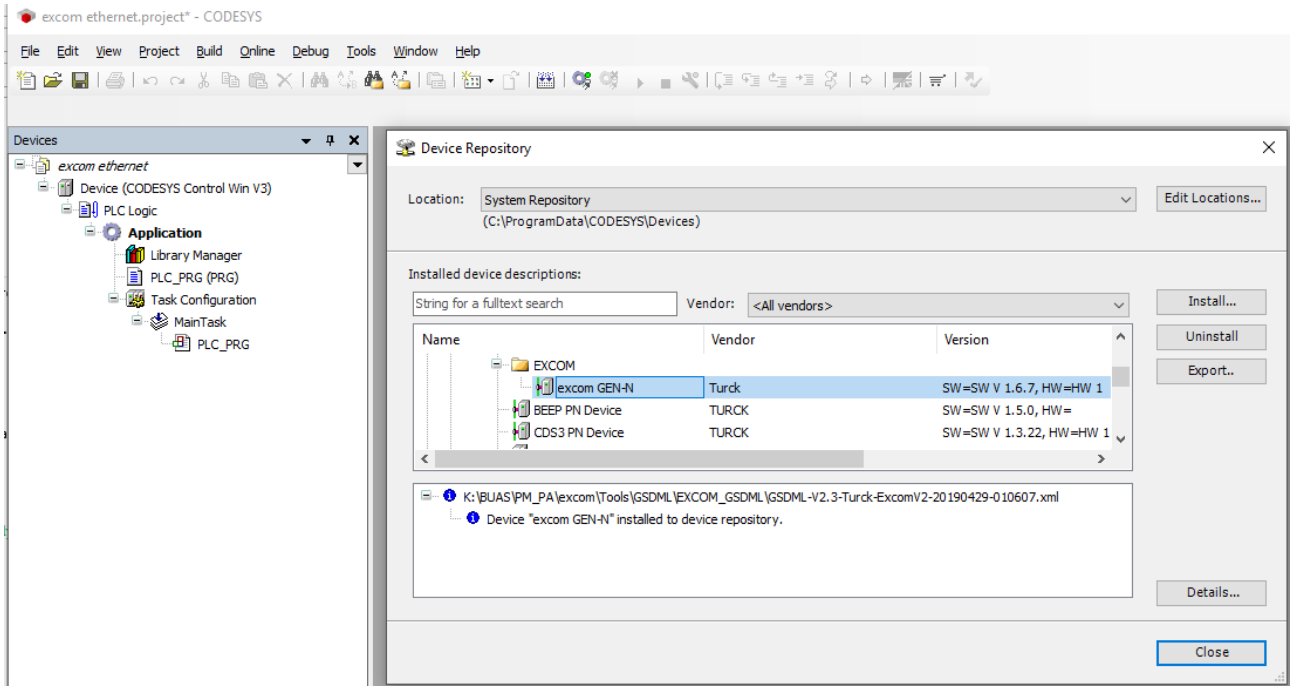

Fig. 34: Installing a GSDML file

6.2 Connecting the device with the controller

- ▶ Right-click **Device** in the project tree.
- ▶ Select **Add device**.
- ▶ Select the Ethernet port.
- ▶ Click **Add device**.
- ⇨ The Ethernet port appears as **Ethernet** in the project tree.

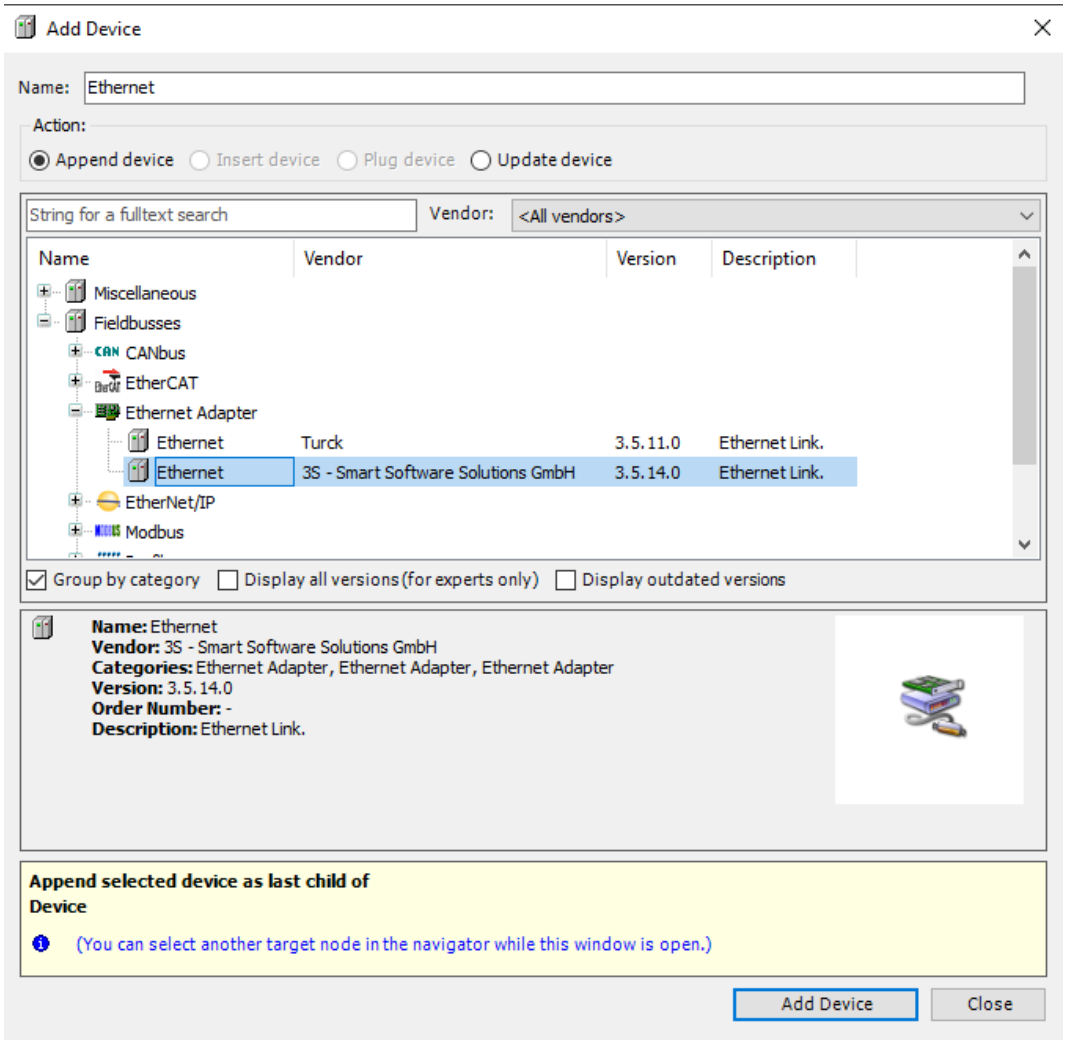

Fig. 35: Adding an Ethernet adapter

Adding a PROFINET master

- ▶ Right-click Device in the project tree.
- ▶ Select **Append device**.
- ▶ Double-click on **PROFINET-Controller** .
- ⇨ The PROFINET master appears as **PN_Controller** in the project tree.

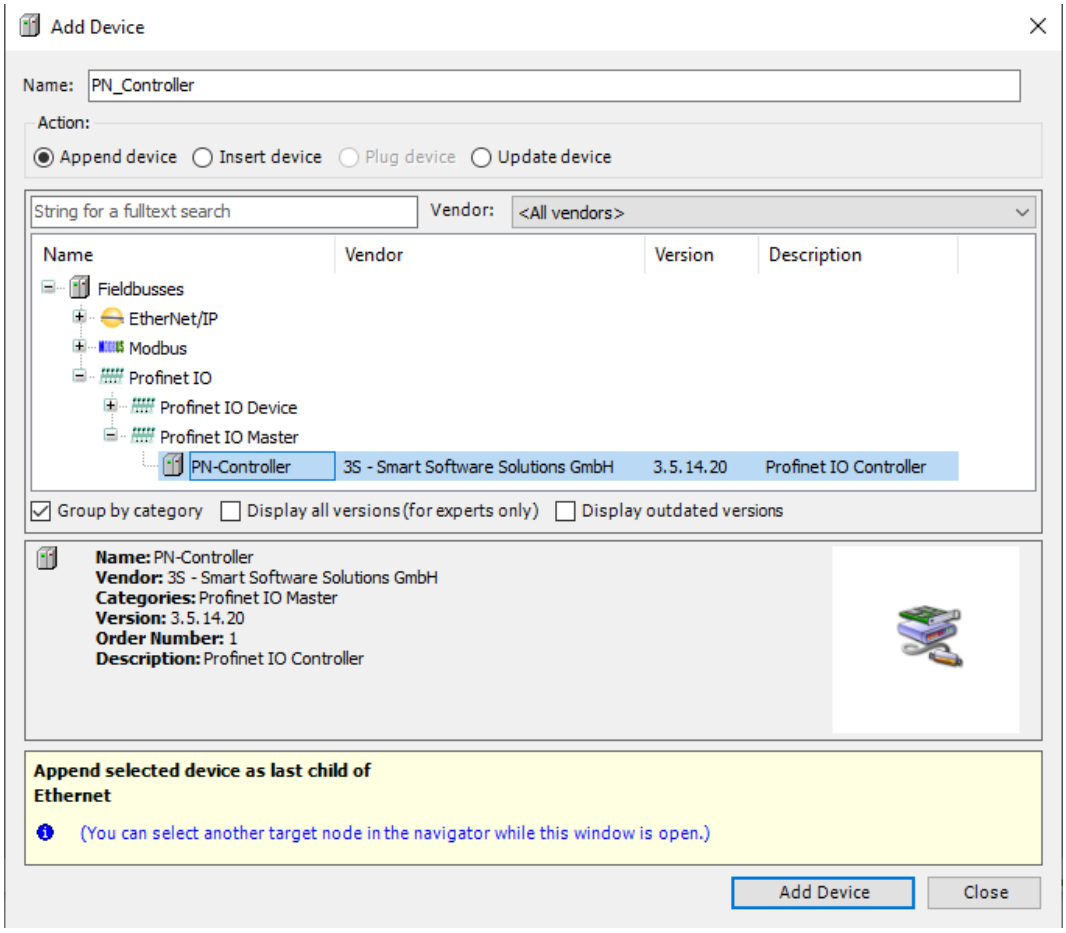

Fig. 36: Adding a PROFINET master

Adding a PROFINET device

- In the project tree, right-click on **PN_Controller (PN-Controller)**.
- Select **Append device**.
- Double-click PROFINET-Device.
- Select **excom GEN-N**.

⇨ The PROFINET device appears as **excom_GEN_N** in the project tree.

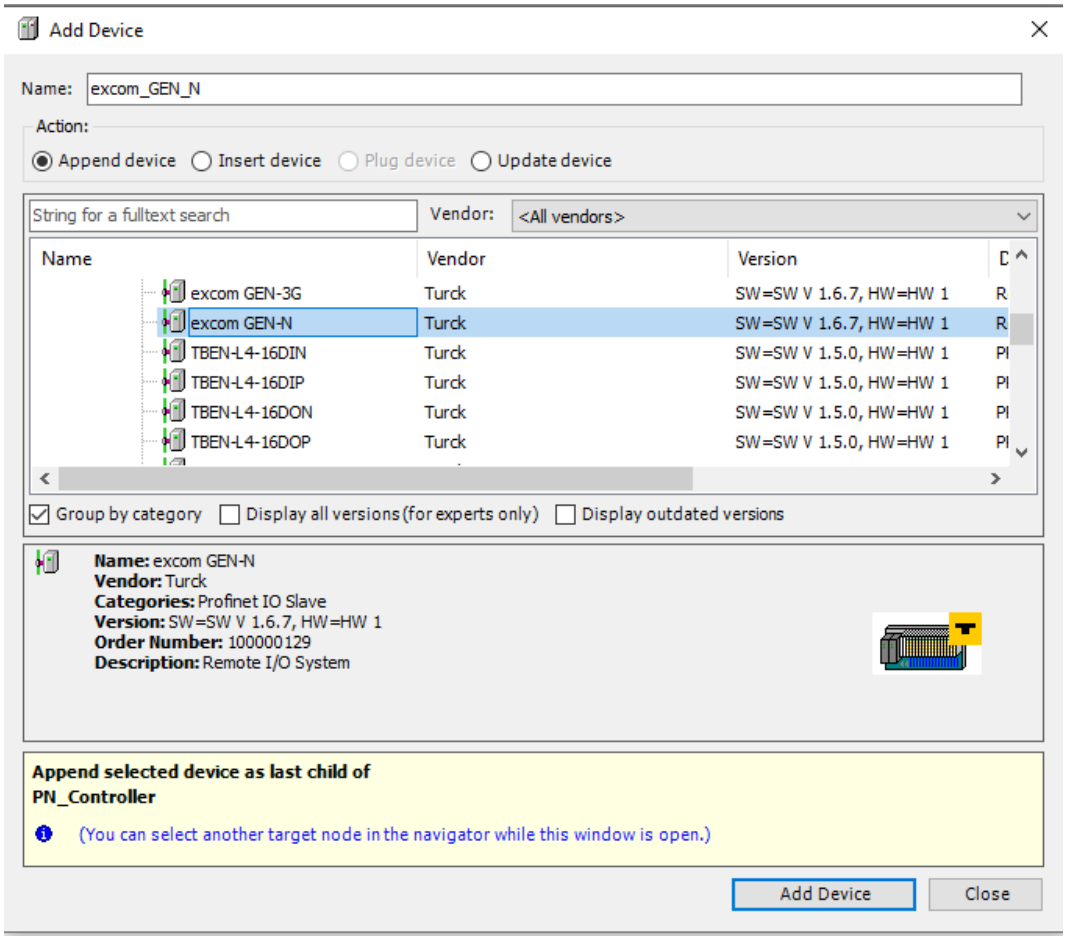

Fig. 37: Adding a PROFINET device

Optional: Renaming the PROFINET device

- Click on the PROFINET device in the project tree.
- Press [F2].
- Adapt the name of the device in the project tree.

Adding excom modules

- Right-click an empty slot in the project tree.
- Double-click to add the required module.

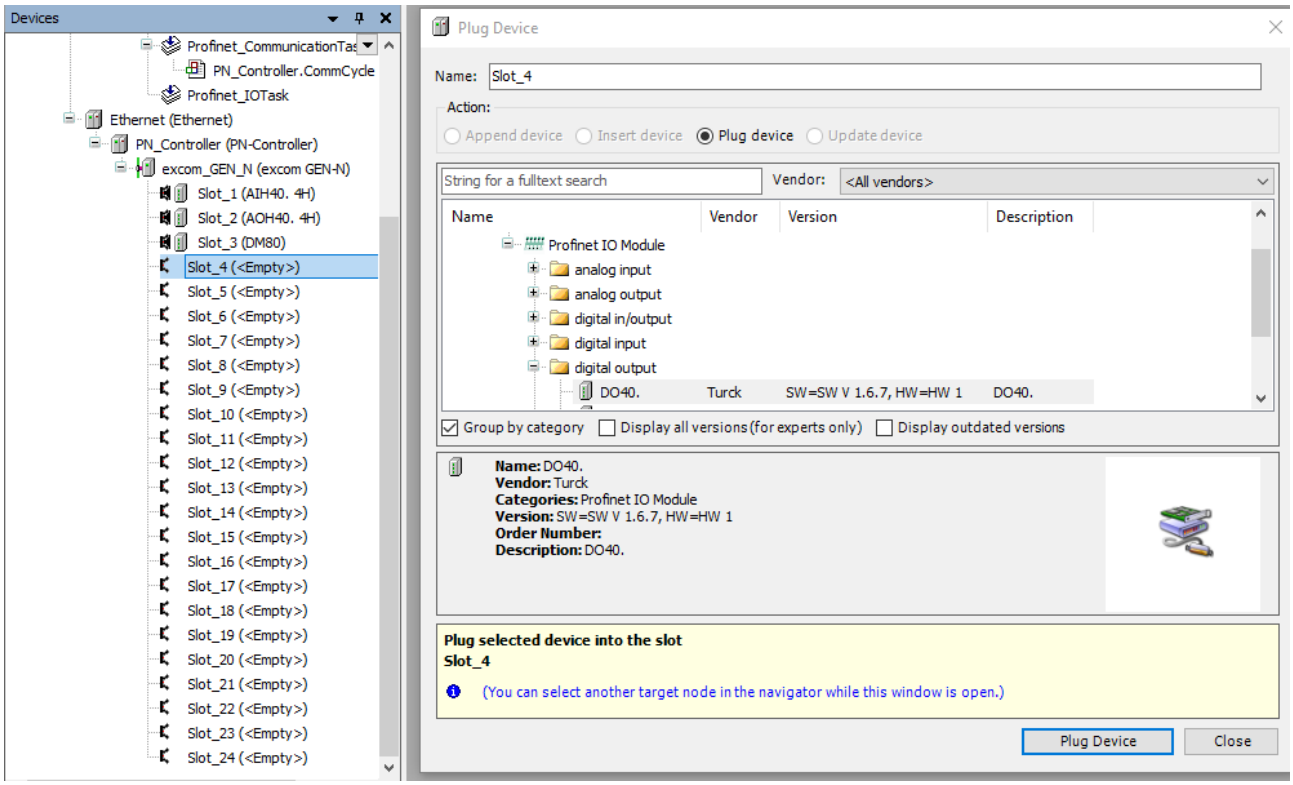

Fig. 38: Adding modules

Parameterizing excom modules

- Double-click the required module in the project tree.
- Set the parameters.

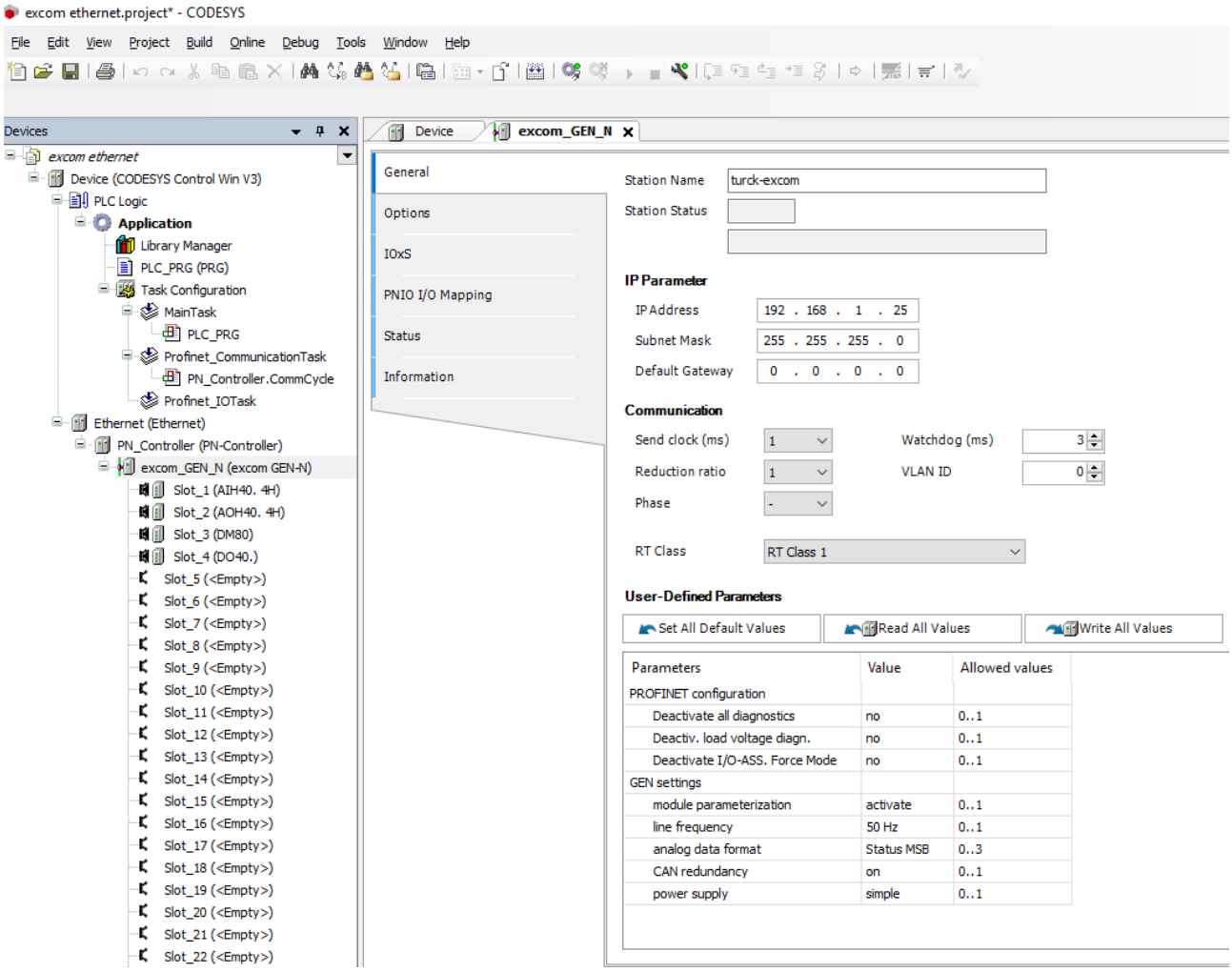

Fig. 39: Changing the gateway and PROFINET parameters

- In order to parameterize I/O modules select the particular slot (in this case: **Slot_1 (AIH40.)**).

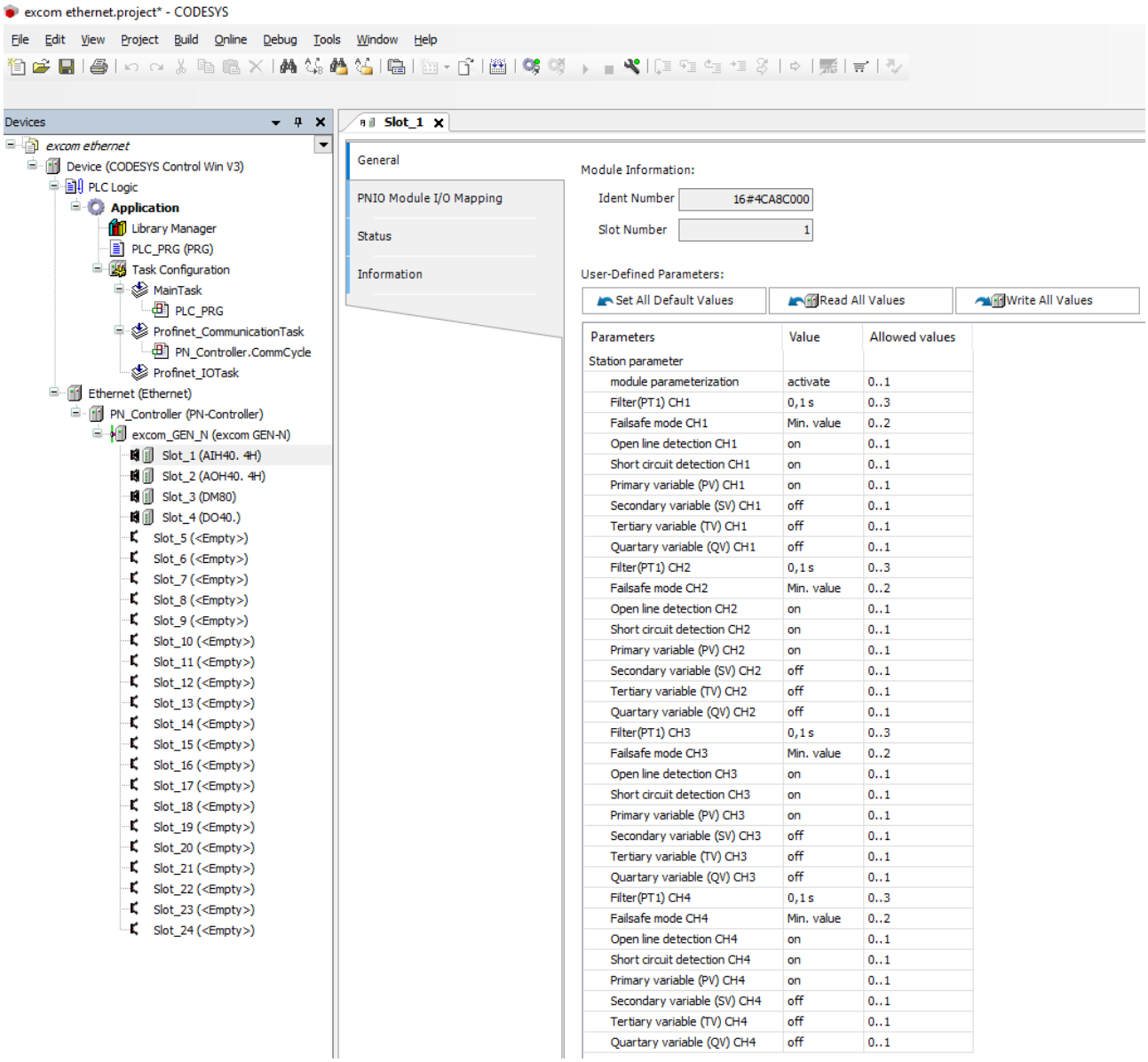

Fig. 40: Parameterize modules according to the AIH40… example

Updating the PROFINET master variables

- Double-click **Device**.
- Click **PLC settings**.
- At **Always refresh variables**: Set **Activated 2 (always in the bus cycle task)**.
- Confirm the following prompt with **Yes**.

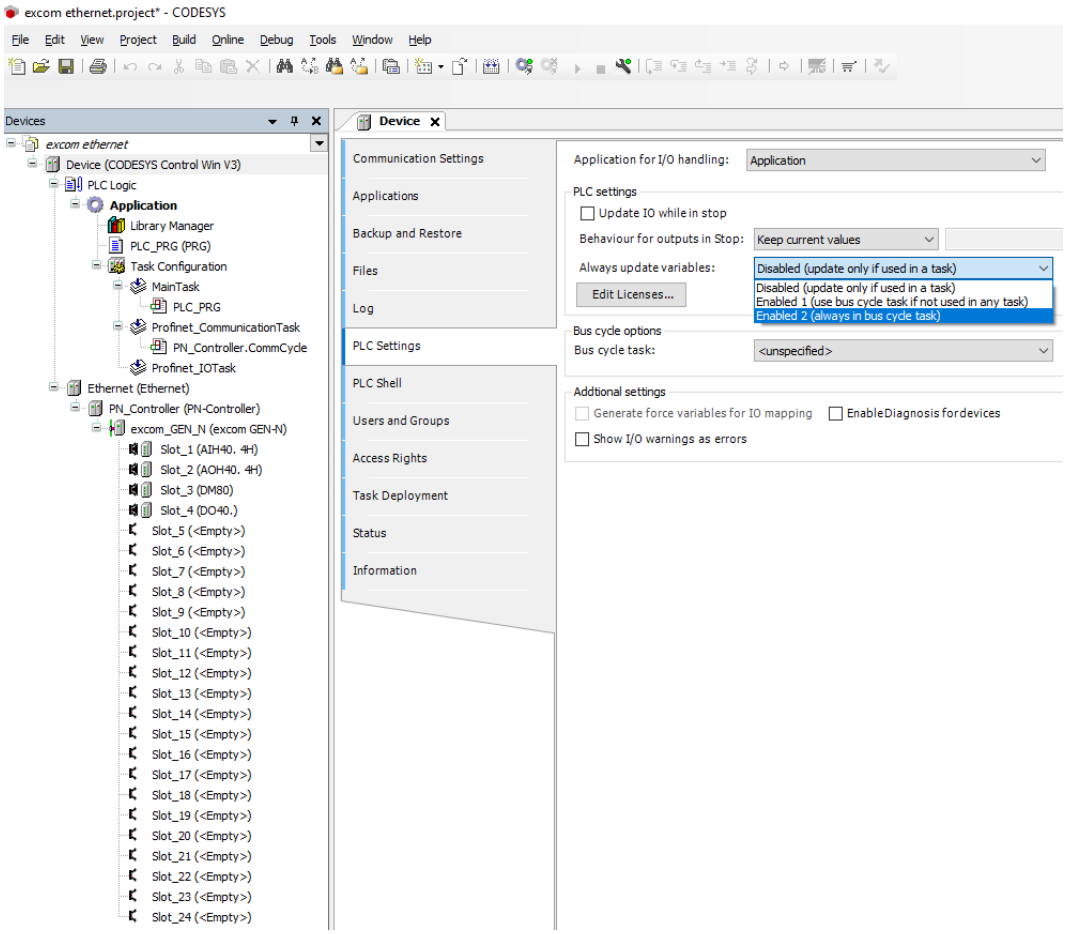

Fig. 41: Updating variables

Loading and starting CODESYS projects

NOTE
The WIN V3-PLC must be started.

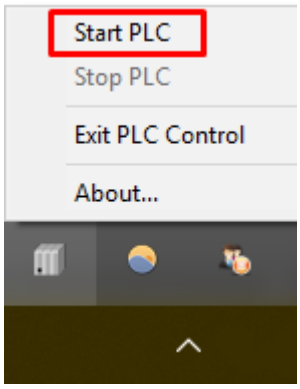

Fig. 42: Starting the WIN V3-PLC

- ▶ Compile the project via **Create** → **Compile** or press [F11].

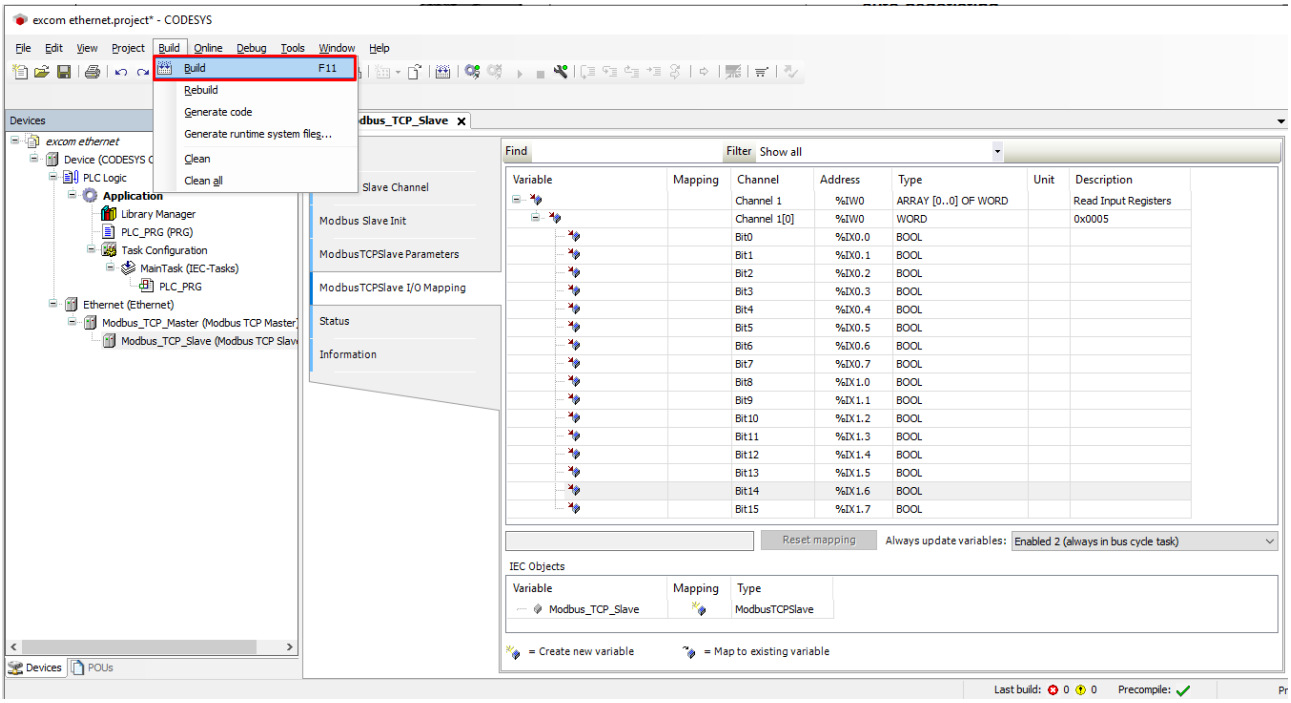

Fig. 43: Compiling the project

▶ Go online via **Online** → **Login** or offline via **Logout**.

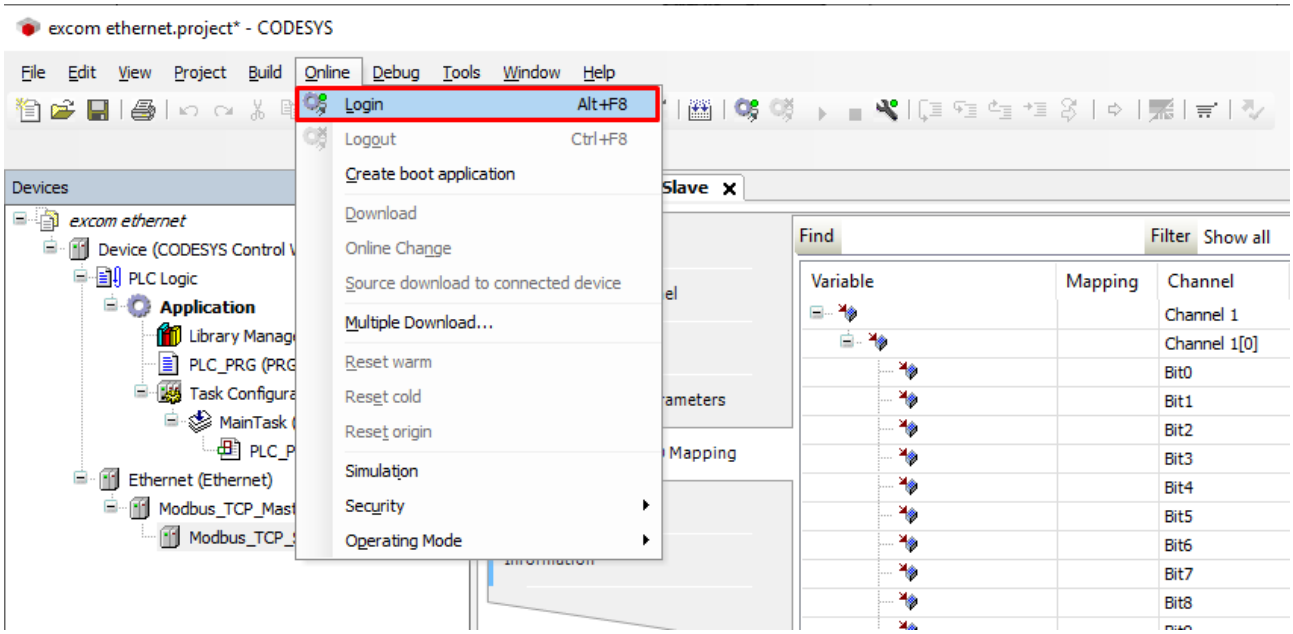

Fig. 44: Online – logging in

▶ Start the program via **Debug** → **Start**.

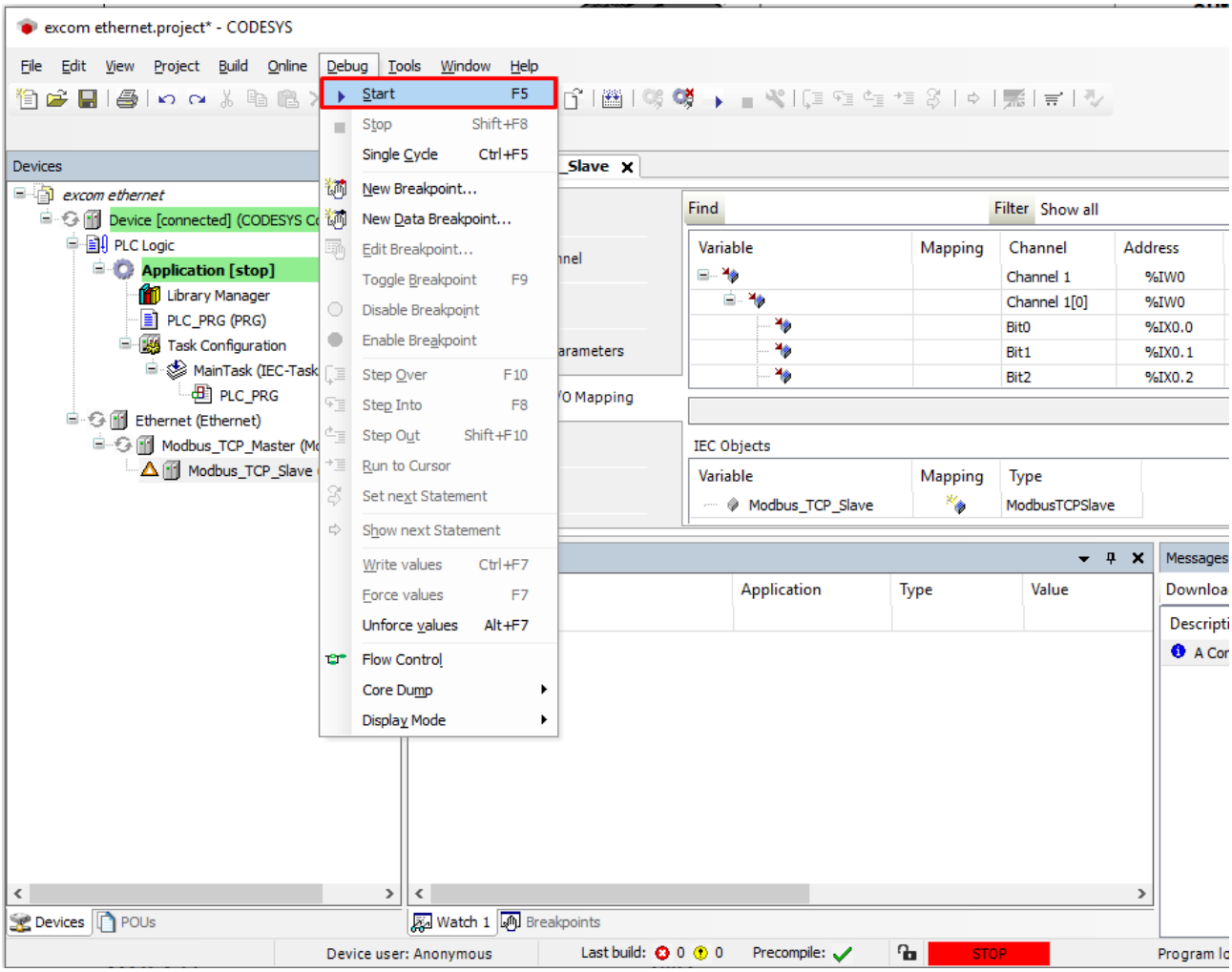

Fig. 45: Starting the program

7 Connecting excom to an EtherNet/IP scanner

The following example shows the integration of excom with CODESYS. The configuration and parameterization are carried out separately via the DTM or the web server.

Hardware used

This example uses the following hardware components:

- Gateway GEN-N
- Ethernet cable with RJ45 connector
- PC

Software used

This example uses the following software:

- CODESYS version 3.5.12 (download free of charge from **www.turck.com**)
- EDS file (available as a download at **www.turck.com**)

Requirements

- The programming software has been opened.
- A new project has been created.
- Codesys PLC has been started via CODESYS Control Win SysTray.

7.1 EtherNet/IP data mapping

Two different EDS files are available for EtherNet/IP for excom:

- Consolidated IO
- CIP bridging

Consolidated IO

"Consolidated IO" uses a single connection for the group of I/O modules. The Consolidated IO file optimizes the network bandwidth since the data for all I/O modules is transferred via a single connection.

If the assembly instances 107 (input) and 104 (output) are used, the connection parameters must be set according to the actual module configuration. The amount of input and output data must match the actual data size of the excom station exactly.

An Exclusive owner connection is in place if the EtherNet/IP is the active fieldbus protocol or the active fieldbus protocol was not defined. If EtherNet/IP is not the active fieldbus protocol, a read-only connection is in place.

The data mapping with “Consolidated IO” is structured as follows:

Data	Mapping	Process data	Meaning
Input data	Permanent	Gateway status word	Gateway status
	Permanent	Local process data	All process input data is shown in 246 units of 16 bits each.
	Optional	Summarized diagnostics module bus	Summarized diagnostics activated or deactivated VSC 102 instance 3 attribute 104
		1 bit for each module	
	Optional	Manufacturer specific module bus diagnostics	Manufacturer specific diagnostics (scheduled diagnostics) activated or deactivated VSC 102 instance 3 attribute 105
		12 bytes for diagnostics	
Output data	Permanent	Gateway control word	Without function
	Permanent	Local process data	All output process data is shown in 246 units of 16 bits each.

The gateway status word is mapped in the input data mapping on the first word:

Gateway status word														
Byte 1							Byte 0							
res	FM	Par	res	I/O cfg	res	res	res	res	res	res	I/O cfg w	FS	res	I/O diag

Designation	Meaning
res	Reserved
FM	Force mode in the DTM active
Par	I/O parameter error
I/O cfg	Configuration error (missing or incorrectly fitted modules)
I/O cfg w	Warning that the I/O configuration was changed
FS	Warning – Fail-safe mode active
I/O diag	I/O diagnostics active

The optional diagnostics can be activated or deactivated in the web server at **Gateway Configuration**. If the summarized diagnostics are activated, 1 bit is returned for each module in the station. If no diagnostics are present on the device, the bit for the particular module is set to 0. If diagnostic messages are present, this bit is set to 1. The diagnostic bits are mapped to the end of the input data of the station.

If the scheduled diagnostics are activated, the scheduled diagnostics bits are mapped to the process data of the station. The scheduled diagnostics are mapped at the end of the input data behind the summarized diagnostics. The scheduled diagnostics are continuous diagnostics. The diagnostics window shows the specific diagnostics data of a module for approx. 125 ms and then changes to the next module. The mechanism is controlled by the gateway.

CIP bridging

The CIP bridging function uses one connection for each I/O module. The CIP bridging file maps the data of the excom station as follows:

Data	Mapping	Process data
Input data	Slot 0	Gateway status word
	Permanent	Process data for slot 0…24 (wordwise)
		Diagnostics data for slot 0…24 (wordwise)
Output data	Slot 0	Gateway control word
	Permanent	Process data for slot 0…24 (wordwise)

7.2 Installing an EDS file

- Include an EDS file: Click **Tools** → **Device Repository**.
- Installing an EDS file: Click **Install**.
- Select the storage location of the EDS file.

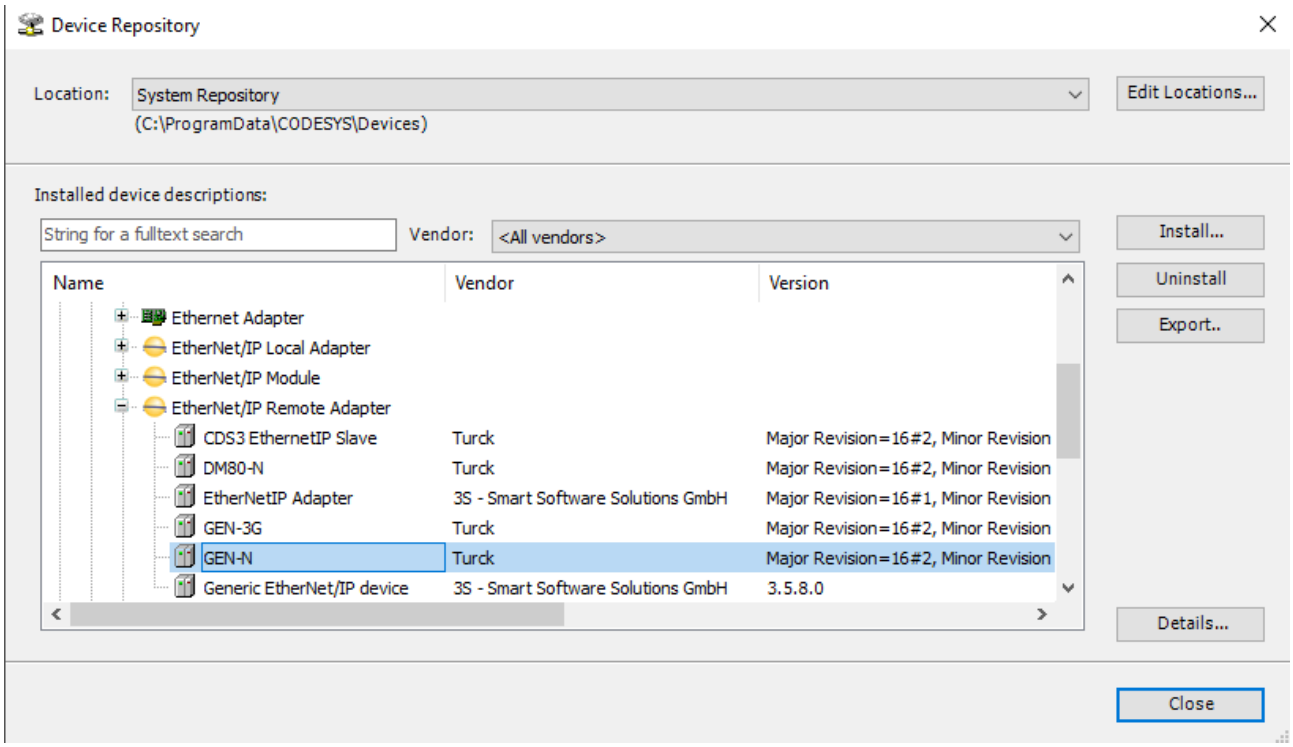

Fig. 46: Installing an EDS file

⇨ The device is entered in the hardware catalog.

Most EtherNet/IP controllers operate with the Consolidated IO EDS file. This example therefore uses Consolidated IO.

With the CIP Bridging EDS file, the appropriate EDS file must be read for each slot in the module rack and added in sequence as EtherNet/IP adapters as is the case here with the GEN-N. The gateway here is called a “station”.

7.3 Connecting the device with the controller

To connect the device to the controller, the following components must be added in CODESYS first of all:

- Ethernet adapter
- EtherNet/IP scanner
- EtherNet/IP adapter

Adding an Ethernet adapter

- ▶ Right-click **Device** in the project tree.
- ▶ Select **Append device**.
- ▶ Select the **Ethernet port**.
- ▶ Click **Append device**.

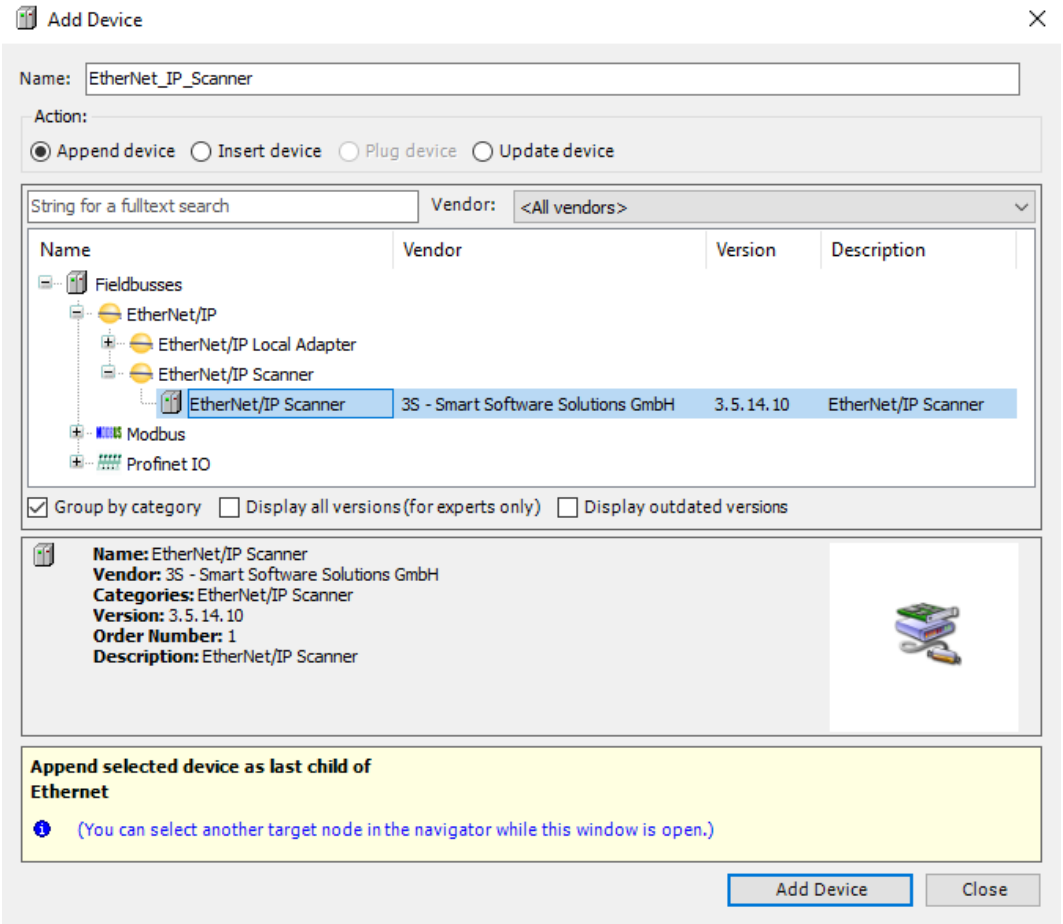

Fig. 47: Adding an Ethernet adapter

⇨ The Ethernet port appears as **Ethernet** in the project tree.

Adding an EtherNet/IP scanner

- ▶ Right-click **Ethernet** in the project tree.
- ▶ Select **Append device**.
- ▶ Double-click **EtherNet/IP Scanner**.

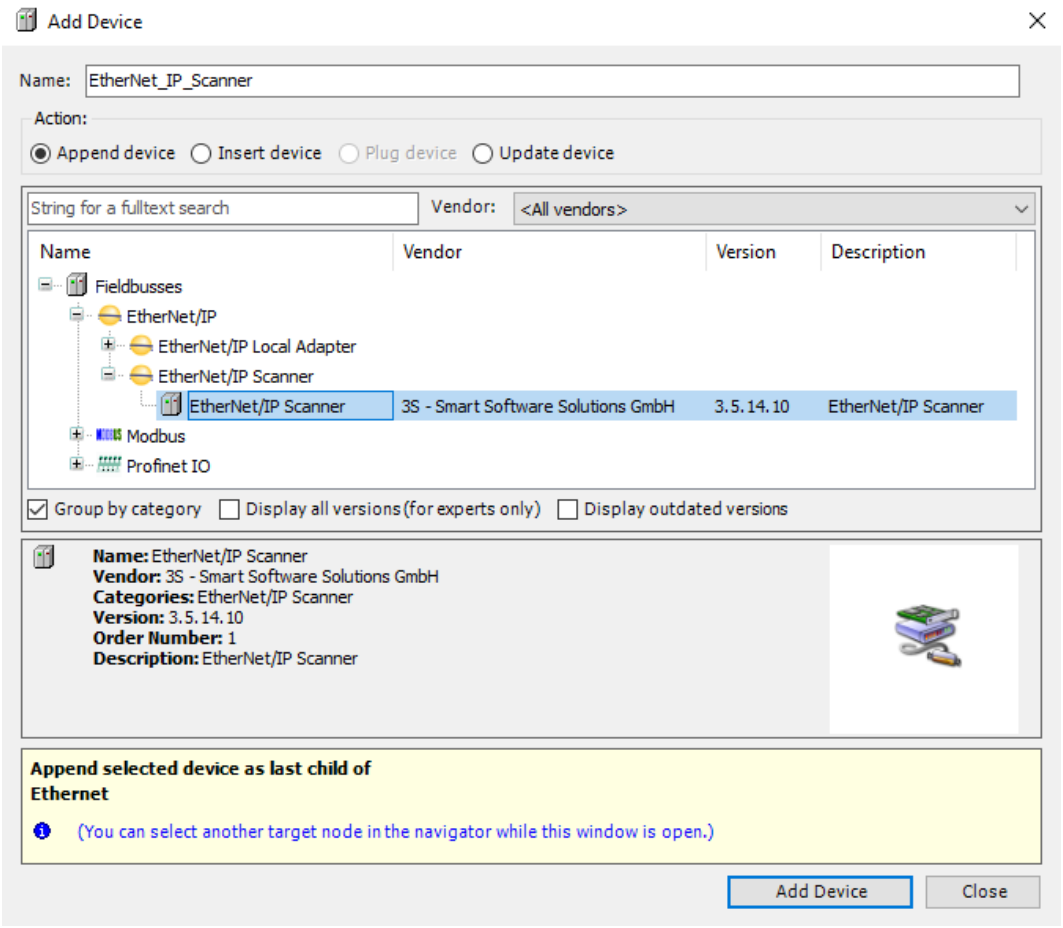

Fig. 48: Adding an EtherNet/IP scanner

⇨ The EtherNet/IP scanner appears as **EtherNet_IP_Scanner (EtherNet/IP Scanner)** in the project tree.

Adding an Ethernet/IP adapter

- ▶ Right-click **EtherNet_IP_Scanner (EtherNet/IP Scanner)** in the project tree.
- ▶ Select **Append device**.
- ▶ Double-click **GEN-N**.

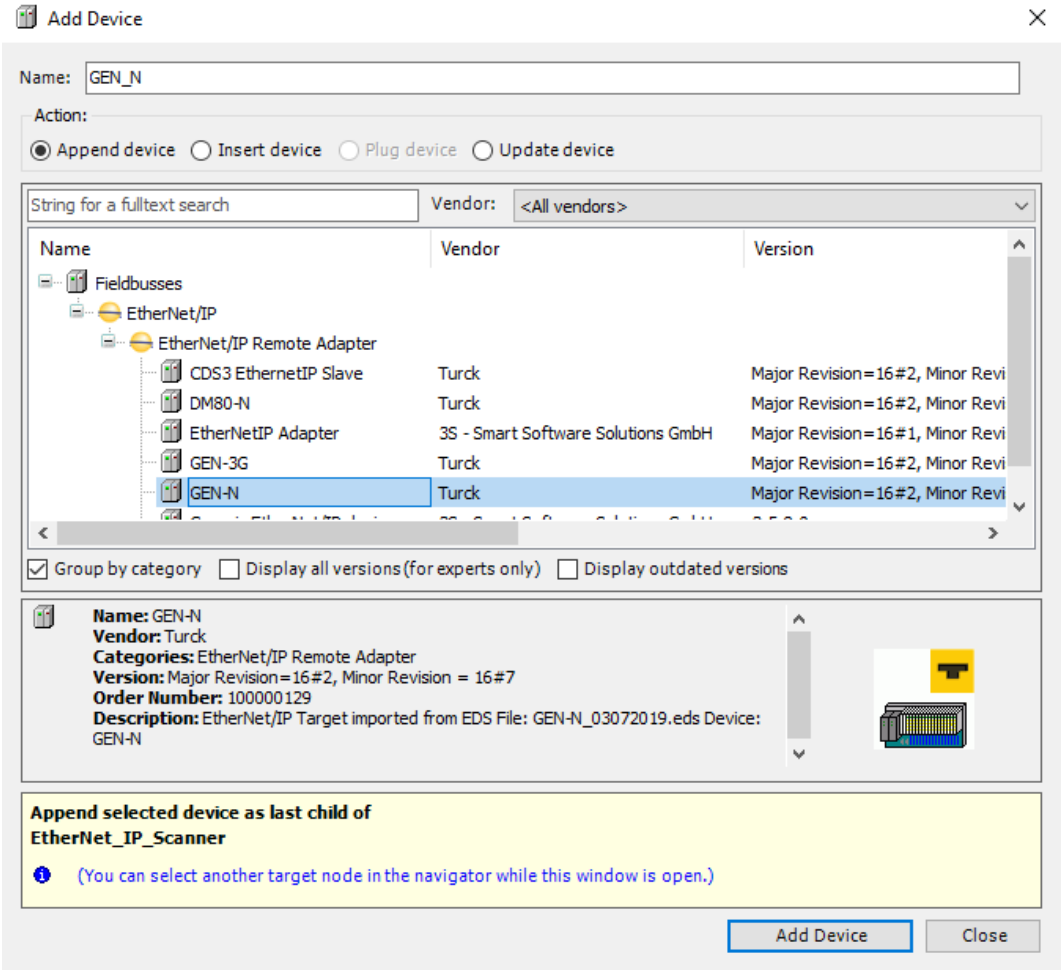

Fig. 49: Adding an Ethernet/IP adapter

➪ The Ethernet/IP adapter appears as **GEN-N** in the project tree.

The device is automatically created with an I/O data width of 492 bytes. The creation of input and output data to be exchanged with the CODESYS controller is not required. The controller tags are automatically created.

Setting the IP address of the EtherNet/IP adapter

- Double-click **GEN-N**.
- Set the IP address in the mask.

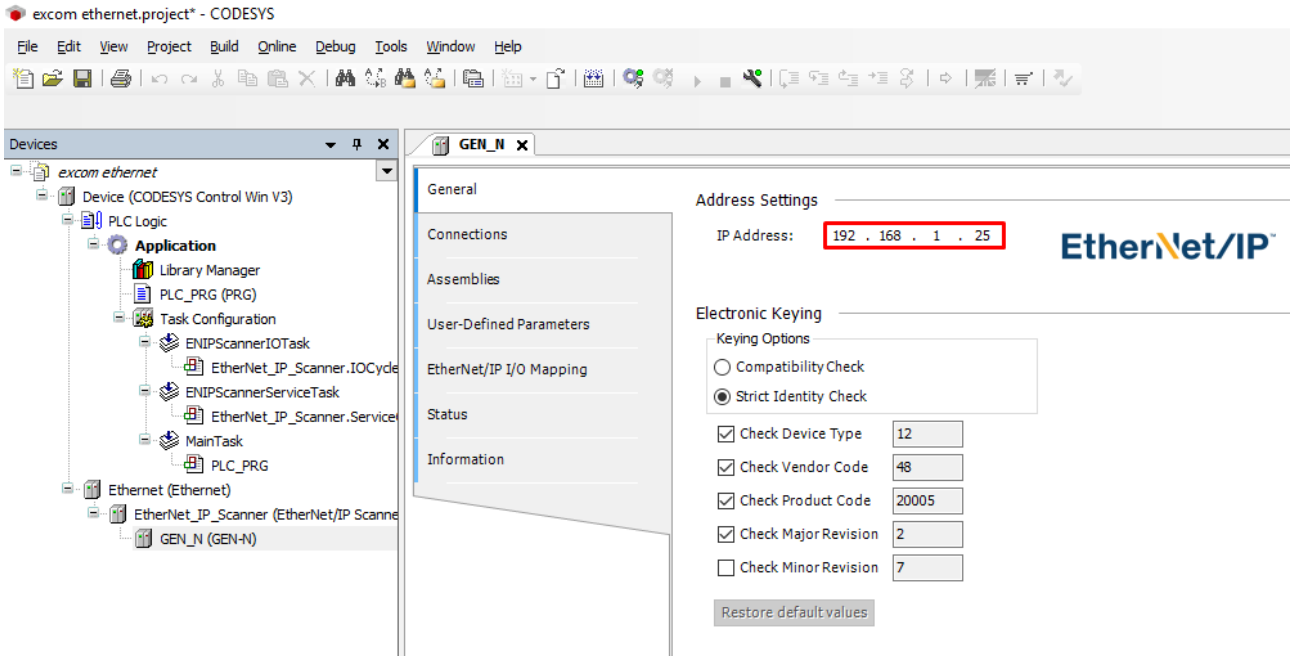

Fig. 50: Setting the IP address of the EtherNet/IP adapter

Reading out the signal

NOTE
All signals are mapped under **EtherNet/IP I/O Mapping** in CODESYS and do not have to be created separately. The updating of the **Enabled 2 (always in the bus cycle task)** variables must be set.

To call up the I/O mapping, proceed as follows:

- Open the web server.
- Under **Documentation**, click **EtherNet/IP Memory Map**.

Input data: Gateway – Status word

Description in the web server	Word offset	Bit offset	Bit length
Module Diagnostics Available	0	0	1
Modulebus Failsafe Mode Enabled	0	2	1
Station Configuration Changed	0	3	1
Overcurrent Isys	0	5	1
Overvoltage Field Supply UI	0	6	1
Undervoltage Field Supply UI	0	7	1
Overvoltage Field Supply Usys	0	8	1
Undervoltage Field Supply Usys	0	9	1
Modulebus Communication Lost	0	10	1
Modulebus Configuration Error	0	11	1
Modulebus Status Error	0	12	1
Modulebus Parameter Error	0	13	1
Force Mode Enabled	0	14	1

Input data: Slot 0 – Station

Description in the web server	Word offset	Bit offset	Bit length
Gateway active	1	0	1
Gateway slot left	1	1	1
Gateway redundancy available	1	2	1
Right supply module available	1	3	1
Left supply module available	1	4	1
Starting up after watchdog-reset	2	1	1
ROM error	2	2	1
RAM error	2	3	1
EEPROM error	2	4	1
Err. power supply module 1	2	5	1
Err. power supply module 2	2	6	1
Starting up after a cold start	2	7	1
Red. switch has taken place	3	0	1
Redundant gateway is missing	3	1	1
Redundant gateway is not ready	3	2	1
Redundant gateway has an error	3	3	1
Red. gateway has no DP comm.	3	4	1
Different conf. (with red.)	3	5	1
Different fw (with redundancy)	3	6	1
Err. internal bus pas. (CAN-err.)	4	0	1
Err. internal bus (CAN error)	4	1	1

Input data: Slot 1 – DM80-N S

Description in the web server	Word offset	Bit offset	Bit length
Digital in-/output 1: Value	5	0	1
Digital in-/output 1: Status	5	8	1
Digital in-/output 2: Value	5	1	1
Digital in-/output 2: Status	5	9	1
Digital in-/output 3: Value	5	2	1
Digital in-/output 3: Status	5	10	1
Digital in-/output 4: Value	5	3	1
Digital in-/output 4: Status	5	11	1
Digital in-/output 5: Value	5	4	1
Digital in-/output 5: Status	5	12	1
Digital in-/output 6: Value	5	5	1
Digital in-/output 6: Status	5	13	1
Digital in-/output 7: Value	5	6	1
Digital in-/output 7: Status	5	14	1
Digital in-/output 8: Value	5	7	1
Digital in-/output 8: Status	5	15	1
Module error	6	0	1
Wrong module	6	1	1
Missing module	6	2	1
Parameter not plausible (inconsistent)	6	6	1
Error channel 1	6	8	1
Error channel 2	6	9	1
Error channel 3	6	10	1
Error channel 4	6	11	1
Error channel 5	6	12	1
Error channel 6	6	13	1
Error channel 7	6	14	1
Error channel 8	6	15	1

Input data: Slot 2 – D040-N

Description in the web server	Word offset	Bit offset	Bit length
Module error	7	0	1
Wrong module	7	1	1
Missing module	7	2	1
Parameter not plausible (inconsistent)	7	6	1
Error channel 1	7	8	1
Error channel 2	7	9	1
Error channel 3	7	10	1
Error channel 4	7	11	1

Input data: Slot 3 – AIH40-N

Description in the web server	Word offset	Bit offset	Bit length
Analog input 1: Value	8	0	15
Analog input 1: Status	8	15	1
Analog input 2: Value	9	0	15
Analog input 2: Status	9	15	1
Analog input 3: Value	10	0	15
Analog input 3: Status	10	15	1
Analog input 4: Value	11	0	15
Analog input 4: Status	12	15	1
Module error	12	0	1
Wrong module	12	1	1
Missing module	12	2	1
Parameter not plausible (inconsistent)	12	6	1
Error channel 1	12	8	1
Error channel 2	12	9	1
Error channel 3	12	10	1
Error channel 4	12	11	1
Error HART channel 1	12	12	1
Error HART channel 2	12	13	1
Error HART channel 3	12	14	1
Error HART channel 4	12	15	1

Input data: Slot 4 – AOH40-N

Description in the web server	Word offset	Bit offset	Bit length
Module error	13	0	1
Wrong module	13	1	1
Missing module	13	2	1
Parameter not plausible (inconsistent)	13	6	1
Error channel 1	13	8	1
Error channel 2	13	9	1
Error channel 3	13	10	1
Error channel 4	13	11	1
Error HART channel 1	13	12	1
Error HART channel 2	13	13	1
Error HART channel 3	13	14	1
Error HART channel 4	13	15	1

Output data: Slot 0 – Station

Description in the web server	Word offset	Bit offset	Bit length
Red switching	1	0	2

Output data: Slot 1 – DM80-N S

Description in the web server	Word offset	Bit offset	Bit length
Digital in-/output 1: Value	2	0	1
Digital in-/output 2: Value	2	1	1
Digital in-/output 3: Value	2	2	1
Digital in-/output 4: Value	2	3	1
Digital in-/output 5: Value	2	4	1
Digital in-/output 6: Value	2	5	1
Digital in-/output 7: Value	2	6	1
Digital in-/output 8: Value	2	7	1

Output data: Slot 2 – DO40-N

Description in the web server	Word offset	Bit offset	Bit length
Digital output 1: Value	2	8	1
Digital output 2: Value	2	9	1
Digital output 3: Value	2	10	1
Digital output 4: Value	2	11	1

Output data: Slot 4 – AOH40-N

Description in the web server	Word offset	Bit offset	Bit length
Analog output 1: Value	3	0	15
Analog output 2: Value	4	0	15
Analog output 3: Value	5	0	15
Analog output 4: Value	6	0	15

Loading and starting CODESYS projects

NOTE
The WIN V3-PLC must be started.

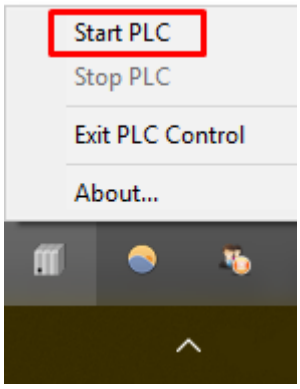

Fig. 51: Starting the WIN V3-PLC

- Compile the project via **Create** → **Compile** or press [F11].

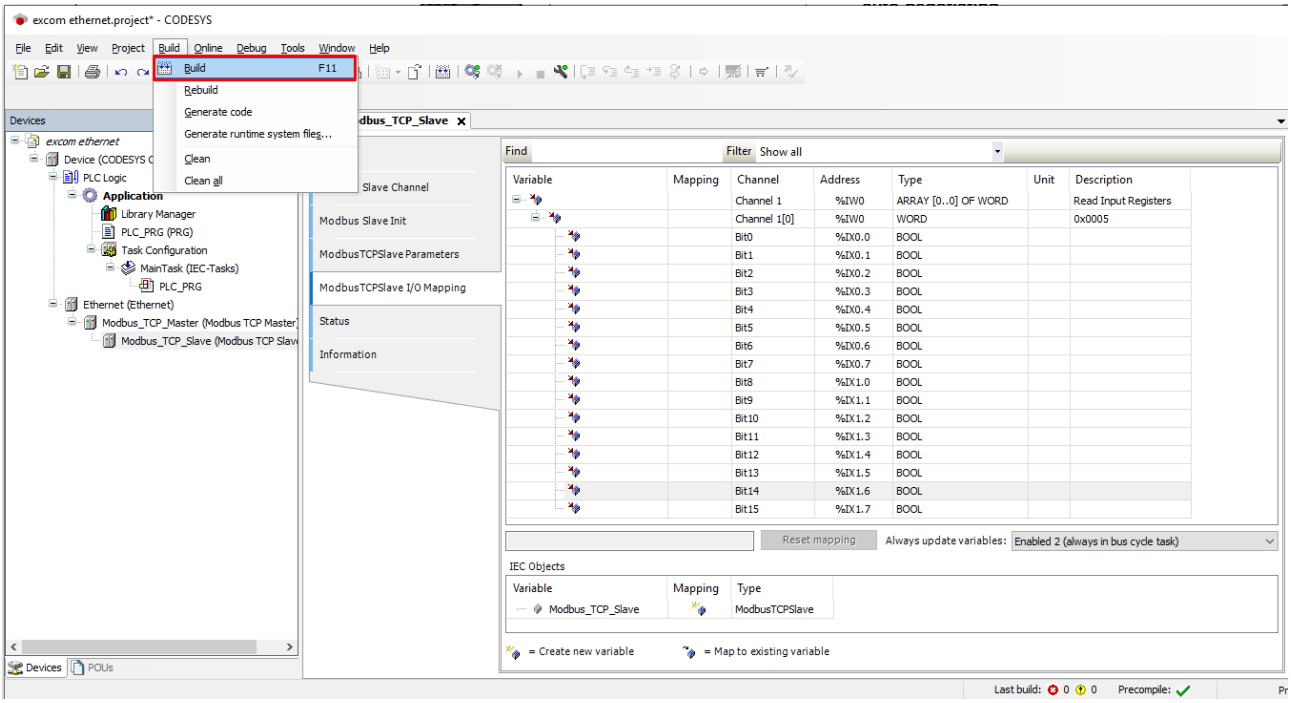

Fig. 52: Compiling the project

▶ Go online via **Online** → **Login** or offline via **Logout**.

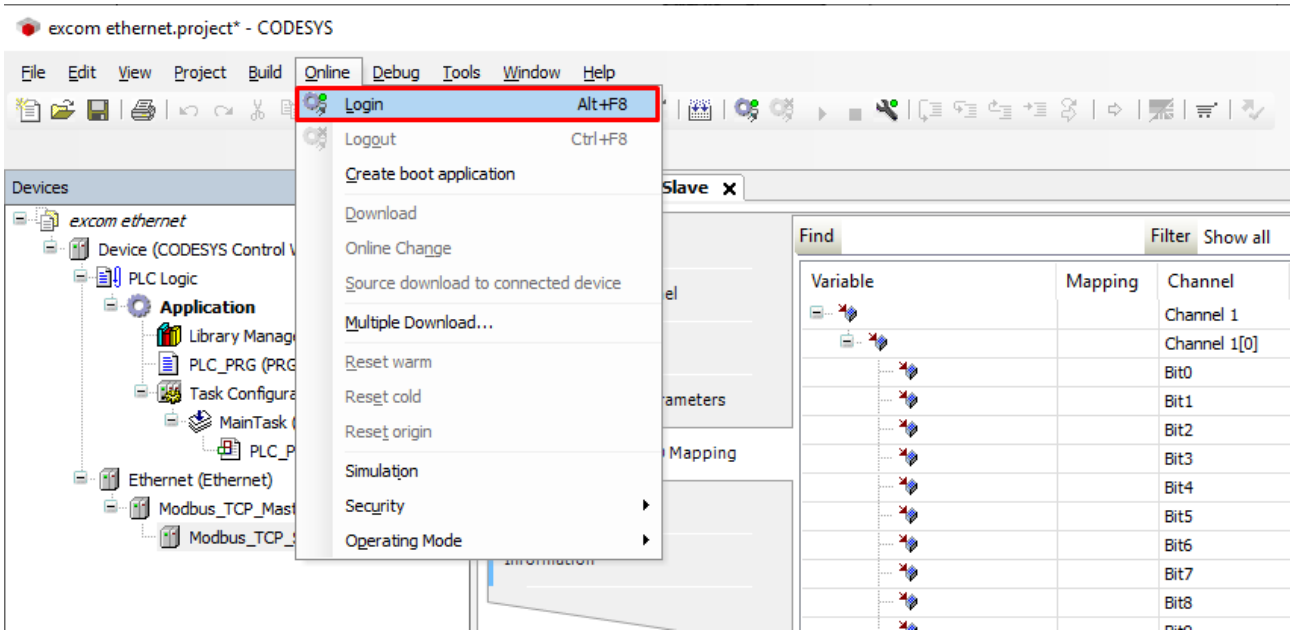

Fig. 53: Online – logging in

▶ Start the program via **Debug** → **Start**.

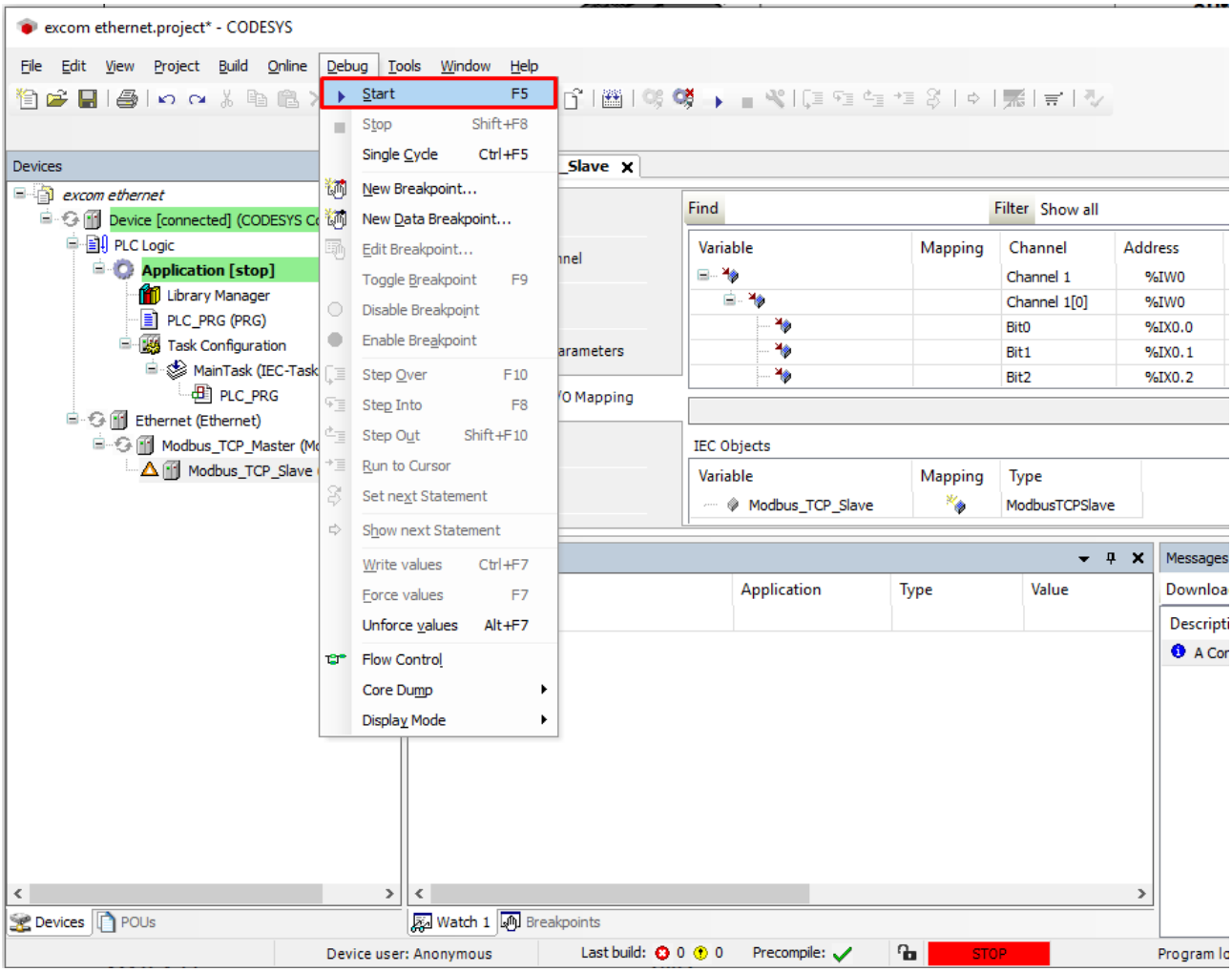

Fig. 54: Starting the program

8 Redundancy strategies

8.1 Topology

The general topology of the Turck-specific system redundancy with the Ethernet protocols EtherNet/IP, Modbus TCP and PROFINET is structured as follows:

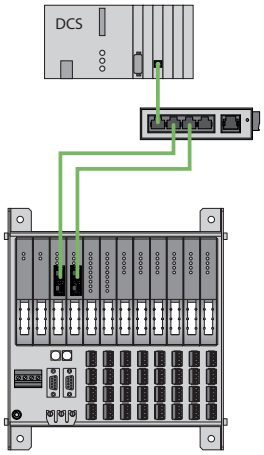

Fig. 55: System redundancy with one master and two gateways

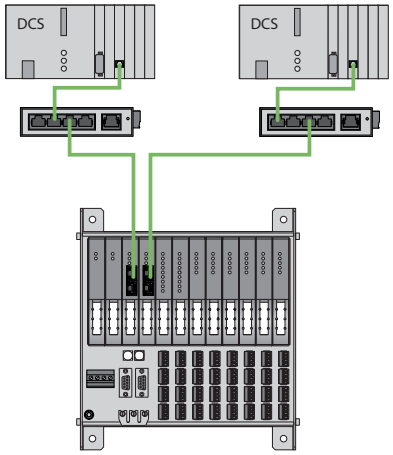

Fig. 56: System redundancy with two masters and two gateways

The system redundancy with one master and two gateways is a Turck-specific, parameterizable redundancy function of the excom system. The two gateways are provided here with separate IP addresses. The separate IP addresses are used to set up independent communication. The gateways communicate the input data and receive the output data via the IP addresses. One gateway is the primary gateway while the second gateway acts as a backup. If the primary gateway fails, a bumpless switchover to the backup gateway is carried out automatically. The redundancy function makes it possible to implement interruption-free communication. The output word of the gateway enables the forcing of a redundancy switchover.

When system redundancy is implemented with two masters and two gateways, two independent Ethernet masters communicate with the associated gateway. Both masters can be controlled via one or two process control system controllers. The process data is processed via two separate and independent Ethernet connections to the excom system.

PROFINET system redundancy

The PROFINET system redundancies are specified by the PNO (PROFIBUS user organization). The specification distinguishes between the following redundancy topologies which are currently available for the Turck-excom system:

- PROFINET S1 represents system redundancy with one master and one gateway. A ring topology can be set up via the two Ethernet interfaces of the gateway for increased availability.
- PROFINET S2 represents system redundancy with two masters and one gateway. Each individual Ethernet interface of the gateway can be connected to a master.

8.2 Redundancy setup

NOTE
Both gateways must have the same configuration, parameterization and firmware.

The **Redundancy mode** gateway parameter must be set for **system redundancy**.

8.3 System redundancy

NOTE
System redundancy via PROFINET is in the form of application redundancy.

NOTE
Both gateways must have the same configuration, parameterization and firmware.

If the **Redundancy mode** parameter is set to **System redundancy** in the DTM, web server or control system, the excom station operates in system redundancy mode. Both gateways communicate with their respective master. The PRIO LED is lit on the active gateway. The active gateway takes over the output data transferred by the master and sends this to the output modules.

The gateway communicating with the secondary master ignores the received output data as the secondary module does not have write access to the output modules.

The gateway is provided with one input word and one output word for monitoring redundancy. The input word describes the current state of the gateway.

The output word is used for the manual redundancy switchover in the master. It is possible to switch in the process control system from the primary gateway to the secondary gateway. A switchover is carried out in response to the following events:

- The primary gateway was removed.
- Communication to the primary gateway was interrupted. The outputs are set to 0 until the switchover to the other gateway is completed. After the timer for interrupted connections has elapsed, the switchover to the other gateway is carried out.

After a switchover, an automatic switchover to the former primary gateway is no longer carried out.

When the excom system is started, the gateway on the left starts to operate as the primary gateway. If communication with the left gateway fails, the gateway on the right tries to establish primary communication.

Assignment of the gateway process data bits

The input word of the gateway process data is used to view the gateway and system redundancy of the excom station:

	Bit							
Status bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Not used			Left power supply module	Right power supply module	Gateway redundancy	Gateway slot	Redundancy status
1	Not used							

Meaning of the gateway process data bits

Designation	Meaning
Left power supply unit	0: Left power supply unit not present
	1: Left power supply unit fitted
Right power supply unit	0: Right power supply unit not present
	1: Right power supply unit fitted
Gateway redundancy	0: Redundant gateway or redundant communication not available
	1: Redundancy available
Slot	0: Gateway is located on the right slot (GW2)
	1: Gateway is located on the left slot (GW1)
Active/ passive	0: Gateway is passive
	1: Gateway is active

Assignment of the command bits

The output word of the gateway makes it possible to force a redundancy switchover in the “Red switching” web server:

<table>
<tr><th></th><th colspan="8">Bit</th></tr>
<tr><th>Byte</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td rowspan="2">0</td><td colspan="5" rowspan="2">Not used</td><td>Control bit</td><td>Redund-ancy switchover is initiated</td><td rowspan="2">Activation of the right or left gate-way</td></tr>
<tr><td colspan="2">Control bits for edge change</td></tr>
<tr><td>1</td><td colspan="8">Not used</td></tr>
</table>

Meaning of the command bits

Designation	Meaning
Bit 2 = 0 Redundancy switchover is initiated	11 → 01: Receiver is the passive gateway. The passive gateway requests control from the active gateway and becomes active.
	11 → 10: Receiver is the active gateway. The active gateway gives control to the passive gateway and becomes passive.
Bit 2 = 1 Activation of the right or left gateway	11 → 01: Receiver is the left gateway. The left gate-way requests control from the right gateway and becomes active.
	11 → 10: Receiver is the right gateway. The right gateway requests control from the left gateway and becomes active.

From gateway firmware version 1.4, the gateways support PROFINET S2 redundancy.

9 Turck branches — contact data

Germany	Hans Turck GmbH & Co. KG Witzlebenstraße 7, 45472 Mülheim an der Ruhr www.turck.de
Australia	Turck Australia Pty Ltd Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria www.turck.com.au
Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna www.turck.at
Belgium	TURCK MULTIPROX Lion d'Orweg 12, B-9300 Aalst www.multiprox.be
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo www.turck.com.br
Canada	Turck Canada Inc. 140 Duffield Drive, CDN-Markham, Ontario L6G 1B5 www.turck.ca
China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin www.turck.com.cn
Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové www.turck.cz
France	TURCK BANNER S.A.S. 11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4 www.turckbanner.fr
Hungary	TURCK Hungary kft. Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest www.turck.hu
India	TURCK India Automation Pvt. Ltd. 401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra www.turck.co.in
Italy	TURCK BANNER S.R.L. Via San Domenico 5, IT-20008 Bareggio (MI) www.turckbanner.it
Japan	TURCK Japan Corporation ISM Akihabara 1F, 1-24-2, Taito, Taito-ku, 110-0016 Tokyo www.turck.jp

Korea	Turck Korea Co, Ltd. B-509 Gwangmyeong Technopark, 60 Haan-ro, Gwangmyeong-si, 14322 Gyeonggi-Do **www.turck.kr**
Malaysia	Turck Banner Malaysia Sdn Bhd Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C, 46200 Petaling Jaya Selangor **www.turckbanner.my**
Mexico	Turck Comercial, S. de RL de CV Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga, Coahuila **www.turck.com.mx**
Netherlands	Turck B. V. Ruiterlaan 7, NL-8019 BN Zwolle **www.turck.nl**
Poland	TURCK sp.z.o.o. Wroclawska 115, PL-45-836 Opole **www.turck.pl**
Romania	Turck Automation Romania SRL Str. Siriului nr. 6-8, Sector 1, RO-014354 Bucuresti **www.turck.ro**
Sweden	Turck AB Fabriksstråket 9, 433 76 Jonsered **www.turck.se**
Singapore	TURCK BANNER Singapore Pte. Ltd. 25 International Business Park, #04-75/77 (West Wing) German Centre, 609916 Singapore **www.turckbanner.sg**
South Africa	Turck Banner (Pty) Ltd Boeing Road East, Bedfordview, ZA-2007 Johannesburg **www.turckbanner.co.za**
Turkey	Turck Otomasyon Ticaret Limited Sirketi Inönü mah. Kayisdagi c., Yesil Konak Evleri No: 178, A Blok D:4, 34755 Kadiköy/ Istanbul **www.turck.com.tr**
United Kingdom	TURCK BANNER LIMITED Blenheim House, Hurricane Way, GB-SS11 8YT Wickford, Essex **www.turckbanner.co.uk**
USA	Turck Inc. 3000 Campus Drive, USA-MN 55441 Minneapolis **www.turck.us**

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