Configuration and Diagnostics of a PROFINET IO System

PROFINET IO Configuration Example

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Table of Contents

1 Application Description

1.1 Overview of the automation task

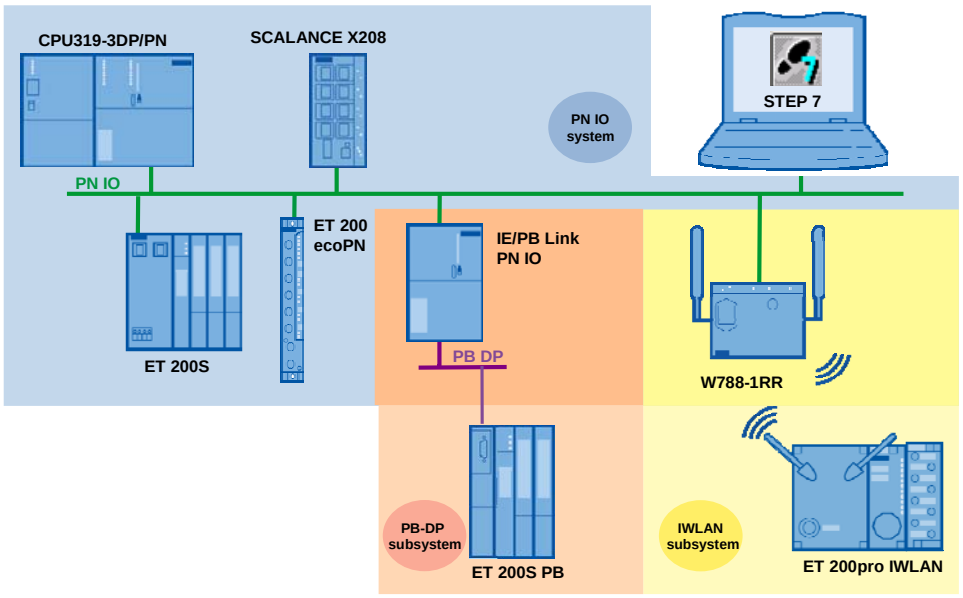
The objective of this application is to describe the configuration and diagnostic capabilities of a PROFINET IO system. In addition, this document describes the integration of a PROFIBUS line and a wireless subsystem into a PROFINET IO system.

1.2 Overview of the automation solution

Diagrammatic representation

The following figure schematically shows the most important components of the solution:

Figure 1-1



Configuration

In this case, the PROFINET IO controller is a CPU 319-3PN/DP. As PROFINET IO devices, the following components are connected to the PN IO system using Ethernet cables:

- ET 200S with IM 151-3 PN
- ET 200ecoPN
- IE/PB Link PN IO
- W788-1RR

These components are connected to the SCALANCE X208 Ethernet switch in a star configuration.

Since the IE/PB Link is used as a gateway between PROFINET IO and PROFIBUS, PROFIBUS DP slaves can also be connected via this module. This module is an ET 200S with IM 151-1 Standard.

An ET 200pro IWLAN is additionally connected to the W788-1 RR wireless access point as a PN IO device.

A PG/PC with Ethernet interface is used as a configuration and programming unit.

Main contents

The following topics are discussed in this application:

1. Configuration of the PROFINET IO system as shown in figure 1-1
2. Fast Start-Up function
3. STEP 7 diagnostic functions (incl. Topology Editor)
4. Web server diagnostic functions

Advantages of this solution

The configuration presented here shows you the advantages currently offered by PROFINET:

- Easy and inexpensive connection of a PROFIBUS line to PROFINET IO
- Increased plant availability due to improved diagnostics
- Integration of a wireless subsystem
- Reliable, flexible, expandable, modular solution that is easy to maintain

1.3 Hardware and software components used

The application was created using the following components:

Hardware components

Table 1-1

Component	No.	MLFB/order number	Note
S7-300 mounting rail	1	6ES7 390-1AE800AA0	
PS307 5A power supply	2	6ES7 307-1EA00-0AA0	
CPU 319-3PN/DP	1	6ES7 318-3EL00-0AB0	V2.8 and higher
64 kB Micro Memory Card (or larger)	1	6ES7 953-8LF20-0AA0	
ET 200eco PN	1	6ES7 142-6BF00-0AB0	8 D0, V6.0 and higher
SCALANCE X208	1	6GK5 208-0BA10-2AA3	
IE/PB Link PN IO	1	6GK1 411-5AB00	
SCALANCE W 788-1 RR	1	6GK5 788-1AA60-6AA0	
ET 200S:			
IM 151-3PN interface module	1	6ES7 151-3AA23-0AB0	V6.0 and higher
PM-E 24 V DC power module	1	6ES7 138-4CA01-0AA0	
Digital input module for ET200S 4 DI 24 V DC	1	6ES7 131-4BD01-0AA0	
Digital output module for ET200S/ 4 DO 24 V DC/0.5 A	1	6ES7 132-4BD02-0AA0	
Terminal module for power modules	1	6ES7 193-4CD30-0AA0	
Terminal module for electronic modules	2	6ES7 193-4CB20-0AA0	
ET 200pro IWLAN:			
Module carrier, narrow for ET 200PRO, LENGTH: 500 MM		6ES7 194-4GA00-0AA0	
IM 154-6 PN HF IWLAN interface module	1	6ES7 154-6AB00-0AB0	
EM 142, 8 DO 24V electronic module	1	6ES7 142-4BF00-0AA0	
Connection module for digital electronic modules	1	6ES7 194-4CB00-0AA0	

1.3 Hardware and software components used

Component	No.	MLFB/order number	Note
ET200S PROFIBUS:			
IM 151-1 Standard interface module	1	6ES7 151-1AA04-0AA0	
PM-E 24 V DC power module	1	6ES7 138-4CA01-0AA0	
Digital input module for ET200S 2 DO 24 V DC/0.5 A	1	6ES7 132-4BB00-0AA0	
Terminal modules for power modules	1	6ES7 193-4CD20-0AA0	
Terminal modules for electronic modules	1	6ES7 193-4CA30-0AA0	
Cables:			
IE FC M12 Plug PRO	1	6GK1 901-0DB20-6AA0	
IE FC RJ45 PLUG	9	6GK1 901-1BB10-2AA0	
IE FC TP STANDARD CABLE		6XV1 840-2AH10	Sold by the meter
IE FC stripping tool	1	6GK1 901-1GA00	
PROFIBUS connecting cable terminated 1.5 m	1	6XV1830-1CH15	
Power Plug Pro	1	6GK1 907-0AB10-6AA0	
IE Power M12 Cable Connector pro	1	6GK1907-0DC10-6AA3	

Standard software components

Table 1-2

Component	No.	MLFB/order number	Note
STEP 7 V5.4 SP5	1	6ES7 810-4CC08-0YA5	Or higher version

2 PROFINET Basics

2.1 General overview

Like the PROFIBUS field bus, PROFINET technology is standardized and developed by the PROFIBUS user organization.

PROFINET differentiates between two applications:

- PROFINET CBA (**C**omponent **B**ased **A**utomation)
  this version – which was developed first – defines the cross-vendor communication of intelligent automation components and plant parts at the control level. Instead of programming the communication between controllers, it is configured using the SIMATIC iMAP interconnection editor.
- PROFINET IO
  defines the connection of distributed field devices to central controllers via Ethernet and the cyclic transmission of I/O data.

One of the main challenges for the development of PROFINET was to use Ethernet and other proven IT technologies in all fields of automation.

Since its introduction, the PROFINET standard has managed to advance to the field bus level based on Ethernet, also enabling the transparent integration of existing field bus systems – for example, PROFIBUS. The essential advantages include:

- Integrated communication is achieved and interfaces are reduced
- Engineering is simplified
- Diagnostics are simplified
- Use of the existing know-how and protection of investments that have already been made

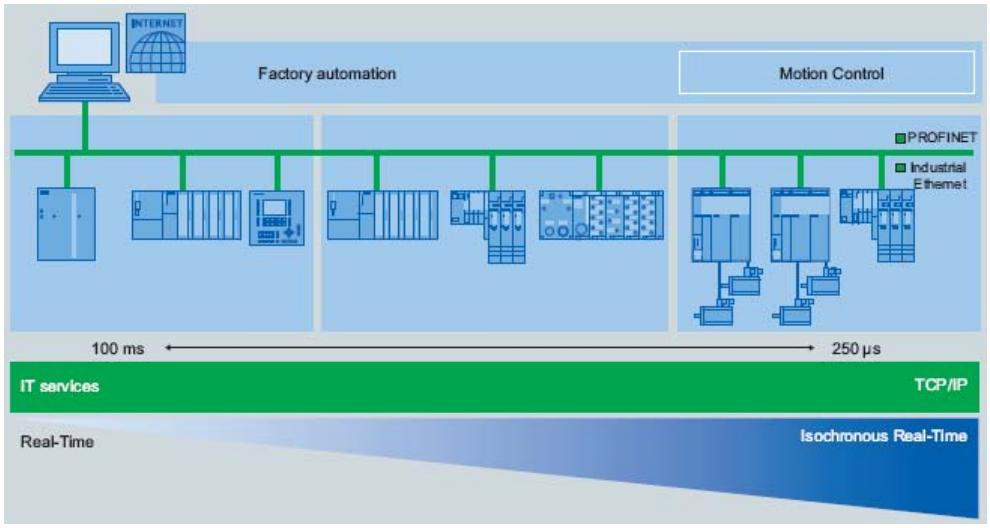
Due to these advantages, the IT world and the automation world grow closer together.

2.2 PROFINET real-time communication

Communication is scalable and three performance levels with different response times are available:

- **TCP/IP (100 ms):** For open TCP communication (e.g., for the transmission of non-time-critical data: Parameterization, diagnostics)
- **RT (10 ms):** Real-time communication for time-critical data (for example, in factory automation: Cyclic data, event-controlled messages, alarms)
- **IRT (1 ms):** Isochronous real-time for sophisticated applications (e.g., in motion control)

Figure 2-2



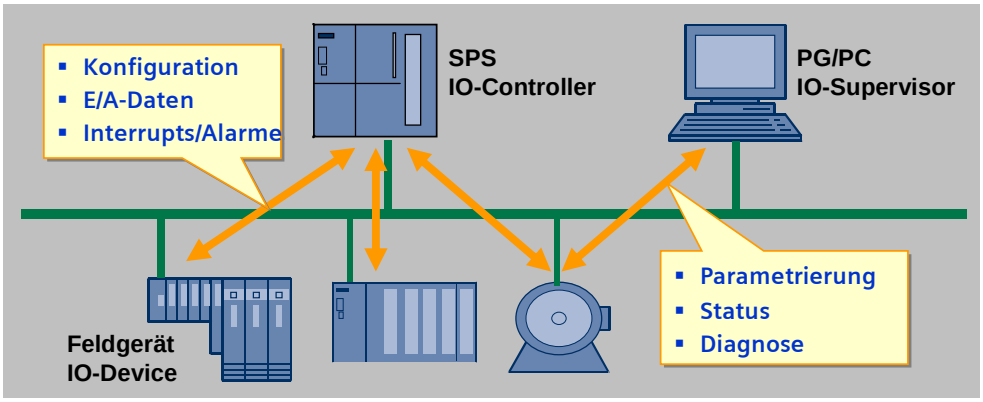
2.3 Functional model

The functional model for PROFINET IO resembles the PROFIBUS DP model, but the master-slave method was converted into a provider-consumer model since all nodes have equal rights when using Ethernet. The devices of PROFINET IO are referred to as IO controller and IO device or IO supervisor.

Table 2-3

Device type	Description
IO controller	Master for the input/output data of the field devices. Represents the communications interface of a controller. Corresponds to DP Master Class 1.
IO device	Distributed field device.
IO supervisor	Name for an engineering and diagnostic station. Corresponds to DP Master Class 2.

Figure 2-3



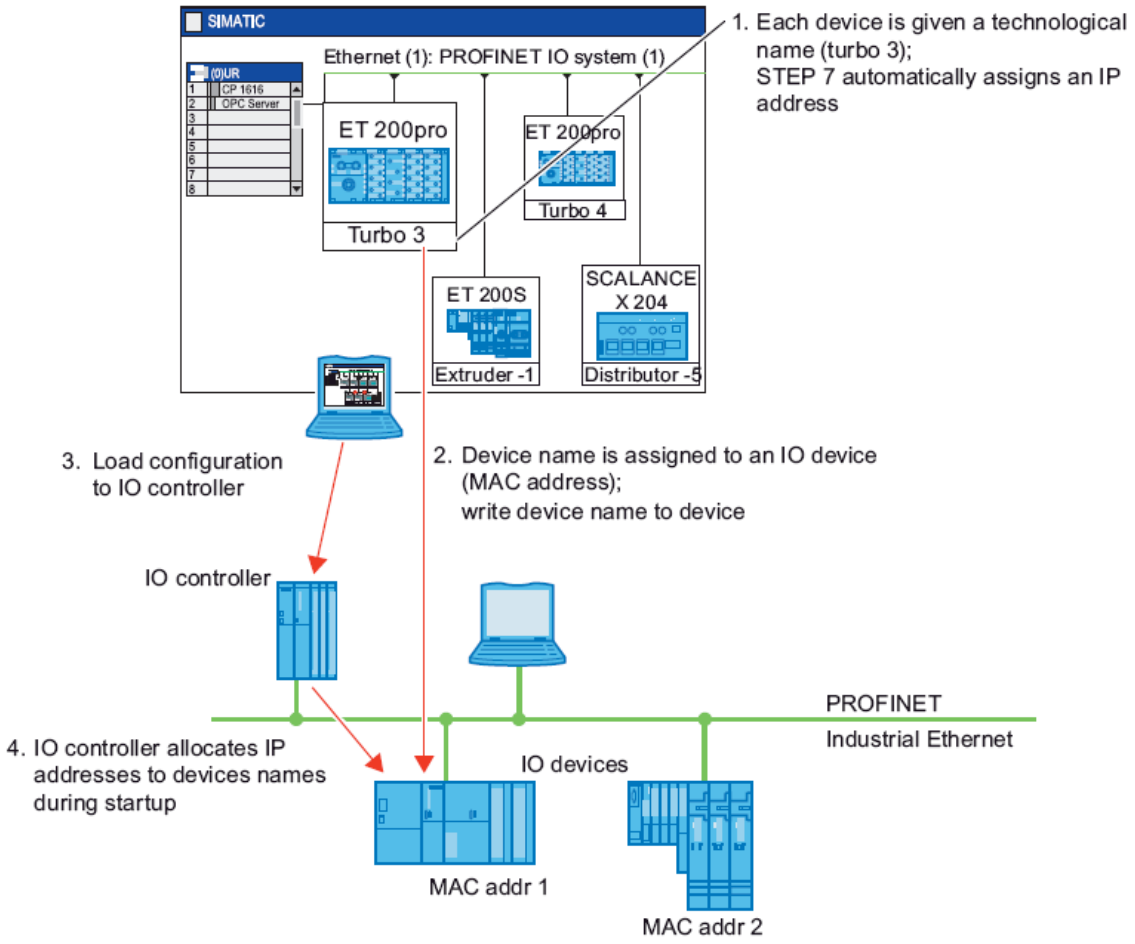
Existing field bus systems can be easily integrated into PROFINET. This is realized using a proxy; this proxy is either integrated in a PROFINET device or it is an independent device (e.g., SIMATIC NET IE PB Link PN IO).

2.4 Configuration

Plant engineering requires the device-specific system data (GSD-XML files) of the used field devices (analogously to PROFIBUS DP). It is imported to the configuration tool (e.g., STEP7), which, based on the network data, creates an address list for the IO controller. The planner assigns a unique logical name to each field device. The actual name assignment in the device is performed by the DCP (Discovery and Control Protocol) integrated in each IO device.
To ensure that each device is detected as a node on the Ethernet, an IP address has to be assigned to each device. The IP addresses are generated by the configuration tool and downloaded to the IO controller as the configuration. During system startup, the controller assigns these configured IP addresses to the configured field devices.

This is demonstrated by the schematic diagram below.

Figure 2-4



2.5 Diagnostics

PROFINET offers a powerful integrated diagnostic concept that comprises all devices configured in PROFINET (including the network components that are PROFINET devices, for example SCALANCE X208).

Device diagnostics are divided into three levels:

- Error on the device: Failure of a station
- Error on the slot: Defect of an individual module
- Channel error: For example, wire break

If an error occurs, the relevant IO device generates a diagnostic interrupt that is reported to the controller. The user is responsible for its evaluation.
This diagnostic information can be read out and evaluated by a programming unit in the following diagnostics views:

- STEP 7 Basis diagnostics
- Diagnostics with the Topology Editor
- Diagnostics using the Web server of the PROFINET IO controller

3 Installation

3.1 Installing the hardware

For the hardware components, please refer to chapter 1.3. For the hardware configuration, please follow the instructions listed in the following table:

Attention

Do not switch on the power supply until after the last step.

Table 3-4

No.	Focus	Action
1.	CPU 319-3 PN/DP	Insert the MMC into the MMC slot of the CPU 319-3 PN/DP.
2.	S7-300 mounting rail	Mount the following devices on the S7-300 mounting rail: • PS • CPU 319-3 PN/DP • IE/PB Link PN IO • SCALANCE W 788-1RR
3.	ET 200S (IM 151-3 PN)	As described in guide /3/, assemble the following modules in the following order: 1. IM151-3 PN interface module 2. Terminal module for power modules 3. 2 x terminal modules for electronic modules 4. Terminating module Insert the following modules into the now available terminal modules in the same order: 1. PM-E 24 V DC 2. DI 24 V DC ST 3. DO 24 V/0.5 A ST
4.	ET 200S (IM 151-1)	As described in guide /3/, assemble the following modules in the following order: 1. IM151-1 interface module 2. Terminal module for power modules 3. Terminal module for electronic modules 4. Terminating module Insert the following modules into the now available terminal modules in the same order: 1. PM-E 24 V DC 2. DO 24 V/0.5 A ST
5.	35 mm standard mounting rail	Mount the following devices on the 35 mm standard mounting rail: • SCALANCE X208 • ET 200S (IM 151-3 PN) • ET 200S (IM 151-1)

Figure 3-5

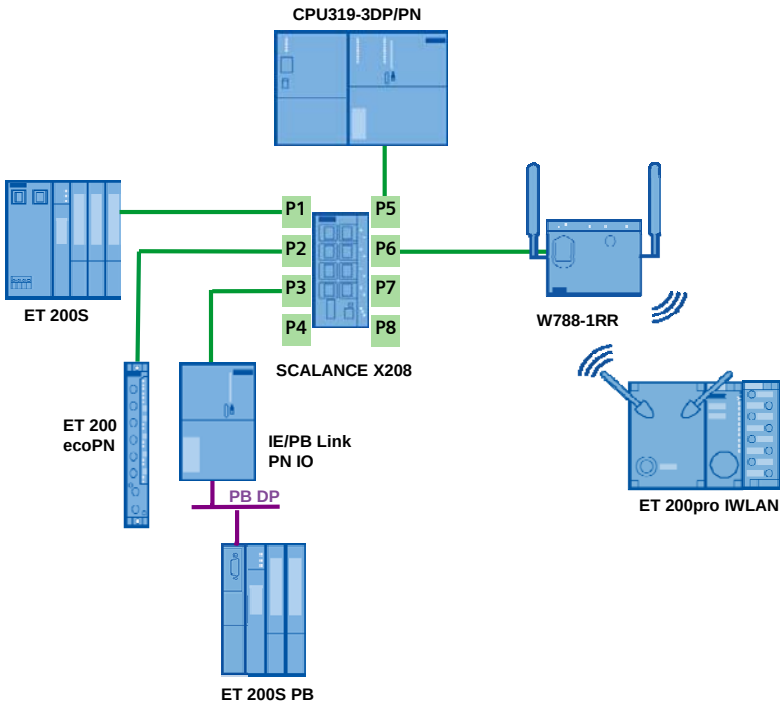


Table 3-5

No.	Focus	Action
1.	Power cables	As described in guides /4/, /5/, /6/, prepare the power cables for the following devices. • ET 200eco PN • ET 200pro IWLAN • SCALANCE W 788-1RR
2.	Ethernet & PROFIBUS cables	Prepare the Ethernet and PROFIBUS cables as described in the guide.
3.	Industrial Ethernet cabling	Cable the system as follows: Connect the devices to the SCALANCE X208 Ethernet switch as shown in figure 3-5.
4.	PROFIBUS cabling	Connect the ET 200S IM 151-1 to the IE/PB LINK PN IO via PROFIBUS.
5.	Electrical connections	• Connect the output signals to the inputs of the ET 200S. • Connect several output signals to the inputs of the electronic block of the ET 200S COMPACT. • Supply all necessary voltage points with 24 V voltage from the PS.

Note The installation guidelines for Industrial Ethernet networks, ET200 and S7-300 must always be observed.

3.2 Installing the software

The table below contains the necessary standard software packages and the advisable or necessary extensions for STEP7.

Table 3-6

No.	Standard software	Comment / link
1.	STEP 7 V 5.4 + SP 5	To configure the S7-300 station and program the user program.
2.	HW update / HSP	Install the most current HW updates online or via the HSP on the Internet. See \1\.
3.	GSD XML files	Install the current GSD / XML files as described in manual /7/: ET 200S if required, see \2\. SCALANCE (necessary for this document) , see \3\.

Configuration of a PROFINET IO System

4

This chapter describes the configuration of the complete PROFINET IO system. For this purpose, a new project is created, the hardware of an S7-300 (PN IO controller) is configured and the PN IO devices are connected to PROFINET.

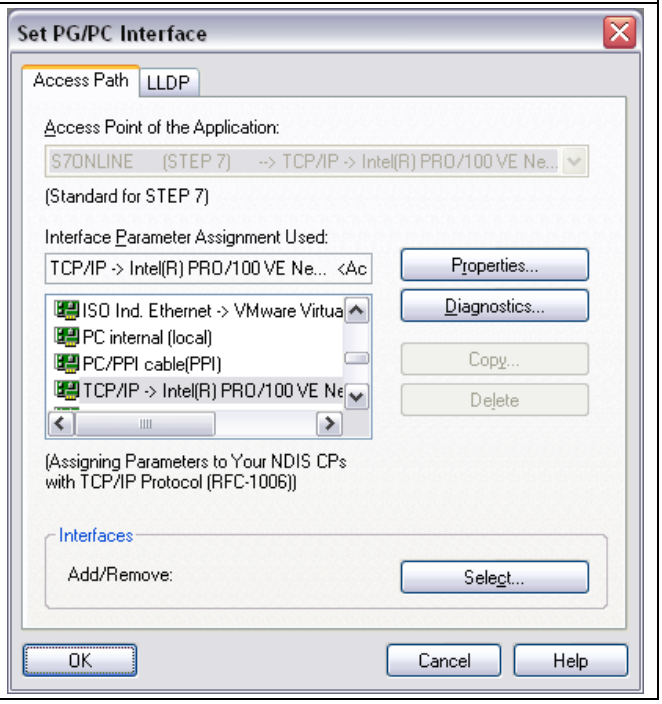
Table 4-7

Device	Chapter	Comment
S7-300	4.3	
SCALANCE X208	4.4	
ET 200S	4.5	
ET 200eco PN	4.6	
IE/PB Link PN IO	4.7	
ET 200S PROFIBUS	4.8	The ET 200S PB is connected to PROFINET IO via the IE/PB Link PN IO.
ET 200pro IWLAN / SCALANCE W	4.9	The ET 200pro IWLAN is connected to PROFINET IO via the SCALANCE W IWLAN Access Point.
IWLAN configuration	4.12	This chapter describes the configuration for the wireless connection of the IWLAN devices.

4.1 Setting the PG/PC interface

The following section describes the basic settings of the PG/PC interface. The “Set PG/PC Interface” dialog box can be accessed within STEP7 and via the menu tree.

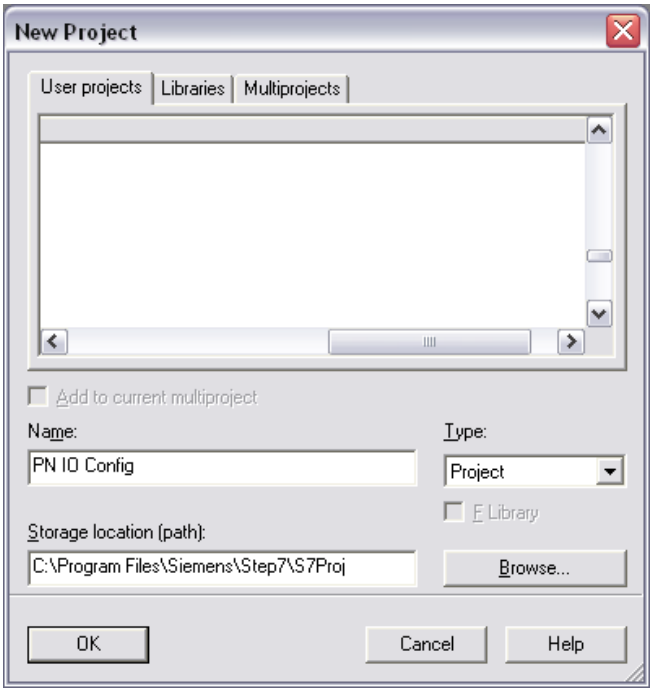
Table 4-8

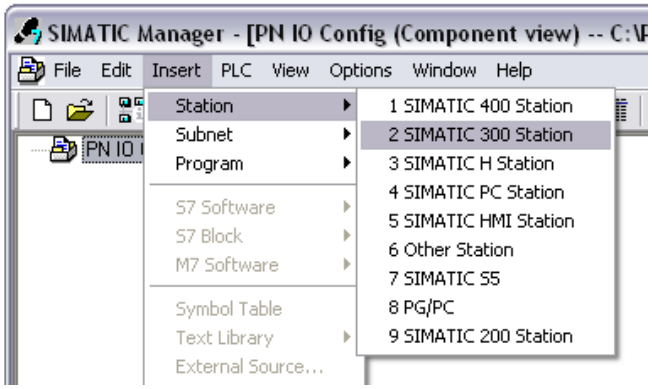
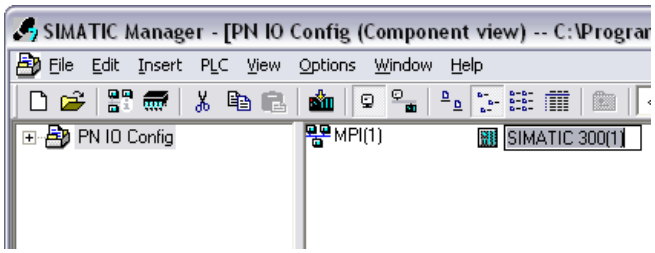
No.	Action	Comment
1.	Open the **SIMATIC Manager** by selecting **`Start-> SIMATIC-> SIMATIC Manager.`**	
2.	Open the window with the PG/PC-interface settings by selecting **`Options`** -> **`Set PG/PC Interface`** Select the network card you are using. Confirm the setting with **OK**.	

4.2 Creating a new project

This section describes the creation of a new project within STEP7.

Table 4-9

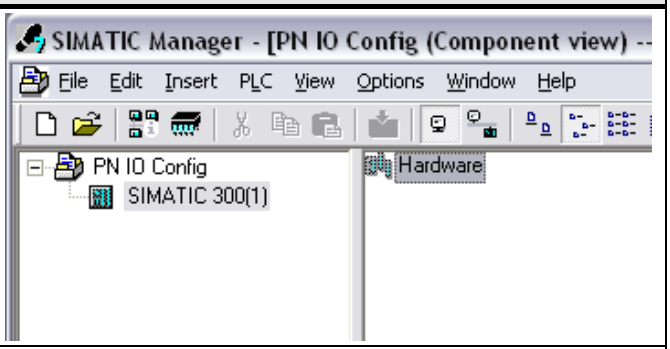
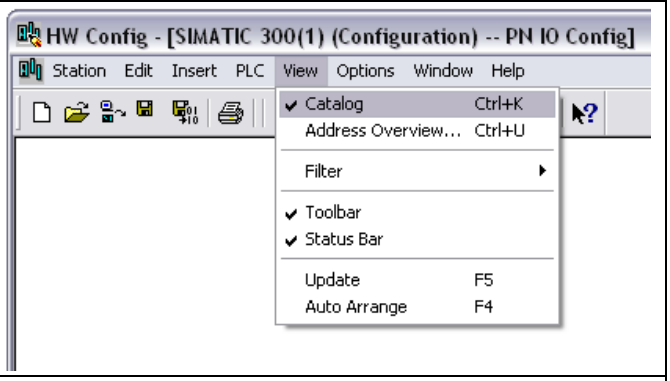
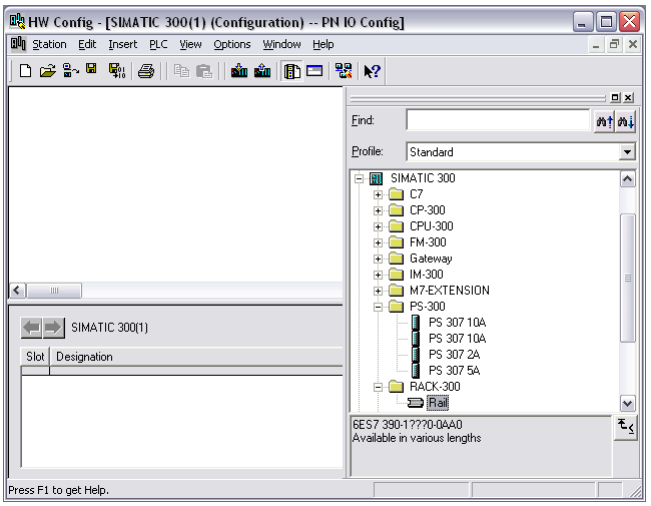
No.	Action	Comment
3.	In the **SIMATIC Manager**, create a new project by selecting **`File -> New`**.	
4.	Enter a name for the project and confirm it by clicking on **OK**.	

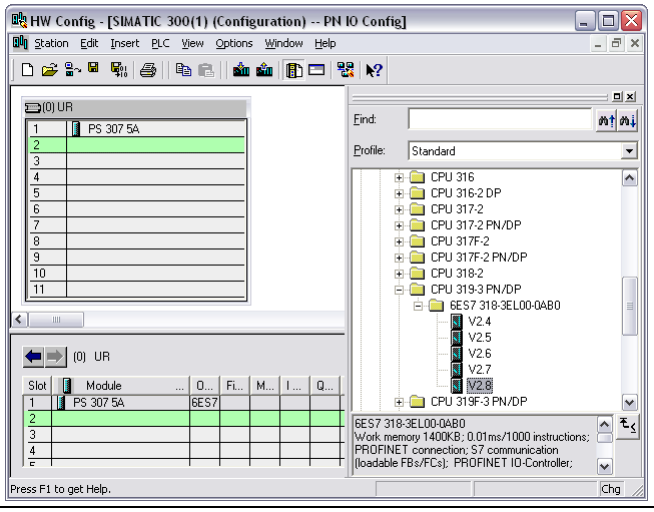
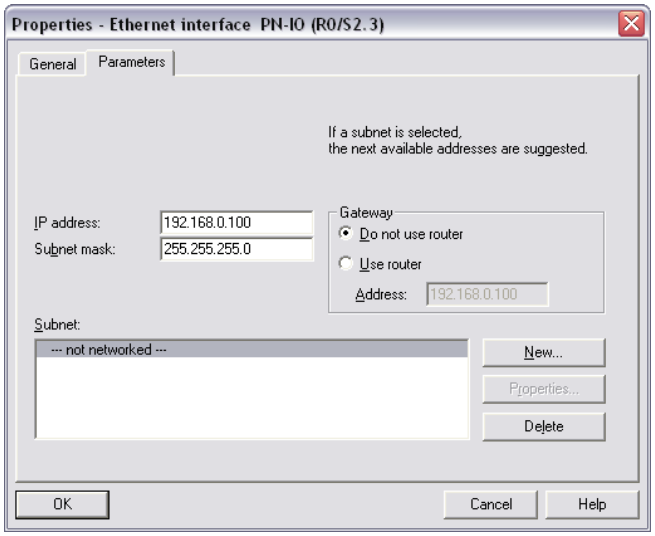
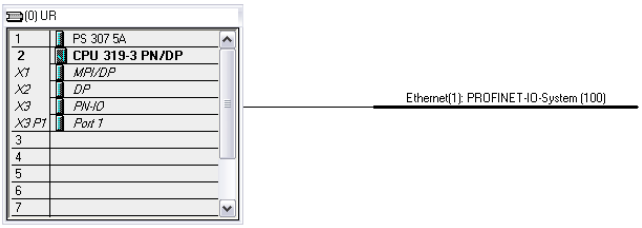
No.	Action	Comment
5.	Insert a new station by selecting **`Insert -> Station -> SIMATIC 300 Station`**.	
6.	Inserting the S7-300 station has now been completed.	

4.3 Hardware configuration of an S7-300 station

The following step sequence describes the procedure for configuring an S7-300 station with a CPU 319-3 PN/DP for a PROFINET IO connection.

Table 4-10

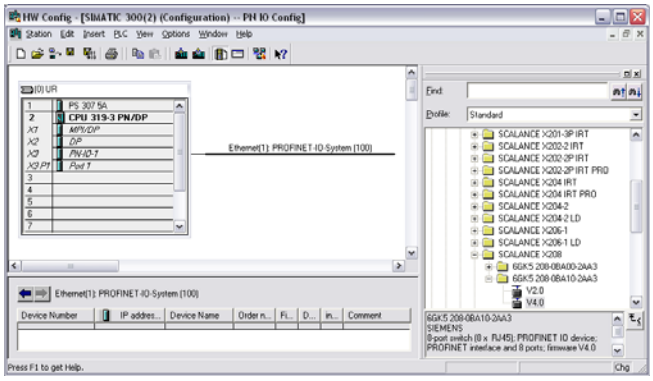
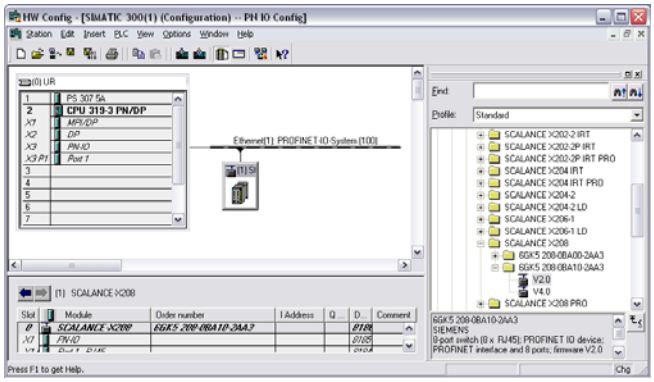
No.	Action	Comment
1.	Open **HW Config** by double-clicking on the **SIMATIC 300** station and then on **Hardware**.	
2.	You can use the hardware catalog to insert your hardware components. If no catalog is displayed, activate it using the **`View -> Catalog`** menu command.	
3.	In the hardware catalog, first navigate via **`SIMATIC 300 -> RACK-300-> Rail`**. Now use drag & drop to move the mounting rail to the top left part of the HW Config window. Subsequently, go to **`PS-300`** and insert the **power supply** you are using into slot 1 of the mounting rail. **Note:** Inserting the power supply into the hardware configuration is optional.	

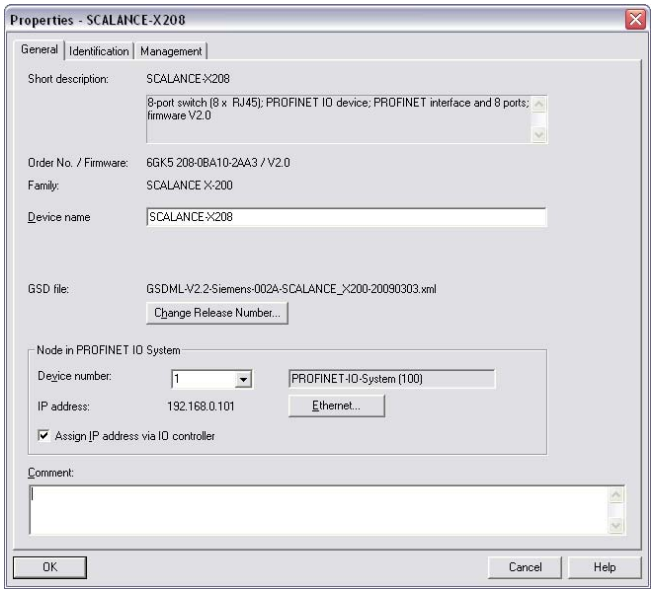
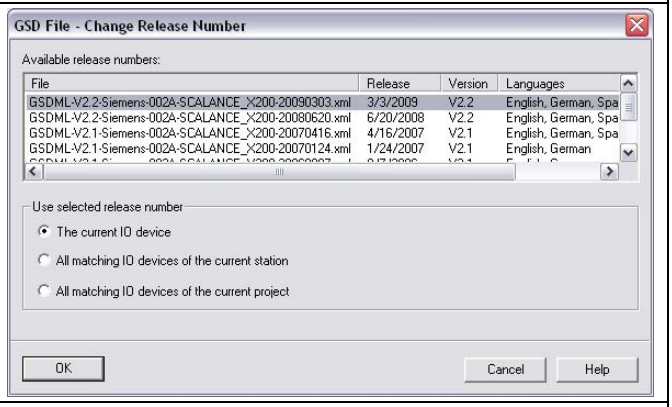
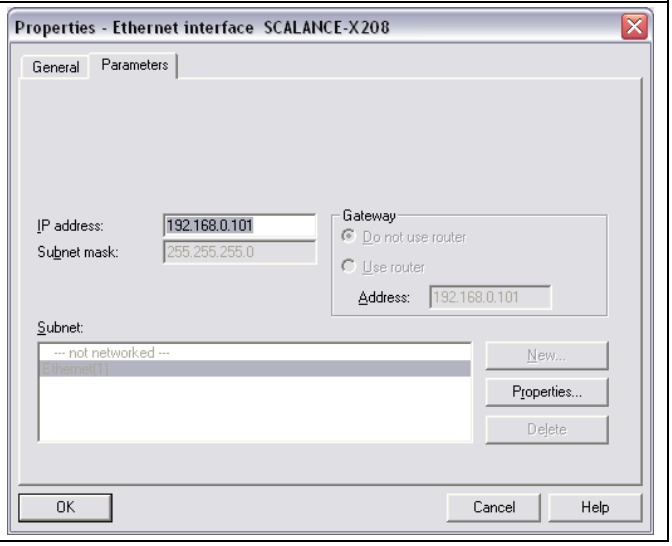
No.	Action	Comment
4.	Now navigate to **CPU-300** and to **CPU 319-3 PN/DP**. Use drag & drop to move the module with version 2.8 (**V 2.8**) to slot 2. **Note:** Please make sure that the order numbers of the modules match!	
5.	The window with the Ethernet properties of the CPU opens. Enter the desired IP address and click on **New** to create a new Industrial Ethernet subnet. Use the suggested entries and confirm all windows with **OK**.	
6.	The CPU has been inserted into the S7 controller with PROFINET IO network.	

4.4 Integrating the SCALANCE X208 into the PROFINET IO system

An advantage of the PROFINET architecture is that PROFINET-capable network infrastructures, such as the SCALANCE X200 switches, can be integrated into PROFINET IO diagnostics.
In the following table, a SCALANCE X208 is inserted as a PROFINET IO device. This function is optional.

Table 4-11

No.	Action	Comment
1.	In the hardware catalog, navigate to **`PROFINET IO -> Network Components -> SCALANCE X-200 -> SCALANCE X208`** Select order number and version of your switch.	
2.	Use drag & drop to move it to the PROFINET **network**.	

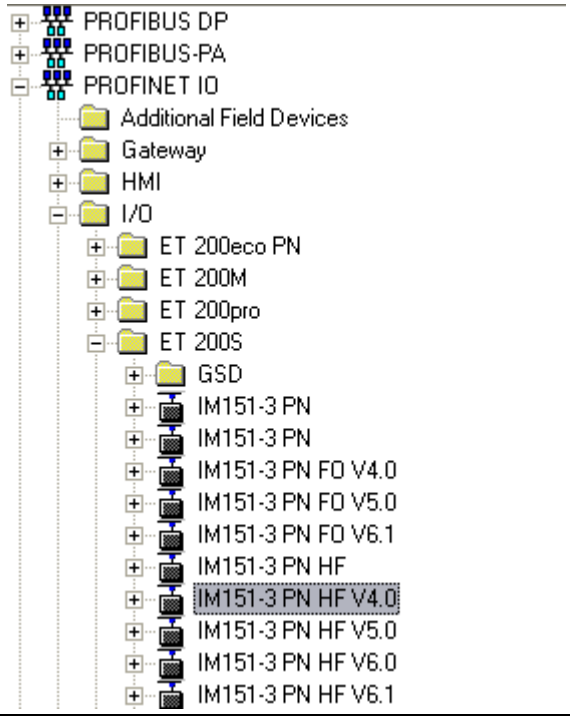
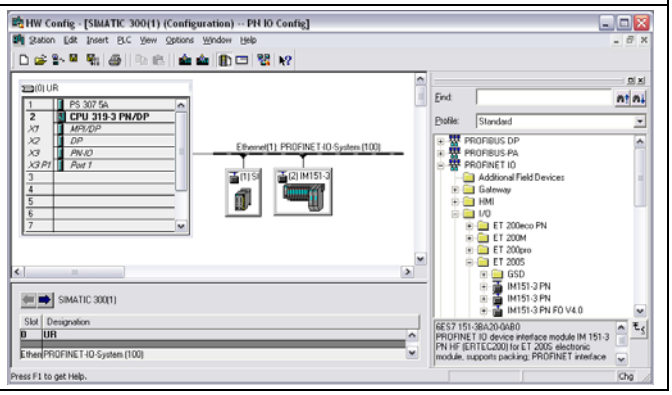
No.	Action	Comment
3.	Double-click on the module to open the Properties dialog box of the module. In this dialog box, you can enter • the device name, • the **GSD XML** file to be used and • the **IP address** to be assigned.	
4.	To change the device name, enter the new name in **Device Name**.	
5.	Use the **Change Release Number…** button to select the **GSD XML file** to be used by the system. It is recommended that the most current version be used. Close the window with **OK**.	
6.	Use the **Ethernet…** button to enter the IP address of the SCALANCE X208. The system specifies a **free IP address** in the STEP7 project, it can be adjusted as desired. The address is dynamically assigned during startup of the controller. Close the dialog boxes with **0K**.	

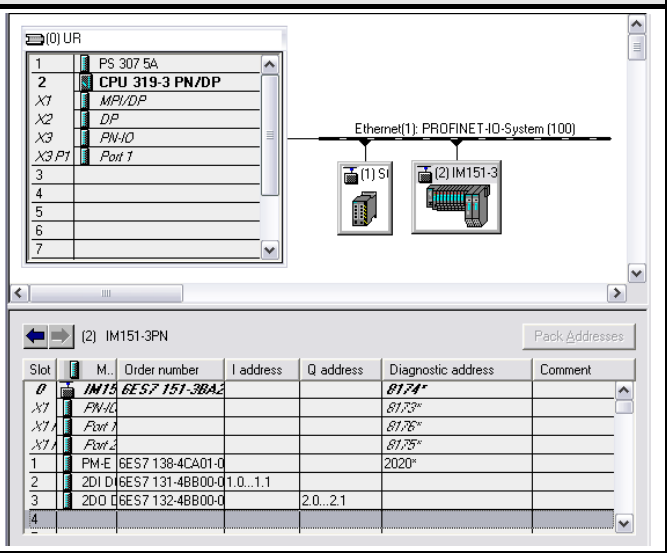
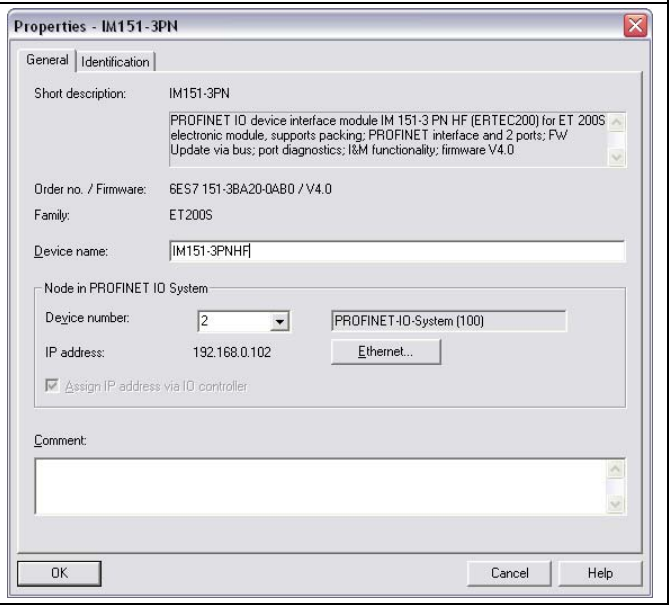
4.5 Hardware configuration of an ET 200S

Like PROFIBUS DP slaves, PROFINET IO devices are assigned to the network and thus to the controller in the hardware configuration.

This section describes the configuration of an ET 200S PN within a PROFINET IO network.

Table 4-12

No.	Action	Comment
1.	From the hardware catalog, select the IM151-3 PN module with the order number from the catalog via **PROFINET IO -> I/O -> ET 200S**.	
2.	Use drag & drop to insert this head module into the PROFINET line.	

No.	Action	Comment
3.	Click on your IM and from the submenu in the tree insert the ET 200S modules you are using into the respective slots. See also chapter 1.3 of this document.	
4.	Double-click on the IM 151-3 station to open the Properties window of the head module. In this window, you can adjust the IP address or the **device name**. The device name **IM151-3PNHF** is used here. Confirm with OK.	

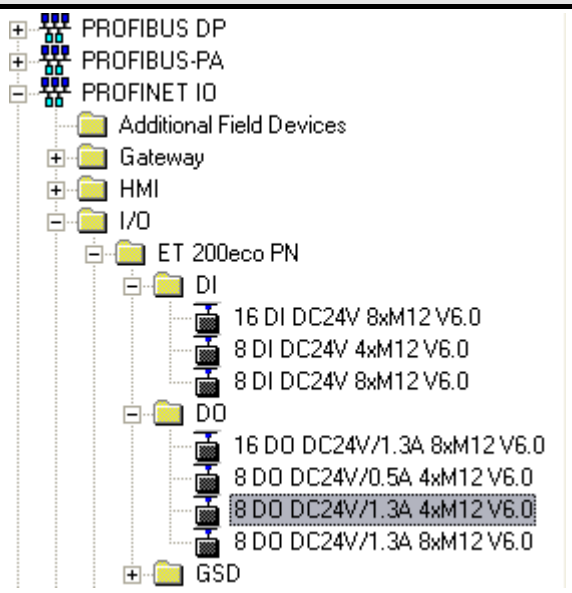
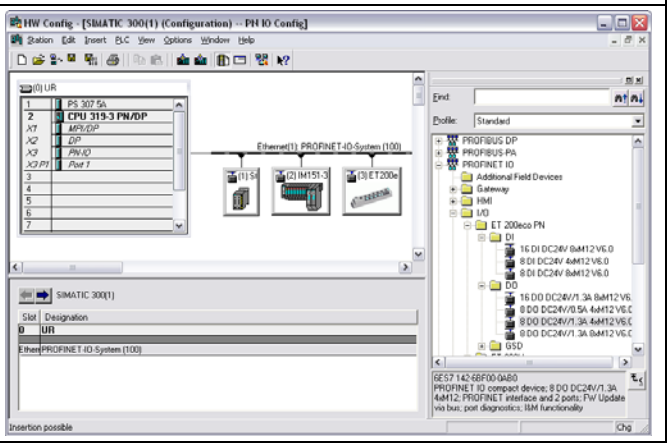
Attention

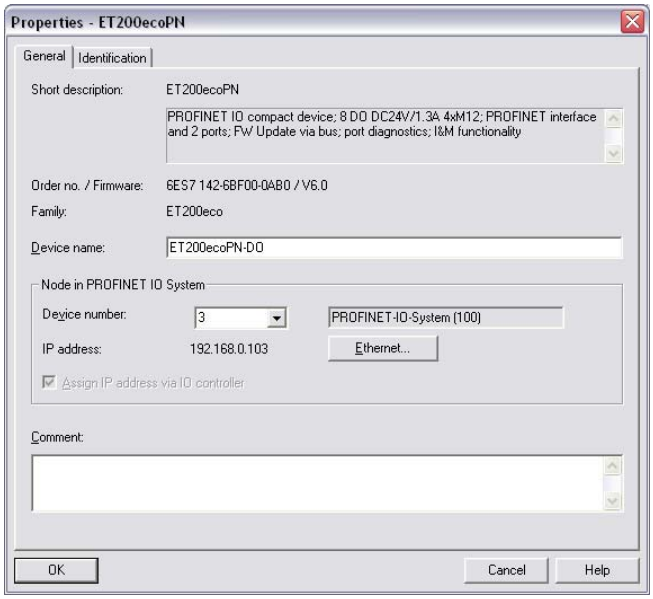
Each device name, both the controller and the device, must be unique network-wide! Two devices must not use the same device name.

4.6 Connecting the ET 200eco PN to PROFINET IO

The procedure for connecting the ET 200eco PN to PROFINET IO is the same as for the ET 200S PN station.

Table 4-13

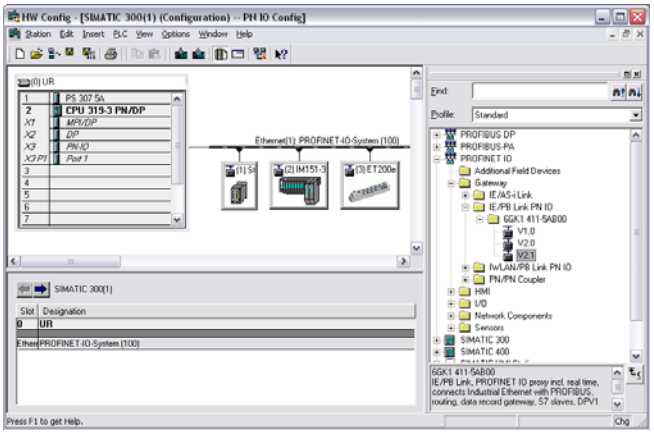
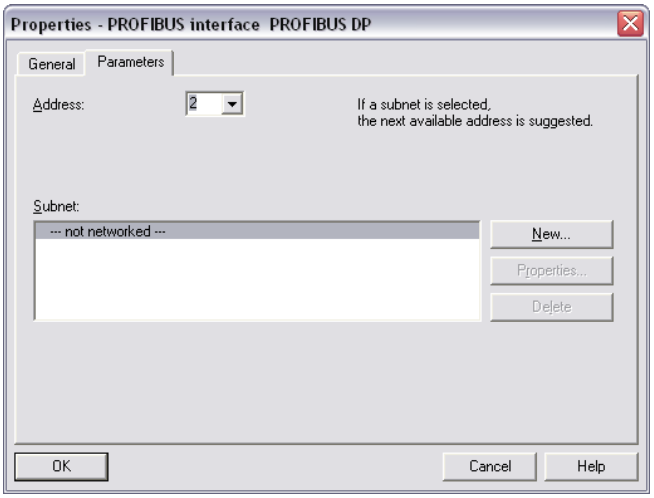
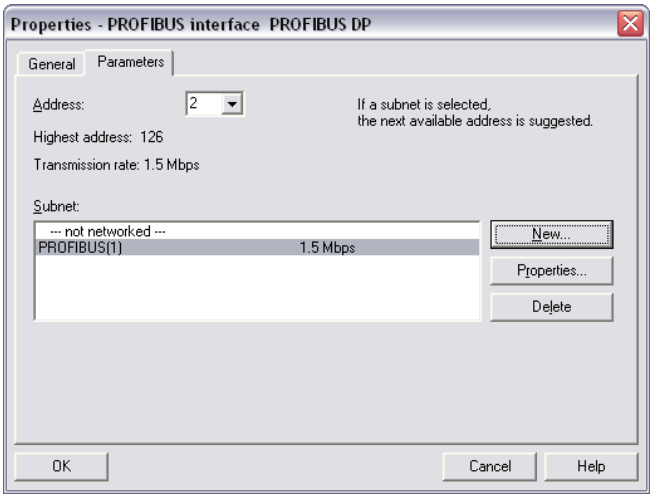
No.	Action	Comment
1.	From the hardware catalog in **PROFINET IO -> I/O -> ET 200eco PN**, select the module with the order number.	
2.	Use drag & drop to insert this module into the PROFINET line.	

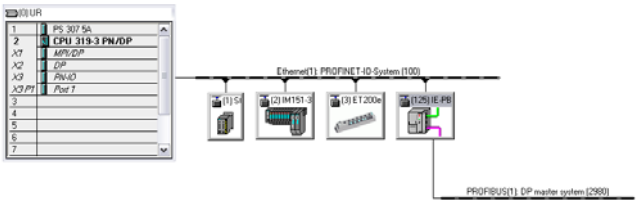
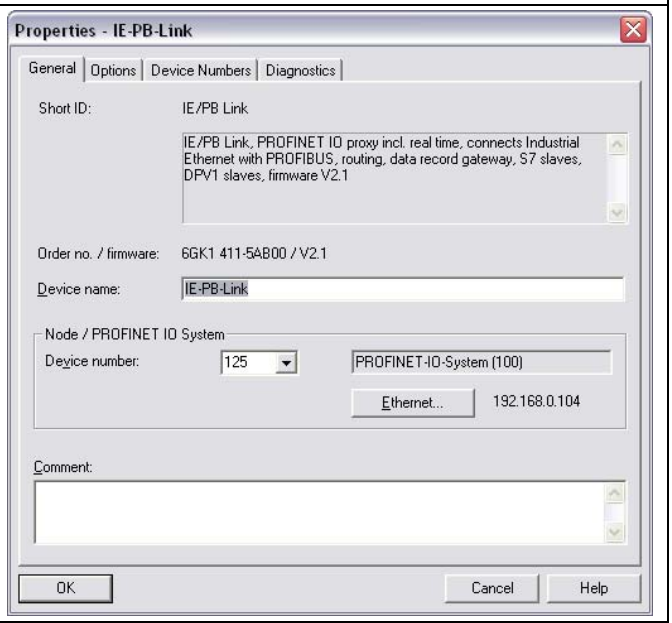
No.	Action	Comment
3.	Double-click on the module to open the Properties window. In this window, you can adjust the IP address or the **`Device name`**. The device name **ET200ecoPN-DO** is used here.	

4.7 Connecting the IE/PB Link PN IO to PROFINET IO

The connection of existing PROFIBUS components, here PROFIBUS DP slaves, to a PROFINET network requires links with proxy functionality. The IE/PB Link PN IO is such a link. The following steps are necessary to connect the link to the PROFINET IO system.

Table 4-14

No.	Action	Comment
1.	In the hardware catalog, navigate to **`PROFINET IO -> Gateway -> IE/PB Link PN IO -> 6GK1 411-5AB00`** Select version 2.1 (**`V 2.1`**) and use drag & drop to move it to the PROFINET network.	
2.	The Properties window of the PROFIBUS interface opens. Select a **PROFIBUS** address for the link.	
3.	Use the **New** button to create a new PROFIBUS subnet according to your desired parameters. By default, a transmission rate of 1.5 Mbps and the DP bus profile are used. Close all windows with **OK**.	

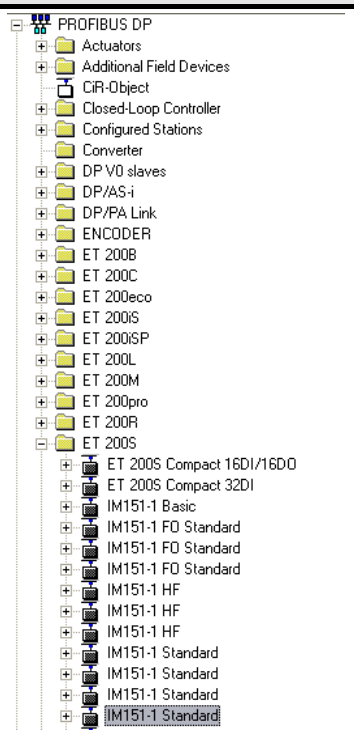
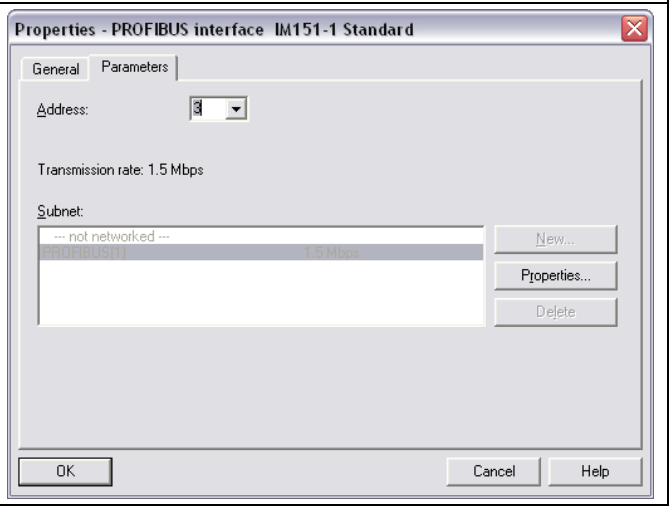
No.	Action	Comment
4.	The IE/PB Link PN IO is displayed on PROFINET. In addition, a PROFIBUS network has been created.	
5.	By double-clicking on the module, you can set the device name and the IP address.	

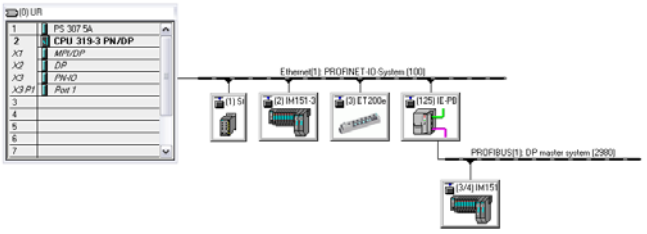
4.8 Connecting the ET 200S to the PROFIBUS DP network

The available IE/PB Link PN IO allows to connect PROFIBUS I/O to a PROFINET network. To show this process, an ET 200S will be connected to a PROFIBUS line of the IE/PB Link PN IO in the following steps.

Note Please observe the address setting on the respective DP slave. The configured address must match the address on the DIP switch of the module.

Table 4-15

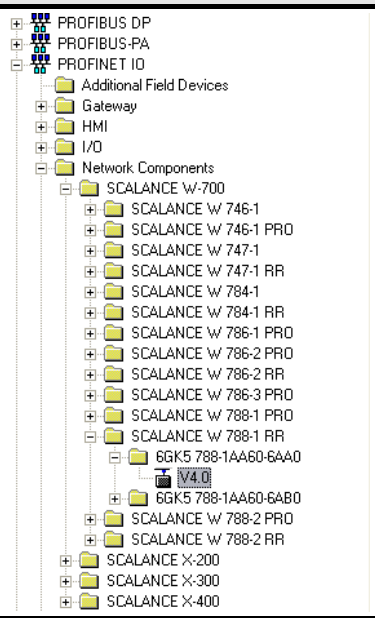
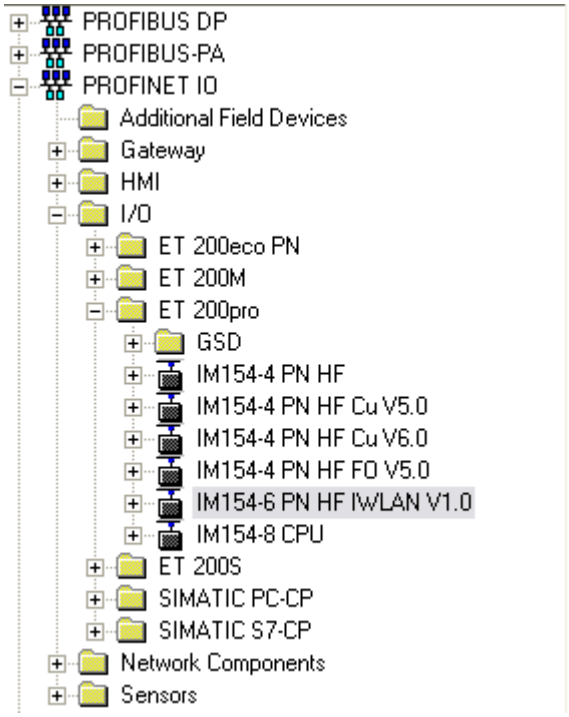
No.	Action	Comment
6.	In the hardware catalog, navigate to **`PROFIBUS DP -> ET 200S -> IM 151-1 Standard`** Select the head module (ensure that the order number is correct) and use drag & drop to move it to the **PROFIBUS DP Master** network.	
7.	After inserting the module into PROFIBUS, the Properties window of the IM 151-1 Standard opens and the **PROFIBUS address** can be selected. The system automatically suggests a free address.	

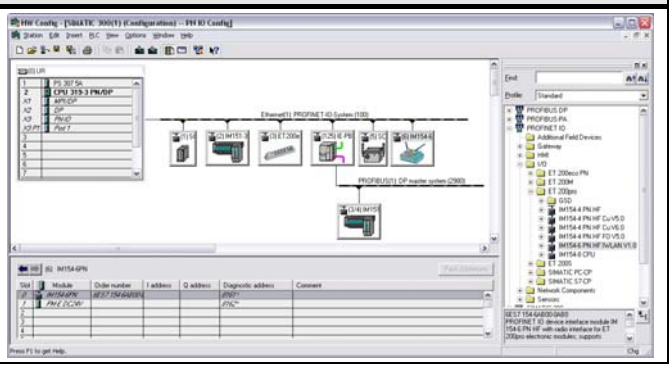
No.	Action	Comment
8.	After exiting the dialog box with OK, the DP slave is displayed in the configuration. Further modules can be added to the slave, please refer to the hardware catalog for the selection of possible modules.	

4.9 Connecting IWLAN components to PROFINET IO

A WLAN access point is necessary to connect the ET 200pro IWLAN to PROFINET.

Table 4-16

No.	Action	Comment
1.	In the hardware catalog, navigate to **PROFINET IO -> Network Components -> SCALANCE W** Select your access point and use drag & drop to move it to the PROFINET network.	
2.	In the hardware catalog, navigate to **PROFINET IO -> I/O -> ET 200pro -> IM154-6 PN HF IWLAN** Use drag & drop to move the head module to the PROFINET network. Use drag & drop to move your power and I/O modules to the hardware configuration of the ET 200pro IWLAN.	

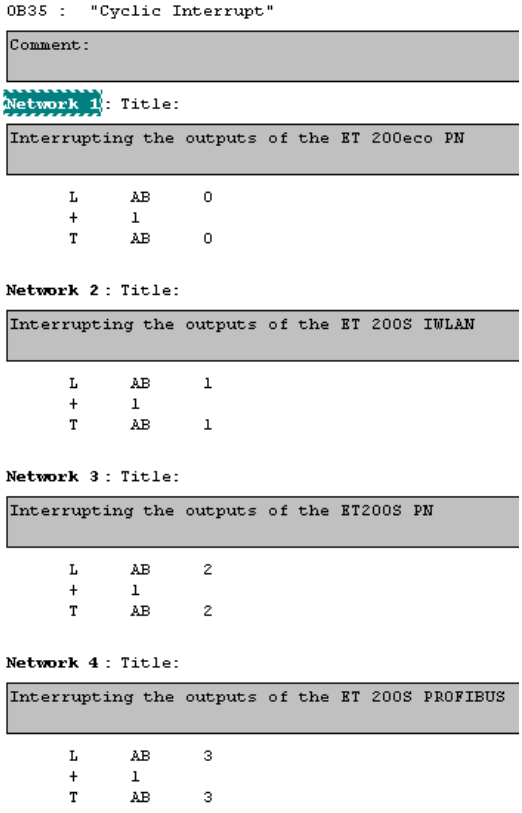
No.	Action	Comment
3.	The hardware configuration of the PROFINET IO system is now complete.	

4.10 Creating the user program

The following user program exemplifies the easy access to the configured I/O modules in bit, byte, word and double word format.

The blocks are additionally used for module failure diagnostics by PROFINET IO controller/devices and PROFIBUS DP master/slaves.

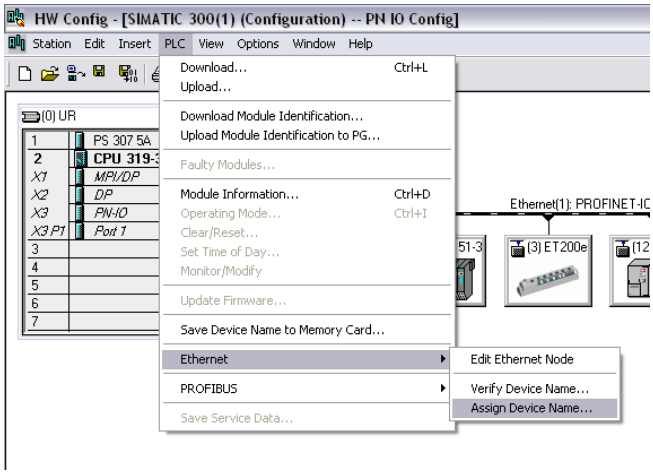
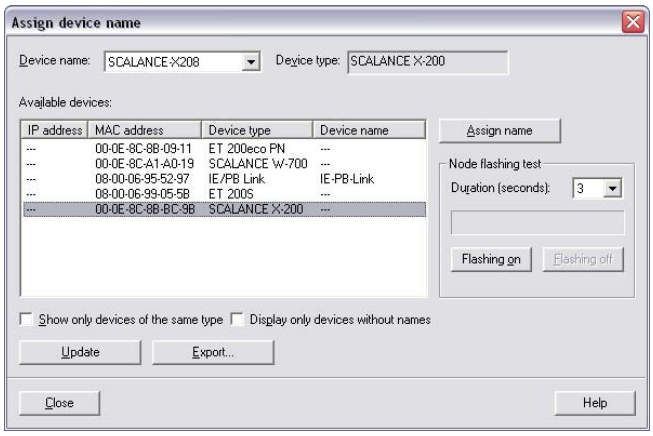
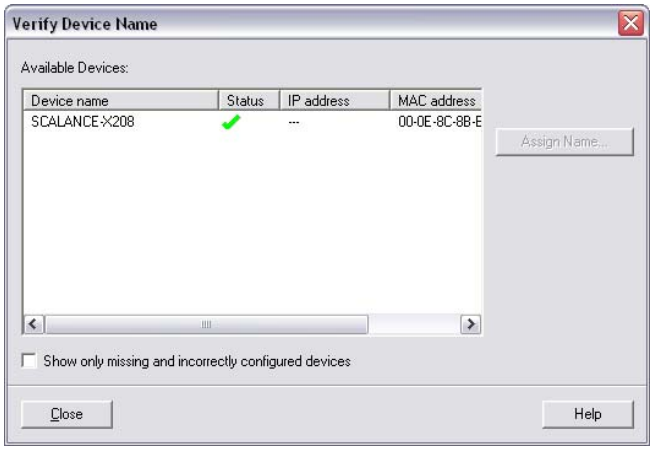
Table 4-17

No.	Action	Comment
1.	After saving and compiling in HW Config, it can be closed. In the tree of the SIMATIC Manager, go to: **SIMATIC 300(1) -> CPU 319-3 PN/DP -> S7-Program(1) -> Blocks**	
2.	In the right window pane, in which previously only the System Data folder and OB 1 have been listed, create the following blocks by selecting **Insert-> s7-Block-> Organization Block**: • OB 35 (watchdog interrupt OB 100 ms) For the execution of the user program in a time sequence that can be better monitored. • OB 82 (diagnostic interrupt OB) Block for the evaluation of diagnostic interrupts of interrupt-capable modules, here of the PN IO controller. • OB 83 (insert/remove OB) Block for the diagnostics / evaluation of module failures. • OB 86 (rack failure OB) Block for the diagnostics / evaluation of failures of expansion units, DP masters, PN IO controllers or of DP slaves or PN IO devices.	
3.	Double-click on the **OB 35** block to open it and insert the code shown in the figure. (By right-clicking, you can insert a new network.) With these code lines the outputs of the ET 200 distributed I/O are incremented in the 100 ms grid. Save the block in the block editor and close this editor.	

4.11 Assigning the device names

For a classic configuration of a PROFINET IO system, the device names are assigned as described in this chapter. The classical way is shown using the example of a SCALANCE X.

Table 4-18

No.	Action	Comment
1.	Connect your programming unit to one of the free ports of the SCALANCE X 208 to assign names to the devices online. Switch on the power supply and your hardware configuration. Return to HW Config. Select the device to which you want to assign a name. For example, SCALANCE X208. Then open: **`PLC-> Ethernet-> Assign Device Name`**	
2.	After searching, the SIMATIC devices on the PROFINET network are displayed. Select the SCALANCE X 200, use the **Assign Name** function to assign the desired **device name** to the switch. Close the window with **Close**.	
3.	You can now verify the device name by selecting **`PLC-> Ethernet-> Verify Device Name`**.	

No.	Action	Comment
4.	Repeat steps 2-3 for the remaining PROFINET IO devices.	

Note To check the selection of the used device, the **`Flashing on`** function shown in the screen shot of step 2 can also be used.

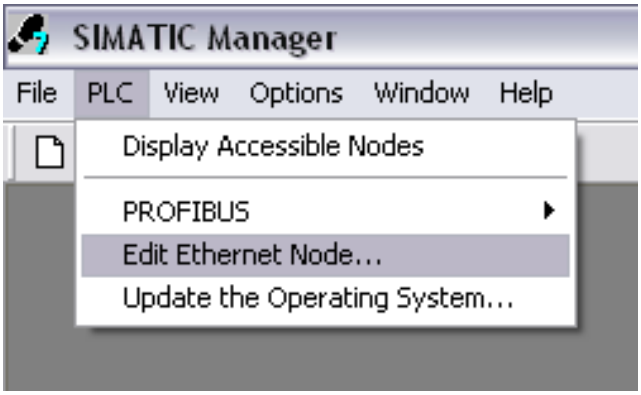
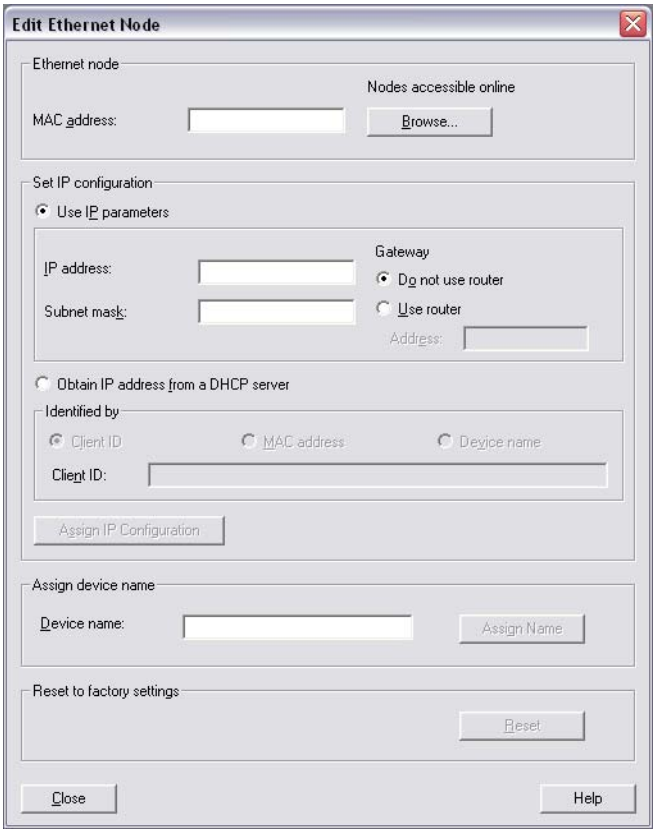
Note There is also the option to automatically commission the PROFINET IO devices. See chapter 5.2.

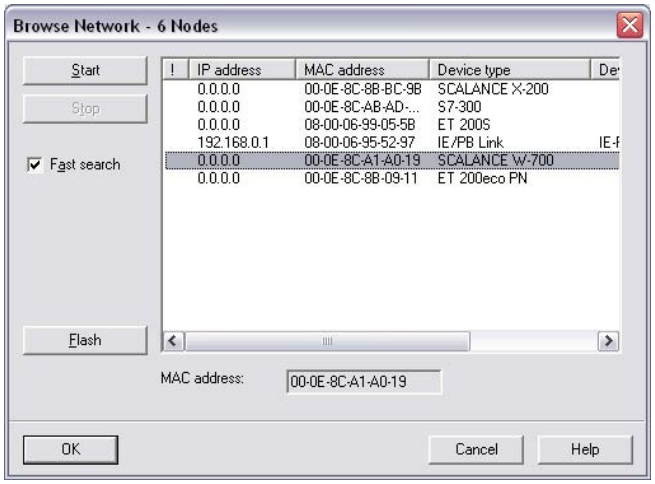
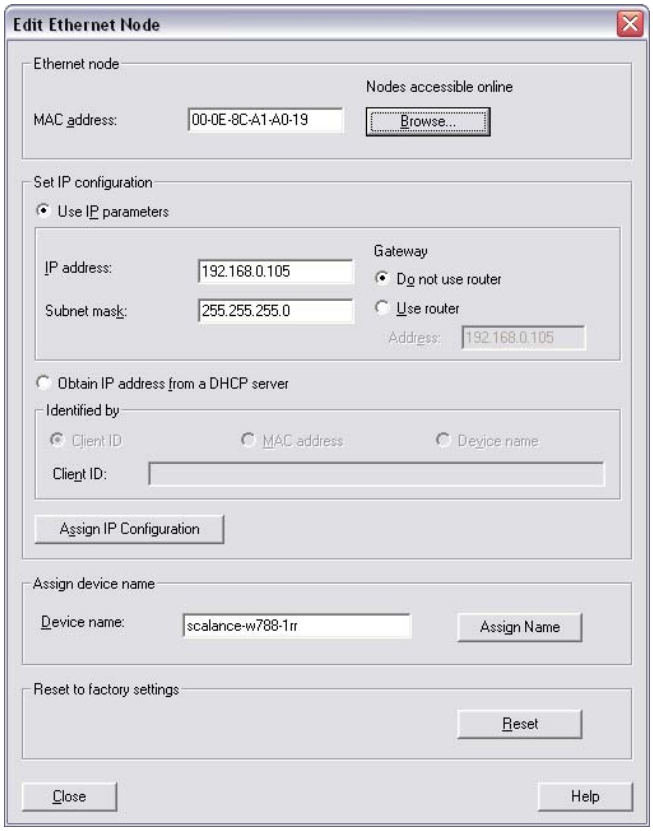
4.12 Configuring the IWLAN devices

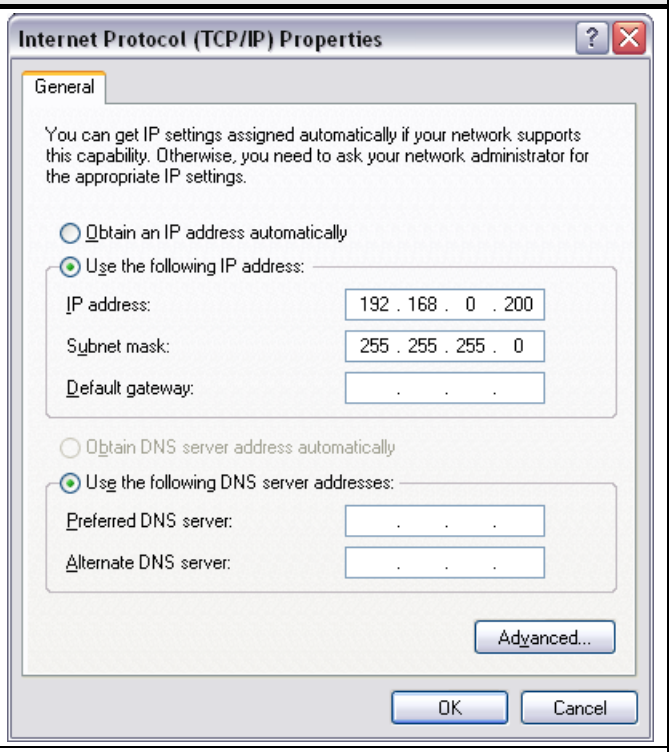
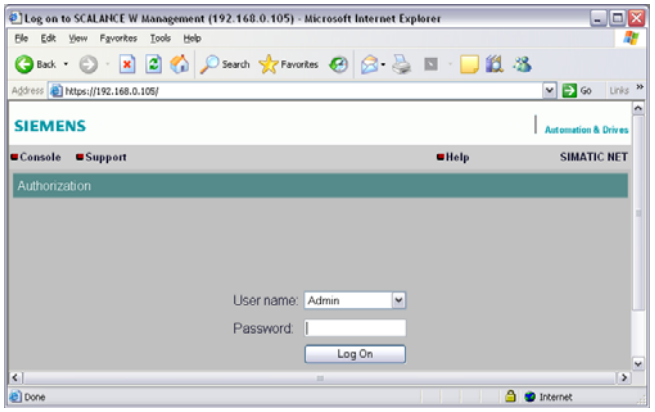
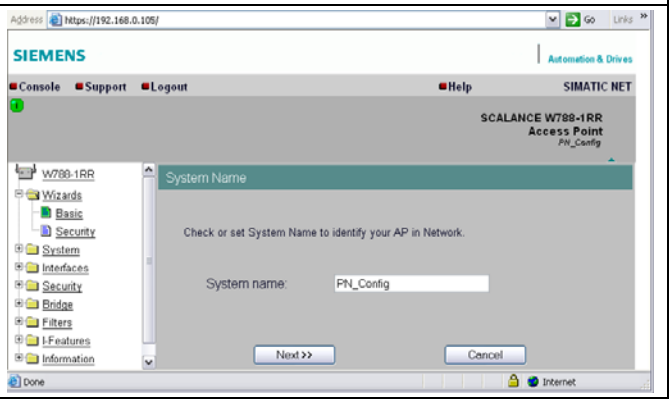
After the configuration of the PROFINET IO devices has been completed and after the device names have been assigned, the IWLAN parameters of the access point and the ET200 pro IWLAN must be set.

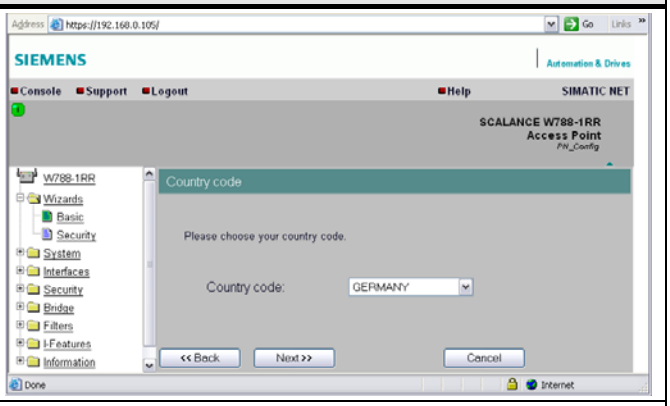
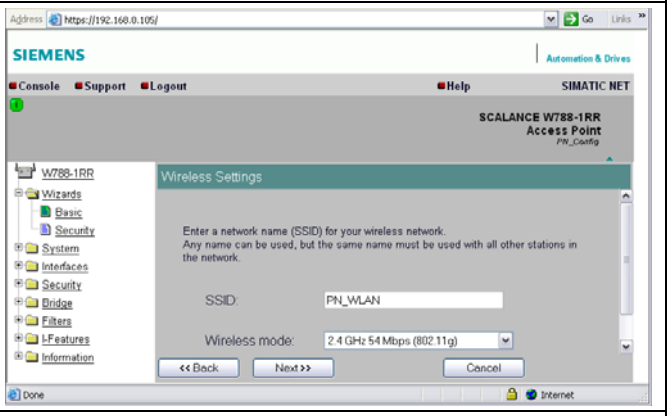
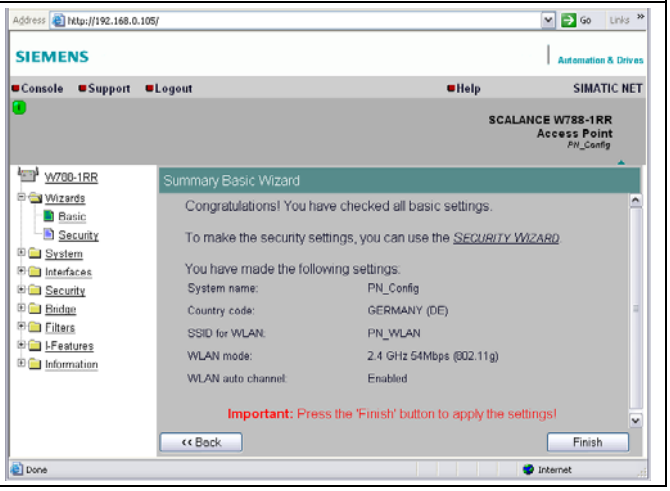
4.12.1 Configuring the IWLAN access point

Table 4-19

No.	Action	Comment
1.	Exit HW Config and open the window with the Ethernet properties by selecting **`PLC -> Edit Ethernet Node...`**	
2.	Click on **Browse**.	

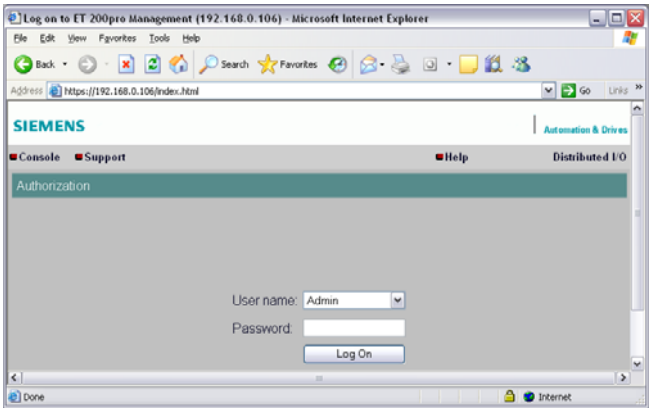
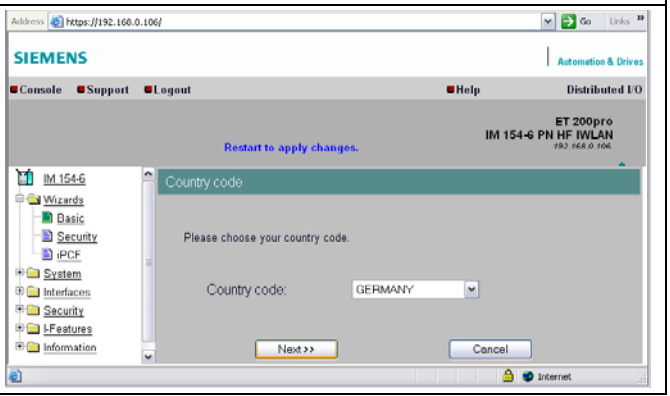
No.	Action	Comment
3.	Select the SCALANCE W and confirm with **OK**.	
4.	Enter the desired IP address. (192.169.0.105) Confirm by selecting **"Assign IP Configuration"** and confirm the following dialog box with OK. Close the window.	

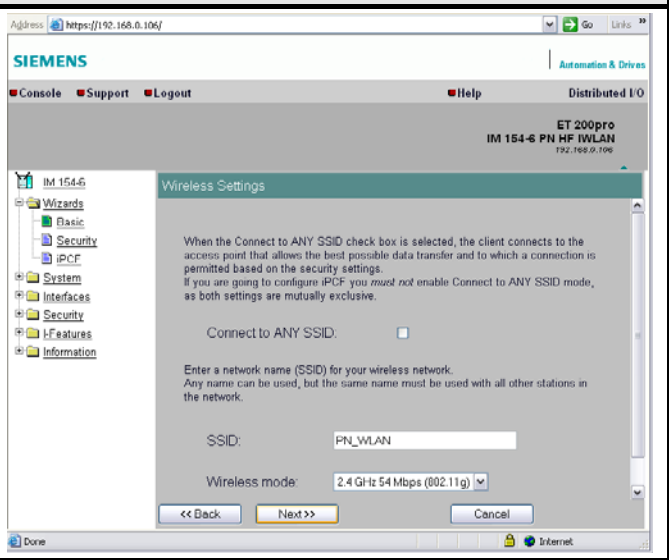
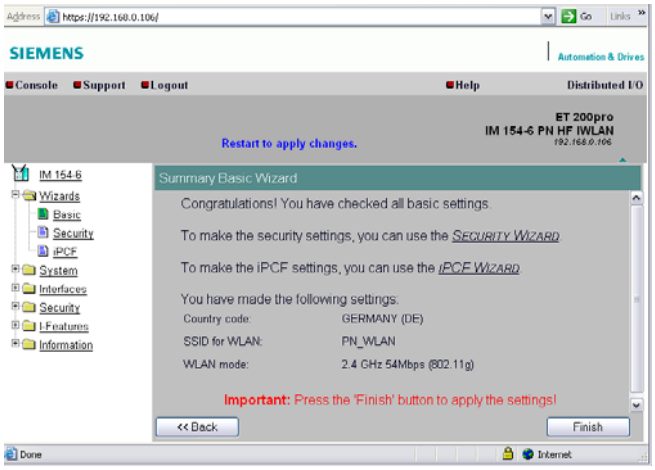
No.	Action	Comment
5.	Now set the IP address of your PG/PC so that it is in the same subnet as the IP addresses of the PROFINET devices. To do this, open the **Internet Protocol (TCP/IP) Properties** by selecting **`Start -> Settings -> Network Connection -> Local Connections`** Click on “Properties” and in “This connection uses the following items:” double-click on “Internet Protocol (TCP/IP)”. Select the **Use following IP-address** option button and fill out the box as shown in the screen shot. Close the dialog boxes with “OK” and “Close”.	
6.	Open your Web browser. Enter the IP address of the access point. Enter the **admin** password and click on **Log on**.	
7.	Start the Basic Wizard in the left column in `Wizards -> Basic`. Enter a system name and confirm with **Next>>**.	

No.	Action	Comment
8.	In **Country code**, select your country and confirm with **Next>>**.	
9.	In **SSID**, enter a network name and select the used wireless mode. Confirm the entry with **Next>>**.	
10.	The last step summarizes the settings. Click on **Finish** to ensure that the Basic Wizard settings become effective.	

4.12.2 Configuring the ET 200pro IWLAN

Table 4-20

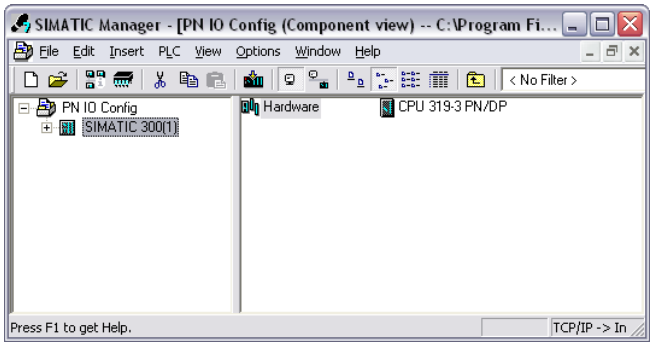
No.	Action	Comment
1.	Use an Ethernet cable to connect the ET200pro IWLAN to the SCALANCE X. Assign an IP address, (192.168.0.106) similarly to the IWLAN access point, to the ET 200 pro IWLAN using the Simatic Manger by selecting **`PLC -> Edit Ethernet Node...`**	
2.	Open your Web browser. Enter the IP address of the ET 200pro IWLAN. Enter the **admin** password and click on **Log on**.	
3.	In the menu tree, restart the Basic Wizard. In **Country code**, select your country and confirm with **Next>>**.	

No.	Action	Comment
4.	Enter the same network name as in **SSID** and the same wireless mode as for the access point. Confirm the entry with **Next>>**.	
5.	The last step summarizes the settings. Click on **Finish** to ensure that the Basic Wizard settings become effective. Log off and close the browser. The ET200pro has now been connected to the SCALANCE W788-1RR via IWLAN.	

Note You can use the SINEMA E software to plan and start up your WLAN. For more information, please refer to \7\.

4.13 Downloading the project

Table 4-21

No.	Action	Comment
1.	In the left project tree of the Simatic Manager, select the **SIMATIC300(1)** station and in the menu, select **PLC -> Download**.	

After downloading the configuration, the CPU automatically assigns the configured IP addresses to the IO devices. If the subnet is set up correctly and if the configuration corresponds to the actual IO device configuration, the IO devices are ready for cyclic data exchange.

After downloading the hardware configuration, the BF LED of the CPU starts to flash. The BF LED of the CPU and the still flashing BF LEDs of the IO devices go out when the CPU has correctly established the communication with the IO devices.

This step completes the planning of the configuration.

5 Advanced Configuration & Functions

5.1 Creating the topology

5.1.1 Features

The SIMATIC Topology Editor (STEP 7 V5.4 SP4 and higher) allows topological configuration of PROFINET IO systems.

The topology is configured by interconnecting the interfaces and ports.

The Topology Editor has the following functions and properties:

- Display of all PROFINET devices and their ports in the project
- Configured cable length and cable type with calculated signal transit time for each port
- Interconnection data with location code of the individual PROFINET devices
- Diagnostic information of PROFINET devices for each single port
- Easy error detection through online/offline comparison of the node data
- Call of diagnostics (module information) from the Graphic view
- Import of the network topology

Note For a list with the devices supporting this function, please refer to \4\.

With the aid of the Topology Editor, a target topology can be configured, which can then be downloaded to the controller.

The topology can be configured in three different ways:

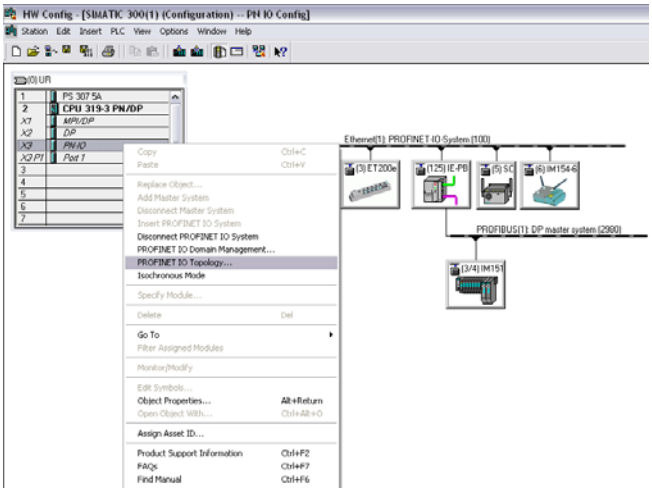
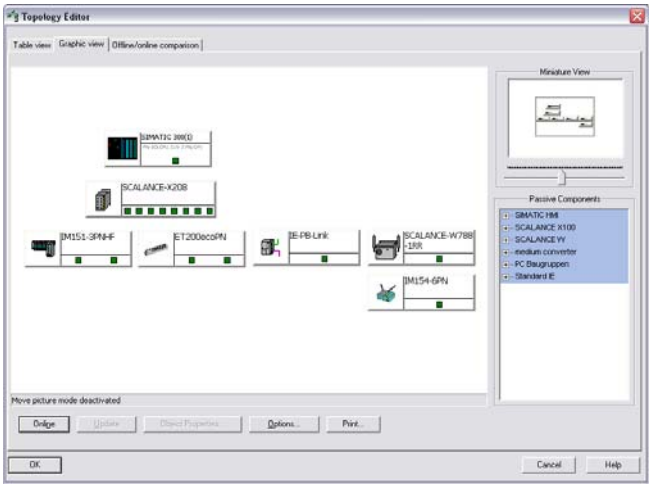
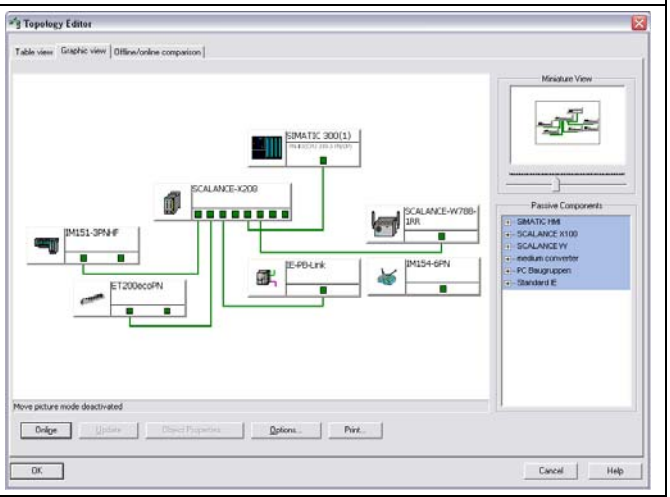
- In the Table view of the Topology Editor
- In the Graphic view of the Topology Editor
- In HW Config

5.1.2 Instructions

In this example, the topology is created in the Graphic view of the Topology Editor as described in the following table.

Note For a detailed description of creating the topology, please refer to \6\.

Table 5-22

No.	Action	Comment
1.	In **PN-IO**, use the right mouse button to select the **PROFINET IO Topology** option. The **Topology Editor** opens.	
2.	Go to Graphic view. The IO controller and the IO devices are displayed.	
3.	Click on the port of the controller and move a line to the SCALANCE X208 port 5. Confirm the dialog box with OK. The port connection between the controller and the SCALANCE Ethernet switch has been configured. Repeat the process for all connections. Exit everything with OK.	

Note The hardware in the real configuration must be connected as configured in the topology.

5.2 Automatic commissioning of a PROFINET IO system

5.2.1 Features

The “Automatic commissioning of a PROFINET IO system” function is based on LLDP.

Using this function, the IP addresses and device names of the PROFINET IO devices are automatically assigned by the respective PROFINET IO controller without requiring

- a removable storage medium (e.g., Micro Memory Card) with stored device name or
- a programming unit (PU).

This minimizes the time and causes of errors when commissioning. The function is particularly important when commissioning series machines with identical configuration and target topology.

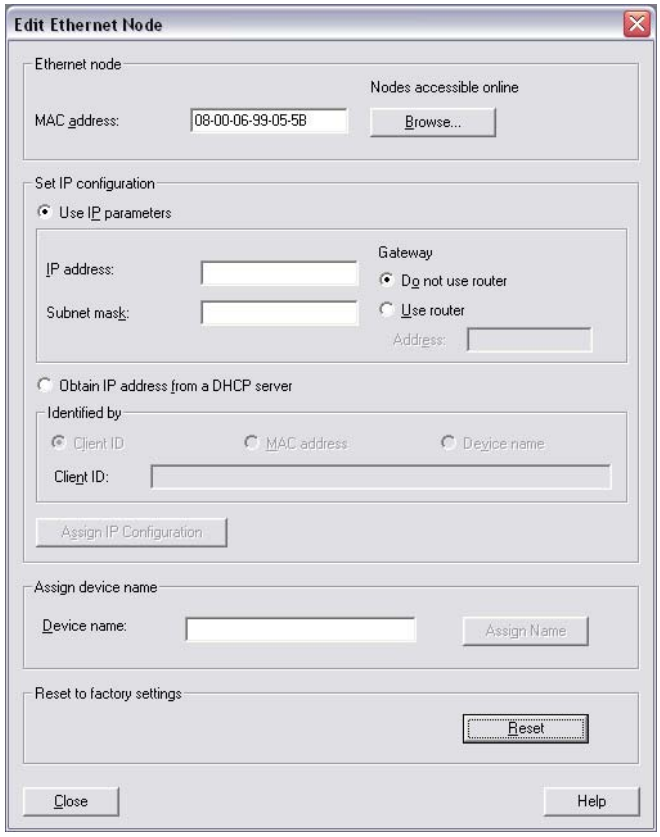
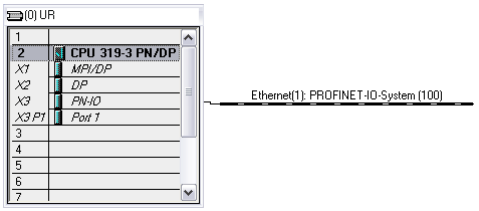
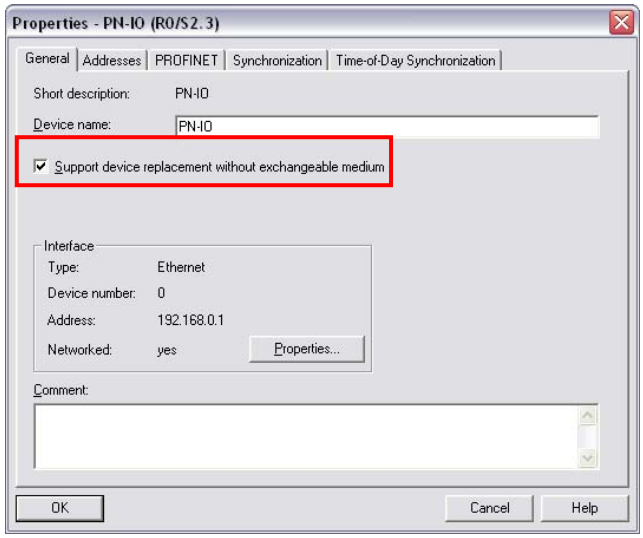
Note For a list of devices supporting this function, please refer to \5\.

5.2.2 Instructions

If your components are new, continue with step 2.

If you have already configured the PROFINET IO devices for other projects, reset them to factory settings as described in step 1:

Table 5-23

No.	Action	Comment
1.	Go to the Simatic Manager. Reset all IO devices to factory settings that are to be automatically commissioned. To do this, open the Ethernet properties of the device by selecting **`PLC -> Edit Ethernet Node...`** Once the device is online, select **Reset**. **Note:** If your device has an MMC, please delete the card first and then reinsert it into the device.	
2.	In HW Config on the PROFINET IO controller (CPU 319-3 PN/DP), double-click on **PN-IO** to open the PN-IO properties.	
3.	Ensure that the **`Support device replacement without exchangeable medium`** option has been checked. Enter your desired device name.	

No.	Action	Comment
4.	If not already done, create the topology as shown in chapter 5.1 and download the controller.	

Note For a detailed description of the “Automatic commissioning of a PROFINET IO system” function, please refer to \6\.

5.3 Start-Up functions

Fast start-up times of IO devices are essential, for example, for the tool changer in the body shop. To reduce start-up times, two configurable functions are available:

- Prioritized Start-Up
- Fast Start-Up

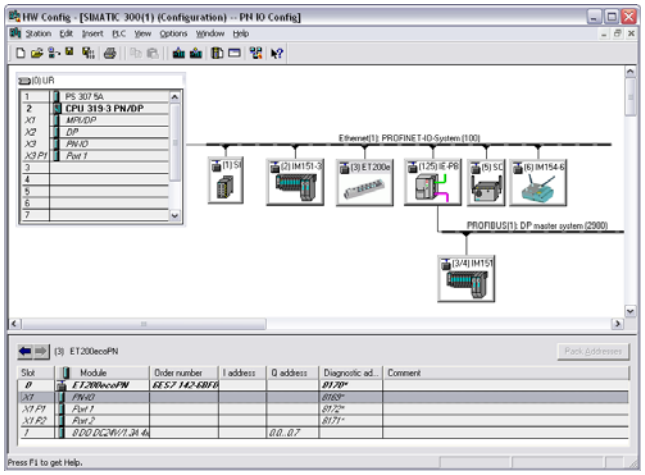
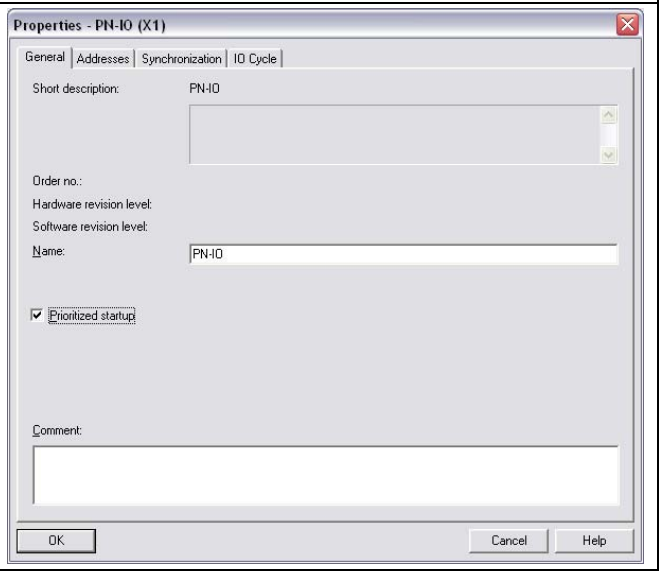
We will show these functions using the configuration of the ET 200eco PN as an example.

5.3.1 Prioritized Start-Up

The start-up times for Prioritized Start-Up are reduced to 2 seconds.

Before you configure and test these functions, you can switch off an IO device, for instance the ET200eco PN, switch it back on and measure the start-up time. Then configure the “Prioritized Start-Up” function as described in the table below.

Table 5-24

No.	Action	Comment
1.	Select the ET 200eco PN and double-click on X1 PN-IO. The window with the properties of the PN IO X1 interface opens.	
2.	Check Prioritized startup.	

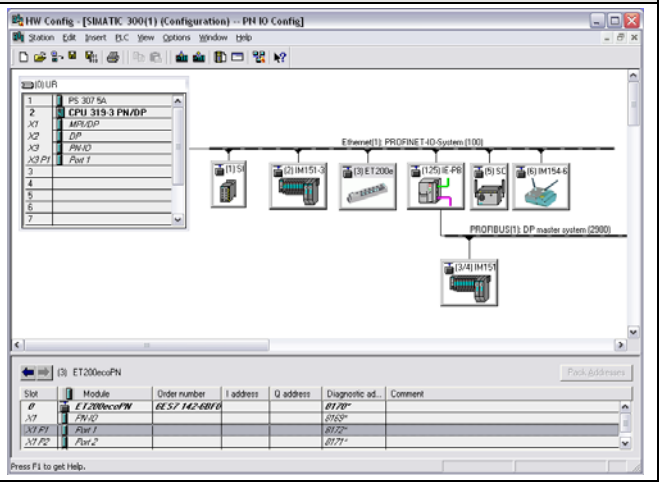
No.	Action	Comment
3.	Generate the blocks for “Report System Error” as described in steps 5 through 7 of table 5-28.	
4.	Save and compile the project in HW Config.	
5.	Download the CPU using the SIMATIC Manager.	
6.	To test the function, switch the ET 200eco PN off and back on. It takes only 2 seconds for the ET 200ecoPN to start up.	

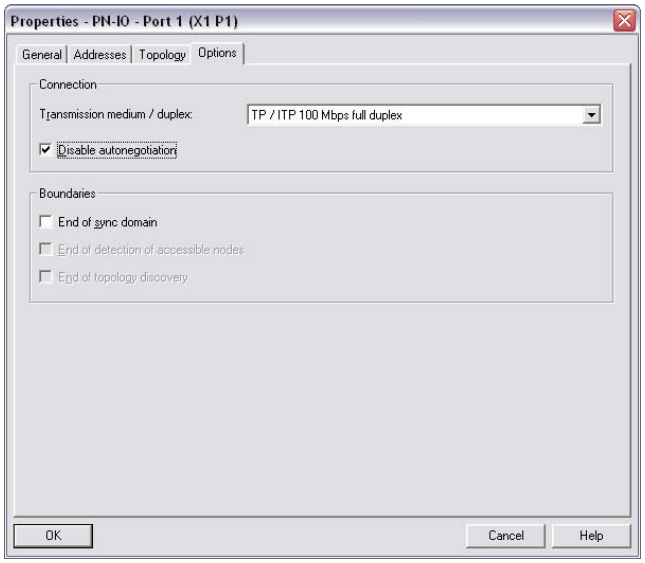
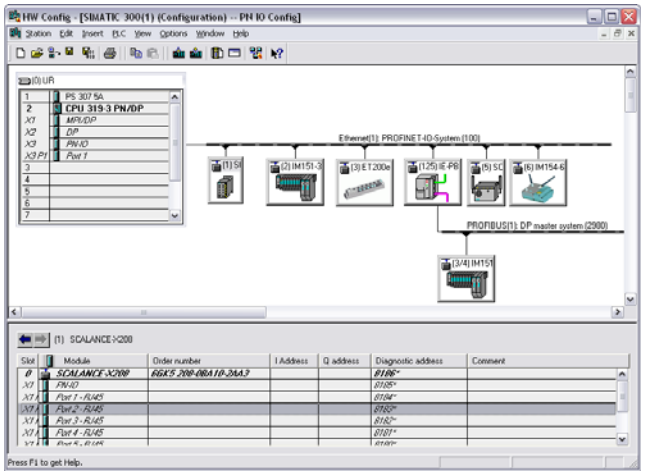
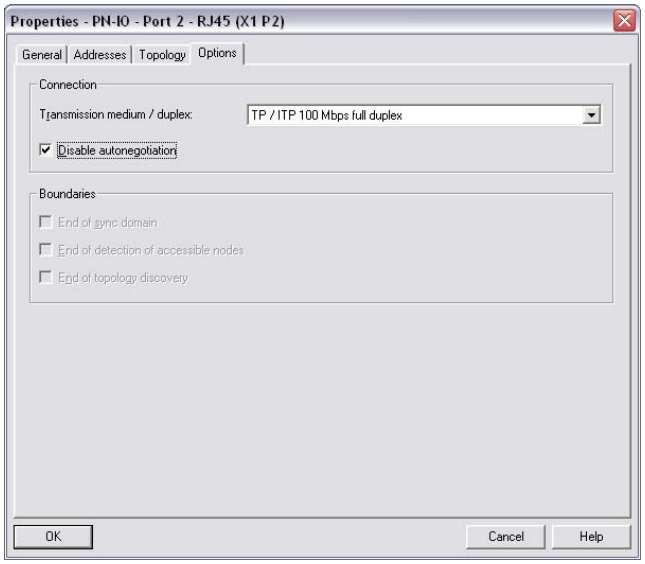
5.3.2 Fast Start-Up

The start-up time can be further reduced to 0.5-1 sec. when disabling the Autonegotiation function. The start-up time is then referred to as Fast Start-Up.

Note The configuration of the Fast Start-Up function is port-specific. For this reason, the configured port must also be used in the real configuration.

Table 5-25

No.	Action	Comment
1.	Double-click on the port of the ET 200eco PN connected to PN IO. In this case, this is port X1 P1. Go to the **Options** tab.	

No.	Action	Comment
2.	Select the **Transmission medium** as shown in the opposite figure and disable autonegotiation by checking **Disable autonegotiation** and close with OK.	
3.	Autonegetiation must also be disabled for the SCALANCE X 208 port 2, where the ET 200eco PN is connected. Double-click on port 2 of the SCALANCE X208.	
4.	Select the **Transmission medium** as shown in the opposite figure and disable autonegotiation by checking **Disable autonegotiation**.	
5.	Generate the blocks for “Report System Error” as described in steps 5 through 7 of table 5-28.	

No.	Action	Comment
6.	Save and compile the project in HW Config.	
7.	Download the blocks to the CPU using the SIMATIC Manager.	
8.	To test the function, switch the ET 200eco PN off and back on. It takes only 0.5-1 sec. until the ET 200eco PN reconnects to PROFINET.	

6 Diagnostics of PROFINET IO Systems

This chapter shows you the diagnostic capabilities enabling you to detect module errors in a PROFINET IO system:

- User scenario 1: Module failure
- User scenario 2: Cable breakage

These failure scenarios are simulated and detected using the following diagnostic functions.

Table 6-26

Diagnostics	Chapter	Comment
STEP 7 basic diagnostics	6.1	
Diagnostics with the Topology Editor	6.2	The topology must already have been created as shown in chapter 5.1.
Diagnostics using the Web server of the PROFINET IO controller	6.3	Please make sure that your PROFINET IO controller supports the Web server function.

6.1 Diagnostics with STEP 7 Basis

6.1.1 Enabling the diagnostic function in STEP 7 Basis

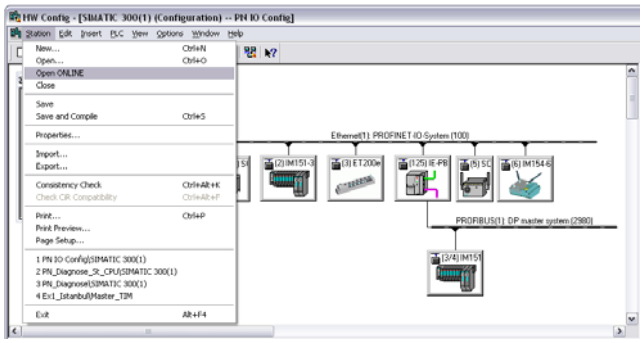
This chapter shows you the basic diagnostic capabilities in STEP7.

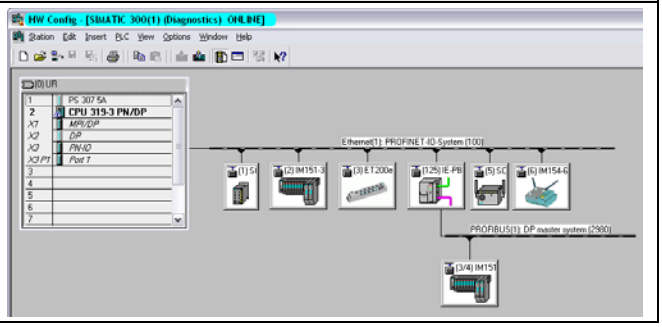
Note

To diagnose the individual modules via the LED displays, please use the relevant operating instructions of the device.

The system description must be observed for diagnostics via the user program.

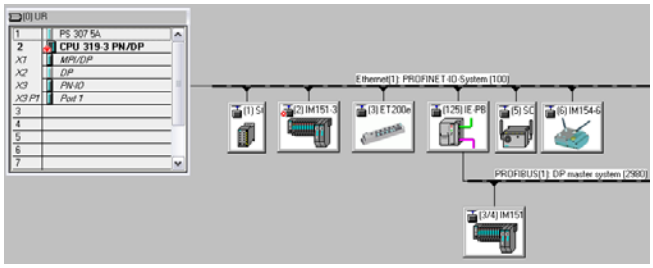
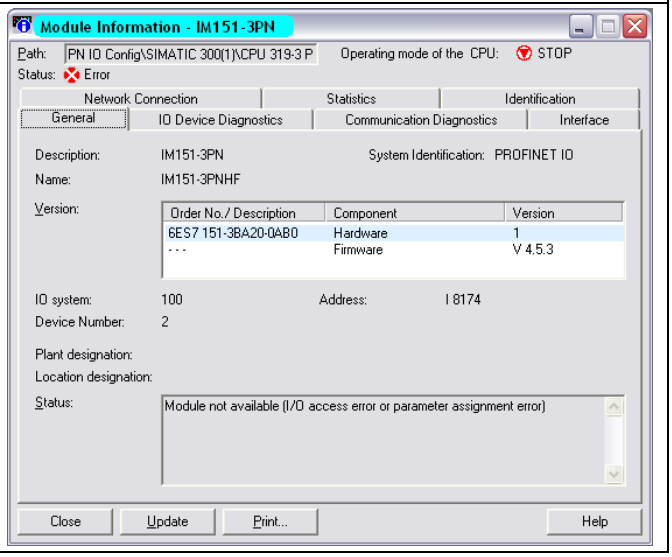
Table 6-27

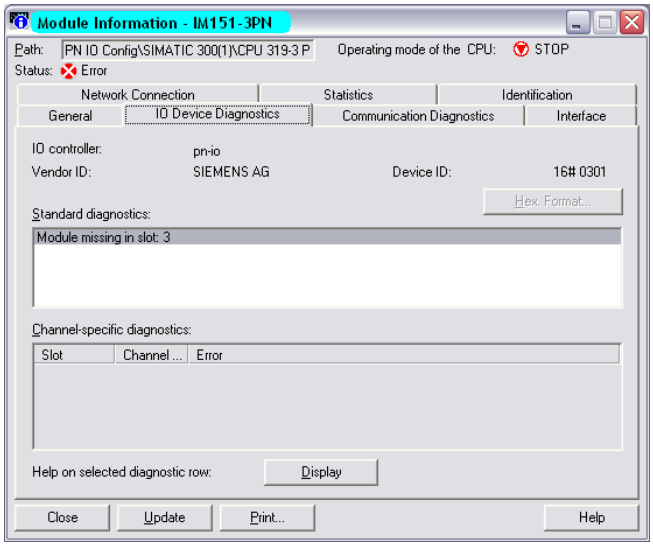
No.	Action	Comment
1.	Open HW Config and select the online view of the configuration via **`Station > Open ONLINE`**.	

No.	Action	Comment
2.	This overview diagnostics shows all parameterized nodes. All intelligent modules are displayed with status information.	

6.1.2 Diagnostics of a module failure

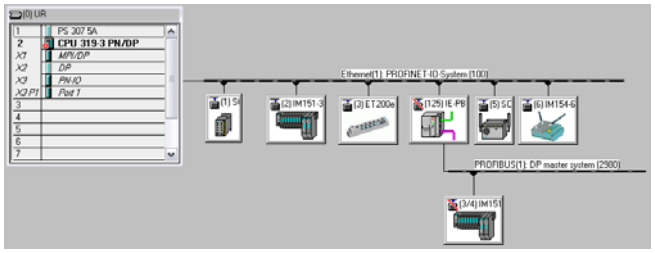
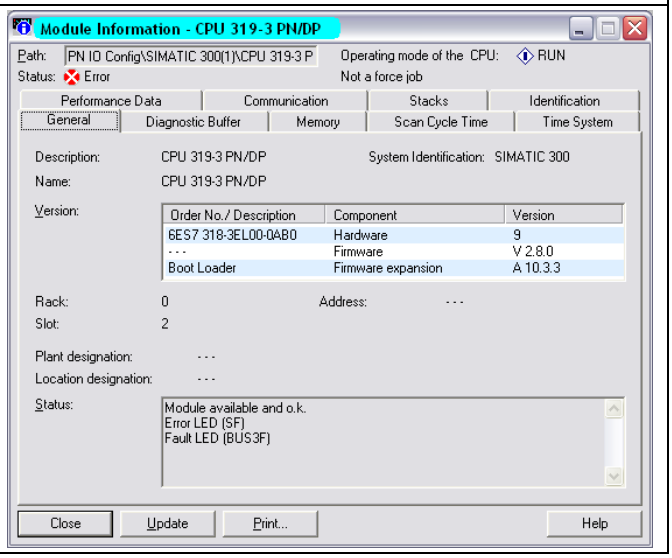
Table 6-28

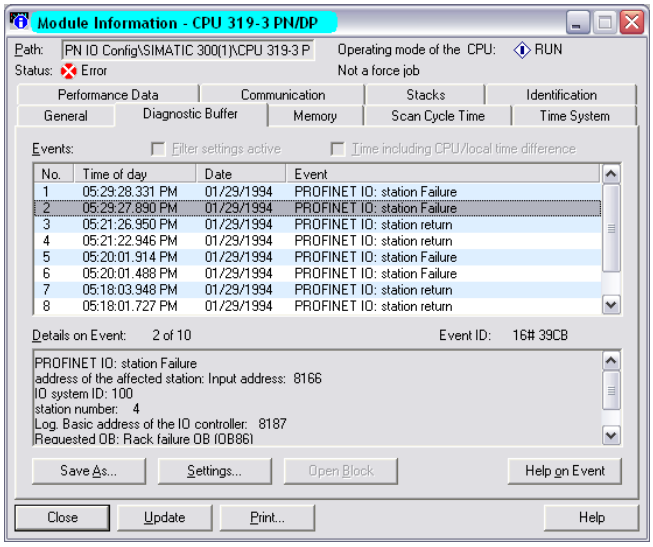
No.	Action	Comment
1.	The **first fault scenario** is to provoke a ***failure of an I/O module***. • Remove an I/O module from the IM 151-3 PN, e.g. the DO module. • **Press the F5 key** to update the display. This display appears in the overview.	
2.	Double-click on **`Device`** to start the detailed diagnostics of the device. Detailed diagnostics indicate that an error has occurred, the exact information on the error is provided in **`IO Device Diagnostics`**.	

No.	Action	Comment
3.	After selecting IO Device Diagnostics, the error message can be read in plain text in **Standard Diagnostics** in the center of the window. In this case, the failure or the removal of the module was diagnosed in slot 3. As soon as you reinsert this module, the error message disappears after the update.	

6.1.3 Diagnostics of a cable breakage

Table 6-29

No.	Action	Comment
1.	The **second fault scenario** is to provoke a ***cable breakage***. Remove the RJ45 plug connected via the IE/PB Link PN IO from the switch. After the update, an error is displayed in the following components: **CPU 319-3PN/DP**, **IE/PB Link PN IO** and **ET 200S PROFIBUS**.	
2.	Double-click on the CPU to open the CPU Module Information.	

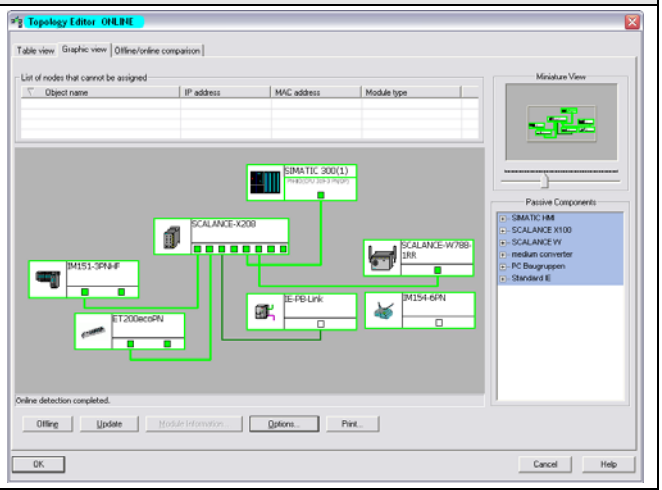
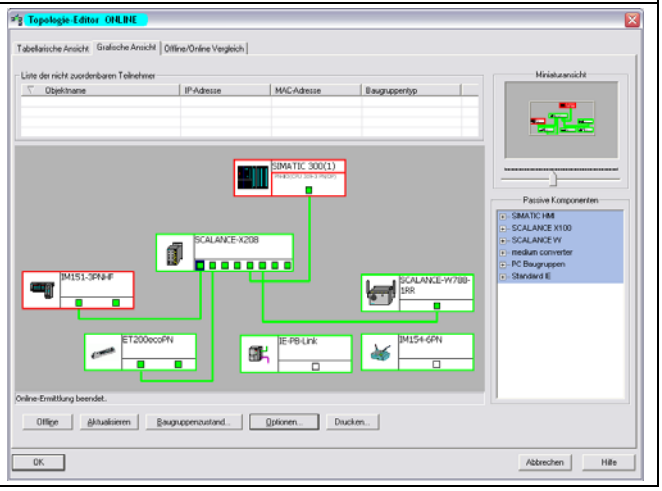
No.	Action	Comment
3.	Go to the **Diagnostics Buffer** tab. This tab displays the Station Failure message. The Details section shows the number of the failed station. To eliminate the error, plug the RJ45 back in and update it.	

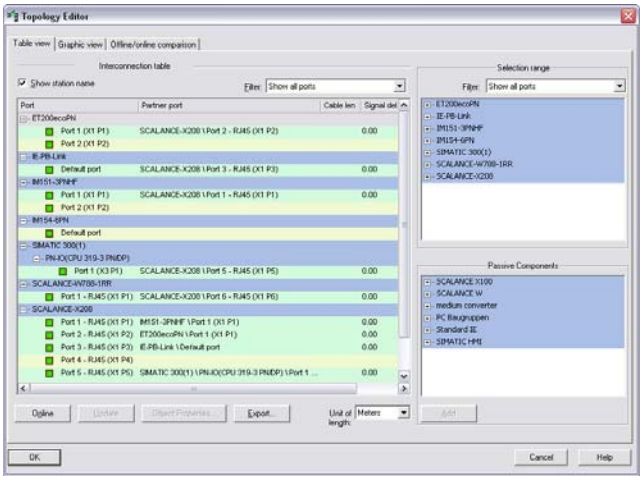
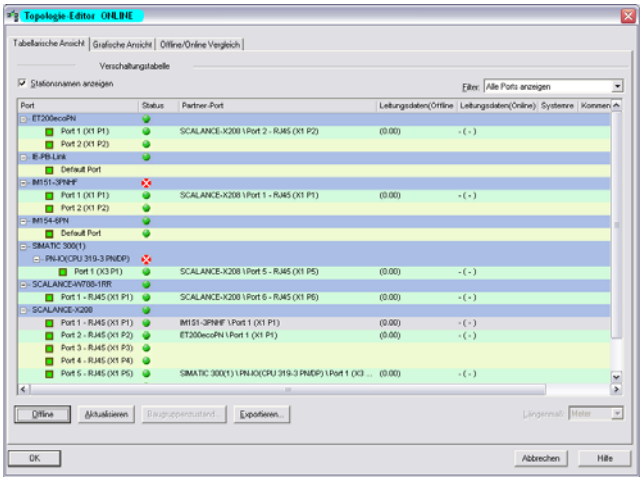
6.2 Diagnostics with the Topology Editor

After the topology has been created, the option to diagnose the PROFINET IO system using the Topology Editor is available in addition to the basic STEP7 diagnostic functions.

6.2.1 Diagnostics of a module failure

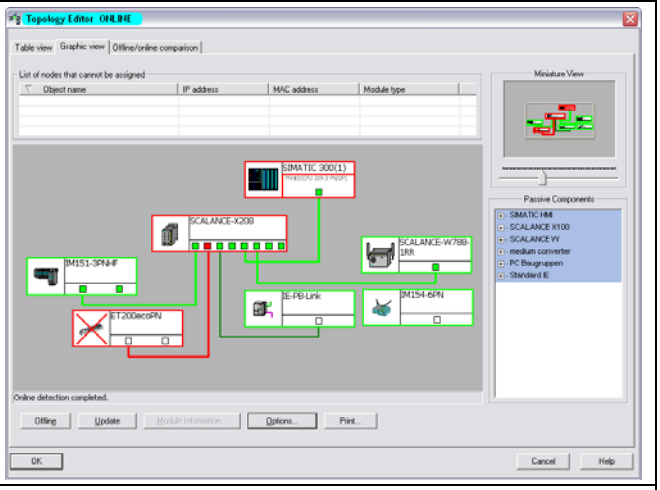
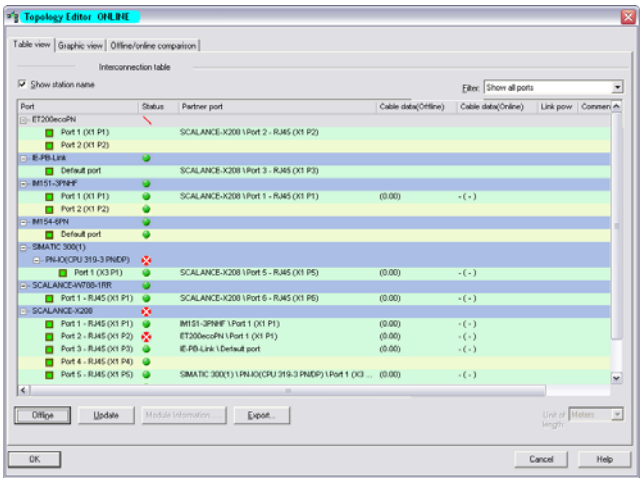
Table 6-30

No.	Action	Comment
1.	The **Online** function in the Topology Editor **Graphic view** allows to see the status of the PROFINET IO devices.	
2.	Provoke the failure of an I/O module. Remove the DO module from the IM 151-3 PN. The IO controller and the ET 200S whose DO has been removed are displayed with a red frame. (See figure) In the CPU, the BF 3 LED flashes and the SF LED is on.	

No.	Action	Comment
3.	Go to the **Table view** tab and click on **Online**.	
4.	The Table view displays the failed device with the “\” symbol in red. The controller and the ET 200S whose DO module has been removed are displayed with a white cross in the red circle. Reinsert the module.	

6.2.2 Diagnostics of a cable breakage

Table 6-31

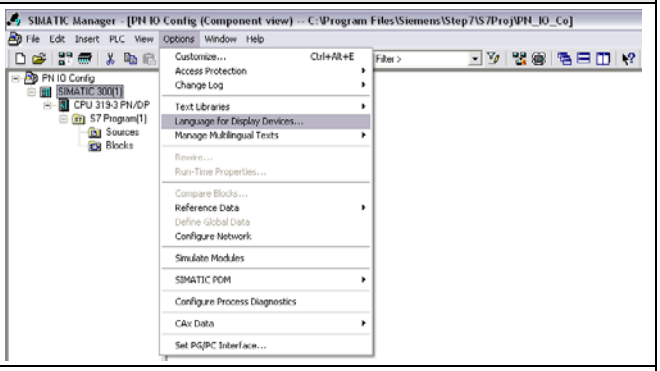
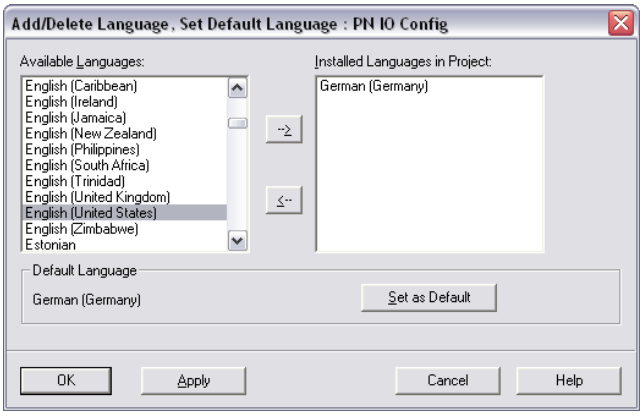
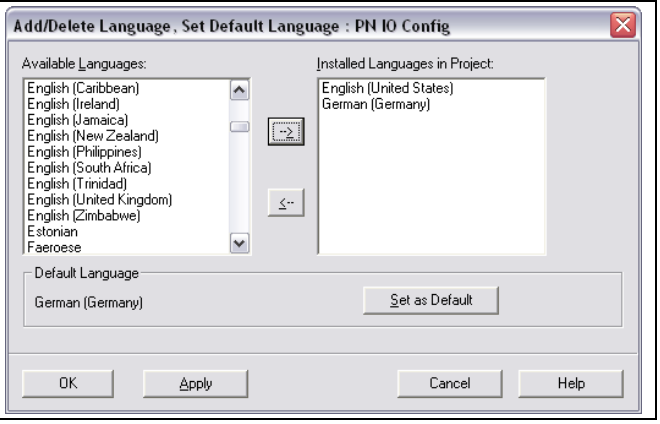
No.	Action	Comment
1.	Provoke the failure of the ET 200eco PN by removing the Ethernet cable. Activate the Online function of the **Graphic view**. The device that is not connected (or that is defective) is displayed with a red cross (see figure). In the CPU, the BF 3 LED flashes and the SF LED is on.	
2.	Go to the **Table view** tab and click on **Online**. The Table view displays the failed device with the “\” symbol in red. The controller and the switch to which the ET 200eco PN was connected are displayed with a white cross in the red circle.	

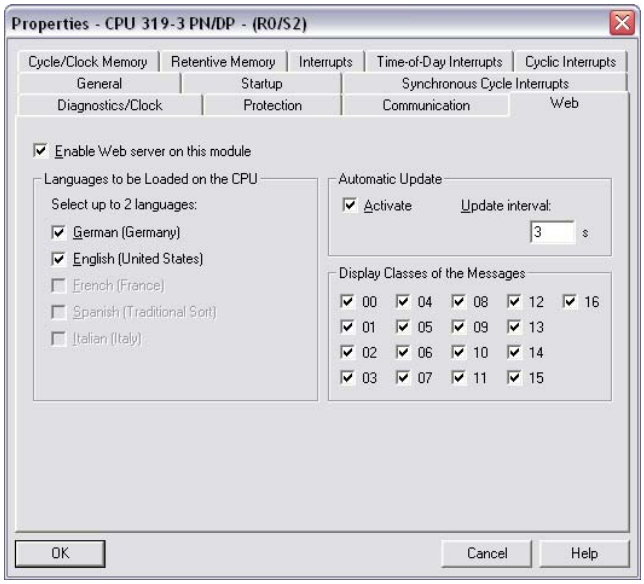
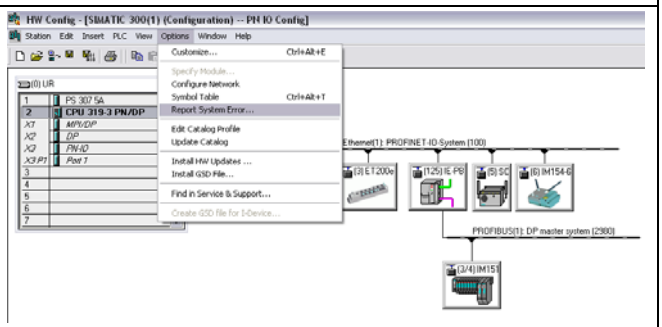
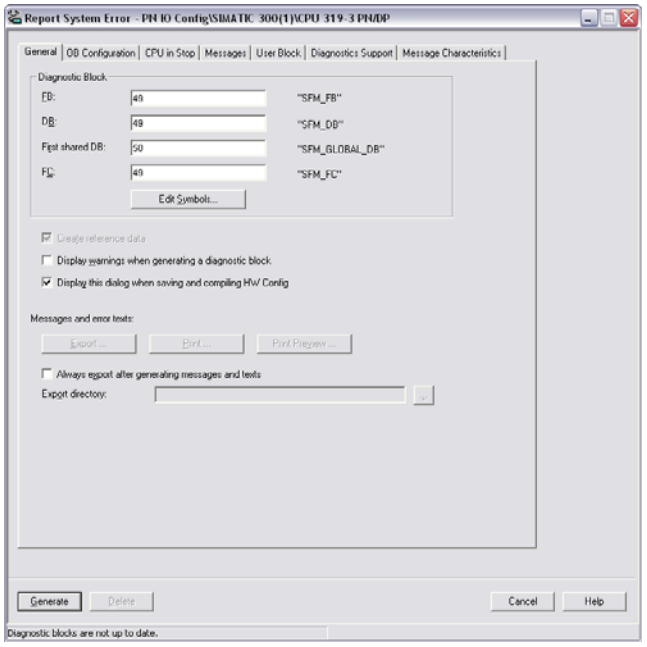
6.3 Diagnostics using the Web server of the PROFINET IO controller

The CPU Web server offers advanced diagnostic capabilities. Status information and status messages are displayed on HTML pages. This enables the user to perform evaluations and diagnostics also through the Internet or the corporate network.

6.3.1 Enabling the Web server and generating RSE

Table 6-32

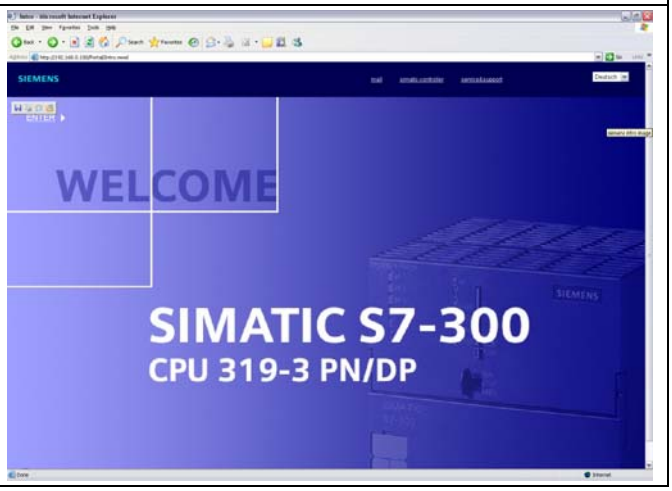
No.	Action	Comment
1.	The language to be used for the messages in the Web server is set in this step. Close HW Config and in the **SIMATIC Manager** open: **`Options-> Language for Display Devices`**	
2.	In the opening window, select your language and apply it by clicking on the "→" icon.	
3.	Confirm the setting with **OK**.	

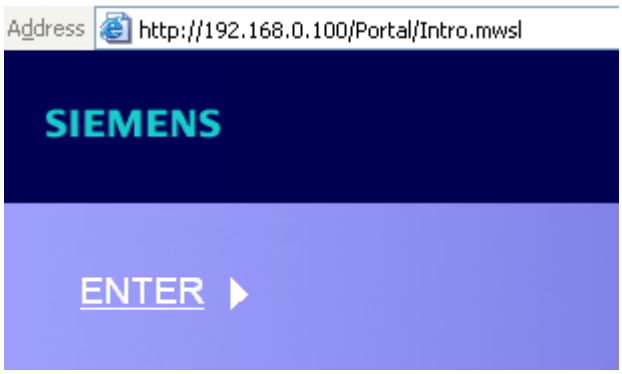
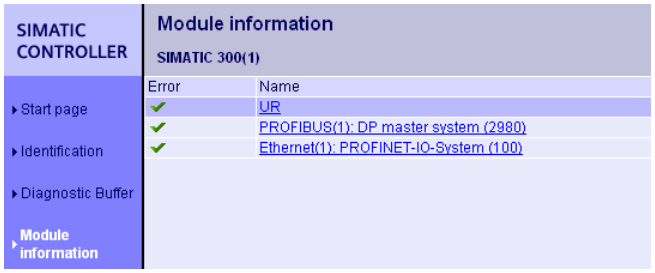
No.	Action	Comment
4.	Open the CPU properties with a double-click in **HW Config**. Go to the **Web** tab. Enable the Web server for this module, the language and the automatic update interval for the automatic update of the server as shown in the screen shot. Close the window with **OK**.	
5.	Generate the blocks for the system error messages by selecting **`Options-> Report System Error`**.	
6.	In the opening window, click on **Generate**.	

No.	Action	Comment
7.	Close the following window with **OK**.	
8.	Save the project in **HW Config** by **compiling**.	
9.	Download the generated blocks to the CPU using the **SIMATIC Manager**.	

6.3.2 Starting the Web server

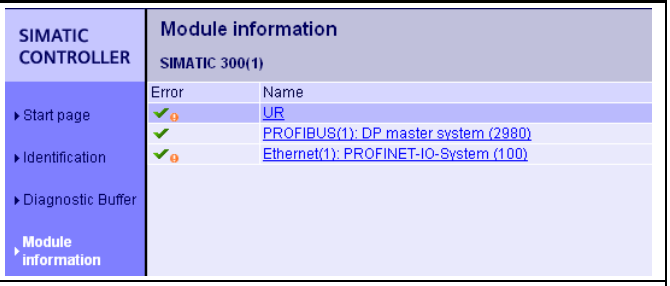
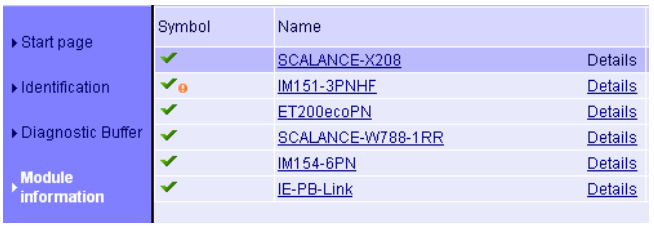
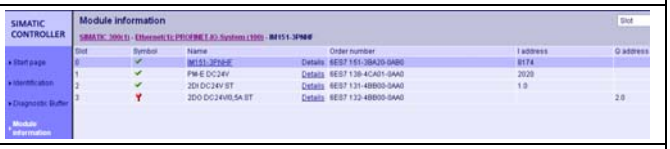
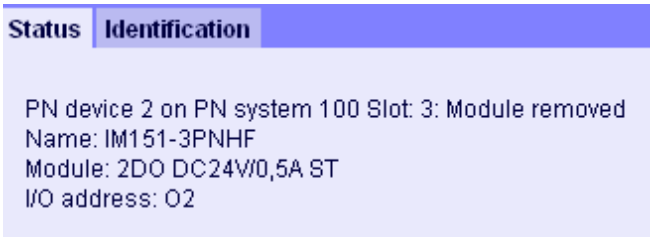
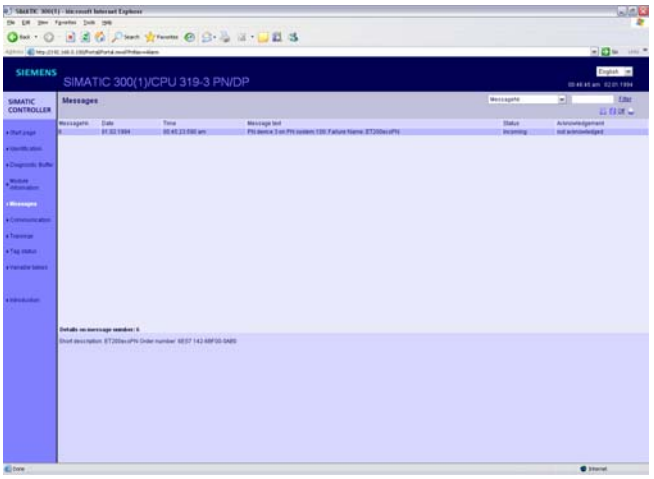
Table 6-33

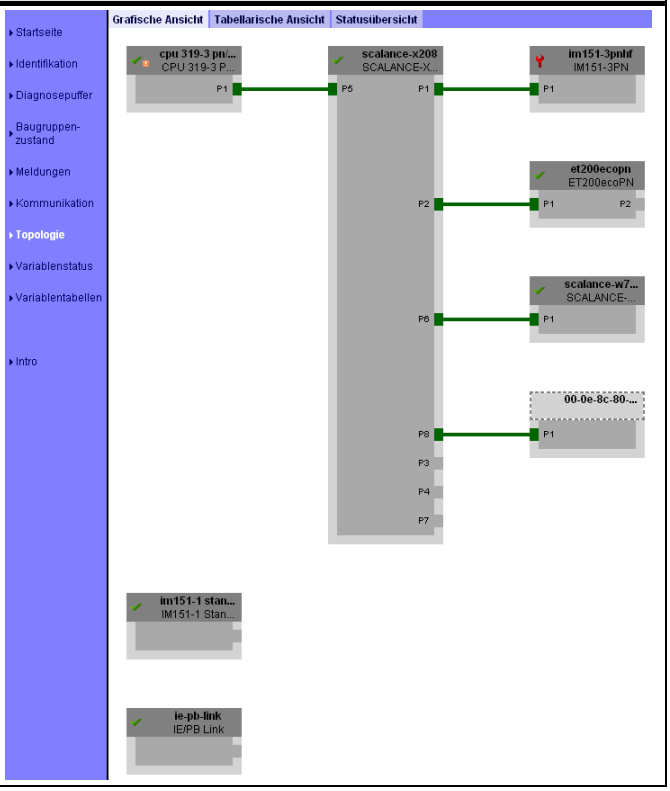
No.	Action	Comment
1.	Connect your PG/PC to one of the available interfaces of the SCALANCE X. Set the IP address of the PG/PC as described in step 5 of table 4-18.	
2.	Open your Web browser. Enter the IP address (192.168.0.100) of the PROFINET IO controller.	

No.	Action	Comment
3.	Set your desired language in the top right of the window.	
4.	Then click on **ENTER >**.	
5.	In the left menu, go to **Module Information**.	

6.3.3 Diagnostics of a module failure

Table 6-34

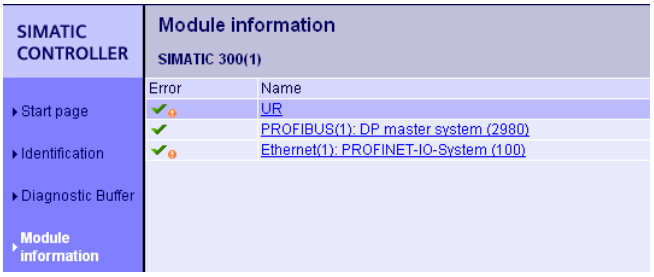
No.	Action	Comment
1.	Provoke the failure of an I/O module. Remove an I/O module from the IM 151-3 PN, e.g. the second DO module. Click on **Ethernet(1):PROFINET-IO-System(100)** to view the PROFINET diagnostics.	
2.	The device with the failed DO is displayed with an exclamation point. Click on the module.	
3.	The name, the slot and the address of the failed DO are displayed with a red wrench symbol.	
4.	When you click on Details, the error message with the cause of the error is displayed in the bottom window. Error message: PN device 2 on PN system 100 Slot 3: Module removed.	
5.	Go to the **Messages** tab. This tab displays the error message.	

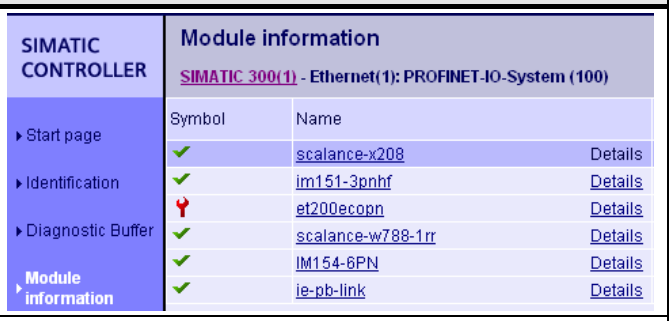
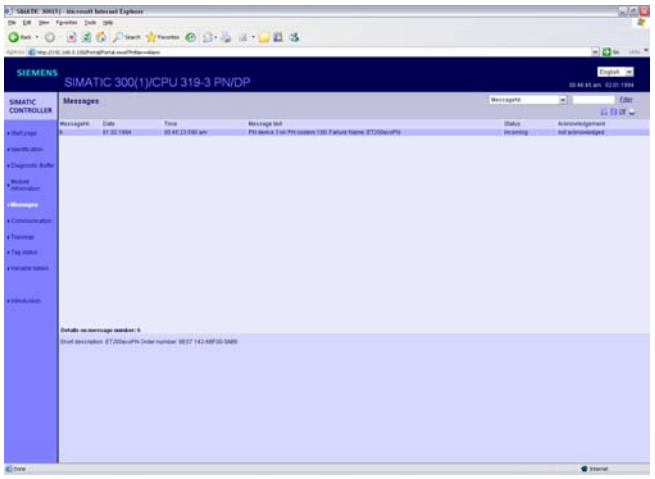
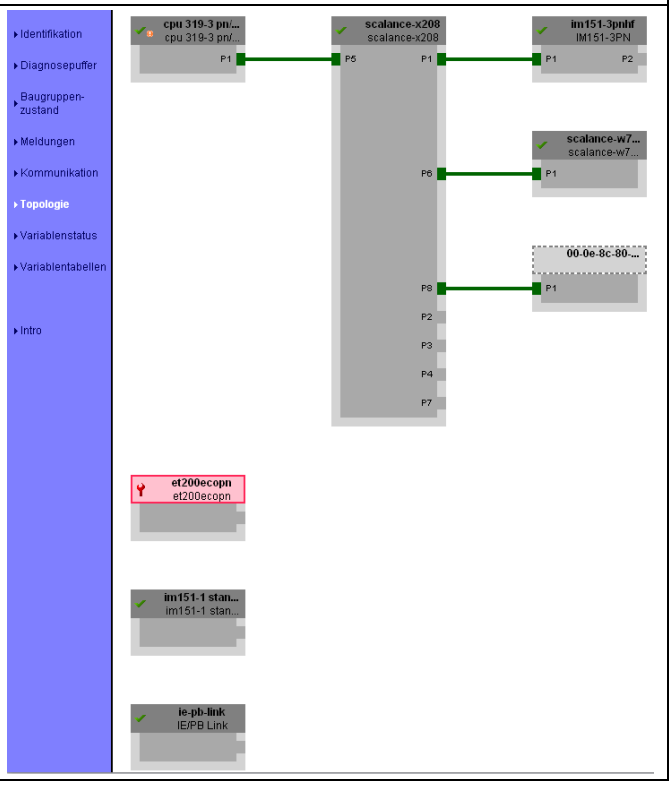
No.	Action	Comment
6.	Go to **Topology**. The device whose DO module was removed is marked with a red wrench. You can also view the topology information via the **Table view**.	

Note The IE/PB Link does not support advanced diagnostics; for this reason, the graphical representation does not show to which port of the SCALANCE X it is connected. The **Network topology of device not detectable** message is displayed at the bottom.

6.3.4 Diagnostics of a cable breakage

Table 6-35

No.	Action	Comment
1.	Provoke the failure of the ET 200eco PN by removing the Ethernet cable. Click on **Ethernet(1):PROFINET-IO-System(100)** to view the PROFINET diagnostics.	

No.	Action	Comment
2.	The failed device is displayed with a red wrench.	
3.	Go to the **Messages** tab. The following message is displayed: **PN device 3 on PN-System100:Failure Name ET200ecoPN**	
4.	Go to **Topology**. The failed device is silhouetted in red and displayed with a red wrench. You can also view the topology information via the **Table view**.	

7 Related literature

7.1 References

This list is not complete and only presents a selection of related references.

Table 7-36 References

	Topic	Title
/1/	SCALANCE X	Industrial Ethernet Switches SCALANCE X-200 Operating Instructions http://support.automation.siemens.com/WW/view/en/25508728
/2/	CPU 319-3 PN/DP	S7-300, CPU 31xC and CPU 31x: Installation Operating Instructions http://support.automation.siemens.com/WW/view/en/13008499
/3/	ET 200S	SIMATIC Distributed I/O System ET 200S http://support.automation.siemens.com/WW/view/en/11144348
/4/	ET 200eco PN	SIMATIC Distributed I/O ET 200eco PN http://support.automation.siemens.com/WW/view/en/29999018
/5/	ET 200pro IWLAN	SIMATIC ET 200pro Interface Module IM 154-6 PN HF IWLAN http://support.automation.siemens.com/WW/view/en/33401769
/6/	SCALANCE W	SCALANCE W-700 Configuration Manual http://support.automation.siemens.com/WW/view/en/32816761
/7/	PROFINET IO	PROFINET System Description http://support.automation.siemens.com/WW/view/en/19292127

7.2 Internet links

This list is by no means complete and only provides a selection of useful information.

Table 7-37 Internet links

	Topic	Title
\1\	Hardware Support Package on the Internet	http://support.automation.siemens.com/WW/view/en/22374877
\2\	GSD XML for ET200S PN on the Internet	http://support.automation.siemens.com/WW/view/en/19699080
\3\	GSD XML for SCALANCE X on the Internet	http://support.automation.siemens.com/WW/view/en/19999730

	Topic	Title
\4\	Which PROFINET nodes support the extended PN diagnostics and what do you have to configure?	http://support.automation.siemens.com/WW/view/en/23678970
\5\	Which PROFINET nodes support automatic commissioning and the replace device without interchangeable medium function?	http://support.automation.siemens.com/WW/view/en/36752540
\6\	Automatic commissioning of a PROFINET IO system	http://support.automation.siemens.com/WW/view/en/36741408
\7\	Which functions does SINEMA E provide and how do you operate SINEMA E to use them?	http://support.automation.siemens.com/WW/view/en/37864062

8 History

Table 8-38 History

Version	Date	Modification
V1.0	05/15/06	First edition
V2.0	01/14/10	Topology configuration, automatic commissioning, Web server diagnostic functions and Fast Start-Up in the PROFINET IO system added.