SIEMENS

SCE Training Curriculum

Siemens Automation Cooperates with Education | 05/2017

TIA Portal Module 012-201

Decentral Hardware configuration
with SIMATIC S7-1500 and
ET 200SP via PROFINET

Cooperates with Education

Automation

SIEMENS

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

Matching SCE trainer packages for these training curriculums

Decentral Periphery SIMATIC ET 200SP
- **SIMATIC ET 200SP Digital**
  Order no.: 6ES7155-6AU00-0AB0
- **SIMATIC ET 200SP Digital with input module ENERGY METER**
  Ordner no.: 6ES7155-6AU00-0AB1
- **SIMATIC ET 200SP Digital with communication module IO-LINK MASTER V1.1**
  Ordner no.: 6ES7155-6AU00-0AB2
- **SIMATIC ET 200SP Digital with communication module CM AS-i MASTER ST**
  Ordner no.: 6ES7155-6AU00-0AB3
- **SIMATIC ET 200SP Analoge expansion module**
  Order no.: 6ES7155-6AU00-0AB6

SIMATIC Controllers
- **SIMATIC ET 200SP Open Controller CPU 1515SP PC F and HMI RT SW**
  Order no.: 6ES7677-2FA41-4A**B1**
- **SIMATIC ET 200SP Distributed Controller CPU 1512SP F-1 PN Safety**
  Order no.: 6ES7512-1SK00-4AB2
- **SIMATIC CPU 1516F PN/DP Safety**
  Order no.: 6ES7516-3FN00-4AB2
- **SIMATIC S7 CPU 1516-3 PN/DP**
  Order no.: 6ES7516-3AN00-4AB3
- **SIMATIC CPU 1512C PN with Software and PM 1507**
  Order no.: 6ES7512-1CK00-4AB1
- **SIMATIC CPU 1512C PN with Software, PM 1507 and CP 1542-5 (PROFIBUS)**
  Order no.: 6ES7512-1CK00-4AB2
- **SIMATIC CPU 1512C PN with Software**
  Order no.: 6ES7512-1CK00-4AB6
- **SIMATIC CPU 1512C PN with Software and CP 1542-5 (PROFIBUS)**
  Order no.: 6ES7512-1CK00-4AB7

SIMATIC STEP 7 Software for Training
- **SIMATIC STEP 7 Professional V14 SP1 - Single license**
  Order no.: 6ES7822-1AA04-4YA5
- **SIMATIC STEP 7 Professional V14 SP1- Classroom license (up to 6 users)**
  Order no.: 6ES7822-1BA04-4YA5
- **SIMATIC STEP 7 Professional V14 SP1 - Upgrade license (up to 6 users)**
  Order no.: 6ES7822-1AA04-4YE5
- **SIMATIC STEP 7 Professional V14 SP1 - Student license (up to 20 users)**
  Order no.: 6ES7822-1AC04-4YA5

Note that these trainer packages are replaced with successor packages when necessary.
An overview of the currently available SCE packages is provided at: siemens.com/sce/tp

Continued training

For regional Siemens SCE continued training, get in touch with your regional SCE contact
siemens.com/sce/contact

Additional information regarding SCE

siemens.com/sce

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

Information regarding use

The SCE training curriculum for the integrated automation solution Totally Integrated Automation (TIA) was prepared for the program "Siemens Automation Cooperates with Education (SCE)" specifically for training purposes for public educational and R&D institutions. Siemens AG does not guarantee the contents.

This document is to be used only for initial training on Siemens products/systems. This means it can be copied in whole or part and given to those being trained for use within the scope of their training. Circulation or copying this training curriculum and sharing its content is permitted within public training and advanced training facilities for training purposes.

Exceptions require written consent from the Siemens AG contact: Roland Scheuerer roland.scheuerer@siemens.com.

Offenders will be held liable. All rights including translation are reserved, particularly if a patent is granted or a utility model or design is registered.

Use for industrial customer courses is expressly prohibited. We do not consent to commercial use of the training curriculums.

We wish to thank the TU Dresden, particularly Prof. Dr.-Ing. Leon Urbas, the Michael Dziallas Engineering Corporation and all other involved persons for their support during the preparation of this training curriculum.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

Table of contents

1 Goal 6

2 Prerequisite 6

3 Required hardware and software 6

4 Theory 8

4.1 SIMATIC S7-1500 automation system 8

4.1.1 Range of modules 10

4.1.2 Example configuration 13

4.2 Operator control and display elements of the CPU 1516F-3 PN/DP 14

4.2.1 Front view of the CPU 1516F-3 PN/DP with integrated display 14

4.2.2 Status and error displays 14

4.2.3 Operator control and connection elements of the CPU 1516F-3 PN/DP behind the front flap 15

4.2.4 SIMATIC Memory Card 16

4.2.5 Mode switch 16

4.2.6 Display der CPU 17

4.3 Memory areas of the CPU 1516F-3 PN/DP and the SIMATIC memory card 19

4.4 Configuration and operation of the SIMATIC ET 200SP 20

4.4.1 SIMATIC ET 200SP Distributed IOIO 20

4.4.2 Range of modules 22

4.4.3 Example configuration 25

4.5 STEP 7 Professional V13 (TIA Portal V13) programming software 26

4.5.1 Project 27

4.5.2 Hardware configuration 27

4.5.3 Central and distributed automation structure 28

4.5.4 Planning the hardware 28

4.5.5 TIA Portal – Project view and portal view 29

4.5.6 Basic settings for the TIA Portal 31

4.5.7 Setting the IP address on the programming device 33

4.5.8 Setting the IP address in the CPU 36

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.9 Formatting the memory card in the CPU ... 39
4.5.10 Resetting the CPU to factory settings ... 40
4.5.11 Setting the IP address in the ET 200SP ... 41
4.5.12 Reading the firmware version of the ET 200SP ... 44
5 Task ... 45
6 Planning ... 46
7 Structured step-by-step instructions ... 47
7.1 Create a new project ... 47
7.2 Insert the CPU 1516F-3 PN/DP ... 48
7.3 Configure the Ethernet interface of the CPU 1516F-3 PN/DP ... 52
7.4 Configure the fail-safe operation of the CPU 1516F-3 PN/DP ... 53
7.5 Configure the access level for the CPU 1516F-3 PN/DP ... 54
7.6 Insert power module PM 190W 120/230VAC ... 55
7.7 Insert the ET 200SP interface module IM155-6PN HF ... 56
7.8 Configure the ET 200SP / IM 155-6PN HF ... 58
7.9 Insert the 2 digital input modules DI 8x24VDC HF ... 60
7.10 Insert the 2 digital output modules DQ 8x24VDC/0.5A HF ... 62
7.11 Replace components in the hardware configuration ... 63
7.12 Insert the server module ... 64
7.13 Configure the address areas DI/DQ: 0…1 ... 65
7.14 Configuration of the potential groups of the Base Units ... 66
7.15 Save and compile the hardware configuration ... 68
7.16 Assign device name to interface module IM 155-6PN HF ... 69
7.17 Download the hardware configuration to the device ... 72
7.18 Archive the project ... 77
7.19 Checklist ... 78
8 Exercise ... 79
8.1 Task – Exercise ... 79
8.2 Planning ... 79
8.3 Checklist – Exercise ... 80
9 Additional information ... 81

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

DECENTRAL HARDWARE CONFIGURATION – SIMATIC S7-1516F PN/DP WITH ET 200SP VIA PROFINET

1 Goal

In this chapter, you will first learn how to ***create a project***. You are then shown how the ***hardware is configured***.

The SIMATIC S7 controllers listed in Chapter 3 can be used.

2 Prerequisite

You do not need any previous knowledge from other chapters to successfully complete this chapter.

3 Required hardware and software

1 Engineering station: requirements include hardware and operating system
(for additional information, see Readme on the TIA Portal Installation DVDs)

2 SIMATIC STEP 7 Professional software in TIA Portal – as of V13

3 SIMATIC S7-1500 controller, e.g. CPU 1516F-3 PN/DP –
Firmware as of V1.6 with memory card

4 ET 200SP distributed IO for PROFINET with 16DI/16DO and 2AI/1AO
Configuration example
Interface module IM155-6PN HF with Bus Adapter BA 2xRJ45
2x IO module 8x digital input DI 8x24VDC HF
2x IO module 8x digital output DQ 8x24VDC/0.5A HF
2x IO module 2x analog input AI 2xU/I 2, 4-wire HS
IO module 2x analog output AQ 2xU/I HS
Server module

5 Ethernet connection between engineering station and controller and
between controller and ET 200SP distributed IO

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

2 SIMATIC STEP 7 Professional (TIA Portal) as of V13

1 Engineering station

5 Ethernet connection

3 SIMATIC S7-1500 controller

5 Ethernet connection

4 ET 200SP distributed IO

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4 Theory

4.1 SIMATIC S7-1500 automation system

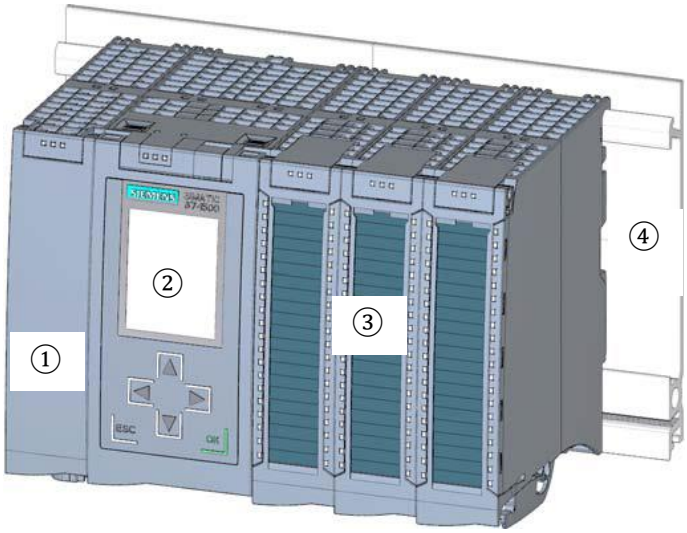
The SIMATIC S7-1500 automation system is a modular controller system for the middle to upper performance range. A comprehensive range of modules is available to optimally adapt the system to the automation task.

SIMATIC S7-1500 is the next generation of the SIMATIC S7-300 and S7-400 automation systems with the following new performance features.

- Increased system performance
- Integrated motion control functionality
- PROFINET IO IRT
- Integrated display for machine-level operation and diagnostics
- STEP 7 language innovations while maintaining proven functions

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

The S7-1500 controller consists of a power supply ①, a CPU with integrated display ② and input and output modules for digital and analog signals ③. The modules are mounted on a mounting rail with integrated DIN rail profile ④. If necessary, communication processors and function modules are also used for special tasks such as stepper motor control.



The programmable logic controller (PLC) uses the S7 program to monitor and control a machine or process. In doing so, the S7 program scans the IO modules via input addresses (%I) and addresses their output addresses (%Q).

The system is programmed with the STEP 7 Professional V13 software.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.1.1 Range of modules

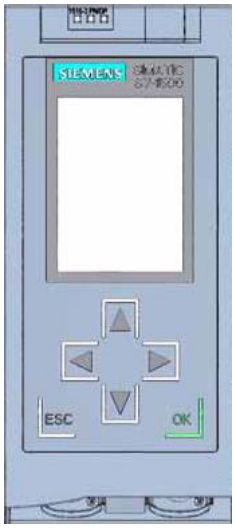
The SIMATIC S7-1500 is a modular automation system and offers the following range of modules:

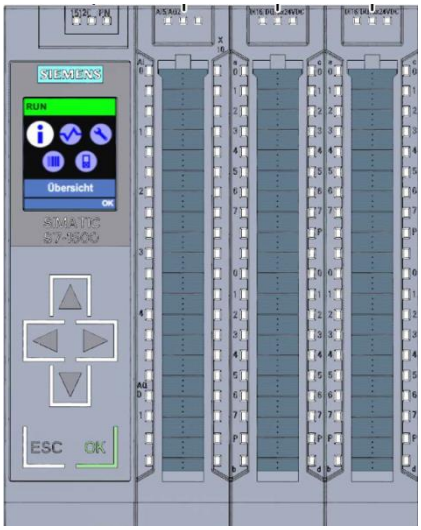
Central processing units (CPUs) with integrated display

The CPUs have different performance capability and execute the user program. In addition, the other modules are supplied power via the backplane bus with the integrated system power supply.

Additional properties and functions of the CPU:

- Communication via Ethernet
- Communication via PROFIBUS/PROFINET
- HMI communication for HMI devices
- Web server
- Integrated technology functions (e.g. PID controller, motion control, etc.)
- System diagnostics
- Integrated security (e.g. know-how, copy, access, integrity protection)
- Integrated digital and analog inputs and outputs (Compact CPUs)

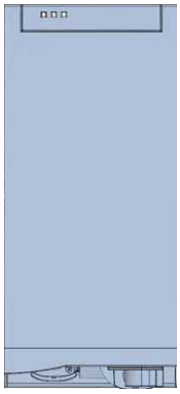




For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

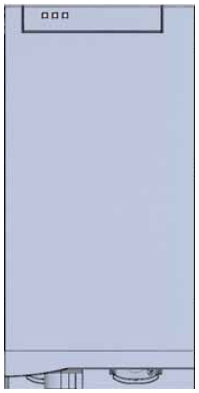
System power supply modules (PS) (rated input voltages 24 V DC to 230 V AC/DC)

with connection to the backplane bus supply the configured modules with the internal supply voltage.



Load current supply modules (PM) (rated input voltages 120/230 V AC)

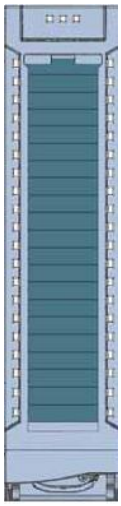
do not have a connection to the backplane bus of the S7-1500 automation system. The load current supply is used to supply 24 V DC to the system power supply of the CPU, the input and output circuits of IO modules and the sensors and actuators.



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

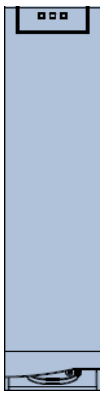
IO modules

for digital input (DI) / digital output (DQ) / analog input (AI) / analog output (AQ)



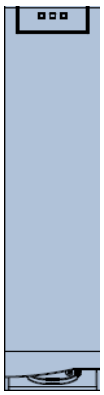
Technology modules (TM)

as incremental encoders and pulse encoders with/without direction signal.



Communication modules (CM)

for serial communication RS232 / RS422 / RS485, PROFIBUS and PROFINET.



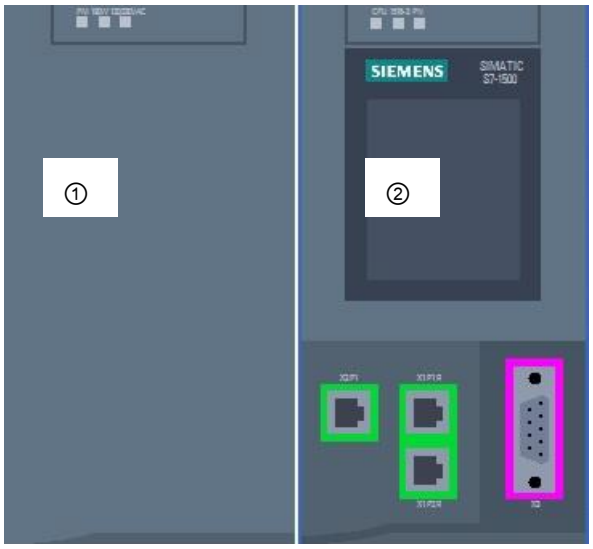
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

SIMATIC memory card

up to a maximum of 32 GB for storing program data and for easy replacement of CPUs during maintenance.

4.1.2 Example configuration

The following configuration of an S7-1500 automation system will be used for the program example in this curriculum.



① Load current supply module (PM) with 120/230 V AC, 50 Hz / 60 Hz, 190 W input and 24 V DC / 8 A output

② Central processing unit CPU 1516F-3 PN/DP with integrated PROFIBUS and PROFINET interfaces

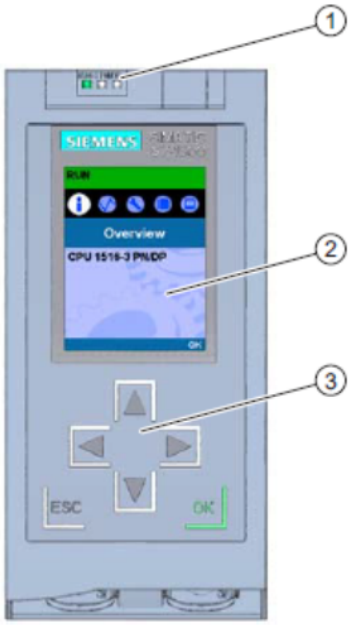
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.2 Operator control and display elements of the CPU 1516F-3 PN/DP

The figure below shows the operator control and display elements of a CPU 1516F-3 PN/DP.

The arrangement and number of elements differ from this figure for other CPUs.

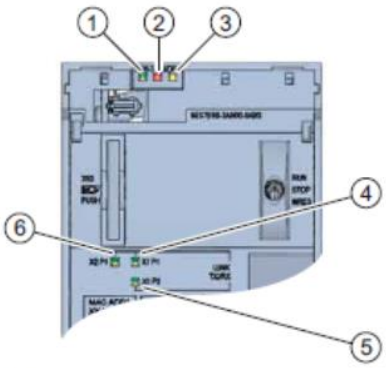
4.2.1 Front view of the CPU 1516F-3 PN/DP with integrated display



① LED displays for the current operating mode and diagnostic status of the CPU
② Display
③ Control keys

4.2.2 Status and error displays

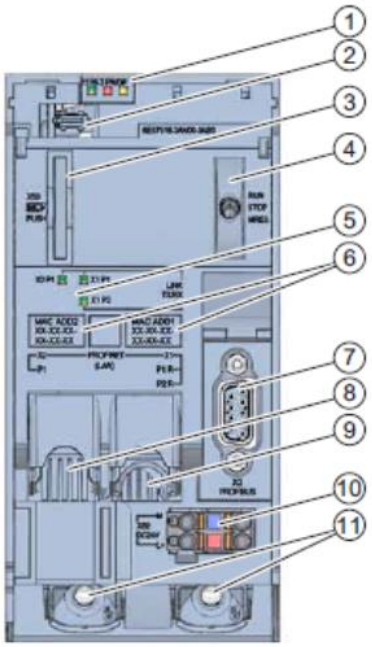
The CPU comes with the following LED displays:



① RUN/STOP LED (yellow/green LED)
② ERROR LED (red LED)
③ MAINT LED (yellow LED)
④ LINK RX/TX LED for port X1 P1 (yellow/green LED)
⑤ LINK RX/TX LED for port X1 P2 (yellow/green LED)
⑥ LINK RX/TX LED for port X2 P1 (yellow/green LED)

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.2.3 Operator control and connection elements of the CPU 1516F-3 PN/DP behind the front flap



① LED displays for the current operating mode and diagnostic status of the CPU
② Display connection
③ Slot for the SIMATIC memory card
④ Mode switch
⑤ LED displays for the 3 ports of the PROFINET interfaces X1 and X2
⑥ MAC addresses of the interfaces
⑦ PROFIBUS interface (X3)
⑧ PROFINET interface (X2) with 1 port
⑨ PROFINET interface (X1) with 2-port switch
⑩ Connection for supply voltage
⑪ Fastening screws

Note: *The front flap with the display can be removed and inserted during operation.*

Note: *The PROFINET field devices (ET 200SP in this case) should be connected to the PROFINET interface(X1) with the 2 ports.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.2.4 SIMATIC Memory Card

A SIMATIC Micro Memory Card is used as the memory module for the CPUs. This is a preformatted memory card that is compatible with the Windows file system. It is available with various storage capacities and can be used for the following purposes:

- Transportable data storage medium
- Program card
- Firmware update card

The MMC **must** be inserted to operate the CPU as the CPUs have no integrated load memory. A commercially available SD card reader is needed to write/read the SIMATIC memory card with the programming device or PC. This allows files to be copied directly to the SIMATIC memory card using Windows Explorer, for example.

> ***Note:*** *It is recommended that the SIMATIC memory card only be removed or inserted when the CPU is in the POWER OFF state.*

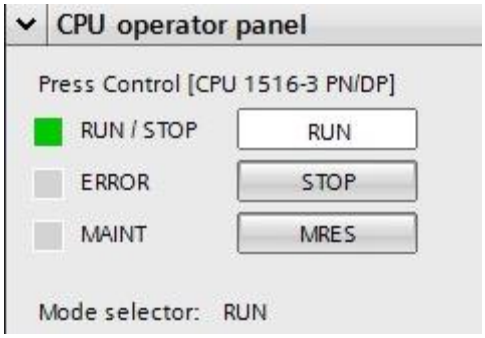
4.2.5 Mode switch

The mode switch allows you to set the operating mode of the CPU. The mode switch is designed as a toggle switch with 3 switch positions.

Position	Meaning	Explanation
RUN	RUN mode	The CPU processes the user program.
STOP	STOP mode	The CPU is not executing the user program.
MRES	Memory reset	Position for CPU memory reset.

You can also use the button on the CPU operator panel of the STEP 7 Professional V13 software in Online & Diagnostics to switch the operating mode (**STOP** or **RUN**).

The operator panel also contains an **MRES** button for performing a memory reset and displays the status LEDs of the CPU.



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

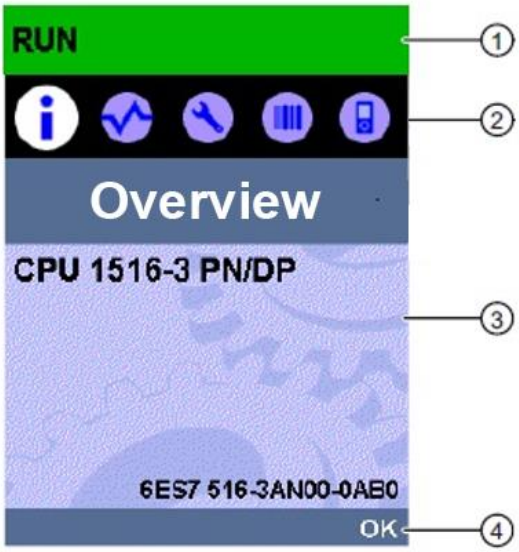
4.2.6 Display der CPU

The S7-1500 CPU has a front flap with a display and control keys. Control data and status data can be displayed in various menus on the display and numerous settings can be configured. You use the control keys to navigate through the menus.

The display of the CPU offers the following functions:

- 6 different display languages can be selected.
- Diagnostic messages are displayed in plain text.
- The interface settings can be changed locally.
- Password assignment for display operation is possible through the TIA Portal.

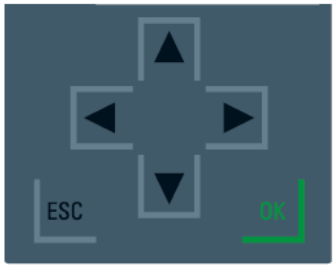
View of the display of an S7-1500:



① CPU status information
② Submenu name
③ Information display field
④ Navigation aid, e.g. OK/ESC or the page number

Control keys of the display

- Four arrow keys: "up", "down", "left", "right"
- An ESC key
- An OK key



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

Functions of the "OK" and "ESC" keys

→ For menu commands in which an input can be made:

- OK → valid access to the menu command, confirmation of input and exit from editing mode
- ESC → restoration of original content (which means changes are not saved) and exit from editing mode

→ For menu commands in which no input can be made:

- OK → to next submenu command
- ESC → back to previous menu command

Available submenus of the display:

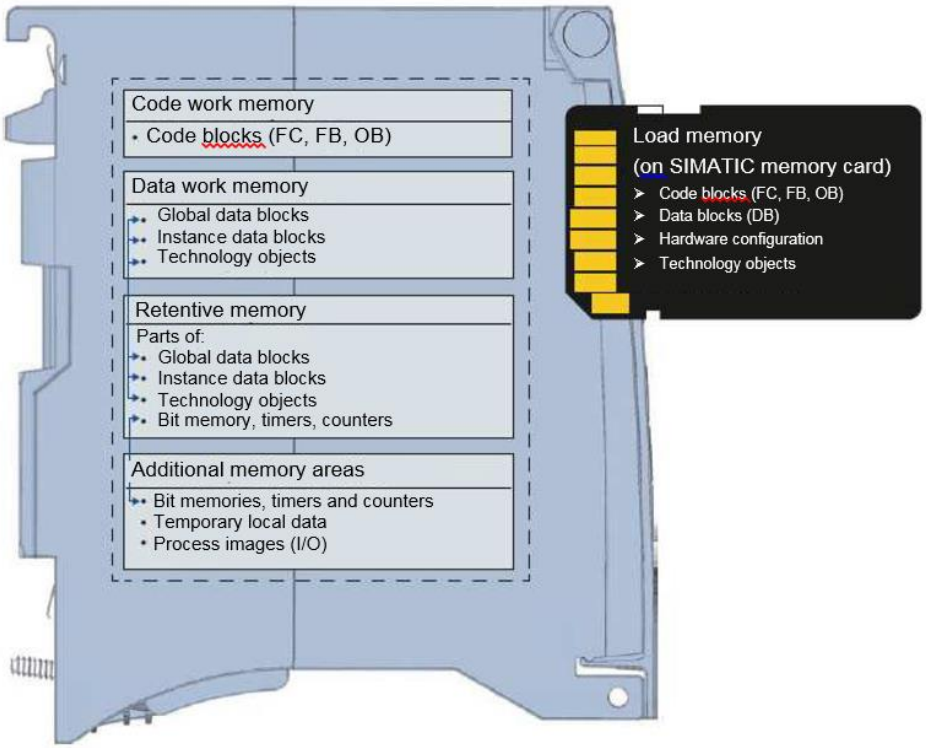
Main menu commands	Meaning	Explanation
	Overview	The "Overview" menu contains information about the properties of the CPU.
	Diagnostics	The "Diagnostics" menu contains information about diagnostic messages, the diagnostic description and the indication of interrupts. There is also information about the network properties of each interface of the CPU.
	Settings	In the "Settings" menu, the IP addresses of the CPU are assigned, the date, time, time zones, operating modes (RUN/STOP) and protection levels are set, the CPU memory is reset and its factory settings are restored and the status of firmware updates is displayed.
	Modules	The "Modules" menu contains information about the modules that are used in your configuration. The modules can be used as central or distributed modules. Distributed modules are connected to the CPU via PROFINET and/or PROFIBUS. You have the option here to set the IP addresses for a CPU.
	Display	In the "Display" menu, settings are made for all aspects of the display, such as the language setting, brightness setting and Energy-saving mode. (Energy-saving darkens the display. Standby mode switches off the display.)

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.3 Memory areas of the CPU 1516F-3 PN/DP and the SIMATIC memory card

The following figure shows the memory areas of the CPU and the load memory on the SIMATIC memory card.

In addition to the load memory, other data can be loaded onto the SIMATIC memory card using Windows Explorer. This includes recipes, data logs, project backups and additional documentation for the program.



Load memory

Load memory is non-volatile memory for code blocks, data blocks, technology objects and the hardware configuration. When these objects are downloaded to the CPU, they are first stored in the load memory. This memory is located on the SIMATIC memory card.

Work memory

Work memory is volatile memory that contains the code and data blocks. The work memory is integrated into the CPU and cannot be expanded. In S7-1500 CPUs, the work memory is divided into two areas:

→ Code work memory:

– The code work memory contains runtime-relevant parts of the program code.

→ Data work memory:

– The data work memory contains the runtime-relevant parts of the data blocks and technology objects.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

At the operating mode transitions from POWER ON to startup and from STOP to startup, tags of global data blocks, instance data blocks and technology objects are initialized with their start values. Retentive tags retain their actual values that were saved in the retentive memory.

Retentive memory

Retentive memory is non-volatile memory for saving certain data in the event of power failure. The tags and operand areas that have been defined as retentive are saved in the retentive memory. This data is retained beyond power-off or power failure.

All other program tags are set to their start values at the operating mode transitions from POWER ON to startup and from STOP to startup.

The content of retentive memory is deleted by the following actions:

- Memory reset
- Reset to factory settings

Note: *Certain tags of technology objects are also stored in the retentive memory. These tags are not deleted by a memory reset.*

4.4 Configuration and operation of the SIMATIC ET 200SP

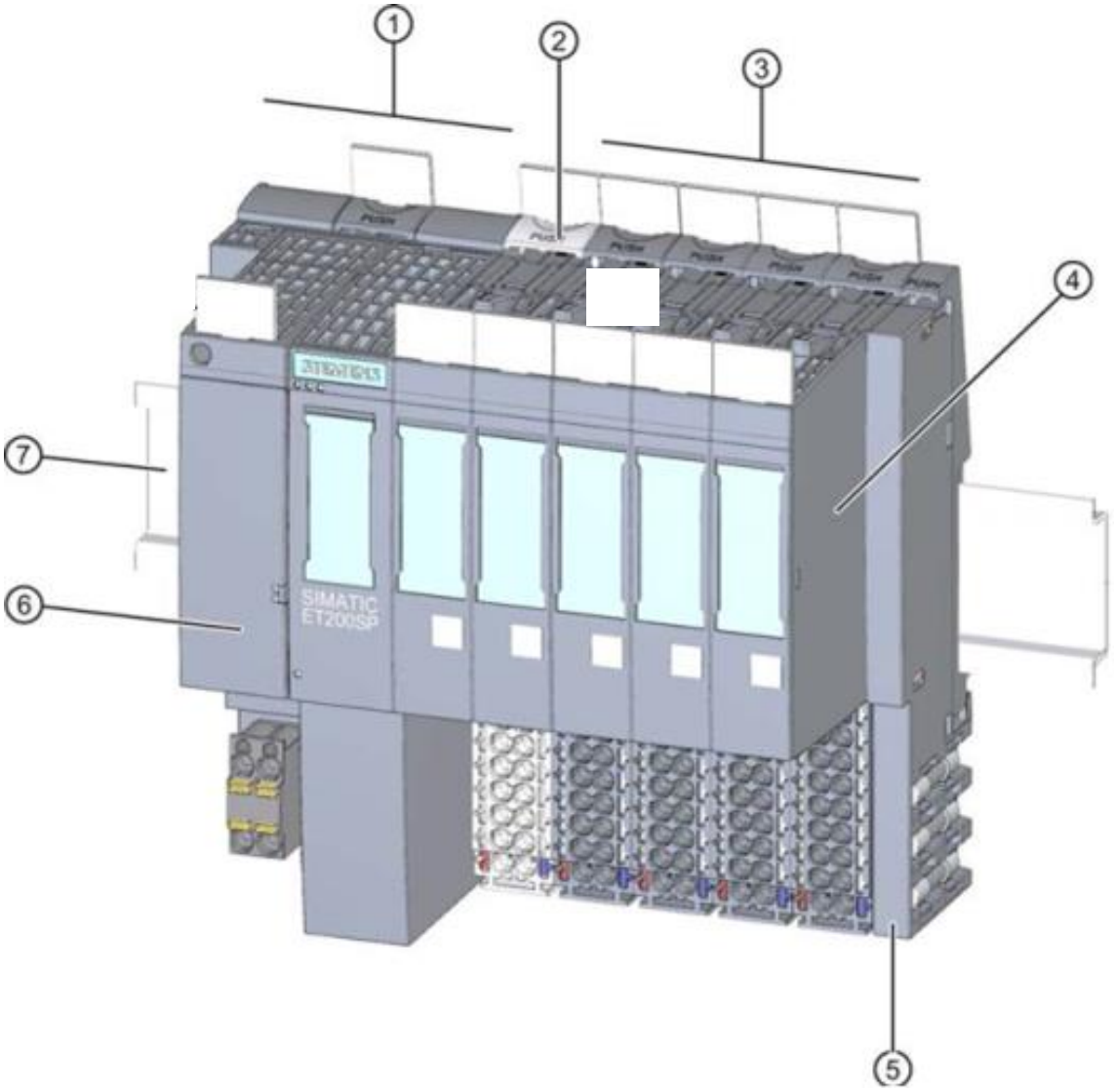
4.4.1 SIMATIC ET 200SP Distributed IOIO

SIMATIC ET 200SP Distributed IO is a modular distributed IO system for connecting process signals to a central automation system such as SIMATIC S7-1500. A comprehensive range of modules is available to optimally adapt the system to the automation task.

Distributed IO are often used when signals must be transmitted over a larger distance and the associated wiring overhead is too high. The signals can be collected locally at the remote location and connected to the central controller via a bus system. In the case of the ET 200SP system, devices can be connected via PROFINET or PROFIBUS.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

The ET 200SP distributed IO is mounted on a standard mounting rail ⑦ and is composed of an interface module ① with bus adapter ⑥, up to 32/64 IO modules ④ inserted on BaseUnits ②, ③ and a terminating server module ⑤.



The distributed IO provide inputs and outputs locally for the process connection, which can be read and written by the central processing unit via a bus protocol. In doing so, the IO modules are scanned in the S7 program using input addresses (%I) and addressed using output addresses (%Q) in the usual way.

Because the distributed IO are an extension of the central controller, the system is also configured with the STEP 7 Professional V13 software.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

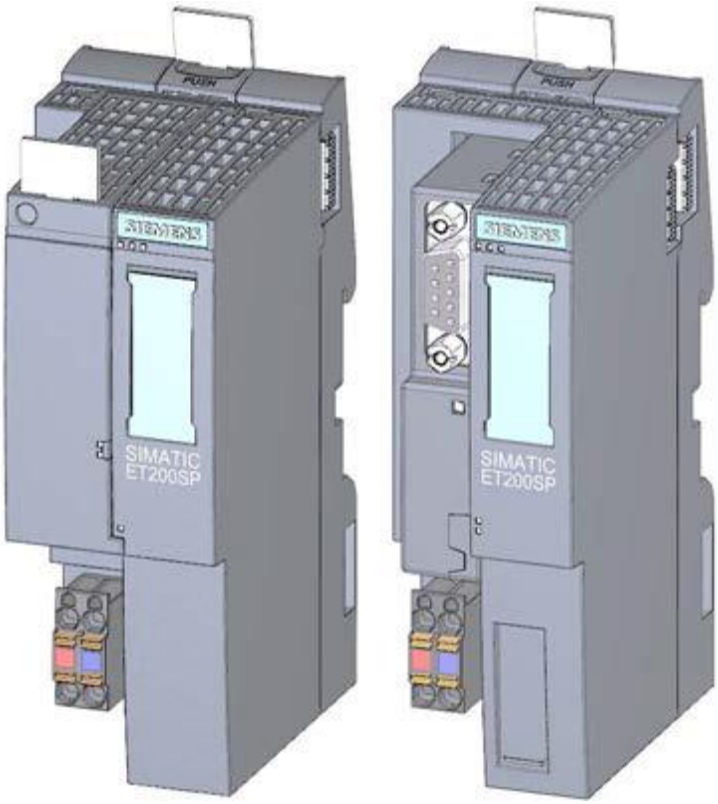
4.4.2 Range of modules

The SIMATIC ET 200SP is a modular distributed IO system and offers the following range of modules:

Interface modules with pluggable bus adapter

for connection of distributed IO to a central processing unit.

The bus adapter enables selection of any type of connection system. Interface modules have their own power supply, which is not connected via the backplane bus.

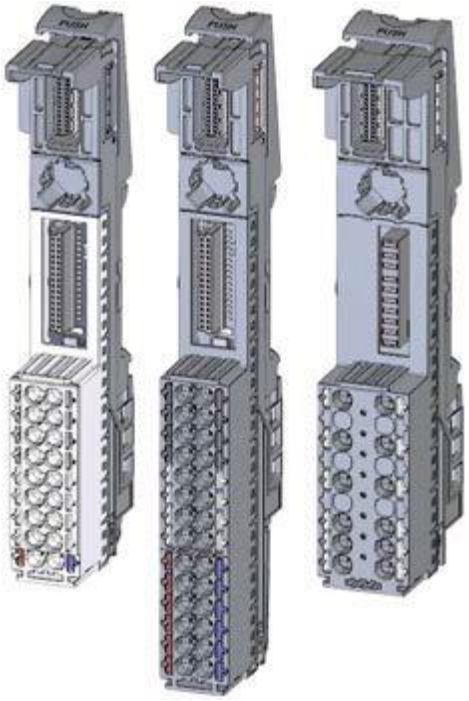


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

BaseUnits

as universal basic modules for electrical and mechanical connection of the IO modules.

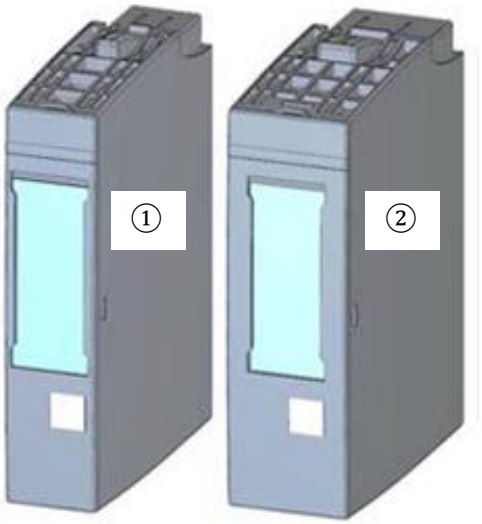
They are available in a light version BU..D that opens a new potential group for the voltage supply over the backplane bus and in a dark version BU..B that continues the potential group. At least one light BaseUnit BU..D must always be used in order to supply at least one potential group with voltage. The IO modules are inserted on the BaseUnits.



IO modules

for digital input (DI) / digital output (DQ) / analog input (AI) / analog output (AQ).

They are available in versions for 24 V DC ① and 400 V AC ②



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

Communication modules (CM)

for a point-to-point (PtP) connection ① or connection to the IO-Link ② and AS-i ③ communication systems.

Server module

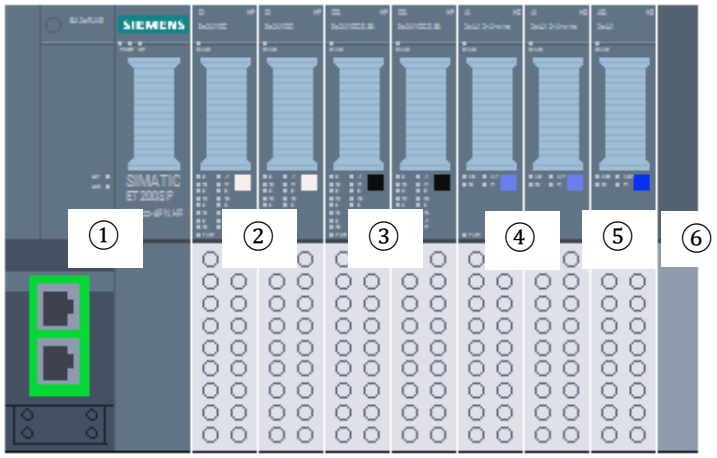
as a termination for the configuration of the ET 200SP system.

It can be used as a holder for 3 spare fuses. It serves as a terminating resistor for the backplane bus and is thus a mandatory component.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.4.3 Example configuration

The following configuration of an ET 200SP distributed IO system will be used for the program example in this curriculum.



① Interface module IM155-6PN HF with Bus Adapter BA 2xRJ45

② IO module 8x digital input DI 8x24VDC HF (2x)

③ IO module 8x digital output DQ 8x24VDC/0.5A HF (2x)

④ IO module 2x analog input AI 2xU/I 2, 4-wire HS (2x)

⑤ IO module 2x analog output AQ 2xU/I HS (1x)

⑥ Server module

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5 STEP 7 Professional V13 (TIA Portal V13) programming software

STEP 7 Professional V13 (TIA Portal V13) software is the programming tool for the following automation systems:

- SIMATIC S7-1500
- SIMATIC S7-1200
- SIMATIC S7-300
- SIMATIC S7-400
- SIMATIC WinAC

STEP 7 Professional V13 provides the following functions for plant automation:

- Configuration and parameter assignment of the hardware
- Specification of the communication
- Programming
- Testing, commissioning and servicing with operational/diagnostic functions
- Documentation
- Creation of visualizations for SIMATIC Basic Panels using the integrated WinCC Basic software
- Visualization solutions for PCs and other panels can also be created with other WinCC software packages

Support is provided for all functions through detailed online help.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.1 Project

To implement a solution for an automation and visualization task, you create a project in the TIA Portal. A project in the TIA Portal contains the configuration data for the configuration and internetworking of devices as well as the programs and the configuration of the visualization.

4.5.2 Hardware configuration

The *hardware configuration* includes the configuration of the devices, consisting of the hardware of the automation system, the intelligent field devices and the hardware for visualization. The configuration of the networks specifies the communication between the various hardware components. The individual hardware components are *inserted in the hardware configuration* from catalogs.

The hardware of automation systems comprises controllers (CPUs), signal modules for input and output signals (SMs) and communication processors, and interface modules (CP, IM). Power supply and voltage supply modules (PS, PM) are also available to supply the modules.

The signal modules and intelligent field devices connect the input and output data of the process to be automated and visualized to the automation system.

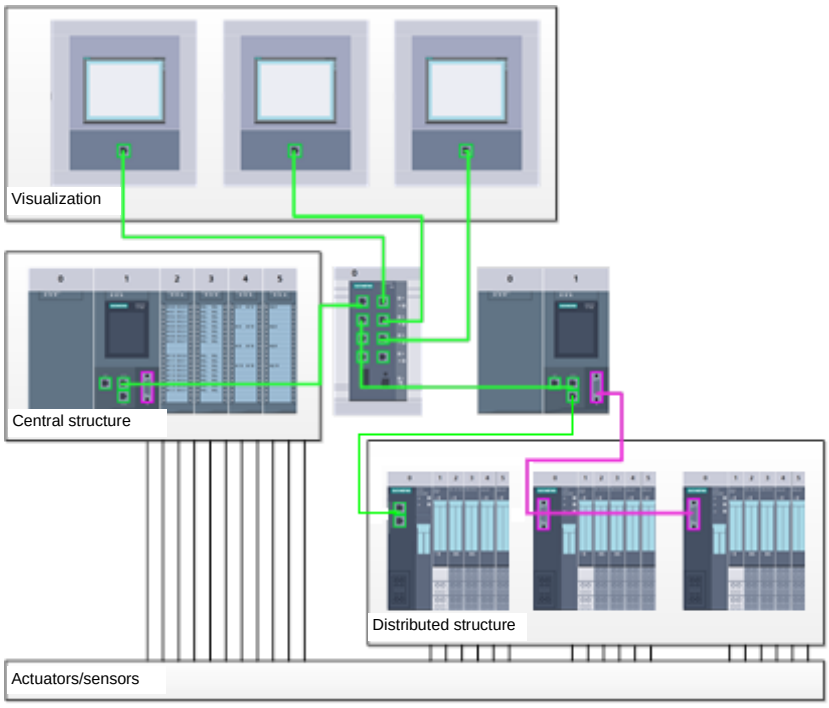


Figure 1: Example of hardware configuration with central and distributed structures

The hardware configuration enables the downloading of automation and visualization solutions to the automation system and access to the connected signal modules by the controller.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.3 Central and distributed automation structure

Figure 1 shows an automation structure that contains both central and distributed structures.

In central structures, the input and output signals of the process are transmitted by way of conventional wiring to the signal modules, which are connected directly to the controller. Conventional wiring refers to the connection of sensors and actuators using 2-wire or 4-wire cables.

The distributed structure is the predominant structure used today. Here, the sensors and actuators are wired conventionally only as far as the signal modules of the field devices. The signal transmission from the field devices to the controller is implemented using an industrial communication system.

Both classic fieldbuses such as PROFIBUS, Modbus and Foundation Fieldbus as well as Ethernet-based communication systems such as PROFINET can be used as the industrial communication system.

In addition, intelligent field devices in which stand-alone programs run can also be connected via the communication system. These programs can also be created with the TIA Portal.

4.5.4 Planning the hardware

Before you can configure the hardware, you must plan it (hardware planning). In general, you begin by selecting which controllers are needed and how many. Next you select the communication modules and signal modules. The selection of signal modules is based on the number and type of inputs and outputs needed. As the final step, a power supply that ensures that the necessary power is supplied must be selected for each controller or field device.

The functionality required and the ambient conditions are of vital importance for planning the hardware configuration. For example, the temperature range in the application area sometimes limits the devices available for selection. Fail-safe operation might be another requirement, for example.

The TIA Selection Tool (Select automation technology → TIA Selection Tool and follow the instructions) provides you support. Note: TIA Selection Tool requires Java.

> ***Note for online research:*** *If more than one manual is available, you should look for the description "Device Manual", "Product Manual" or simply "Manual" (as opposed to "Function Manual", "List Manual", "System Manual", etc.) in order to find the device specifications.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.5 TIA Portal – Project view and portal view

The TIA Portal has two important views. When started, the portal view appears by default. This view makes getting started easier, especially for beginning users.

The portal view provides a task-oriented view of the tools for working on the project. Here, you can quickly decide what you want to do and open the tool for the task at hand. If necessary, a change to the project view takes place automatically for the selected task.

Figure 2 shows the portal view. At the bottom left, there is an option to switch between this view and the project view.

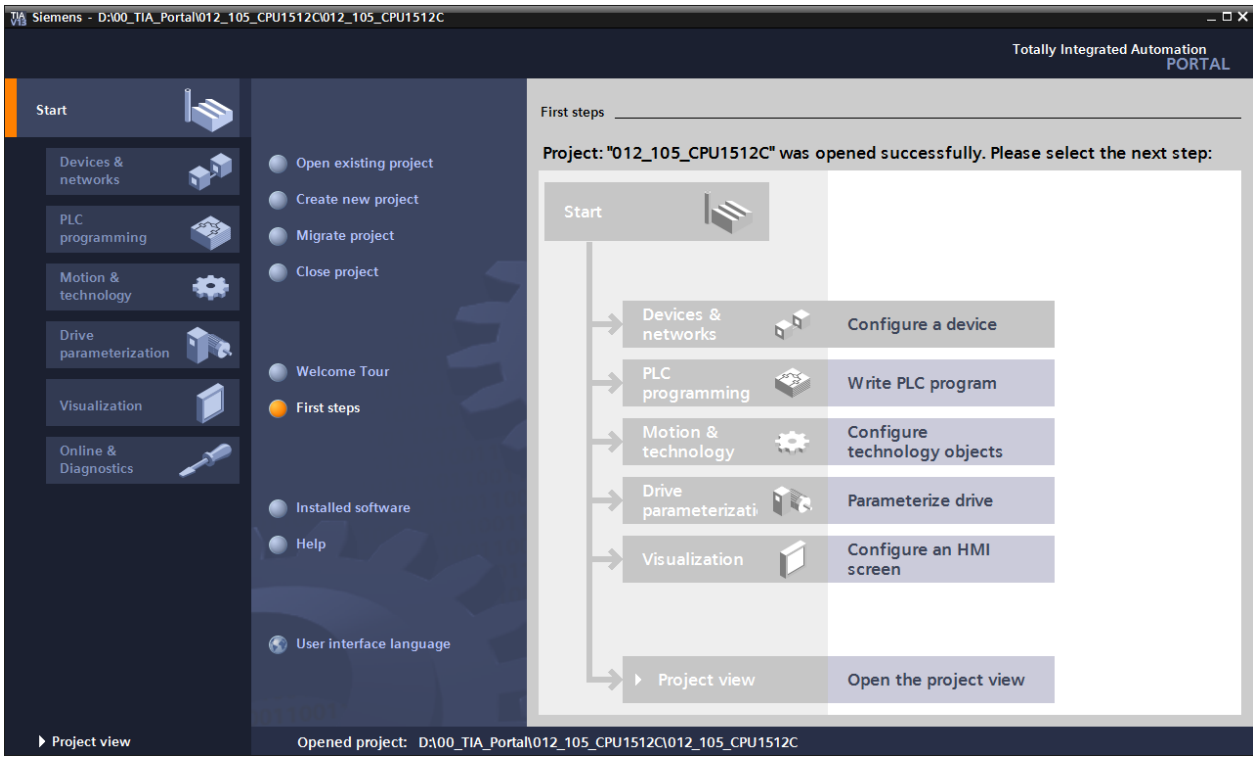


Figure 2: Portal view

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

The project view, as shown in Figure 3 is used for hardware configuration, programming, creation of the visualization and many other tasks.

By default, the project view displays the menu bar with the toolbars at the top, the project tree with all components of a project on the left and the so-called task cards with instructions and libraries, for example, on the right.

If an element (for example, the device configuration) is selected in the project tree, it is displayed in the center and can be worked on there.

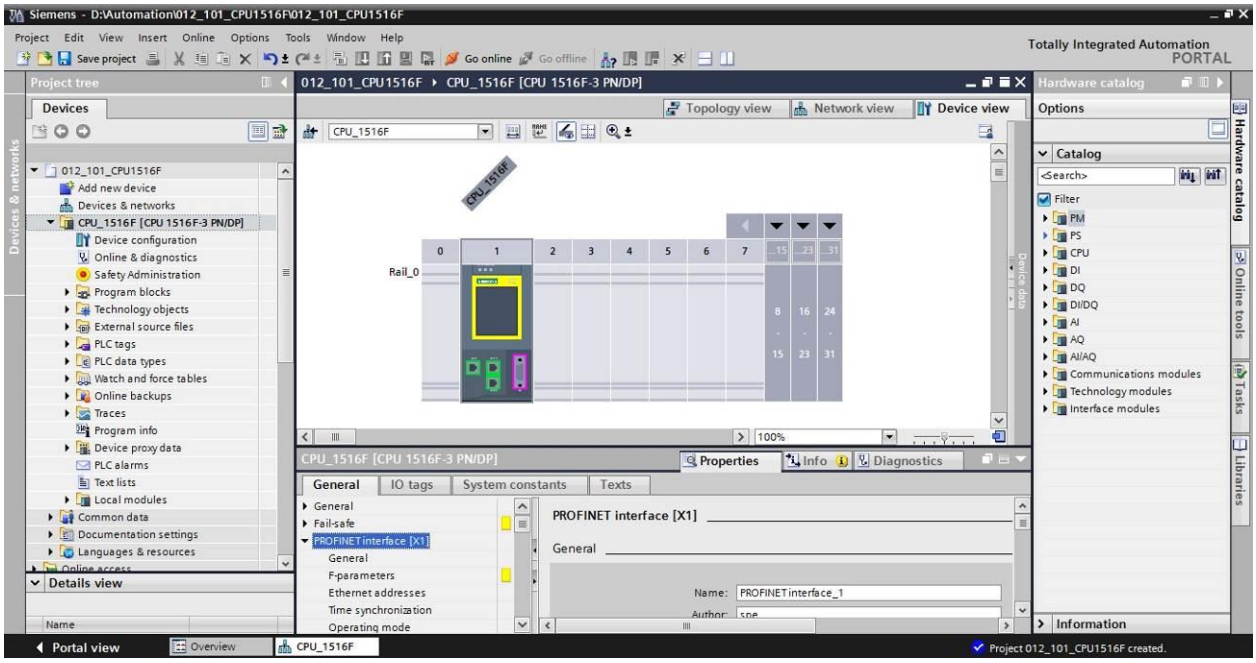


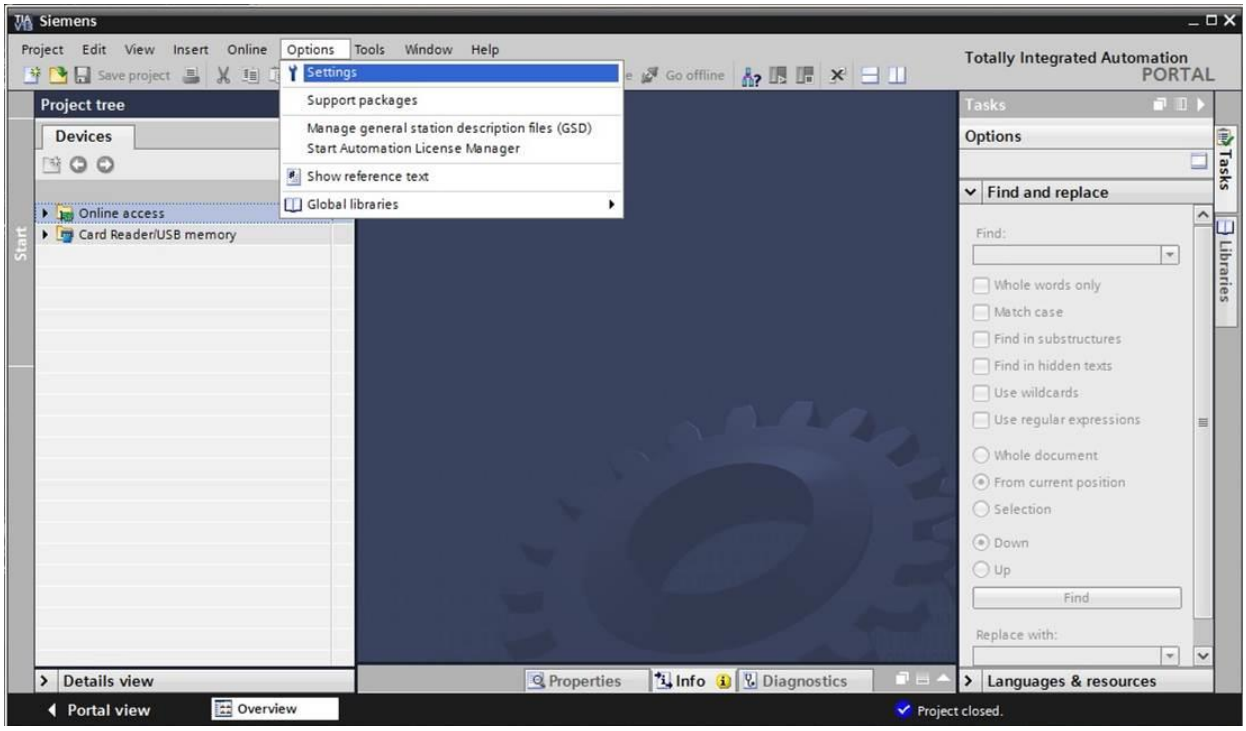
Figure 3: Project view

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.6 Basic settings for the TIA Portal

→ Users can specify their own default settings for certain settings in the TIA Portal. A few important settings are shown here.

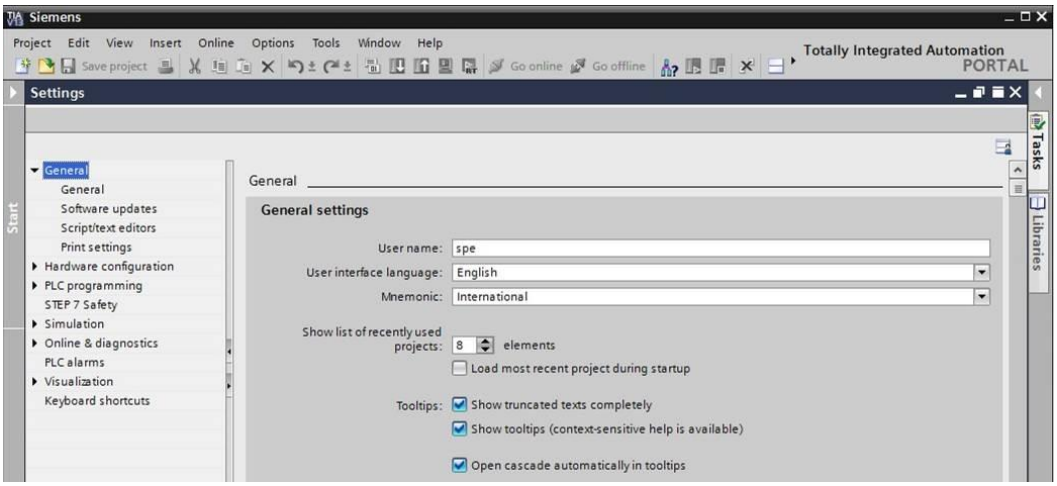
→ In the project view, select the →"Options" menu and then → "Settings".



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ One basic setting is the selection of the user interface language and the language for the program display. In the curriculums to follow, "English" will be used for both settings.

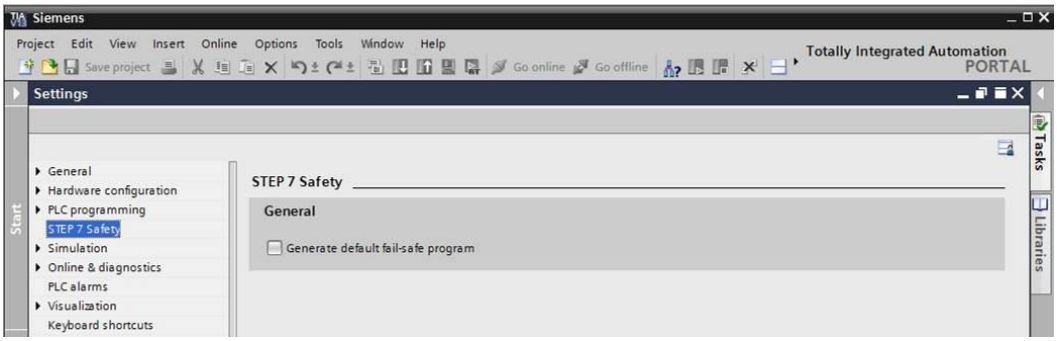
→ Under → "General" in "Settings", select "User interface language → English" and "Mnemonic → International".



Note: *These settings can always be changed.*

→ When Safety CPUs are used (e.g. CPU 1516F-3 PN/DP) without the use of safety engineering, it is recommended that automatic creation of the safety program be deactivated before creating a project.

→ In "Settings" under the → "STEP 7 Safety" item, deactivate → "Generate default fail-safe program".



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.7 Setting the IP address on the programming device

To program SIMATIC S7-1500 from the PC, the programming device or a laptop, you need a TCP/IP connection or an optional PROFIBUS connection.

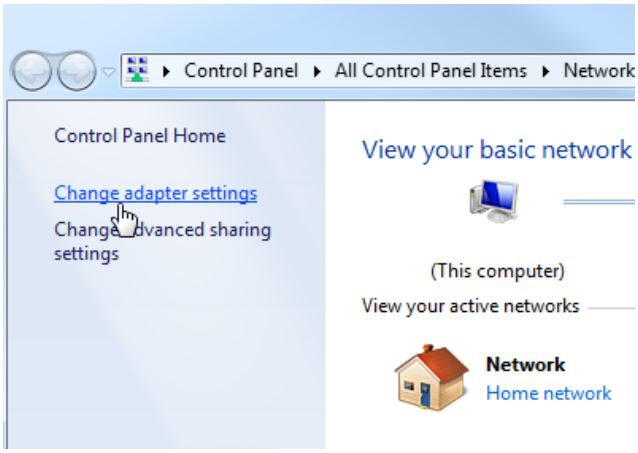
For the PC and SIMATIC S7-1500 to communicate with each other via TCP/IP, it is important that the IP addresses of both devices match.

First, we show you how to set the IP address of a computer with the Windows 7 operating system.

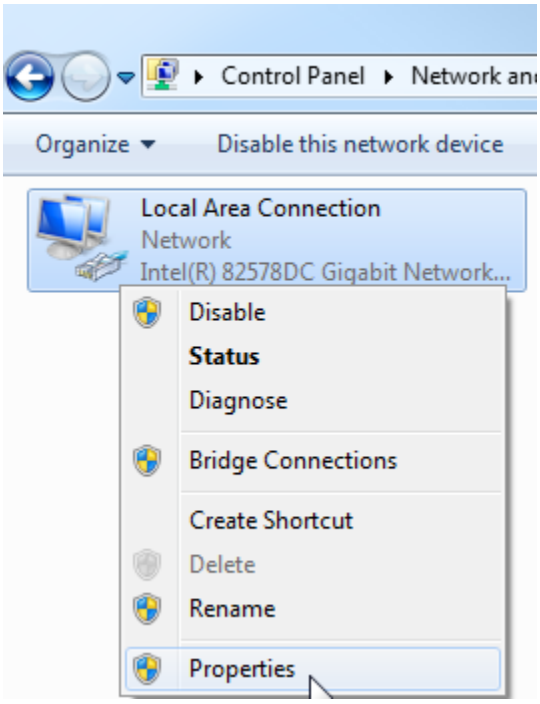
→ Locate the network icon in the taskbar at the bottom and click → "Open Network and Sharing Center".

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ In the open Network and Sharing Center window, click → "Change adapter settings".

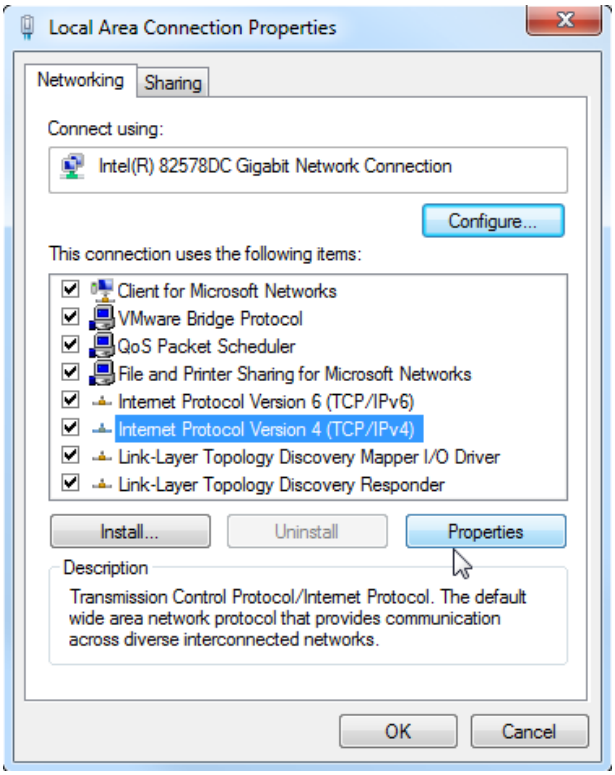


→ Select the desired → "Local Area Connection" that you want to use to connect to the controller and click → "Properties".

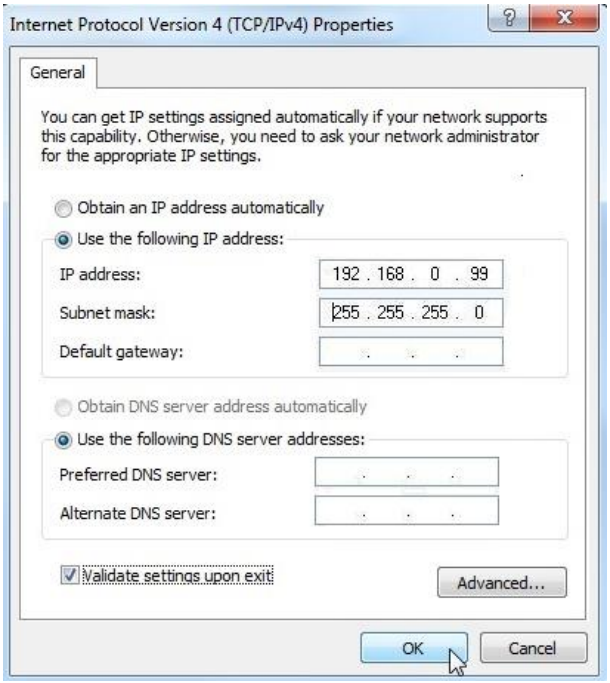


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Next, select → "Properties" for → "Internet Protocol Version 4 (TCP/IP)".



→ You can use the following IP address, for example → IP address: 192.168.0.99 → Subnet mask 255.255.255.0 and accept the settings (→ "OK")



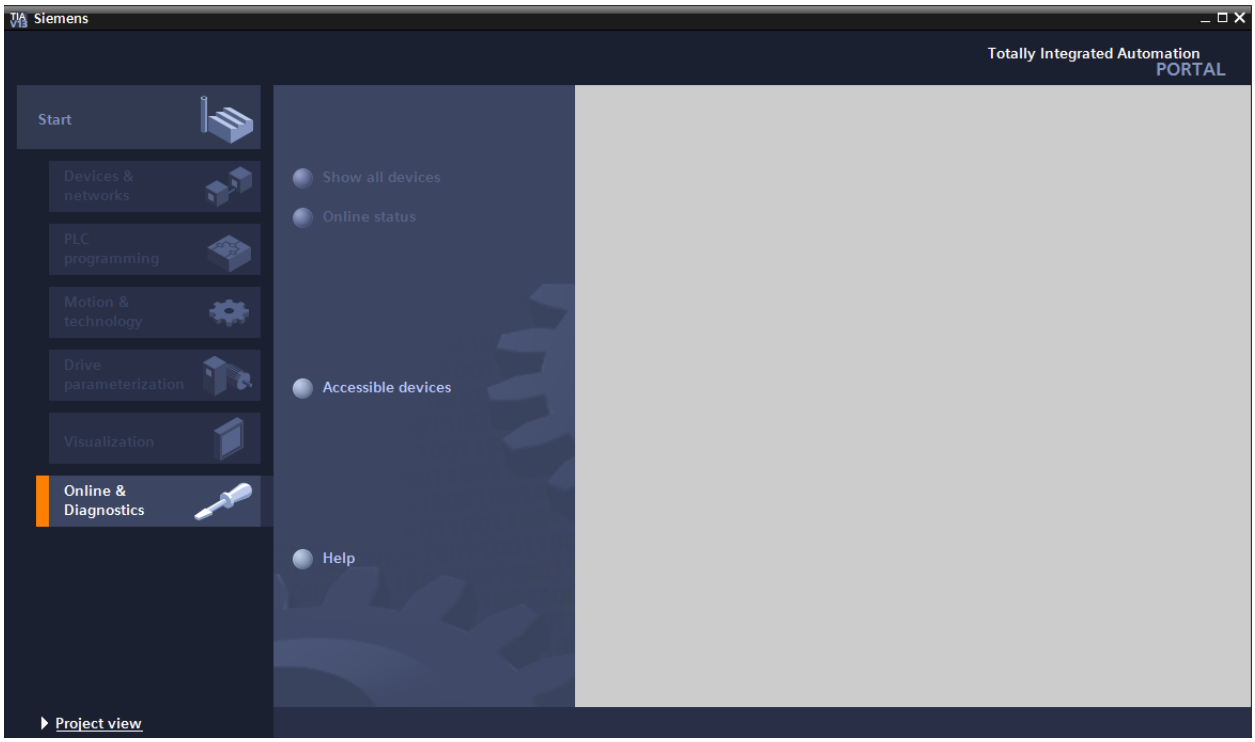
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.8 Setting the IP address in the CPU

The IP address of SIMATIC S7-1500 is set as follows.

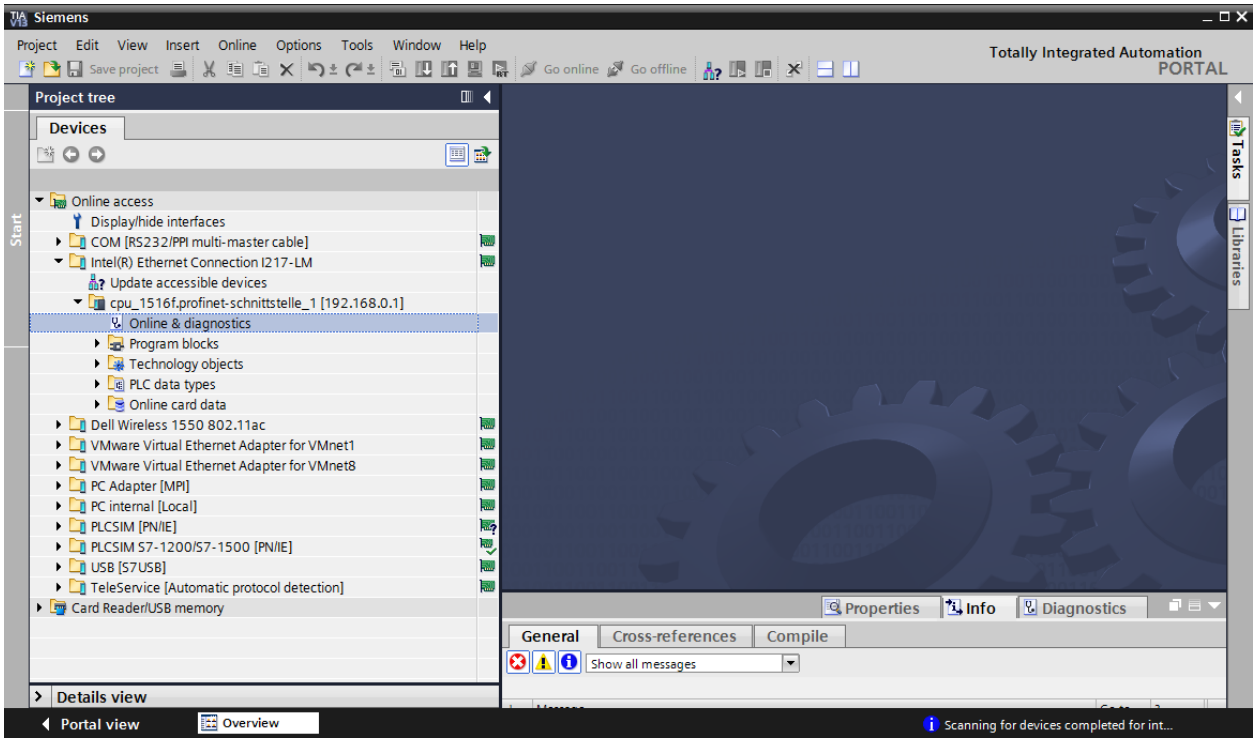
→ Select the Totally Integrated Automation Portal for this, which is opened here with a double-click. (→ TIA Portal V13)

→ Select → "Online & Diagnostics" and open the →"project view".



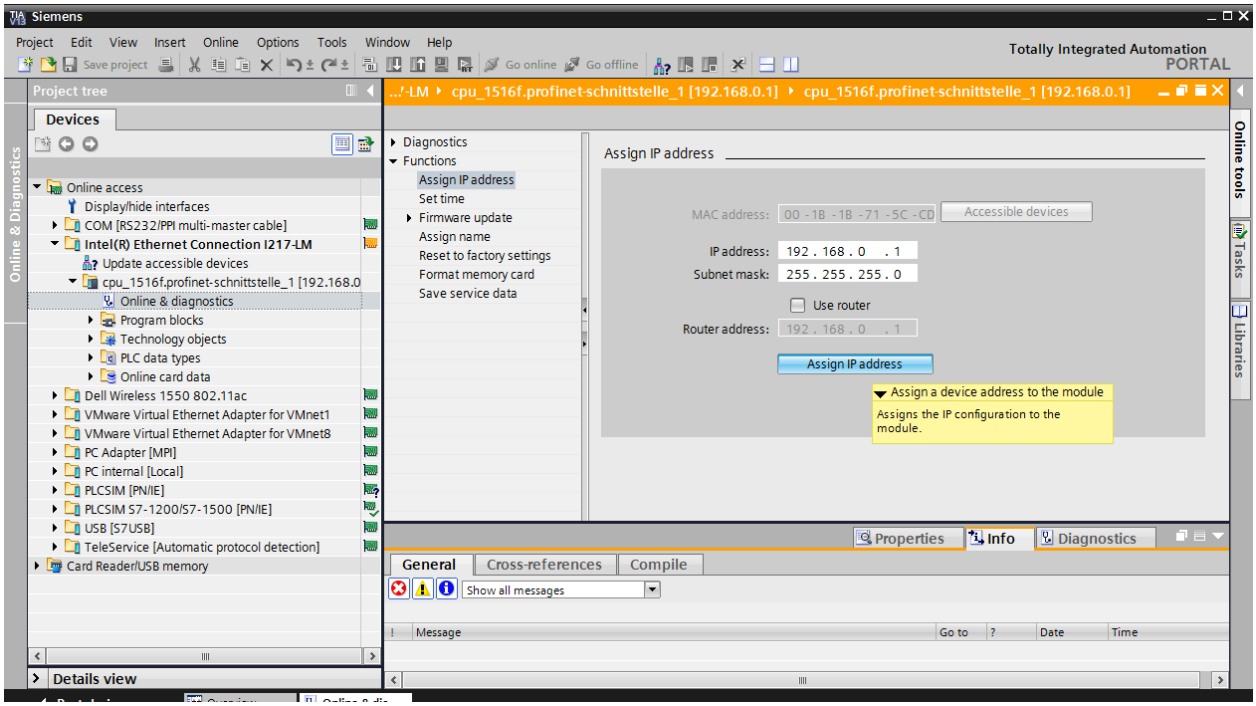
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ In the project tree under → "Online access", select the network adapter that was set previously. If you click → "Update accessible devices" here, you will see the IP address (if previously set) or the MAC address (if IP address not yet assigned) of the connected SIMATIC S7-1500. Select → "Online & Diagnostics" here.



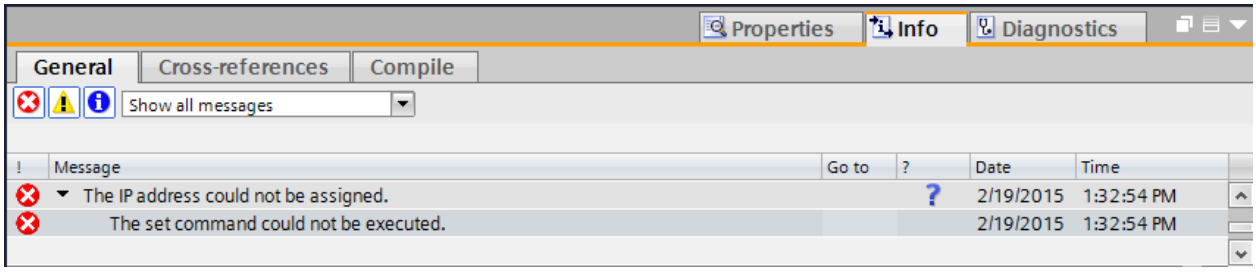
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Under→ "Functions", you now find the → "Assign IP address" item. Enter the following IP address here (example): → IP address: 192.168.0.1 → Subnet mask 255.255.255.0. Next, click → "Assign IP address" and this new address will be assigned to your SIMATIC S7-1500.



Note: *The IP address of the SIMATIC S7-1500 can also be set via the display on the CPU, provided this is enabled in the hardware configuration.*

→ If the IP address was not successfully assigned, you will receive a message in the → "Info" window under → "General".

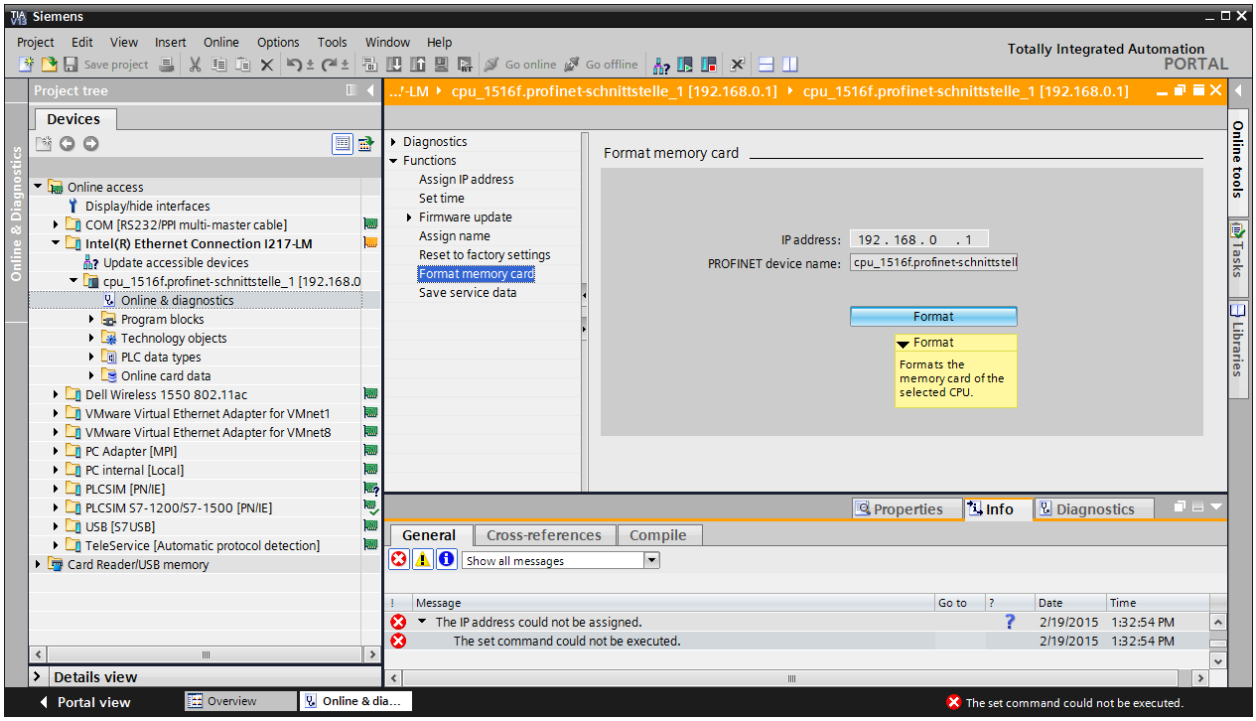


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

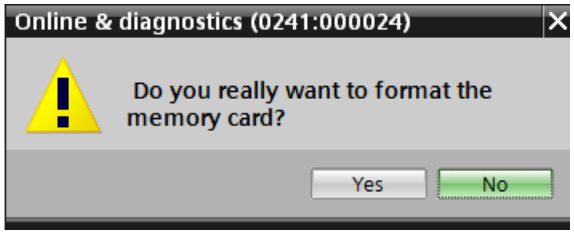
4.5.9 Formatting the memory card in the CPU

→ If the IP address could not be assigned, the program data on the CPU must be deleted. This is accomplished in 2 steps: → "Format memory card" and →"Reset to factory settings".

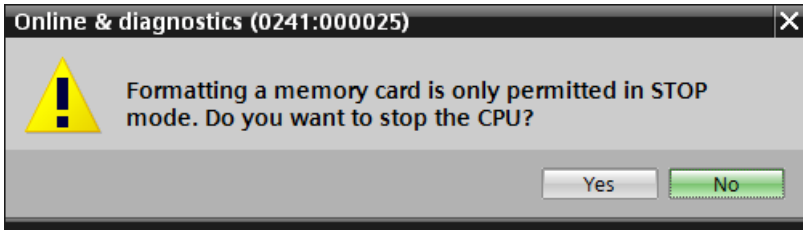
→ First, select the → "Format memory card" function and press the → "Format" button.



→ Confirm the prompt asking if you really want to format the memory card with → "Yes".



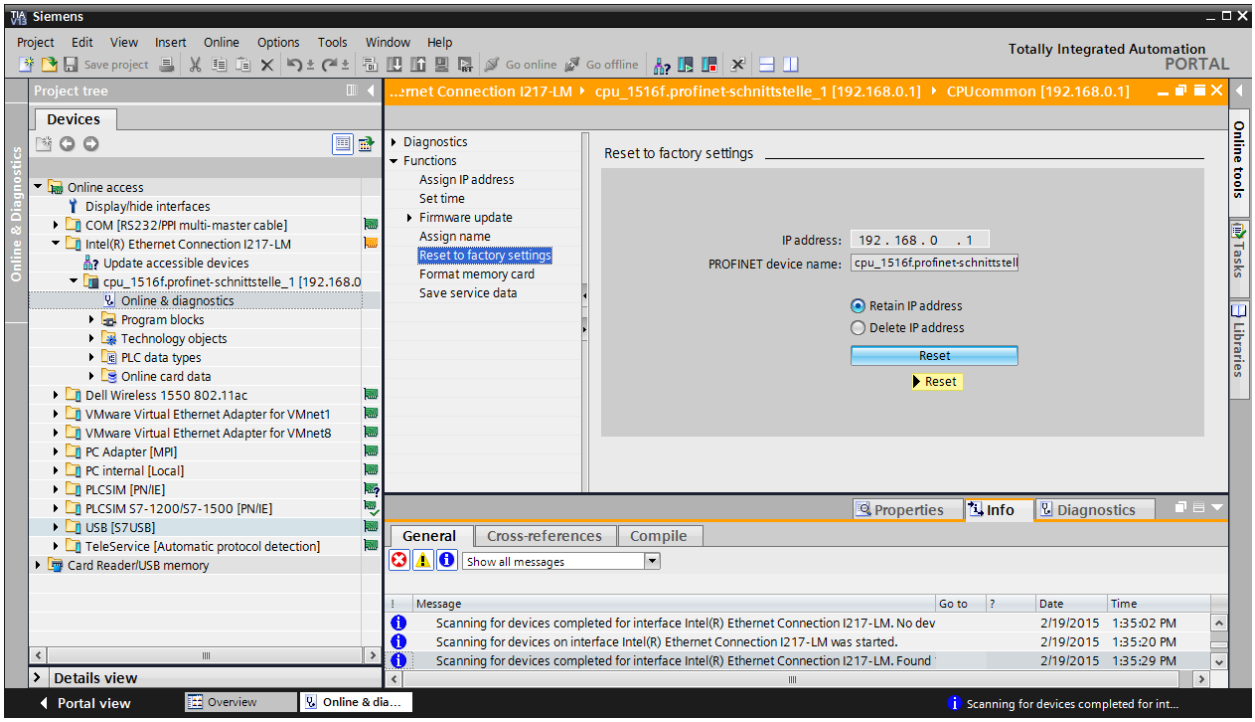
→ If necessary, stop the CPU. (→ "Yes")



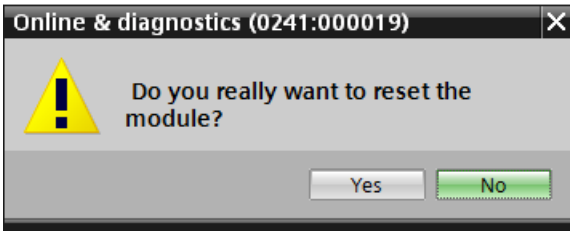
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.10 Resetting the CPU to factory settings

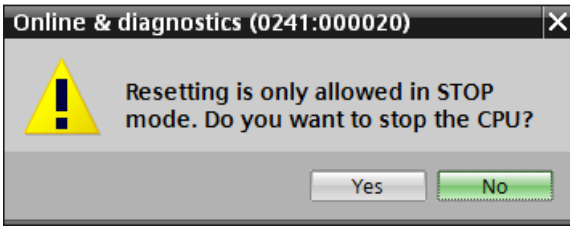
→ Before you can reset the CPU, you must wait until the formatting in the CPU has finished. Then you must select → "Update accessible devices" and → "Online & diagnostics" of your CPU again. To reset the controller, select the → "Reset to factory settings" function and click → "Reset".



→ Confirm the prompt asking if you really want to reset the module with → "Yes".



→ If necessary, stop the CPU. (→ "Yes")



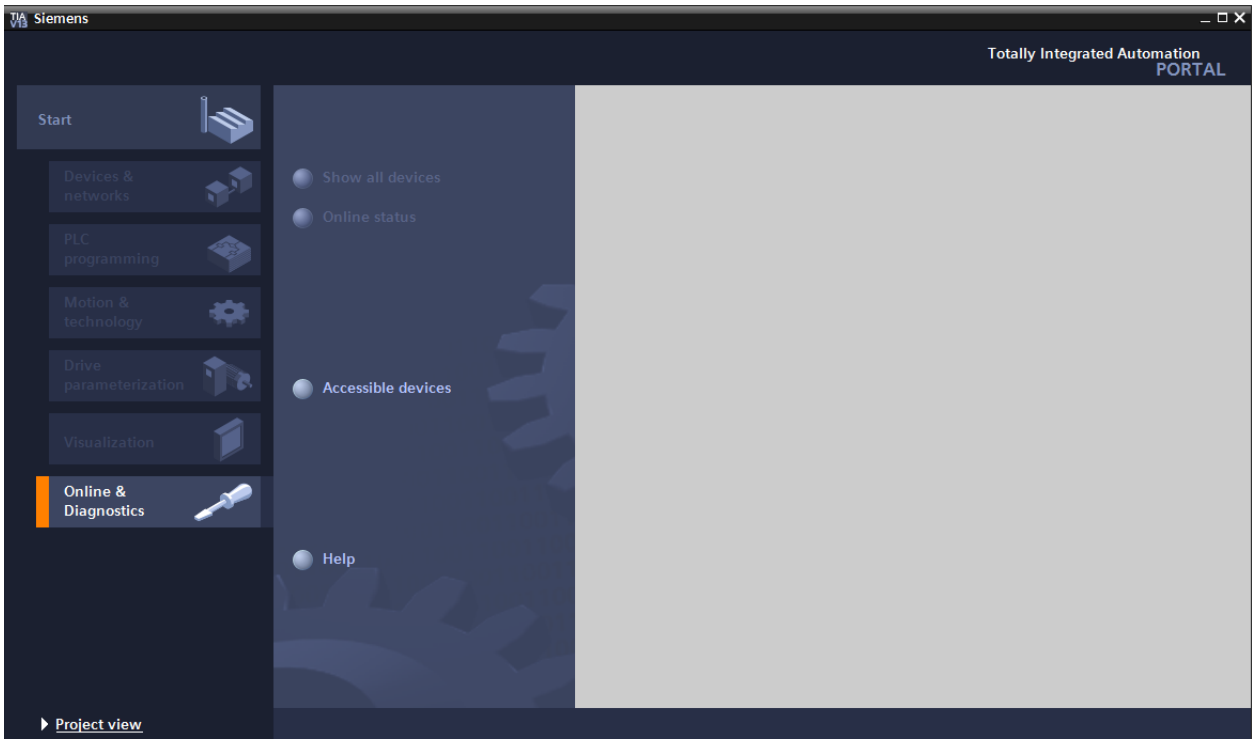
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.11 Setting the IP address in the ET 200SP

The IP address of the ET 200SP is set as follows.

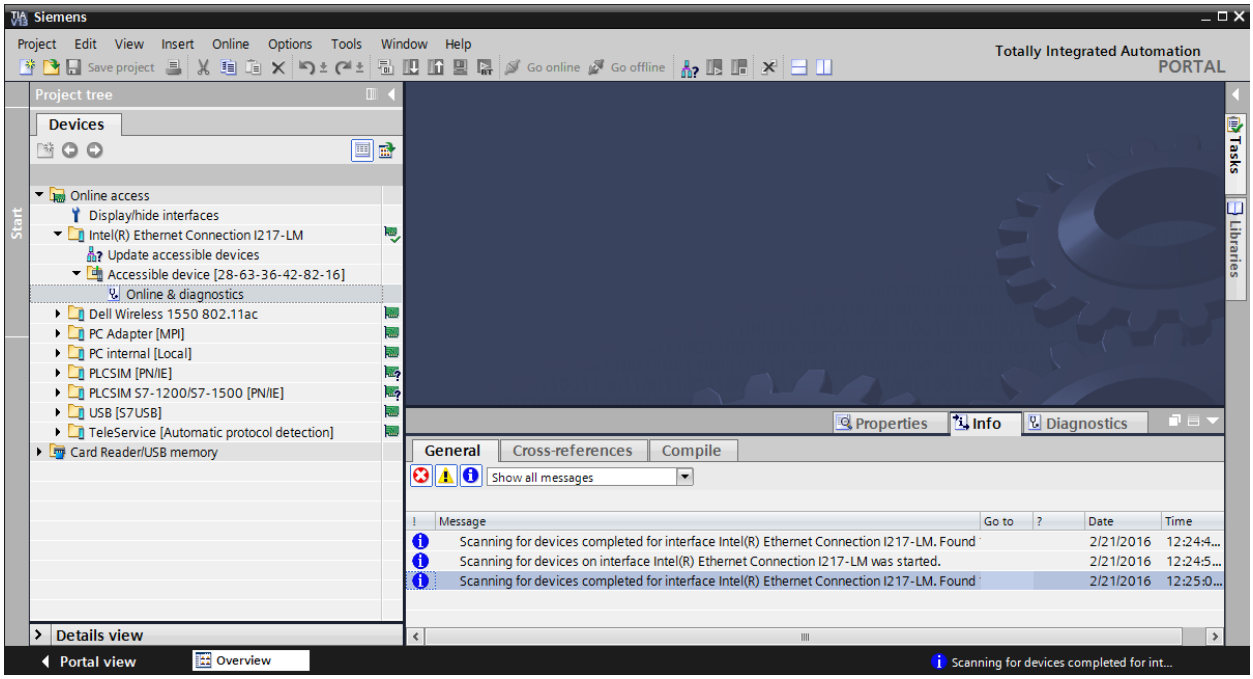
→ Select the Totally Integrated Automation Portal for this, which is opened here with a double-click. (→ TIA Portal V13)

→ Select → "Online & Diagnostics" and open the →"Project view".



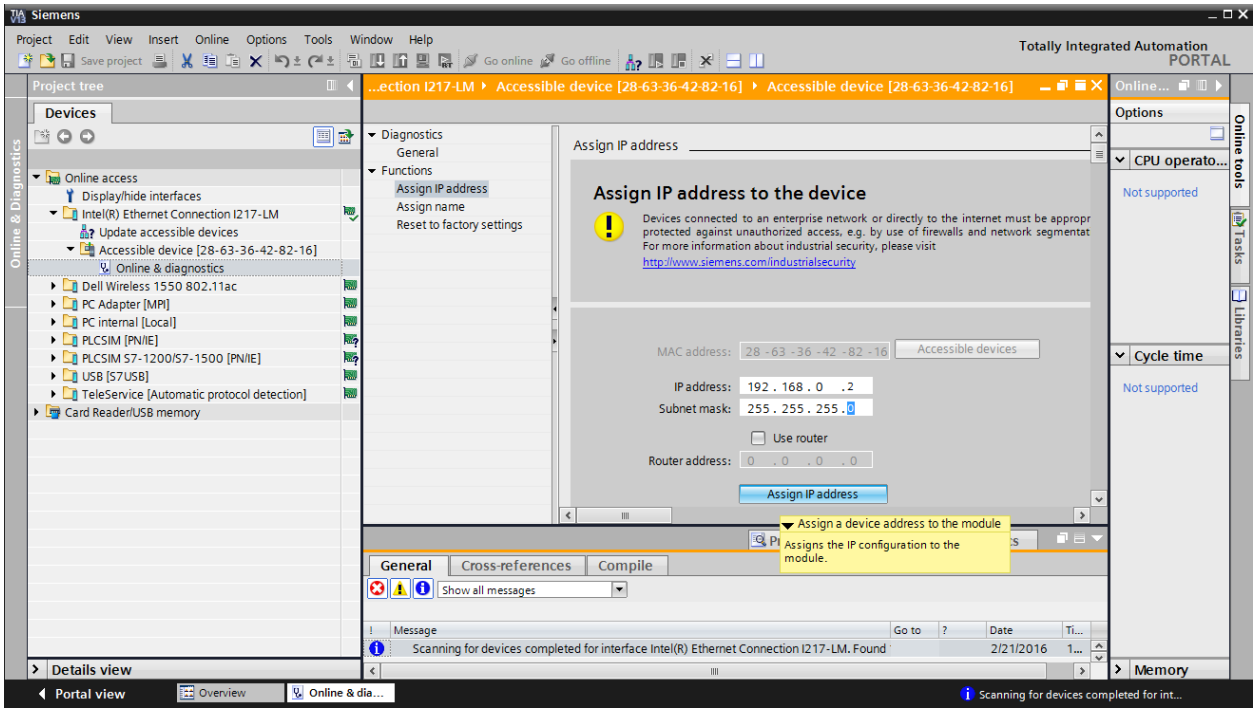
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ In the project tree under → "Online access", select the network adapter that was set previously. If you click → "Update accessible devices" here, you will see the IP address (if previously set) or the MAC address (if the IP address is not yet assigned) of the connected ET 200SP. Select → "Online & Diagnostics" here.

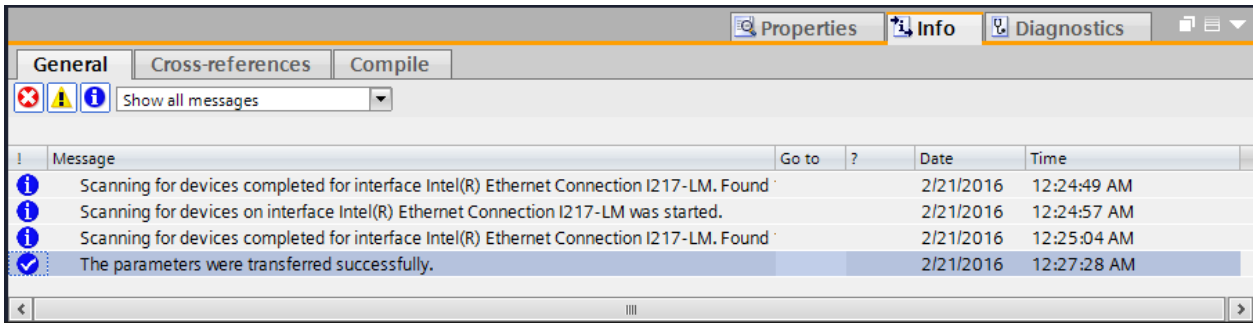


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Under→ "Functions", you now find the → "Assign IP address" item. Enter the following IP address here (example): → IP address: 192.168.0.2 → Subnet mask 255.255.255.0. Next, click → "Assign IP address" and this new address will be assigned to your ET 200SP.



→ A feedback message for the assignment of the IP address is provided in the → "Info" window under → "General".

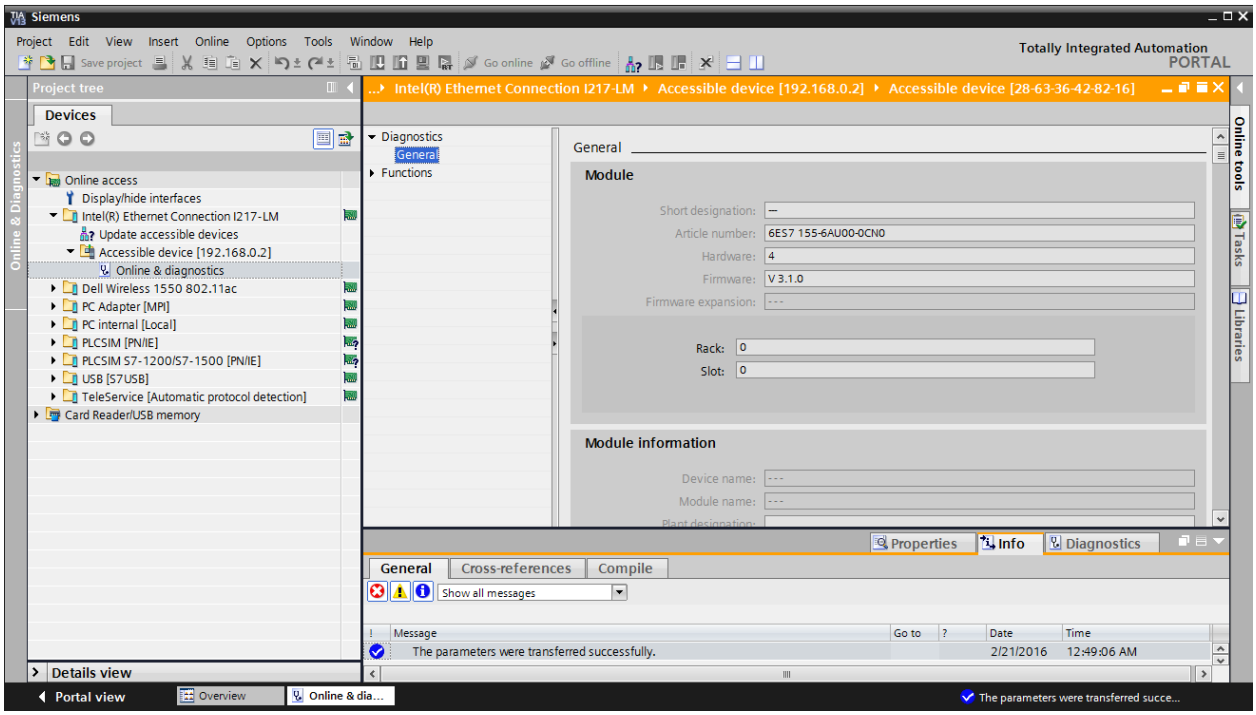


Note: *If a communication connection already exists between the ET 200SP (as device) and a higher-level controller (as controller), the IP address cannot be changed.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

4.5.12 Reading the firmware version of the ET 200SP

→ Before you can read the firmware version of the ET 200SP, you must select → "Update accessible devices" and → "Online & diagnostics" of your ET 200SP again. You can read the Short description, Article number, Hardware version and Firmware version in menu item → "Diagnostics" → "General".



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

5 Task

Create a project and configure the following modules of your hardware, which correspond to one part of the trainer packages SIMATIC CPU 1516F PN/DP Safety and SIMATIC ET 200SP Digital.

- SIMATIC S7-1500F, CPU 1516F-3 PN/DP, WORK MEMORY 1.5 MB PROGRAM, 5 MB DATA,1. INTERFACE, PROFINET IRT WITH 2 PORT SWITCH, 2. INTERFACE, ETHERNET, 3. INTERFACE, PROFIBUS, 10 NS BITPERFORMANCE, SIMATIC MEMORY CARD REQUIRED (order number: 6ES7 516-3FN01-0AB0)
- 1X SIMATIC PM 1507 24 V/8 A STABILIZED POWER SUPPLY INPUT: 120/230 V AC OUTPUT: 24 V DC / 8 A (order number: 6EP1333-4BA00)
- 1X INTERFACE MODULE IM155-6PN HF (order number: 6ES7 155-6AU00-0CN0)
- 1X BUS ADAPTER BA 2XRJ45 (order number: 6ES7 193-6AR00-0AA0)
- 2X DI 8X24VDC/0.5A HF (order number: 6ES7 131-6BF00-0CA0
- 2X DQ 8X24VDC/0.5A HF (order number: 6ES7 132-6BF00-0CA0)
- Server module (order number: 6ES7 193-6PA00-0AA0)

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

6 Planning

Because this is a new system, a new project must be created.

The hardware for this project is already specified by the existing hardware (in this case, part of the trainer packages SIMATIC CPU 1516F PN/DP Safety and SIMATIC ET 200SP Digital. Therefore, a selection does not have to be made. Instead, the listed modules of the trainer packages only have to be inserted in the project and connected. The order numbers (see Table 1 and Table 2) can be used to check that the correct modules are inserted.

Module	Order number	Slot	Address area
PM 190W 120/230VAC	6EP1333-4BA00	0	
CPU 1516F-3 PN/DP	6ES7516-3FN01-0AB0	1	

Table 1: Modules of the S7-1500

Module	Order number	Slot	Address area
IM155-6PN HF	6ES7155-6AU00-0CN0	0	
DI 8x24VDC HF	6ES7131-6BF00-0CA0	1	0
DI 8x24VDC HF	6ES7131-6BF00-0CA0	2	1
DQ 8x24VDC/0.5A HF	6ES7132-6BF00-0CA0	3	0
DQ 8x24VDC/0.5A HF	6ES7132-6BF00-0CA0	4	1
Server module	6ES7193-6PA00-0AA0	5	

Table 2: Modules of the ET 200SP

The Base Units are relevant for additional handling of the ET 200SP modules. These determine whether the potential is taken from the left terminal (dark Base Unit) or whether a new voltage supply must be connected and thus a new potential group is created (light Base Unit). The applicable rule here is that a new potential must always be provided on slot 1.

All Base Units included in the trainer packages are type BU15-P16+A0+2D (6ES7193-6BP00-0DA0). As a result, the light Base Unit version is set by default.

As the final step, the hardware configuration is saved, compiled, downloaded and started.

Any errors present can be detected during compilation and incorrect modules can be detected when the controller is started *(only possible when hardware is present and structured identically)*.

The result is archived to back up the working version.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

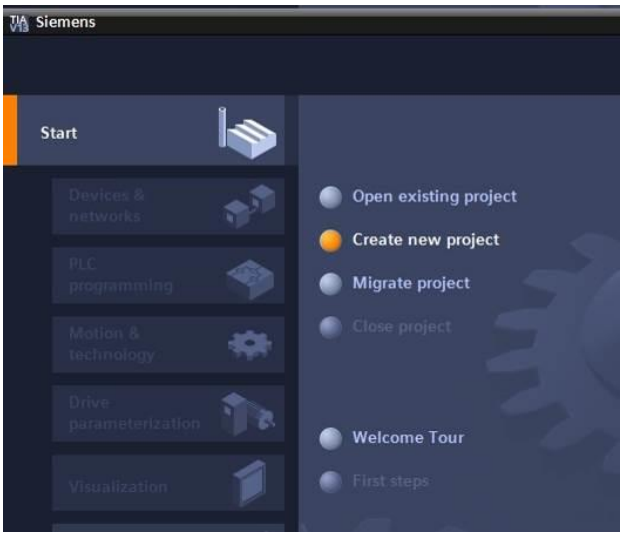
7 Structured step-by-step instructions

You can find instructions on how to carry out planning below. If you already have a good understanding of everything, it is sufficient to focus on the numbered steps. Otherwise, simply follow the steps of the instructions illustrated below.

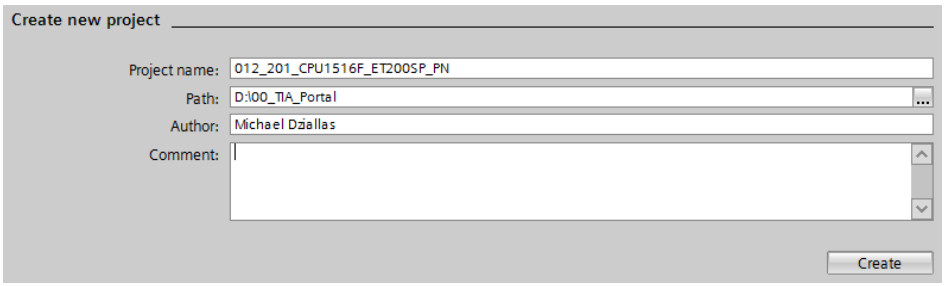
7.1 Create a new project

→ Select the Totally Integrated Automation Portal for this, which is opened here with a double-click. (→ TIA Portal V13)

→ In the portal view under the "Start" menu, select → "Create new project".



→ Modify Project name, Path, Author and Comment as appropriate and click → "Create".

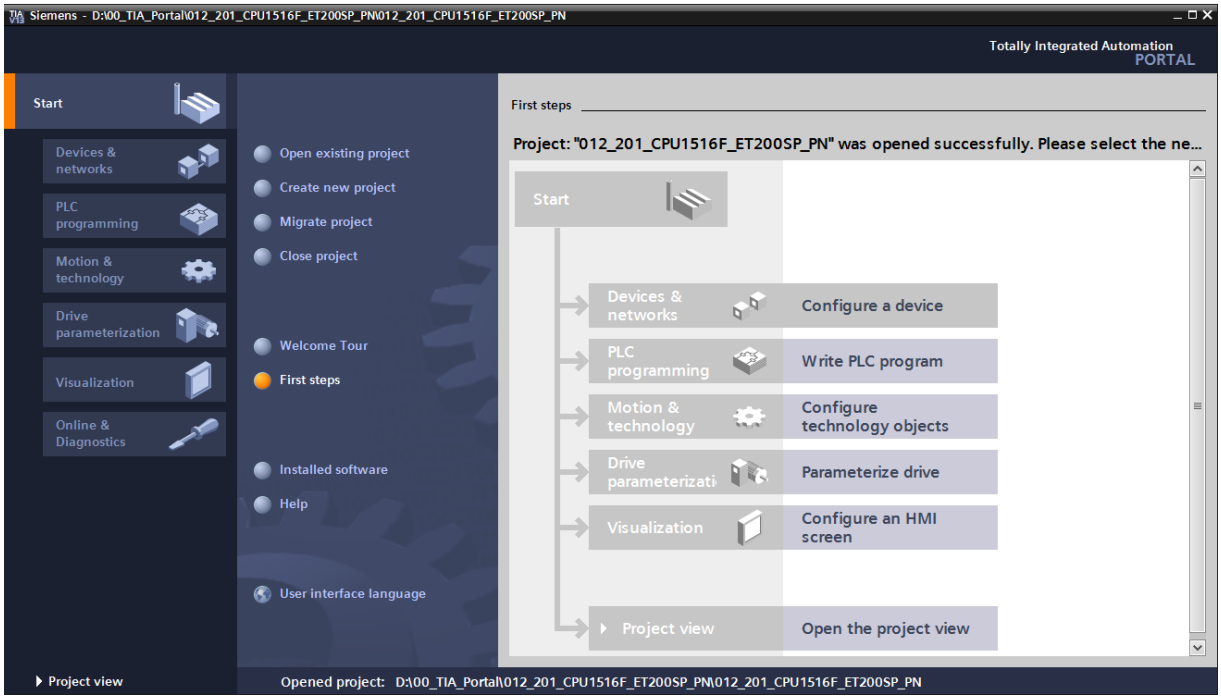


→ The project is created and opened and the menu "Start", "First steps" opens automatically.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

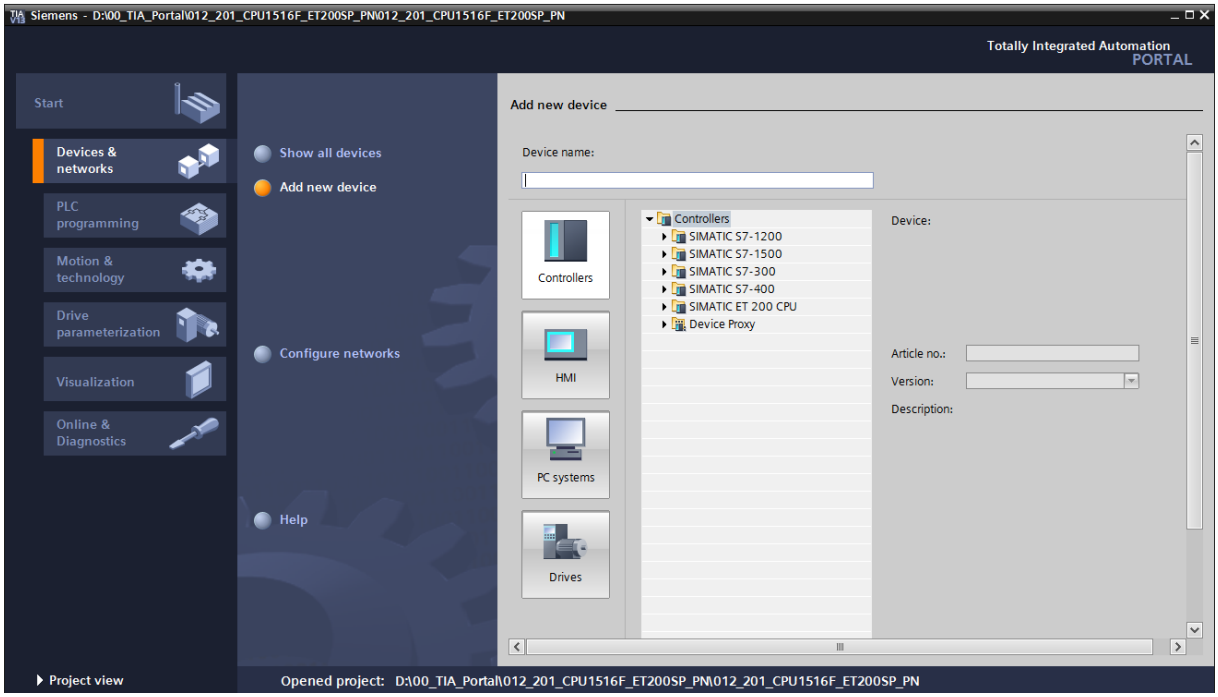
7.2 Insert the CPU 1516F-3 PN/DP

→ In the → "Start" → portal, select "First steps" → "Devices & Networks" → "Configure a device".



→ In the "Devices & Networks" portal, the "Show all devices" menu opens

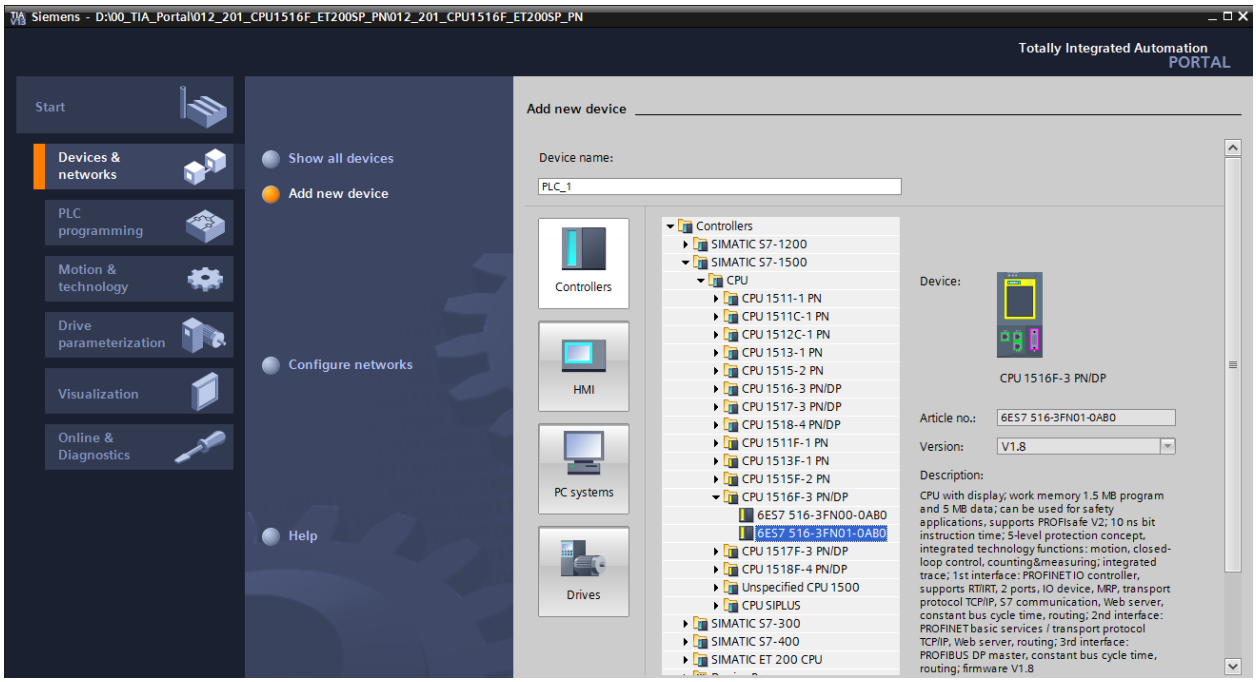
→ Switch to the "Add new device" menu.



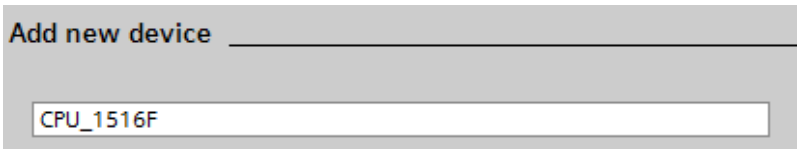
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ The specified model of the CPU will now be added as a new device.

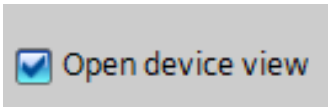
(Controllers → SIMATIC S7-1500 → CPU → CPU 1516F-3 PN/DP → 6ES7516-3FN01-0AB0 → V1.8)



→ Assign a device name (Device name → "CPU_1516F").

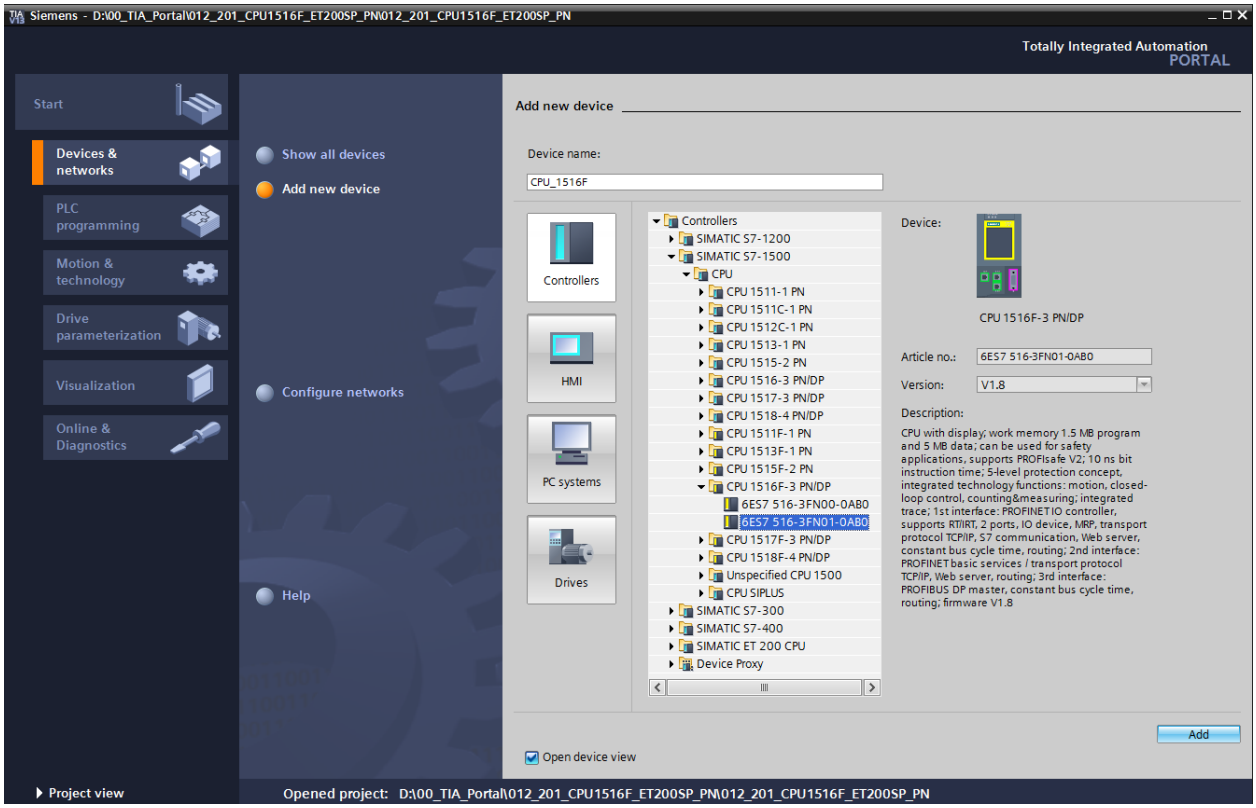


→ Select "Open device view".



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Click "Add".



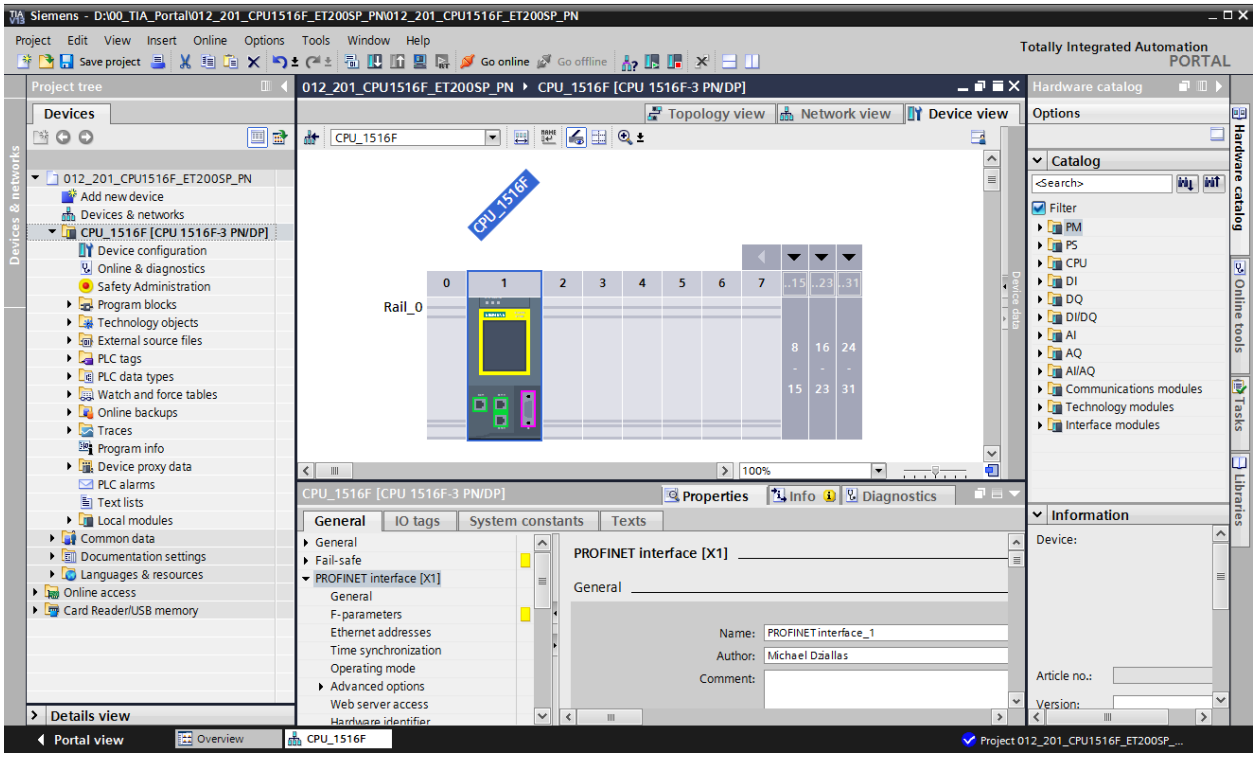
Note: *The desired CPU may have multiple versions that differ in functionality (work memory, integrated memory, technology functions, etc.). In this case, you should ensure that the selected CPU corresponds to the existing hardware.*

Note: *Different firmware versions are often offered for the hardware. In this case, it is recommended that the latest firmware (selected by default) be used and that the CPU be upgraded, if necessary.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ The TIA Portal now changes automatically to the project view and displays the selected CPU in the device configuration in slot 1 of a rail.

→ Select the CPU with a double-click

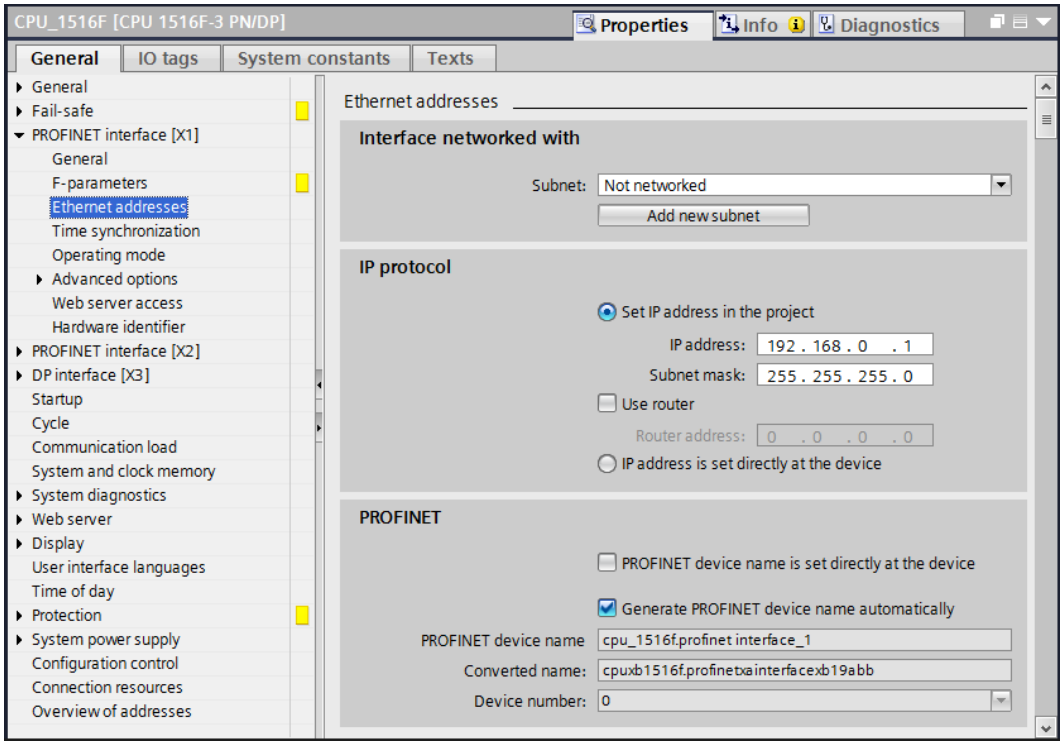


Note: *You can now configure the CPU there according to your specifications. Possible settings include the PROFINET and PROFIBUS DP interfaces, startup characteristics, cycle, communication load and many others.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

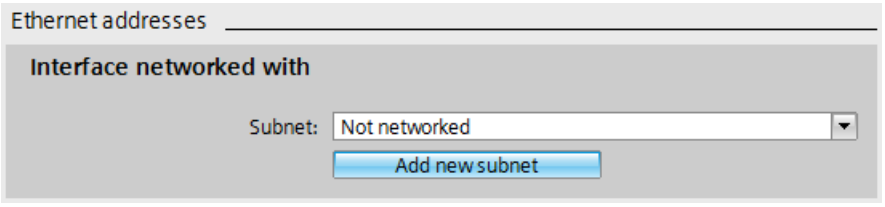
7.3 Configure the Ethernet interface of the CPU 1516F-3 PN/DP

→ Double-click the CPU to select it. Then open the → "PROFINET interface [X1]" menu in → "Properties" and select the → "Ethernet addresses" entry there.



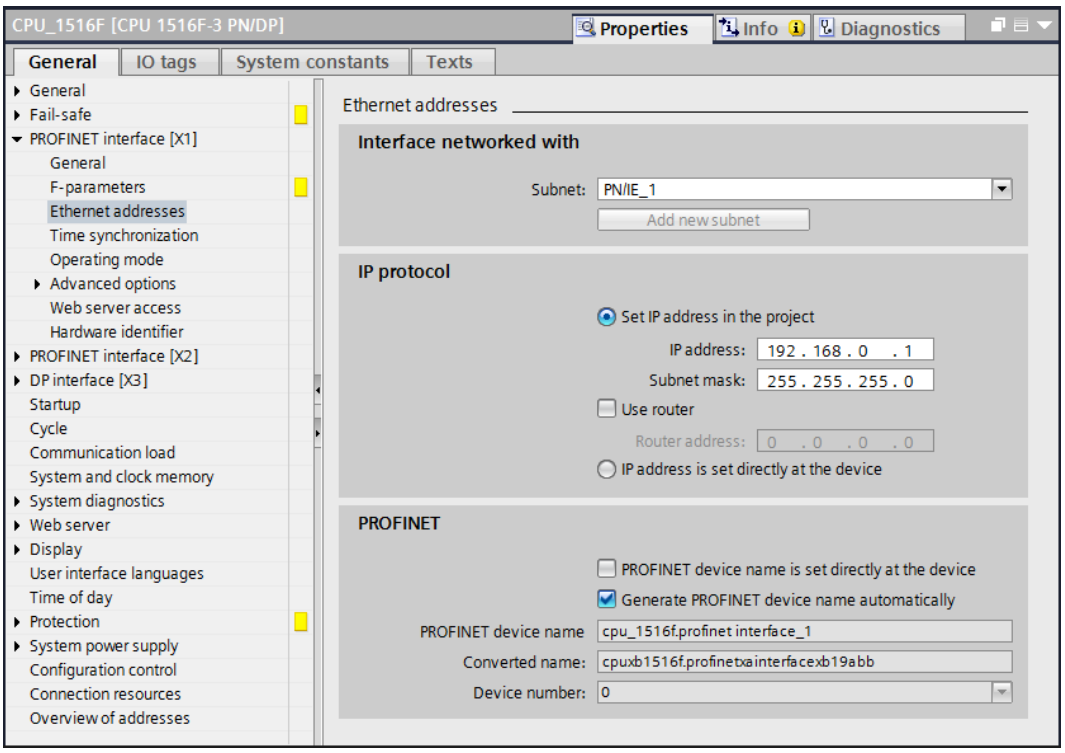
→ Under "Interface networked with", only the "Not networked" entry is available.

→ Add an Ethernet subnet with the → "Add new subnet" button.



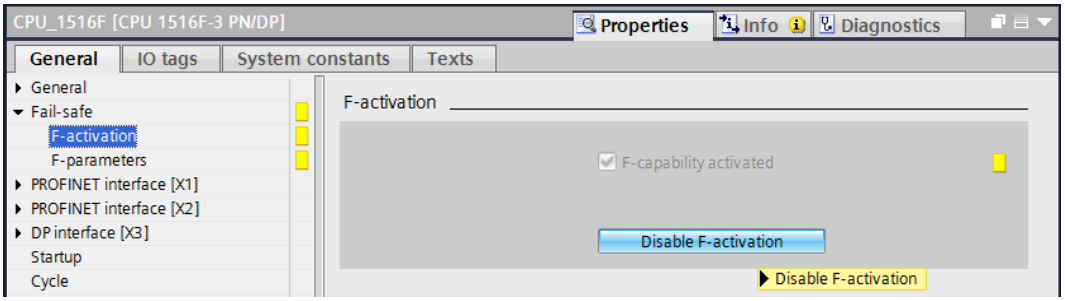
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Keep the preassigned "IP address" and "Subnet mask".

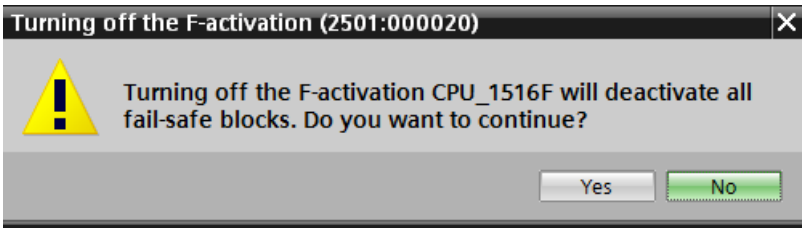


7.4 Configure the fail-safe operation of the CPU 1516F-3 PN/DP

→ In the → "Fail-safe" menu, select → "F-activation" and select → "Disable F-activation" there.



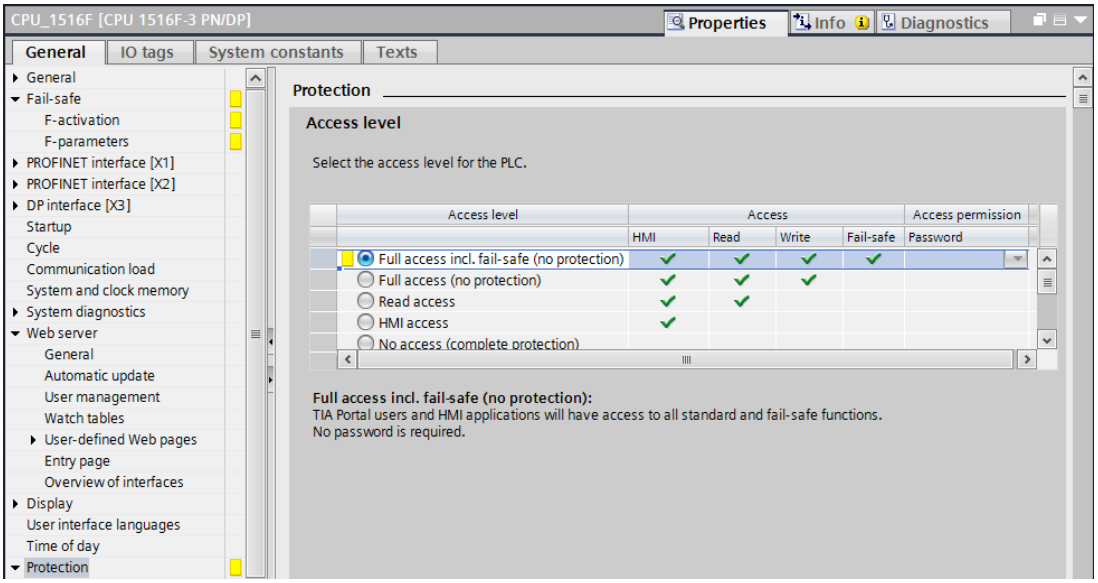
→ Confirm the prompt asking if you want to continue with → "Yes".



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.5 Configure the access level for the CPU 1516F-3 PN/DP

→ Switch to the → "Protection" menu and select access level → "Full access incl. fail-safe (no protection)".

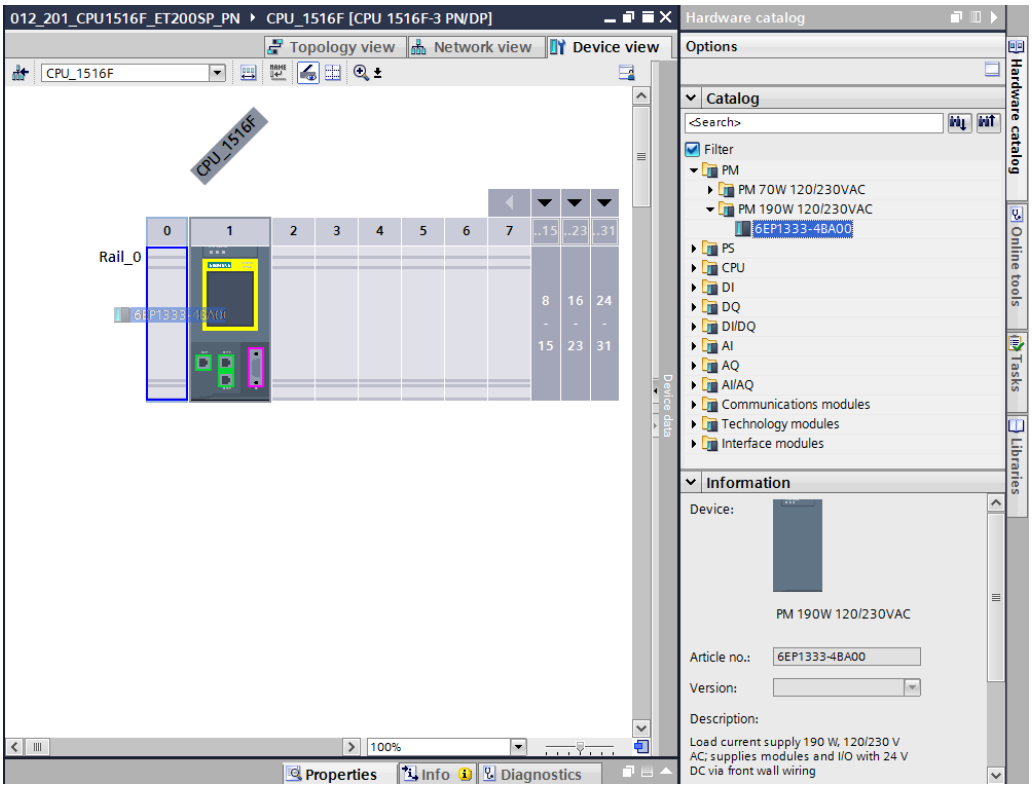


Note: *The "Full access incl. fail-safe (no protection)" setting is recommended because we do not have to assign a password.*

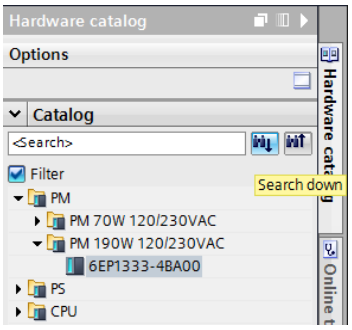
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.6 Insert power module PM 190W 120/230VAC

→ Find the correct module in the hardware catalog and insert the power module in slot 0.
(→ Hardware Catalog → PM → PM 190W 120/230VAC (order number 6EP1333-4BA00) → Slot 0)



Note: *To select a component in the hardware catalog, you can simply enter the order number in the Search field and then click the "Search down" icon . The hardware catalog will open at the correct position.*

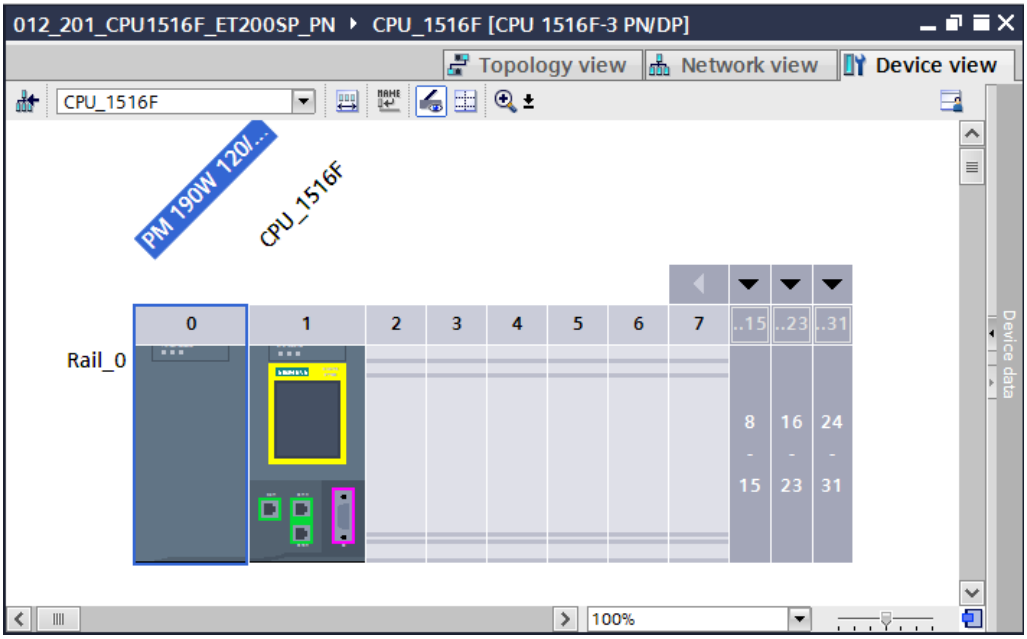


Note: *When you double-click a module in the hardware catalog, you insert it at the next available compatible slot.*

Note: *If a module such as the power module is planned only for one slot, it is also not possible to place it at another position in the device configuration.*

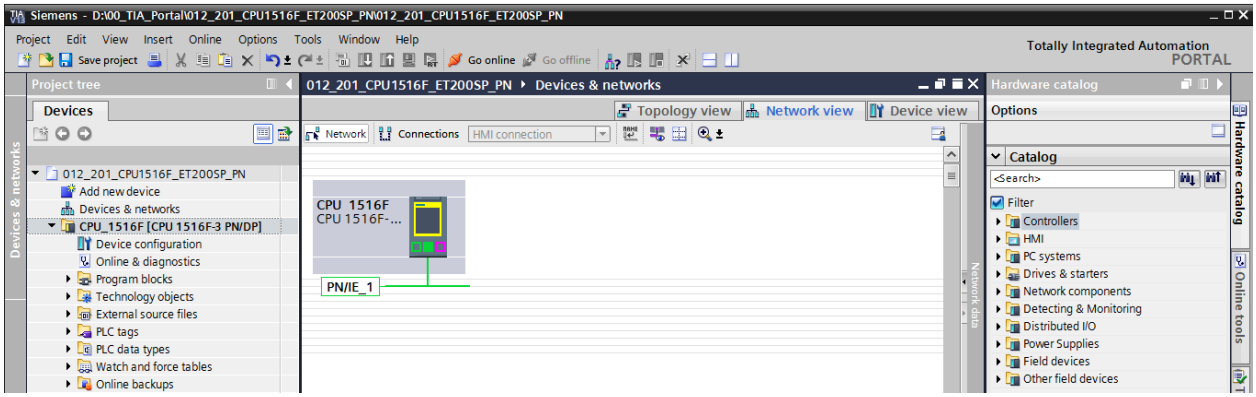
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Compare your device configuration with the following figure.



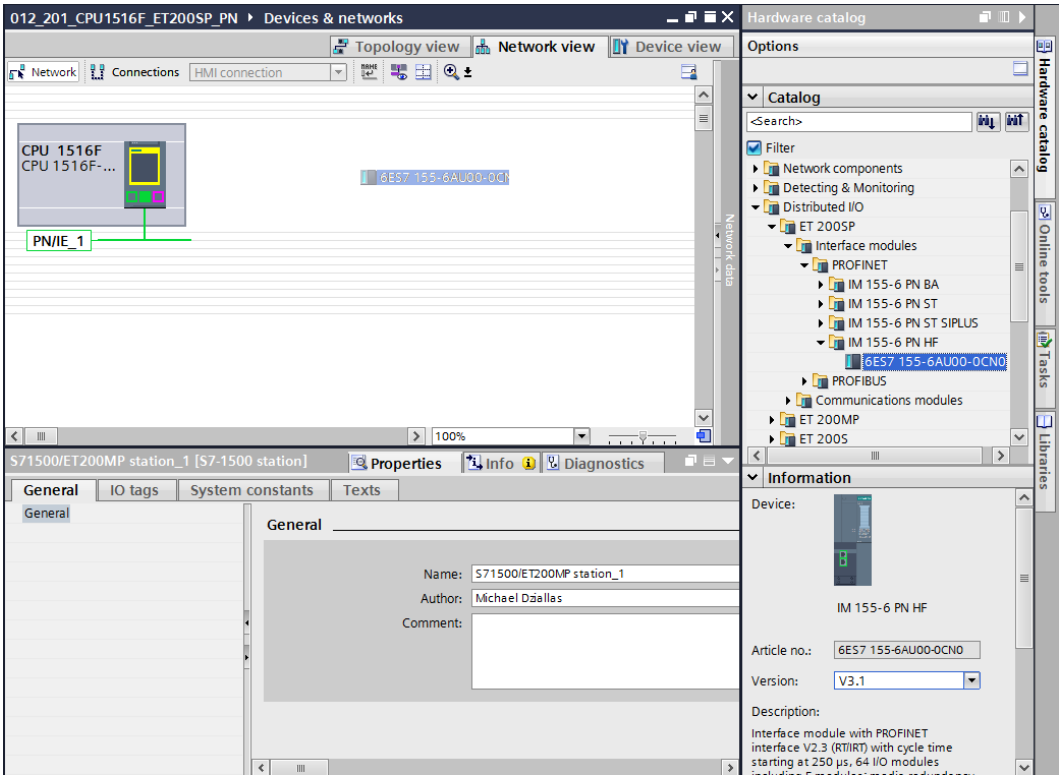
7.7 Insert the ET 200SP interface module IM155-6PN HF

→ Open the network view (→ Network view)

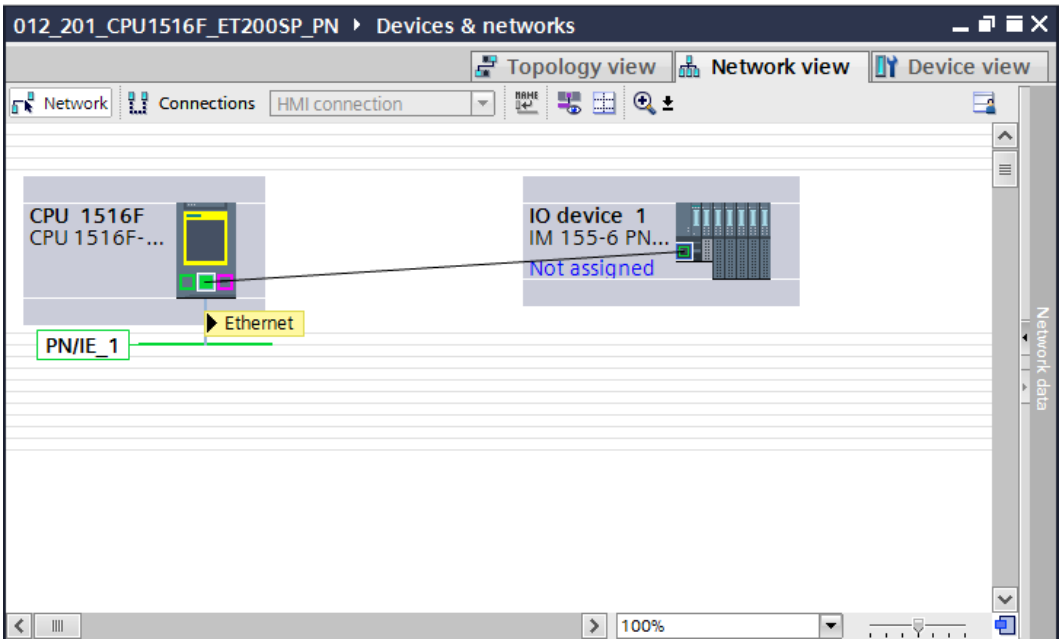


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Find the correct IM155-6PN HF interface module in the hardware catalog and insert it by moving it to the network view using drag-and-drop. (→ Hardware Catalog → Distributed IO → ET 200SP → Interface modules → PROFINET → IM 155-6 PN HF → 6ES7 155-6AU00-0CN0 → Version: V3.1)



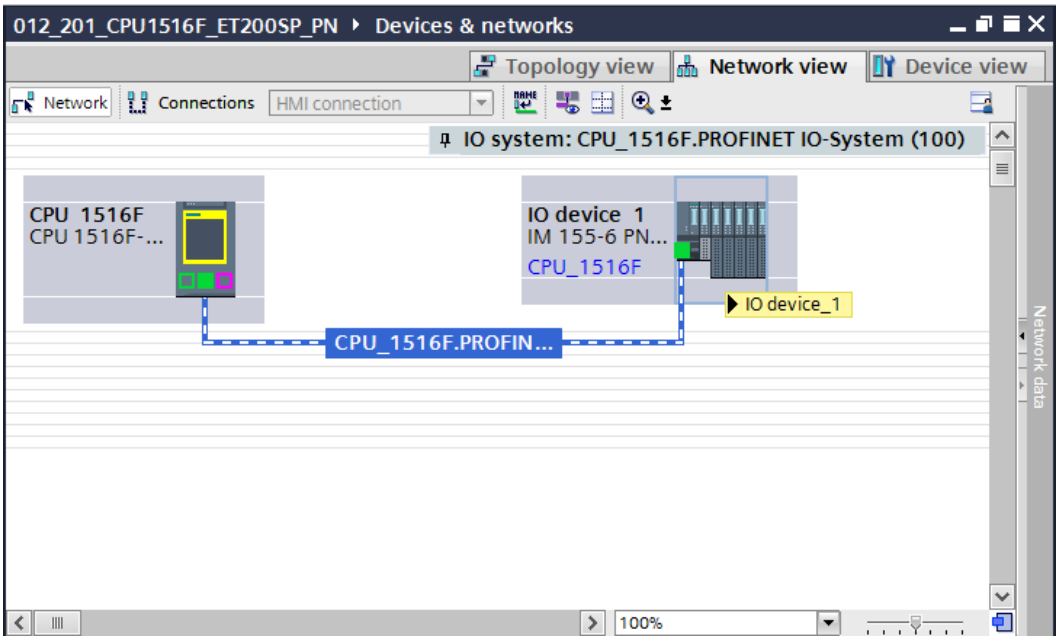
→ Assign the field device of the CPU 1516F by first clicking on the interface of the IM155-6PN HF in the network view and then connecting it to the PROFINET interface (X1) of the CPU 1516F.



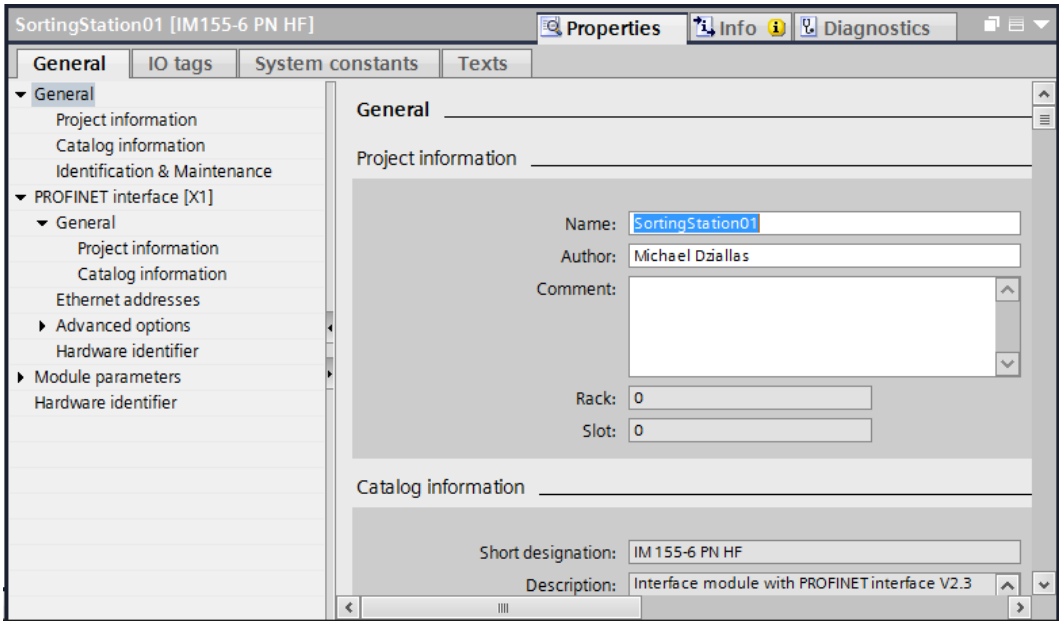
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.8 Configure the ET 200SP / IM 155-6PN HF

→ To configure the IM155-6PN HF, first select the IO device. (→ IO device 1)



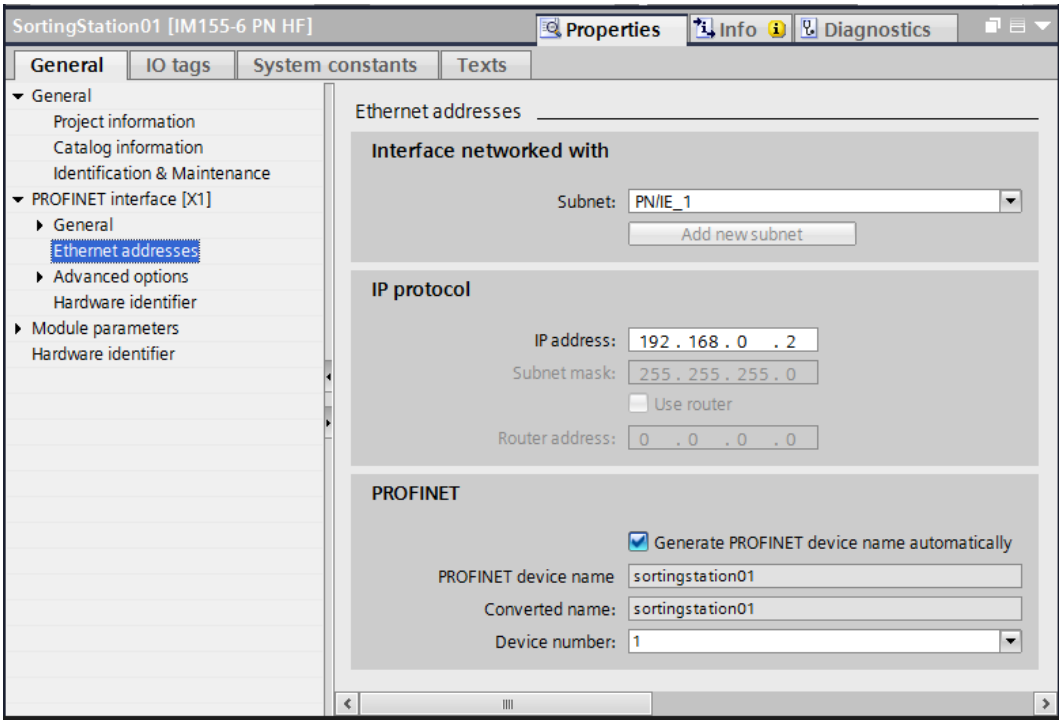
→ In → "Properties", open the → "General" menu and enter the "Name" → "SortingStation01".



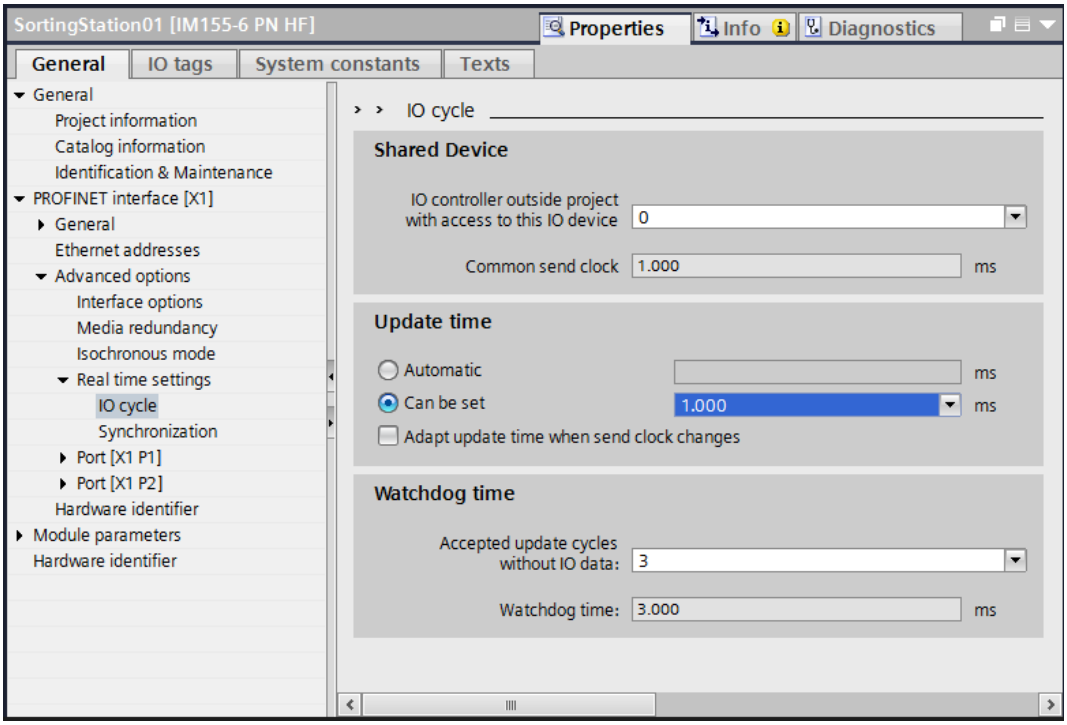
Note: *This name is then applied as the device name for PROFINET communication.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Under "PROFINET device name interface[X1]", the IP address can then be set or the IO device and the "PROFINET device name" can be checked.
(→ PROFINET interface[X1] → Ethernet addresses → IP protocol → IP address: 192.168.0.2 → PROFINET → PROFINET device name → SortingStation01)



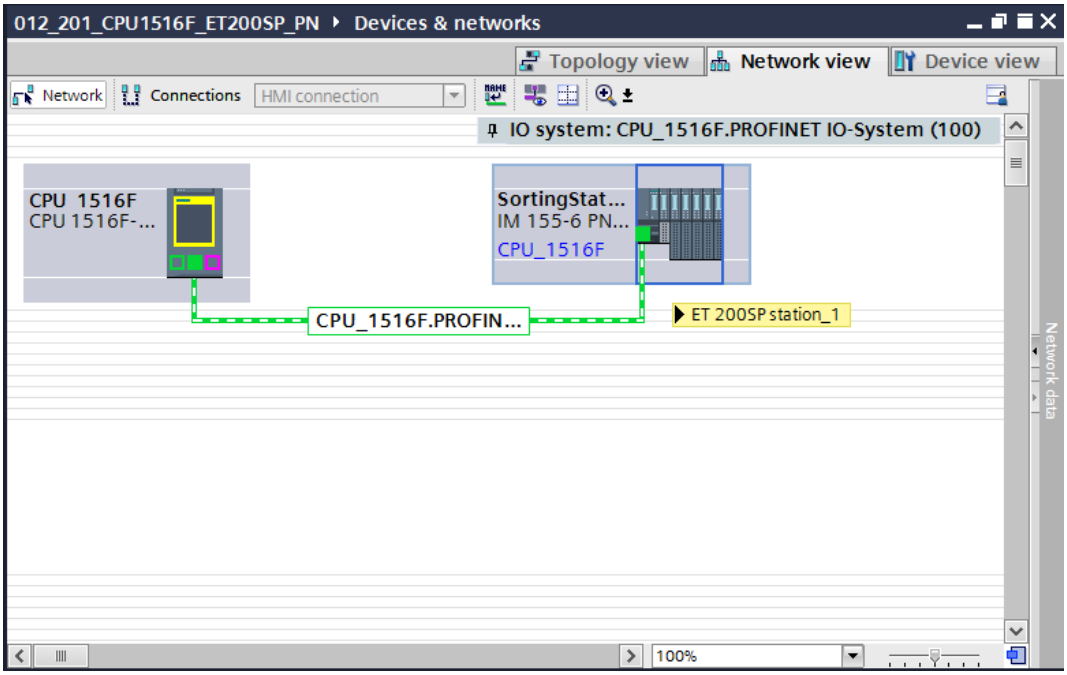
→ The settings for the 'IO cycle' such as 'Update time' and 'Watchdog time' can also be set here for the device.
(→ PROFINET interface[X1] → Advanced options → Real time settings → IO cycle → Update time → 1,000 ms → Watchdog time → 3,000 ms)



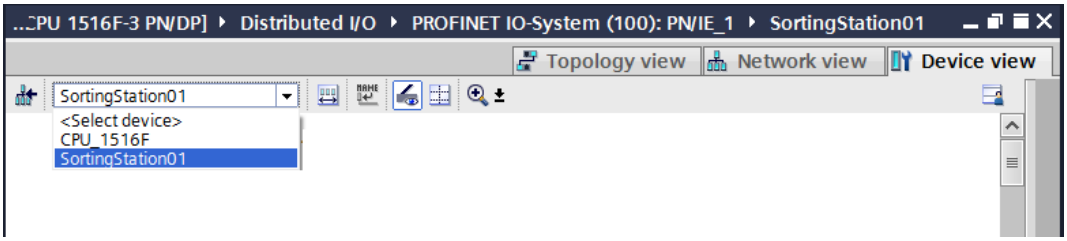
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.9 Insert the 2 digital input modules DI 8x24VDC HF

→ Double-click the PROFINET device to change to the device view of the ET 200SP.

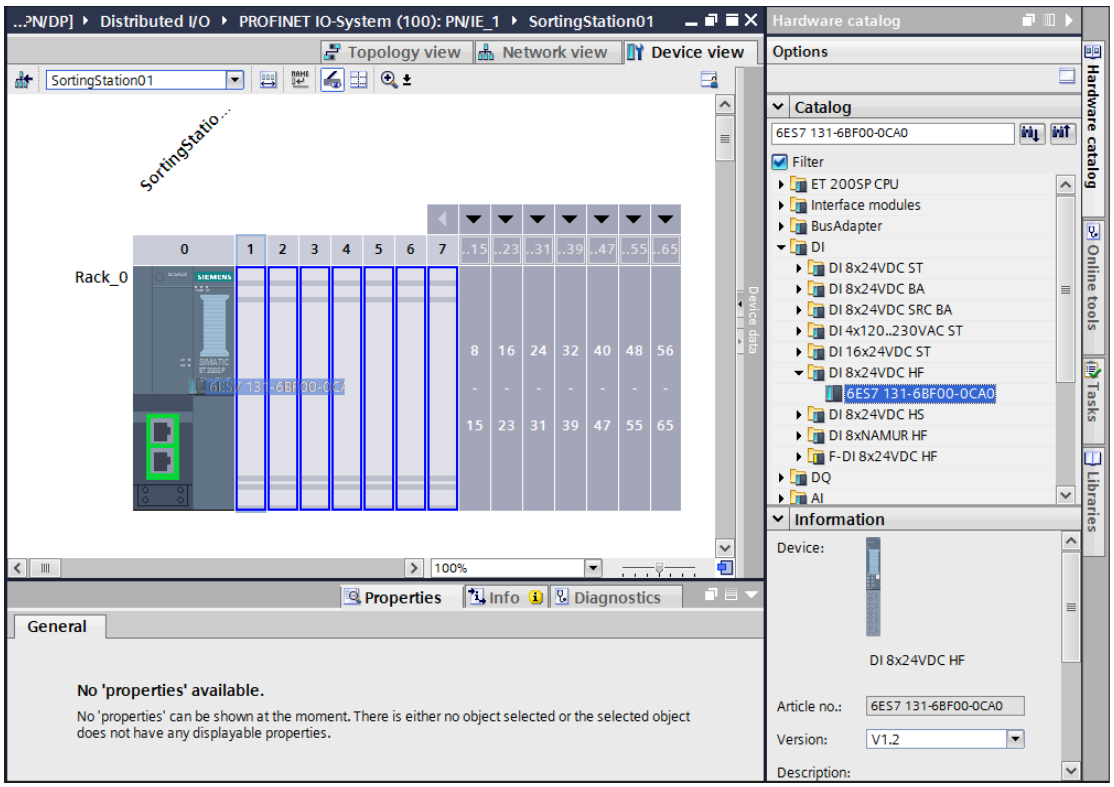


→ ***Note:*** *You can also open the device view of the different devices in the drop-down menu at the top left of the device view.*



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Find the correct digital input module with the matching order number and version in the hardware catalog. Insert the digital input module into slot 1. (→Hardware Catalog → DI → DI 8x24VDC HF → 6ES7 131-6BF00-0CA0 → Version: V1.2)



Notes:

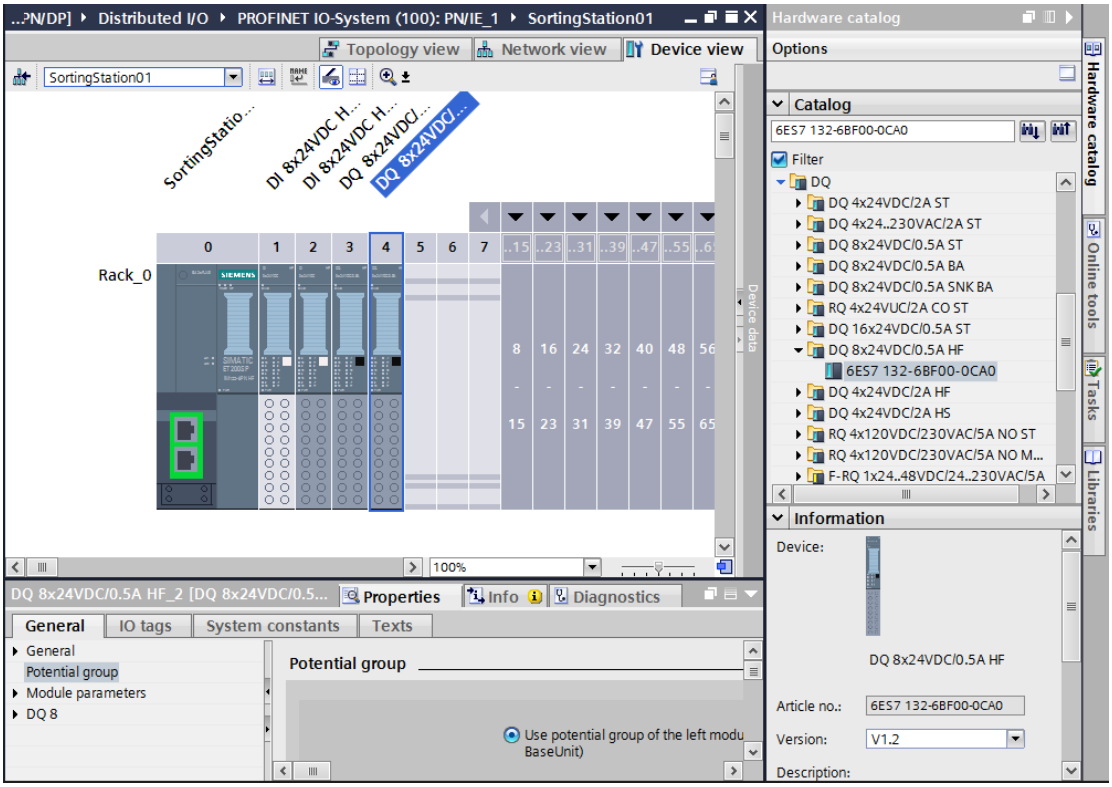
When you double-click a module in the hardware catalog, you insert it automatically at the next available compatible slot .Insert a digital input module of the same type into slot 2

If you do not use a slot, you must close the gap before you compile. Otherwise, an error message occurs.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.10 Insert the 2 digital output modules DQ 8x24VDC/0.5A HF

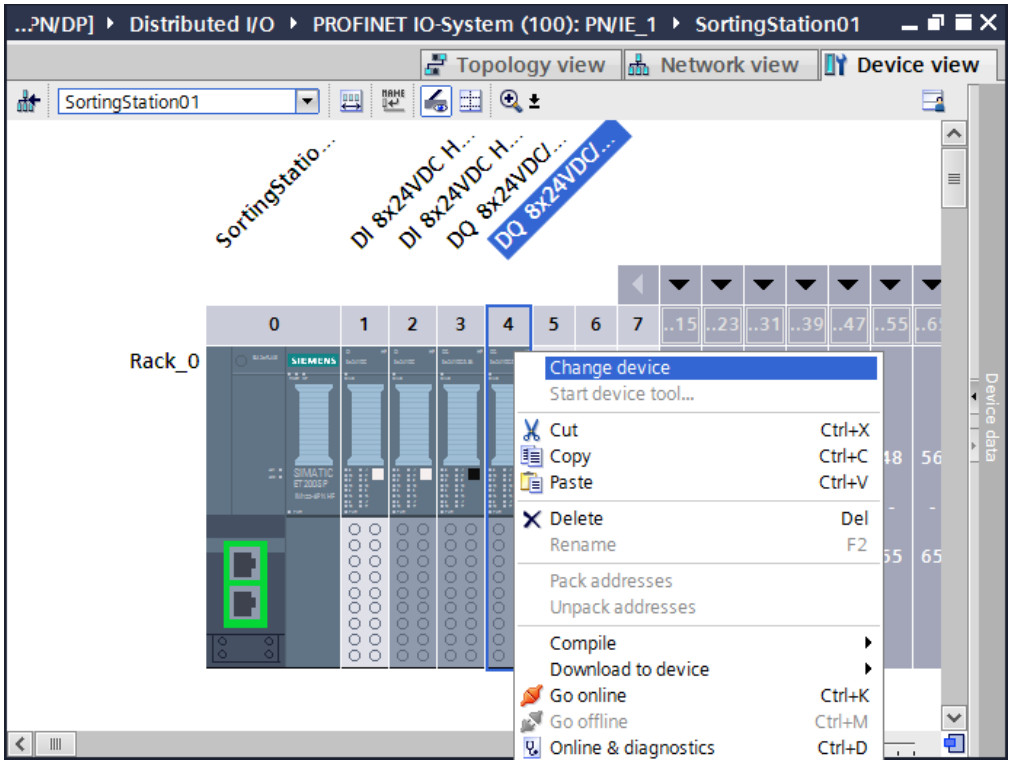
→ Find the correct digital output module with the matching order number and version in the hardware catalog. Insert two digital output modules into slots 3 and 4. (→ Hardware catalog → DQ → DQ 8x24VDC/0.5A HF → (6ES7 132-6BF00-0CA0) → Version: V1.2)

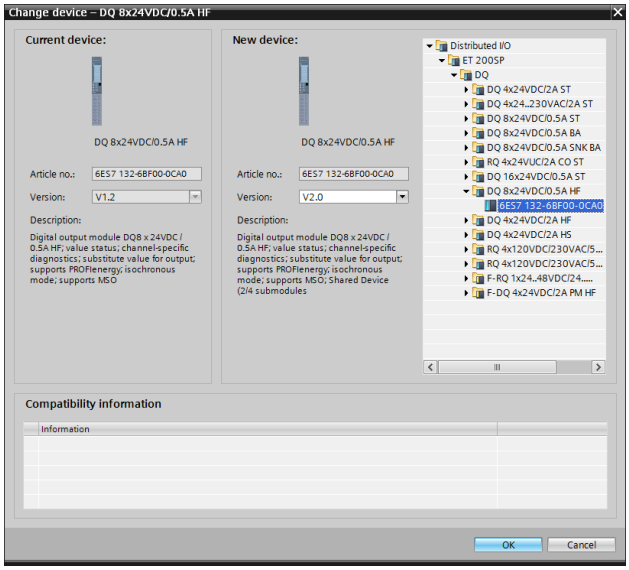


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.11 Replace components in the hardware configuration

→ If it becomes necessary to replace a component in the hardware configuration with a newer version or a different type, this can be done by right-clicking the component and selecting "Change device". The new replacement component can be selected in the displayed dialog and the selection can be applied with "OK". (→ Change device → OK)



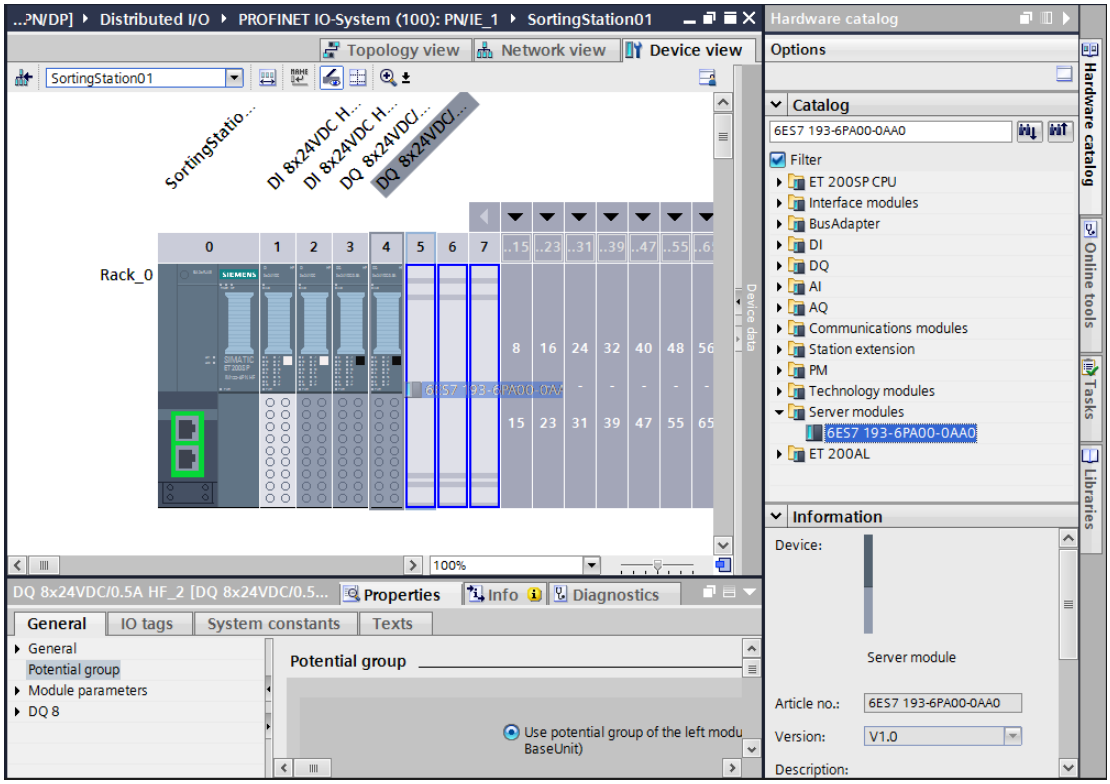


Note: *If the new component is not displayed for selection, it is not compatible with the previous component. In this case, the old component must be deleted and the new component must then be inserted from the hardware catalog.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.12 Insert the server module

→ Find the correct server module with matching order number and version in the hardware catalog. Insert the server module into slot 5.
(→ Hardware Catalog → Server module → 6ES7 193-6PA00-0AA0 → Version: V1.0)



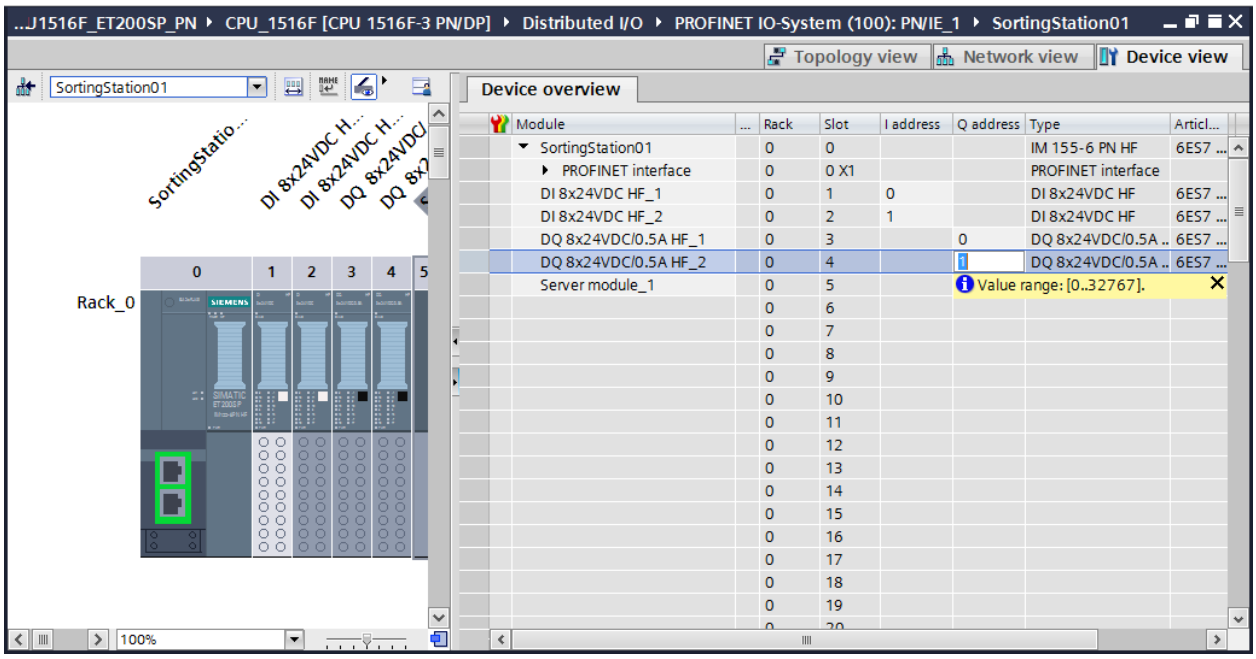
Note: *If you forget the server module, it is automatically created when the device configuration is compiled.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.13 Configure the address areas DI/DQ: 0…1

→ The next step is to check the address areas of the inputs and output cards and adapt them if necessary. Inputs and outputs (DI/DQ) should have an address area of 0…1.

(→ Device overview → DI → I addresses: 0/1 → DQ → O addresses: 0/1)

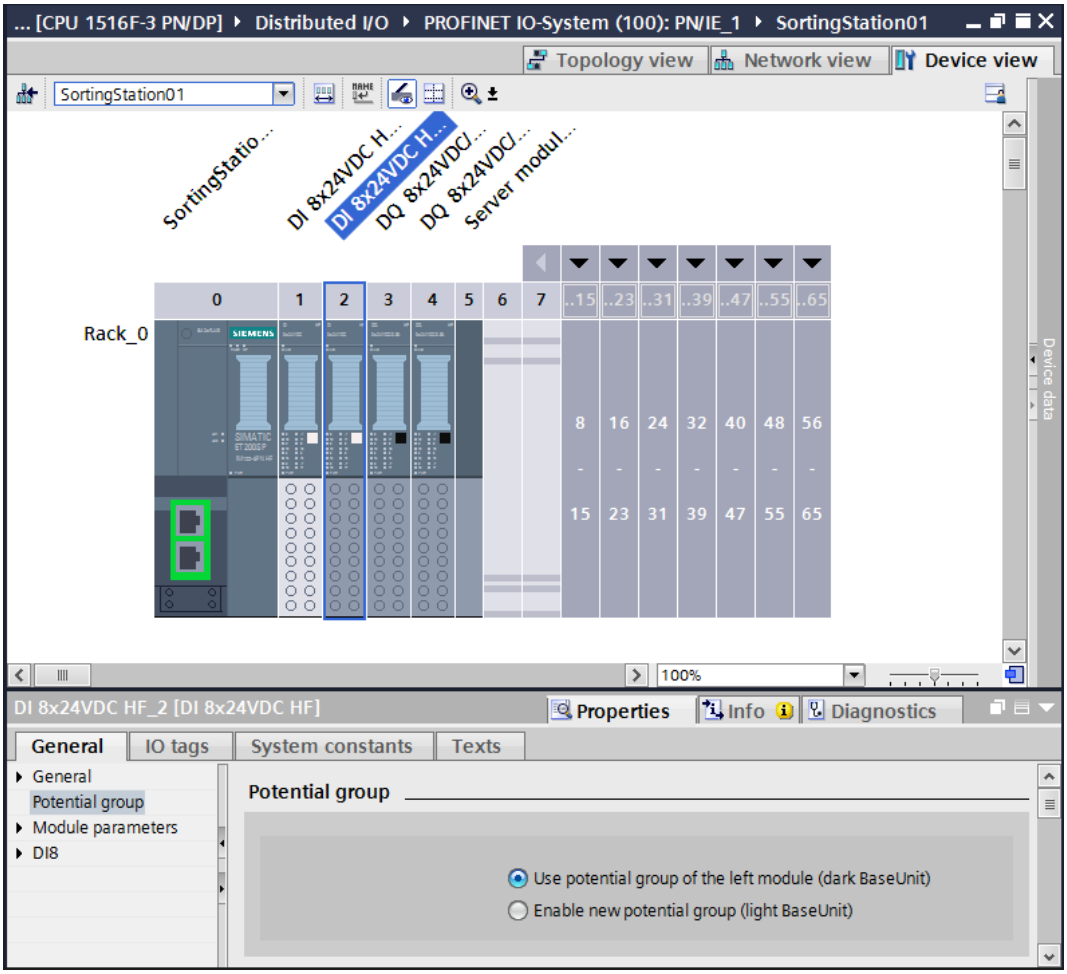


Note: *To show and hide the Device overview, you must click the small arrow next to "Device data" on the right side of the hardware configuration.*

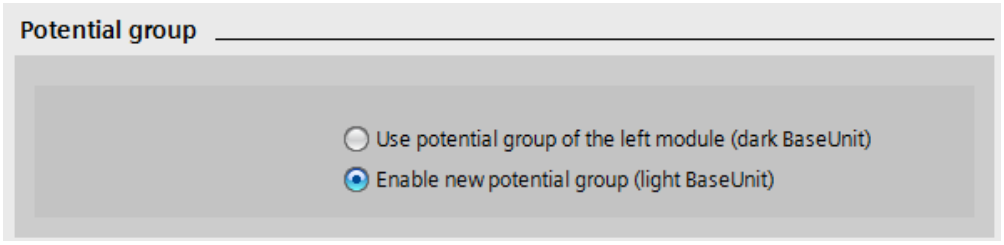
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.14 Configuration of the potential groups of the Base Units

→ To change the potential group of a Base Unit, select the associated module and open the Potential group section in the general properties.
(Slot 2 → Properties → General → Potential group)

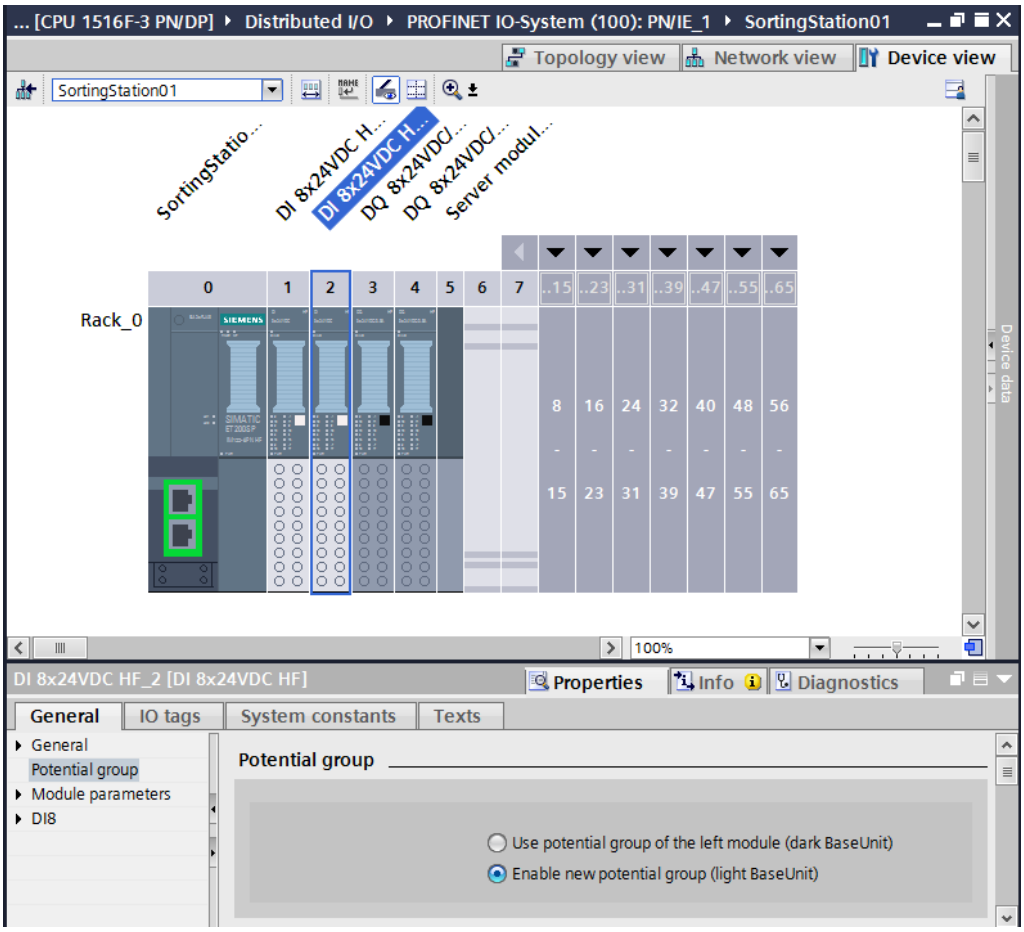


→ Select the "Enable new potential group (light BaseUnit)" option.

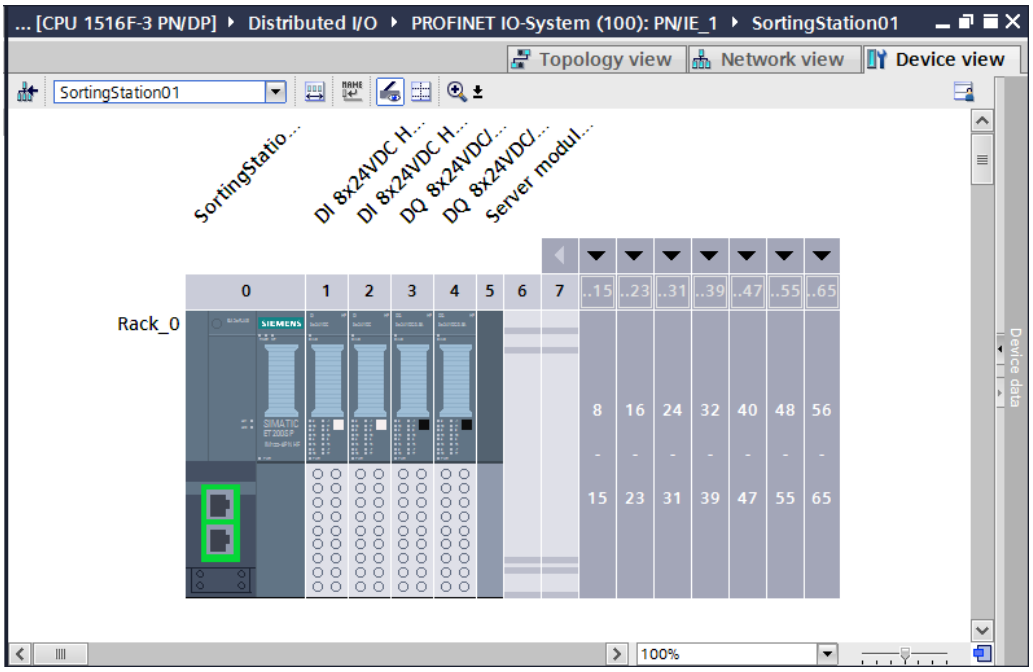


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ The Base Unit now becomes light in the configuration.



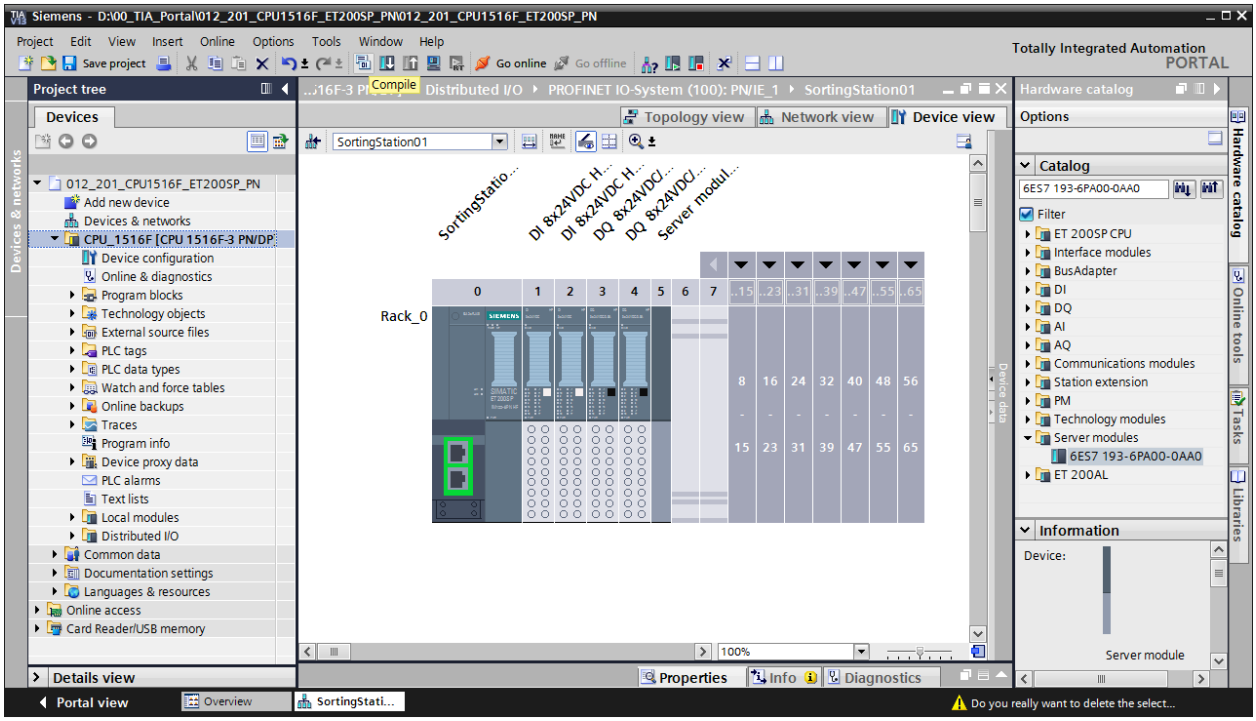
→ Repeat these steps for slots 3 to 4 and compare the device configuration with the following figure.



For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

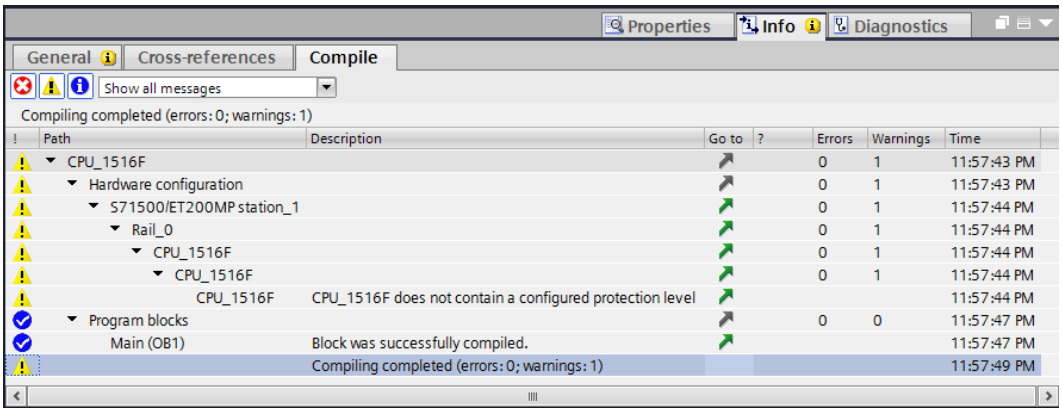
7.15 Save and compile the hardware configuration

→ Before you compile the configuration, you should save your project by clicking the → Save project button. To compile your CPU with the device configuration, first select the → "CPU_1516F [CPU1516F-3 PN/DP]" folder and click the "Compile" icon →.



Note: *"Save project" should be used repeatedly when working on a project since this does not happen automatically. A prompt to save the project only occurs when the TIA Portal is closed.*

→ If the project was compiled without errors, you see the following screen.



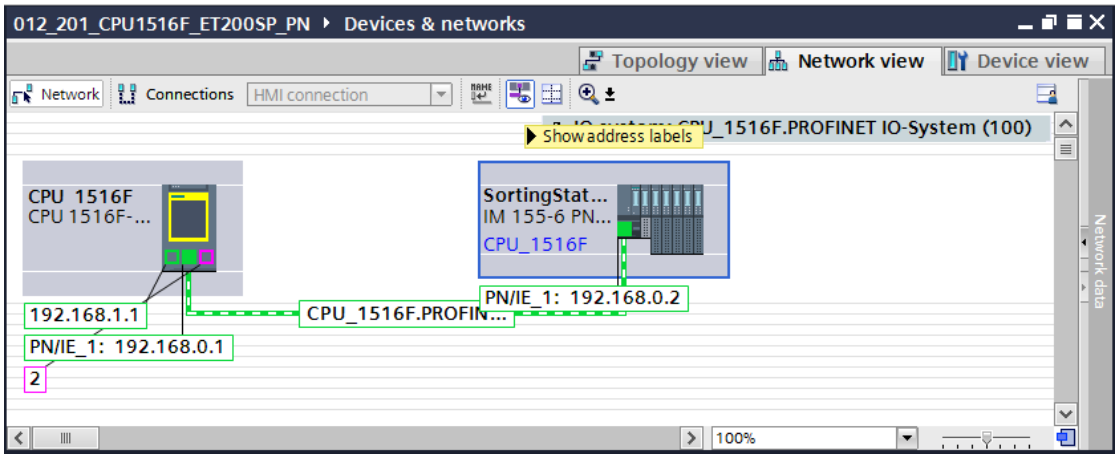
Note: *A warning appears here because no protection level has been configured. This warning can be ignored.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.16 Assign device name to interface module IM 155-6PN HF

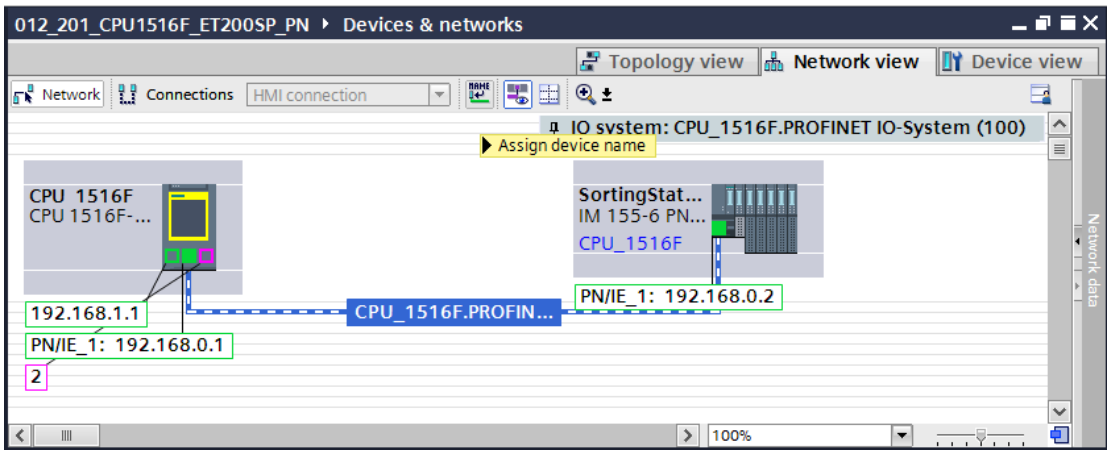
→ To obtain an overview of the assigned addresses within a project, you can click the "" icon in the "Network view".

(→ Network view → Show addresses)



→ In order for the controller, CPU1516F-3 PN/DP in this case, to find the assigned PROFINET devices in the network, the device name must be assigned to them. This is done by selecting the network connecting the devices in the "Network view" and clicking the "" icon.

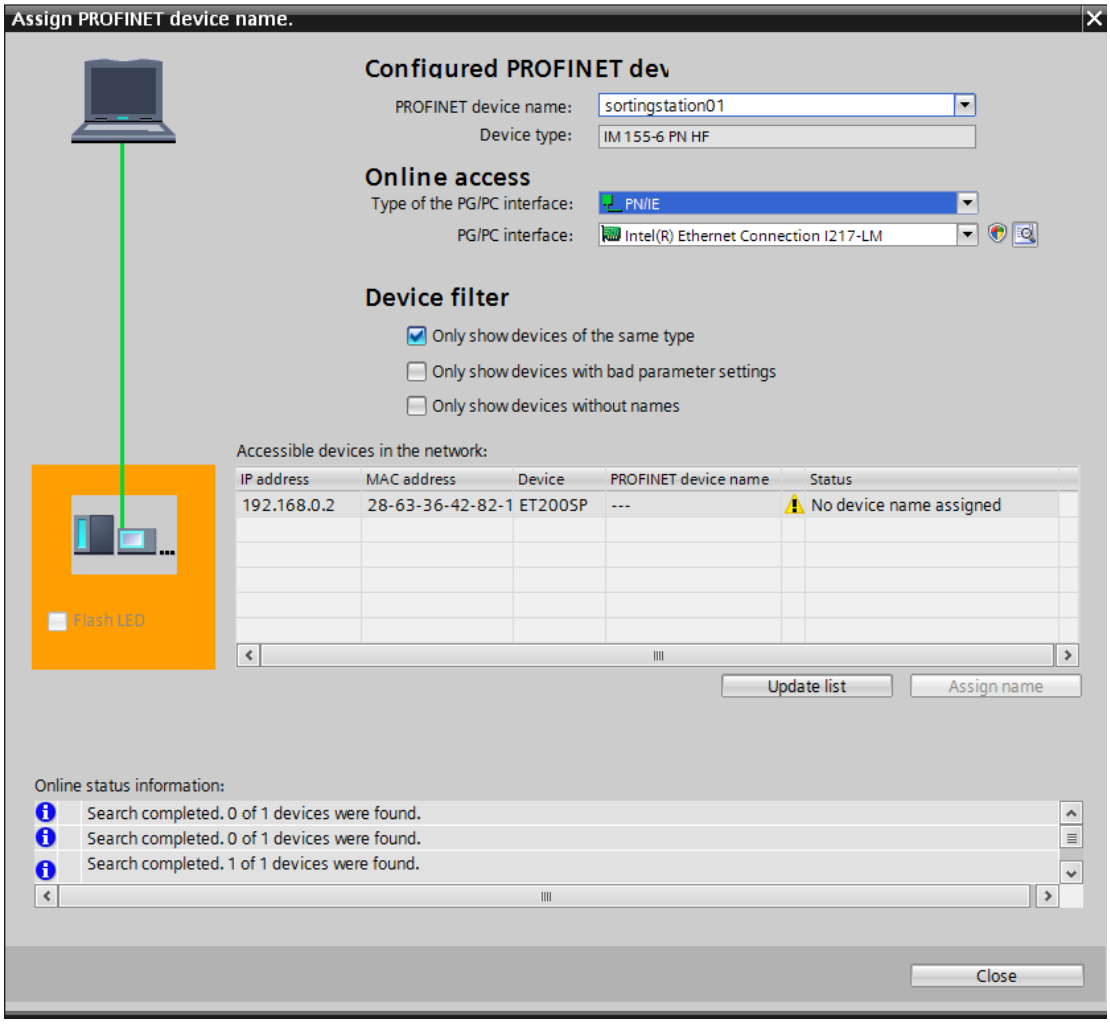
(→ Assign device name)



Note: *The IP addresses set in the project are assigned by the controller to the devices later when the communication connection is established.*

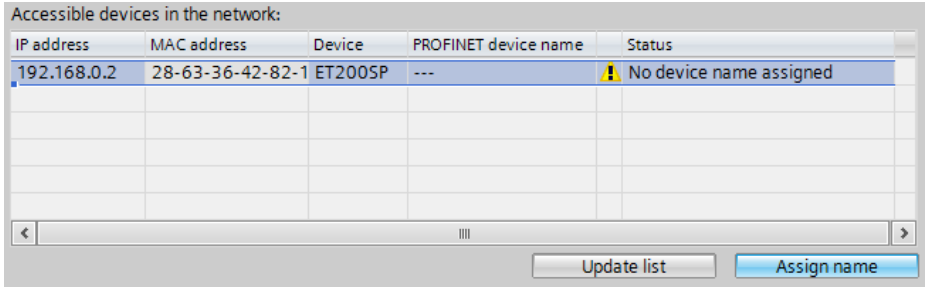
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ Online access must be correctly set in the dialog for assignment of the PROFINET device names. Any device can then be selected individually and filtered by devices of the same type. If a new device is being connected for the first time, the list has to be updated again. (→ PROFINET device name: sortingstation01 → Type of PG/PC interface: PN/IE → PG/PC interface: here: Intel(R) Ethernet Connection I217-LM → ☑ Only show devices of the same type → Update list)

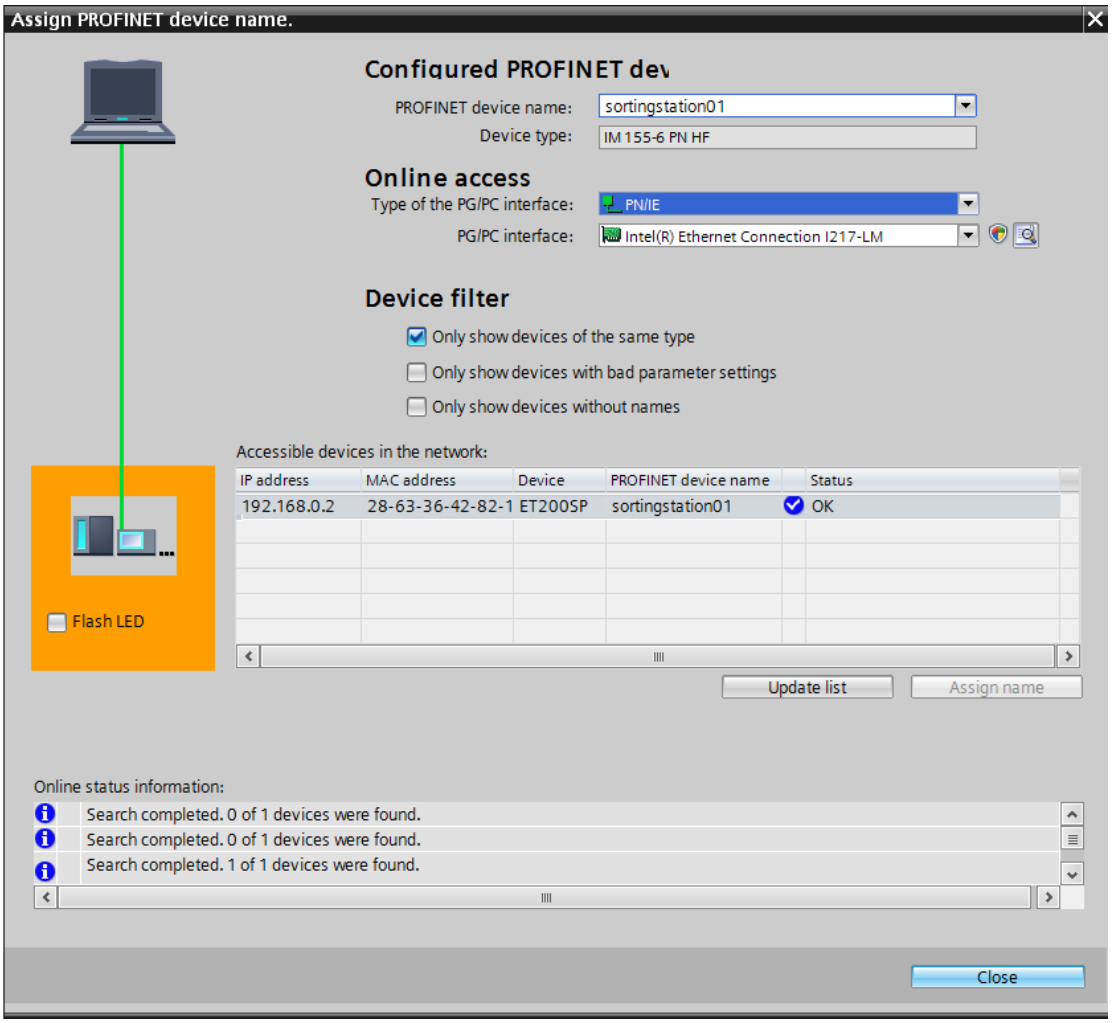


→ The correct device must be always be clearly determined by the MAC address printed on the device before the name is assigned. To check this, you can also have the LEDs on the device flash.

(→ ☐ Flash LED → Assign name



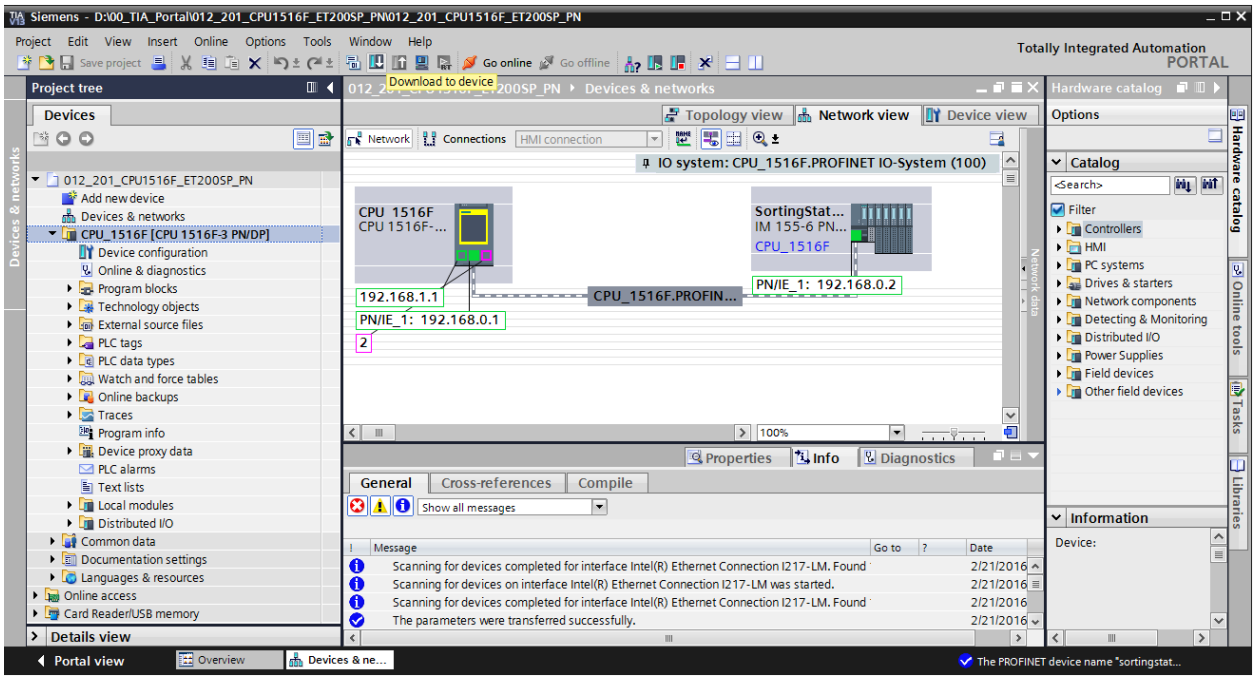
→ Successful assignment of the PROFINET device name should be checked before closing the dialog. (→ Close)



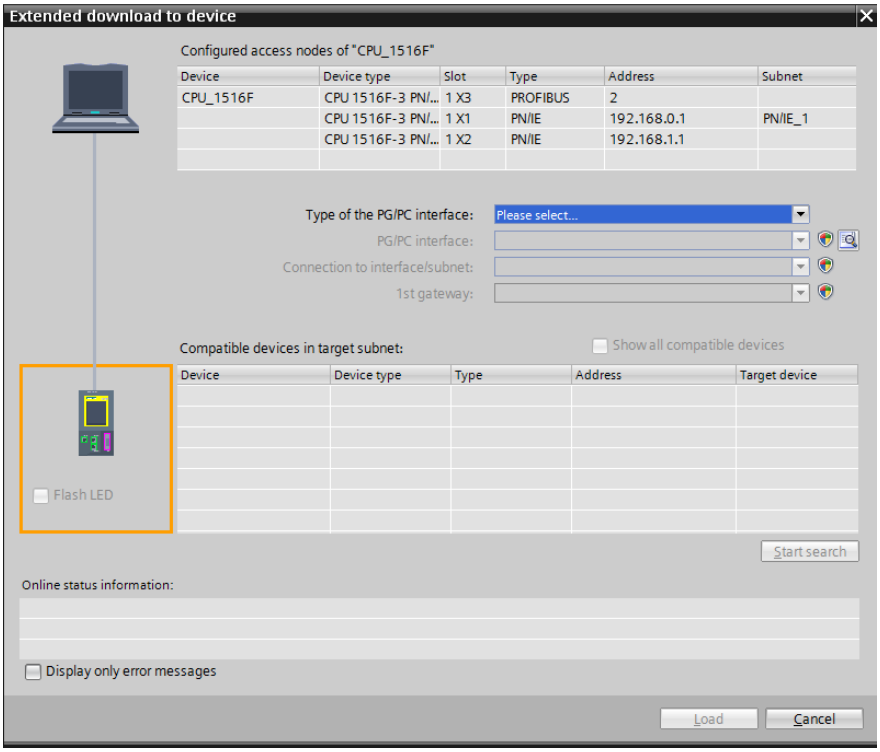
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.17 Download the hardware configuration to the device

→ To download your entire CPU, select the → "CPU_1516F [CPU1516F-3 PN/DP]" folder and click the → "Download to device" icon.



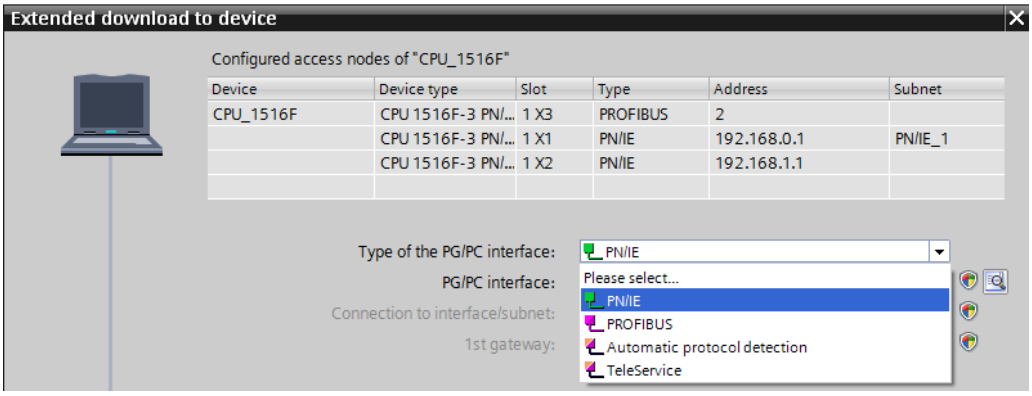
→ The manager for configuring the connection properties (extended download) opens.



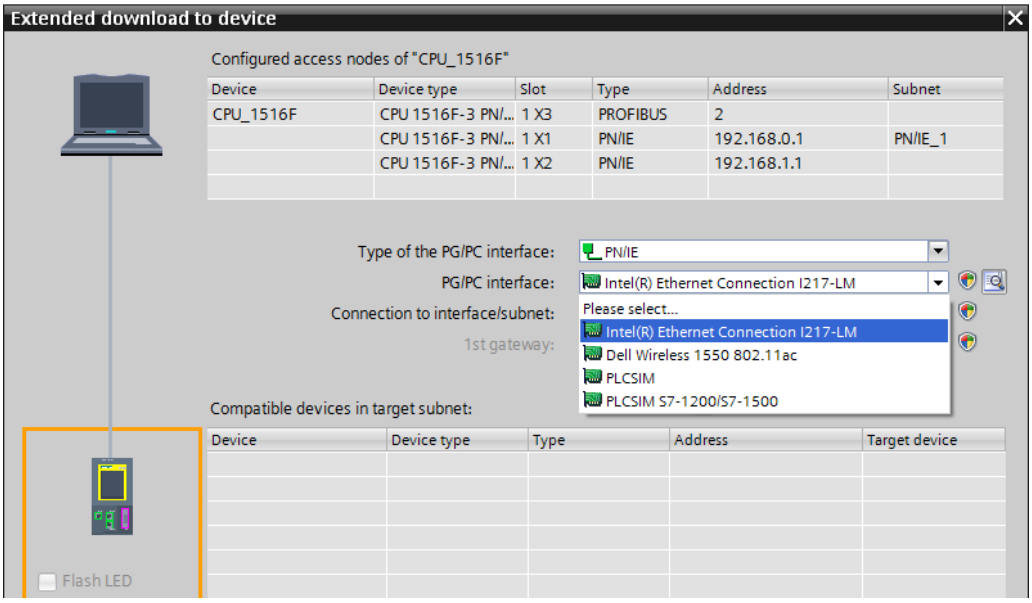
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ First, the interface must be correctly selected. This happens in three steps.

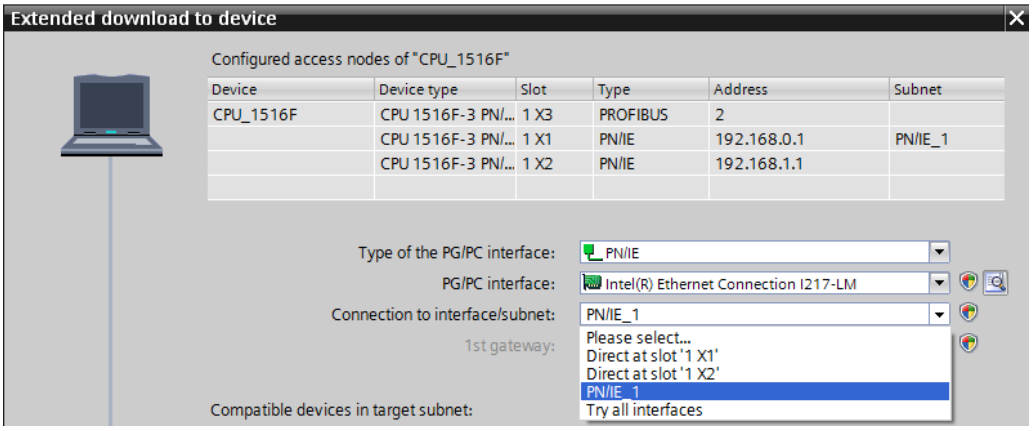
→ Type of the PG/PC interface → PN/IE



→PG/PC interface → here: Intel(R) Ethernet Connection I217-LM

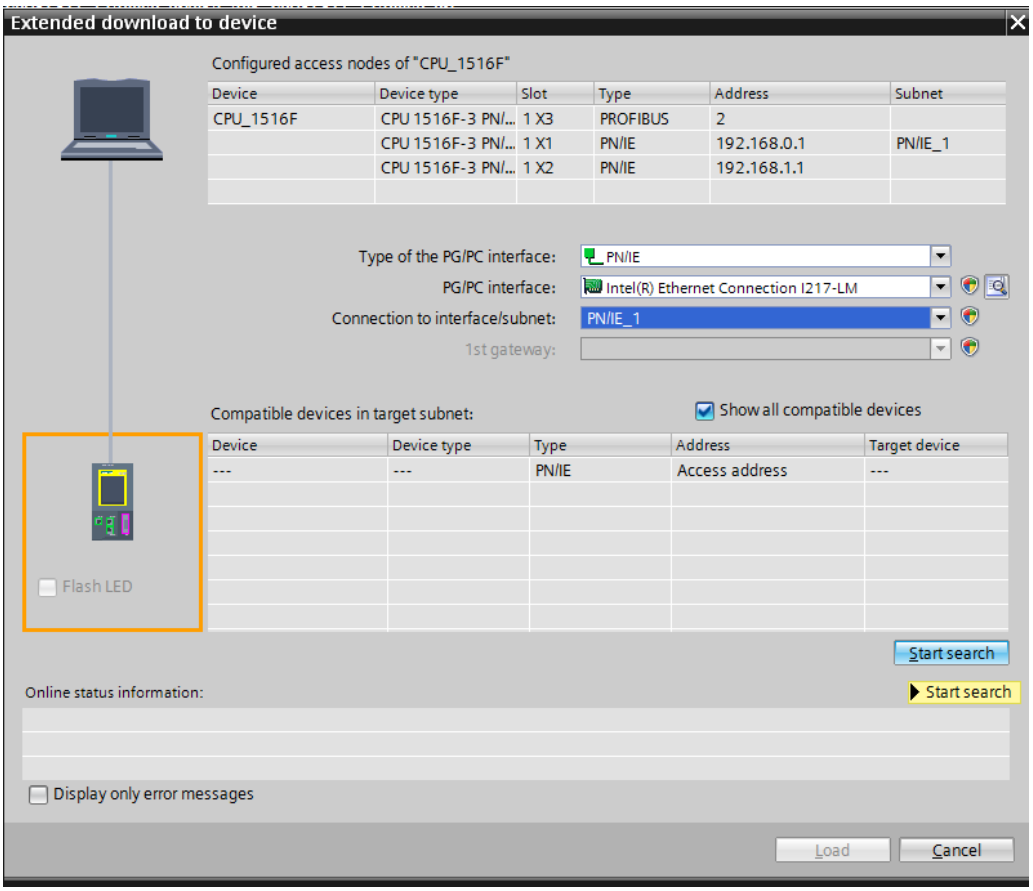


→ Connection to interface/subnet → "PN/IE_1"



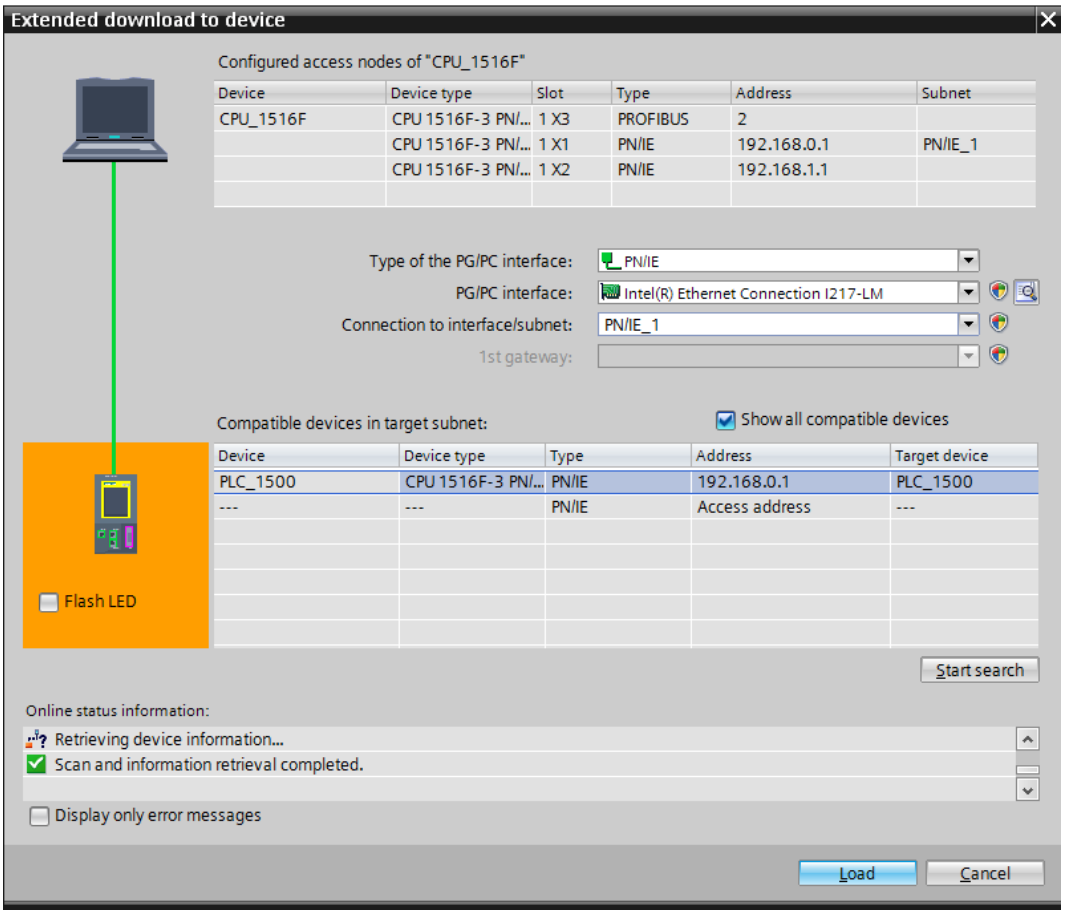
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ The → "Show all compatible devices" check box must then be selected. The search for devices in the network is started by clicking the → Start search button.

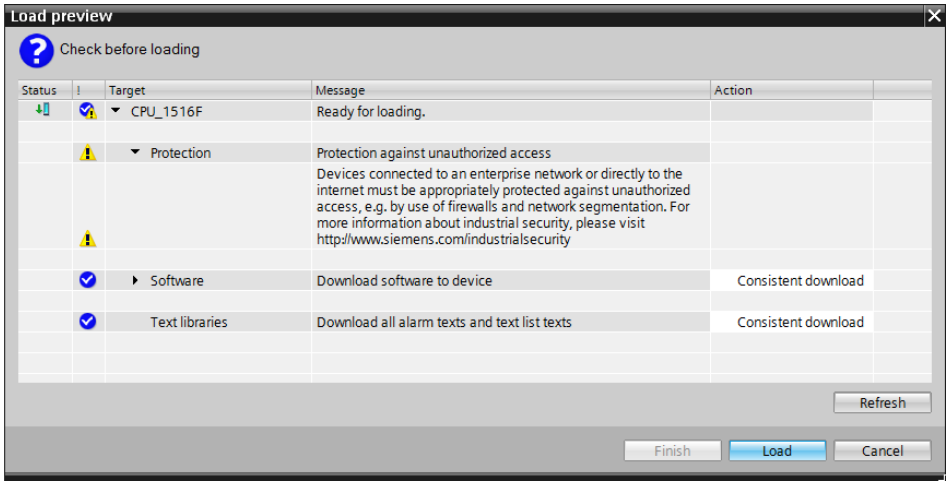


For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ If your CPU is shown in the "Compatible devices in target subnet" list, it must be selected and the download started.
(→ CPU 1516F-3 PN/DP → Load)



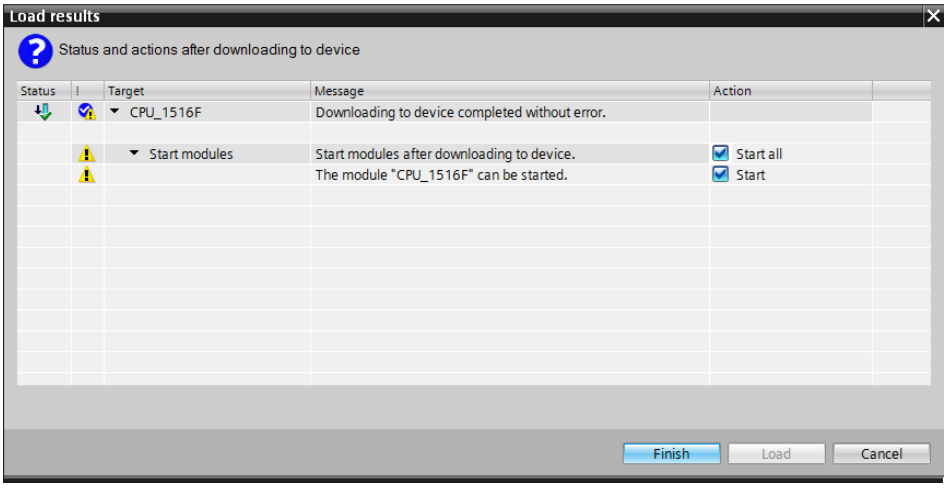
→ You first obtain a preview. Confirm the prompt → "Overwrite all" and continue with → Load.



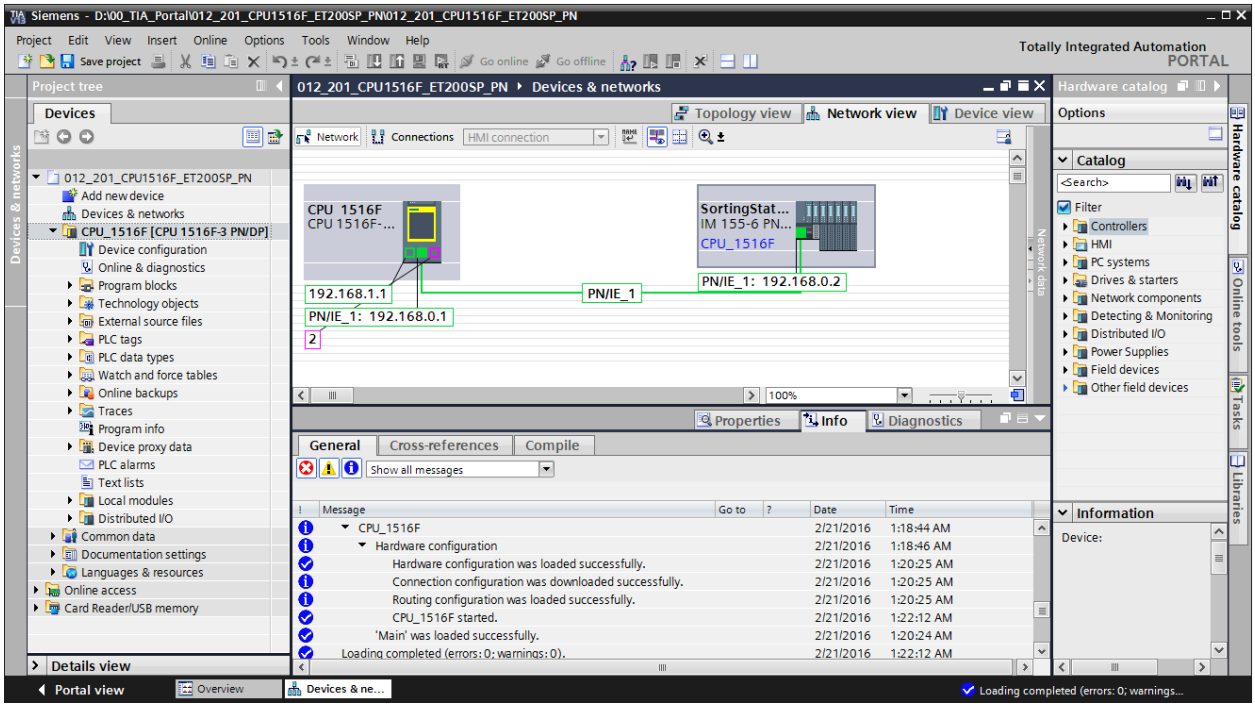
Note: *The ✓ symbol should be visible in every line of the "Load preview". You can find additional information in the "Message" column.*

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

→ The → "Start all" option will be selected next before the download operation can be completed with → Finish.



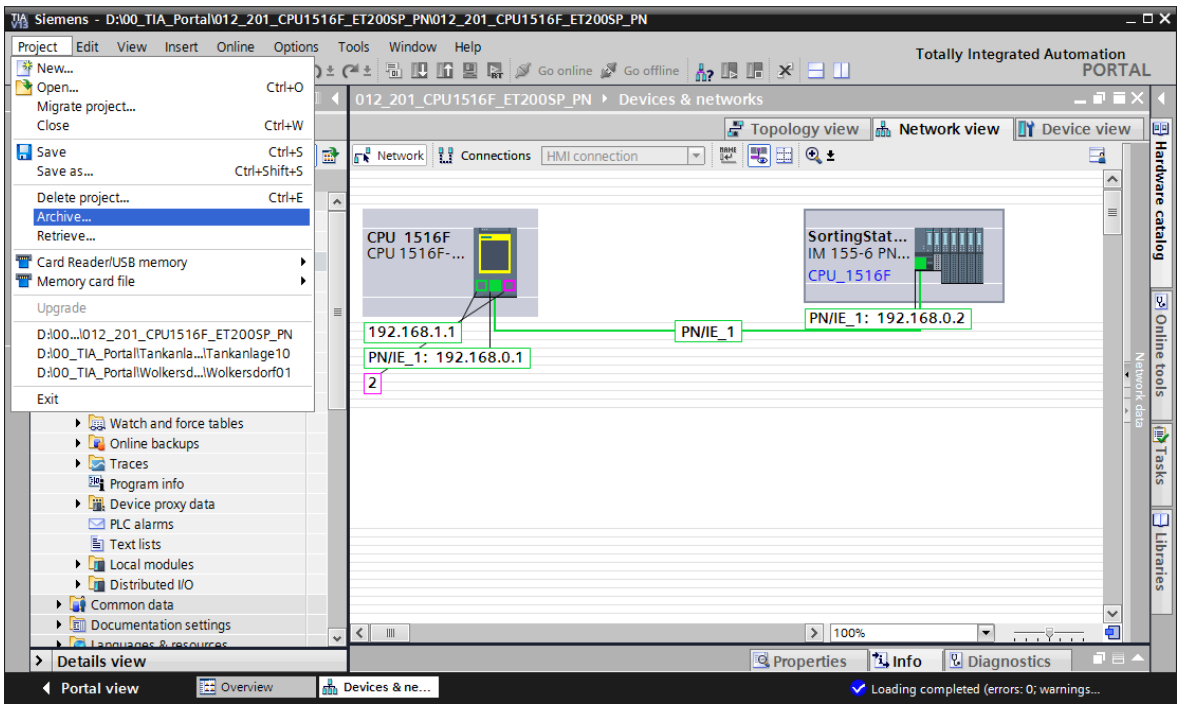
→ After a successful download, the project view will open again automatically. A download report appears in the information field under "General". This can be helpful when troubleshooting an unsuccessful download.



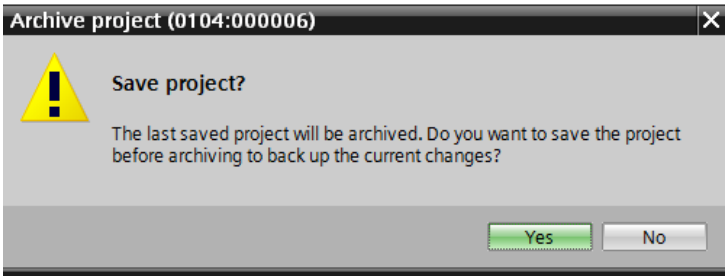
For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.18 Archive the project

→ To archive the project, select the → "Archive ..." command in the → "Project" menu.



→ Confirm the prompt to save the project with → "Yes".



→ Select a folder where you want to archive your project and save it as a "TIA Portal project archive" file type.

(→ "TIA Portal project archive" → "SCE_EN_012-201_Decentral Hardware Configuration S7-1500 ET 200SP PN_…" → "Save")

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

7.19 **Checklist**

No.	Description	Completed
1	Project was created	
2	Slot 0: Power module with correct order number	
3	Slot 1: CPU with correct order number	
4	Slot 1: CPU with correct firmware version	
5	IM of the ET 200SP created as distributed IO	
6	CPU and IM connected to the same subnet	
7	IM is assigned to the CPU	
8	ET 200SP slot 1…2: Digital input module with correct order number	
9	ET 200SP slot 1…2: Digital input module with correct firmware version	
10	ET 200SP slot 1…2: Address area of the digital input module is correct	
11	ET 200SP slot 3…4: Digital output module with correct order number	
12	ET 200SP slot 3…4: Digital output module with correct firmware version	
13	ET 200SP slot 3…4: Address area of the digital output module is correct	
14	ET 200SP slot 5: Server module with correct order number	
15	ET 200SP slot 5: Server module with correct firmware version	
16	ET 200SP modules have all the correct potential groups set for the Base Units	
17	Hardware configuration was compiled without error message	
18	Hardware configuration was downloaded without error message	
19	Project was successfully archived	

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

8 Exercise

8.1 Task – Exercise

The hardware configuration is to be expanded to include the trainer package SIMATIC ET 200SP Analogy Modules Expansion. Insert the modules that are still missing. In so doing, select slots 5 and 6 for the analog input modules and slot 7 for the analog output module. The server module is moved to slot 8 Use the address area starting from 64 for the analog modules.

- 2X AI 2XU/I 2-/4-WIRE HS (order number: 6ES7134-6HB00-0DA1)
- 1X AQ 2XU/I HS (order number: 6ES7135-6HB00-0DA1)

Module	Order number	Slot	Address area
AI 2xU/I 2-/4-wire HS	6ES7134-6HB00-0DA1	5	64…67
AI 2xU/I 2-/4-wire HS	6ES7134-6HB00-0DA1	6	68…71
AQ 2xU/I HS	6ES7135-6HB00-0DA1	7	64…67

Table 1: Analog modules of the ET 200SP

8.2 Planning

Plan the implementation of the task on your own.

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

8.3 Checklist – Exercise

No.	Description	Completed
1	ET 200SP slot 5…6: Analog input modules with correct order number	
2	ET 200SP slot 5…6: Analog input modules with correct firmware version	
3	ET 200SP slot 5…6: Address areas of the analog input modules are	
4	ET 200SP slot 7: Analog output module with correct order number	
5	ET 200SP slot 7: Analog output module with correct firmware version	
6	ET 200SP slot 7: Address area of the analog output module is correct	
7	ET 200SP slot 8: Server module	
8	ET 200SP modules have all the correct potential groups set for the Base Units	
9	Hardware configuration was compiled without error message	
10	Hardware configuration was downloaded without error message	
11	Project was successfully archived	

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.

9 Additional information

You can find additional information as an orientation aid for initial and advanced training, for example: Getting Started, videos, tutorials, apps, manuals, programming guidelines and trial software/firmware, at the following link:

www.siemens.com/sce/s7-1500

For unrestricted use in educational and R&D institutions. © Siemens AG 2017. All rights reserved.