SIEMENS

SCE Training Curriculum

Siemens Automation Cooperates with Education | 05/2017

TIA Portal Module 012-100

Unspecified Hardware Configuration
with SIMATIC S7-1500

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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.

Table of contents

UNSPECIFIED HARDWARE CONFIGURATION – FOR A SIMATIC S7-1500

1 Goal

In this chapter, you will first learn how to ***create a project***. Next you will be shown in one part of the task how you can use the ***TIA Portal*** to detect ***hardware*** already installed and add it to a project. This hardware will then be 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. You only need an S7-1500 controller.

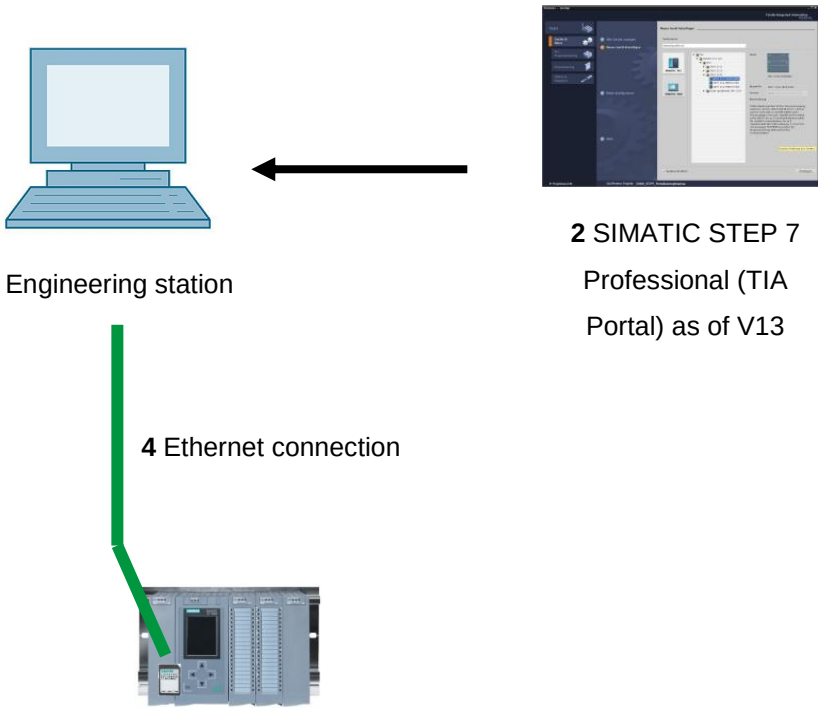
3 Required hardware and software

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 and 16DI/16DO and 2AI/1AO

4 Ethernet connection between engineering station and controller



4 Theory

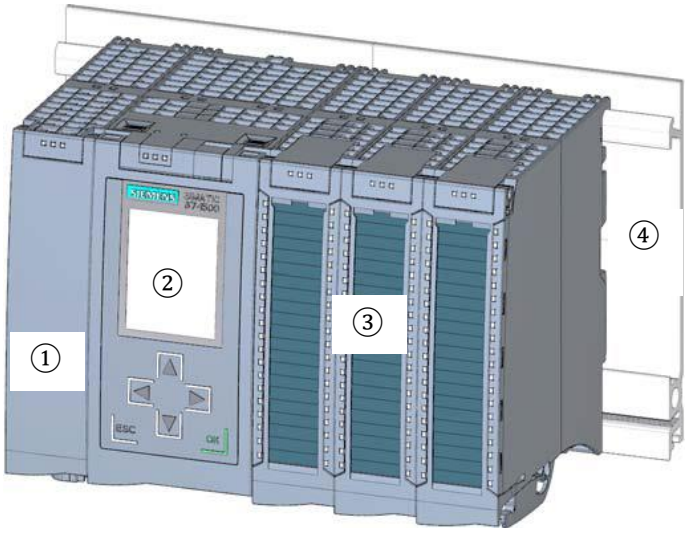
4.1 SIMATIC S7-1500 automation system

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

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.

4.1.1 Range of modules

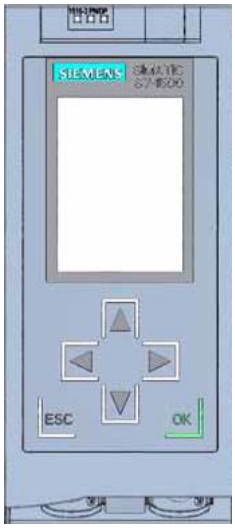
The SIMATIC S7-1500 is a modular automation system and offers the following range of modules:

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.

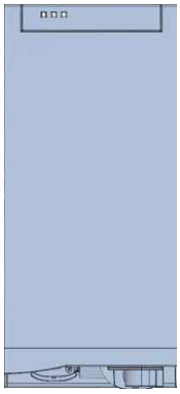
Additional properties and functions of the CPU:

- 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)



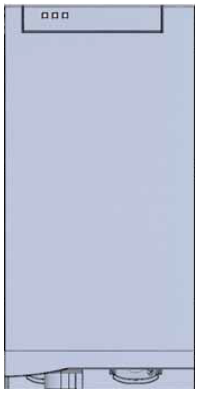
System power supply modules (PS) (rated input voltages 24 V DC to 230 V AC/DC)

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



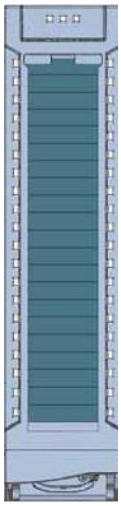
Load current supply modules (PM) (rated input voltages 120/230 V AC)

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.



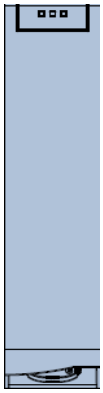
IO modules

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



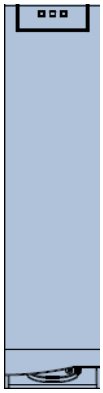
Technology modules (TM)

as incremental encoders and pulse encoders with/without direction signal



Communication modules (CM)

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

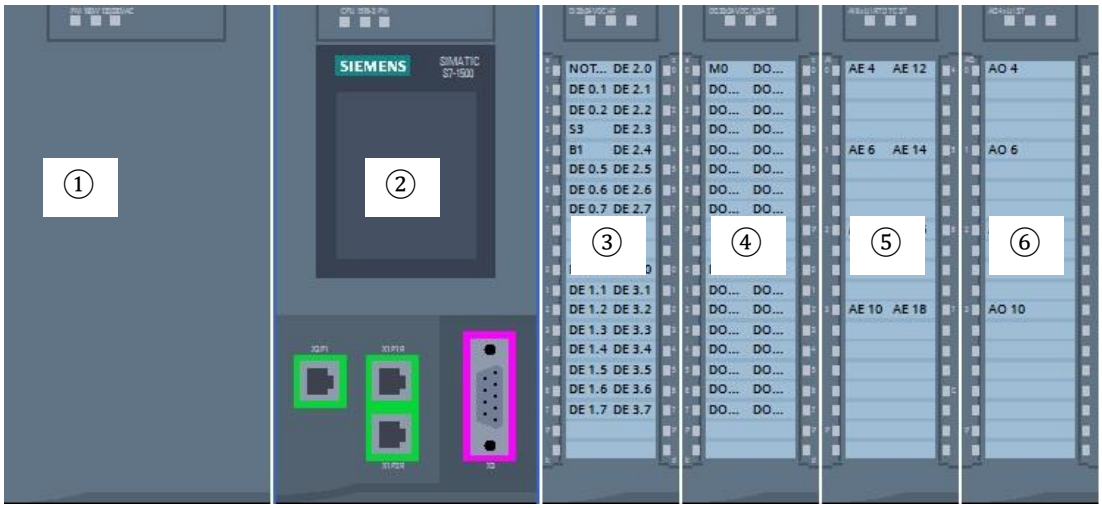


SIMATIC memory card

up to a maximum of 2 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

③ IO module 32x digital input DI 32x24VDC HF

④ IO module 32x digital output DQ 32x24VDC/0.5A HF

⑤ IO module 8x analog input AI 8xU/I/RTD/TC ST

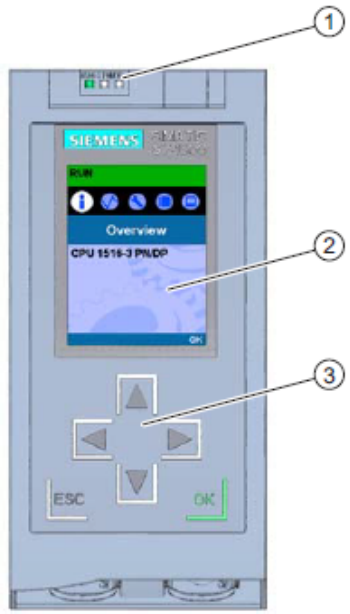
⑥ IO module 4x analog output AQ 4xU/I ST

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.

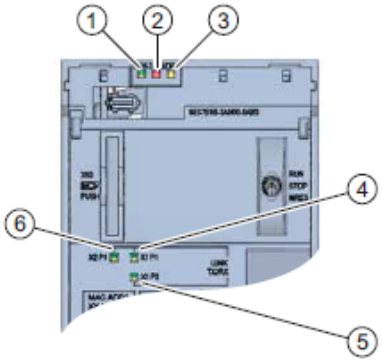
4.2.1 Front view of the CPU 1516F-3 PN/DP with integrated display



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

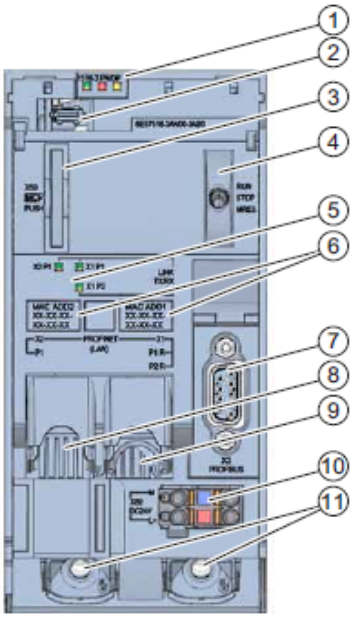
4.2.2 Status and error displays

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)

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.*

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 PG/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.*

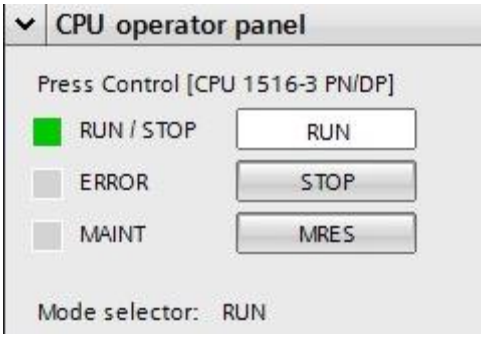
4.2.5 Mode switch

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.



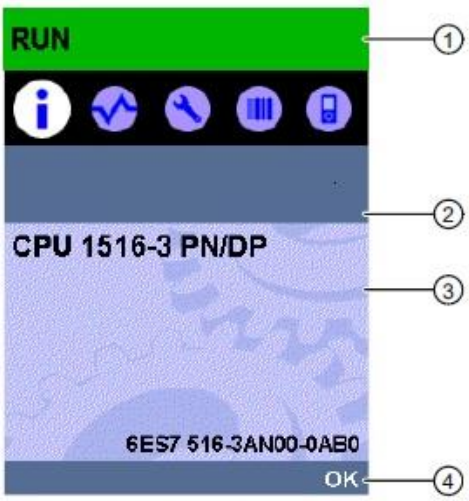
4.2.6 Display of the CPU

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

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

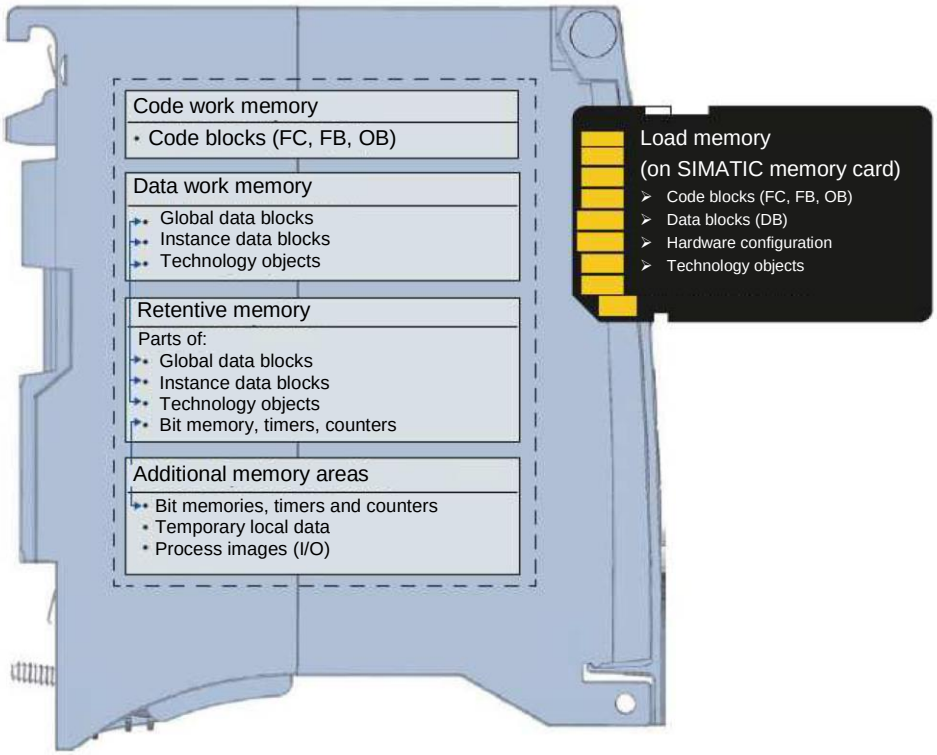
Available submenus of the display:

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.)

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.

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 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.

4.4.1 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.

4.4.2 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.

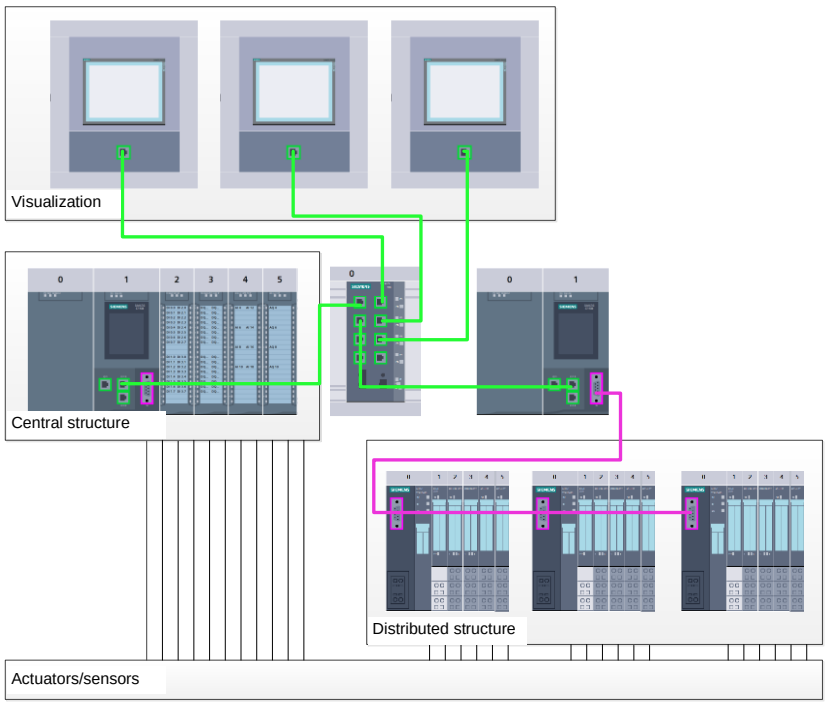


Figure 1: Example of hardware configuration with central and distributed structures

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.

4.4.3 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.

4.4.4 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.*

4.4.5 TIA Portal – Project view and portal view

The TIA Portal has two important views. When started, the TIA Portal displays the portal view 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.

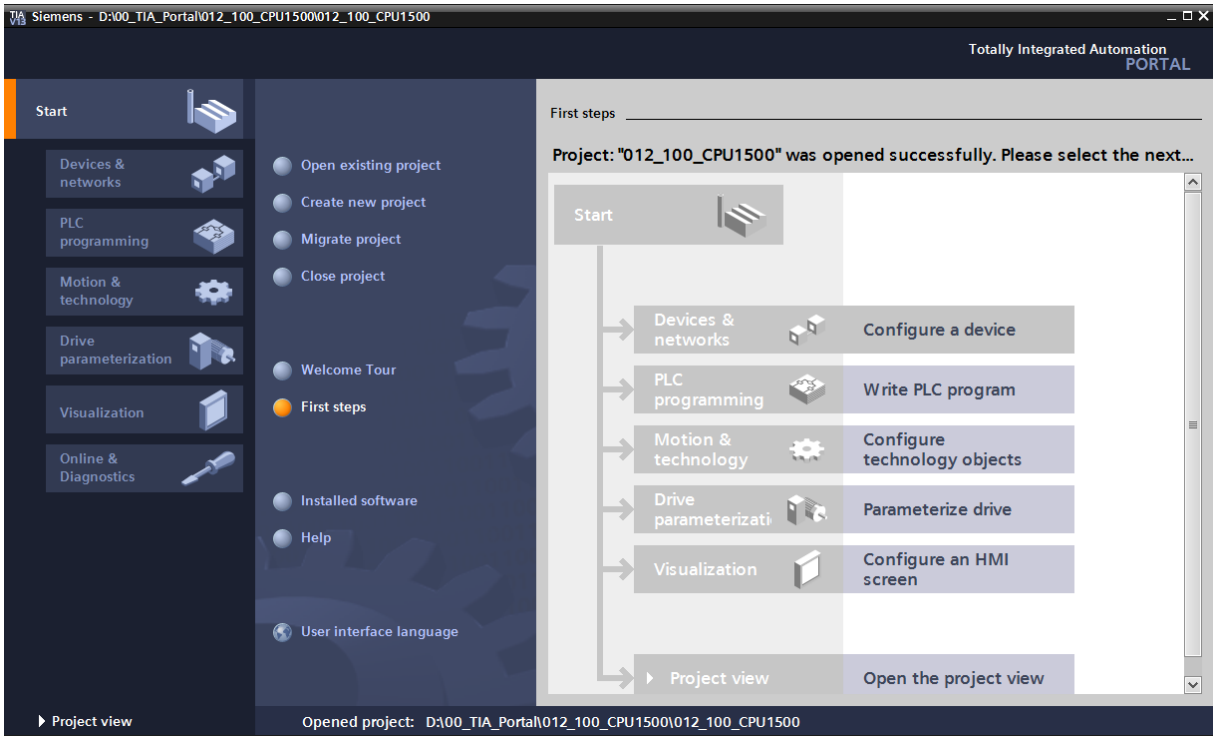


Figure 2: Portal view

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.

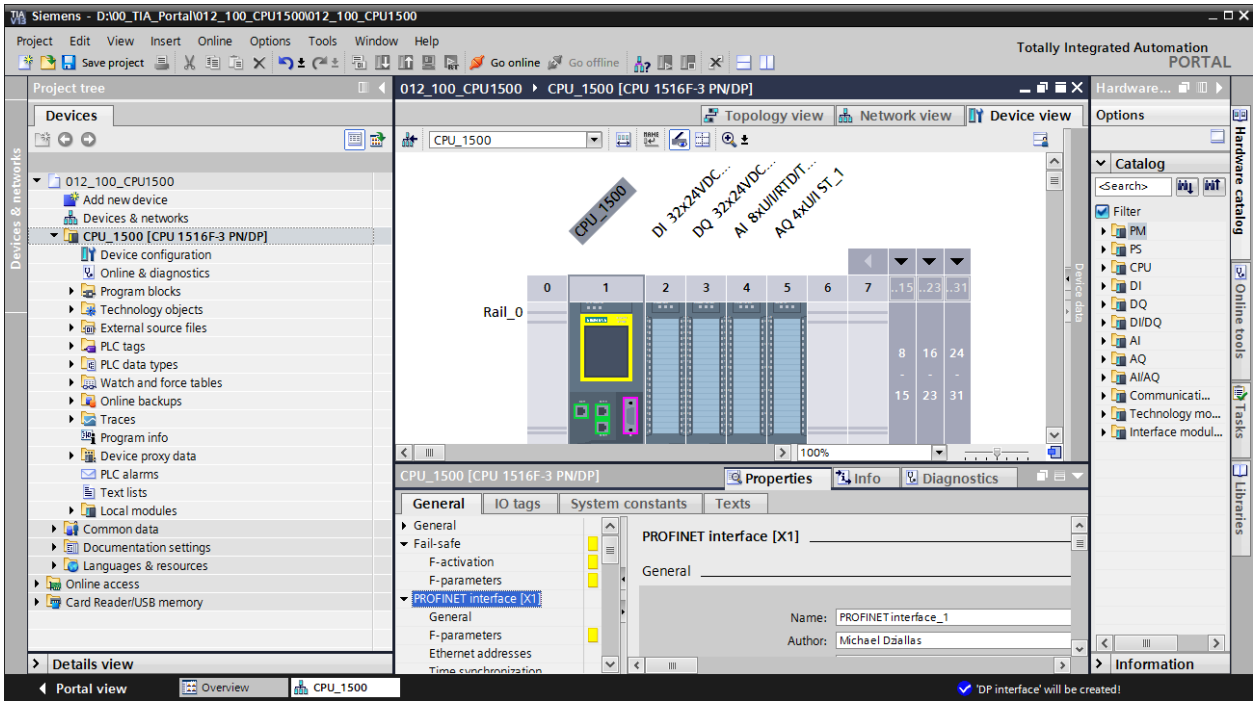
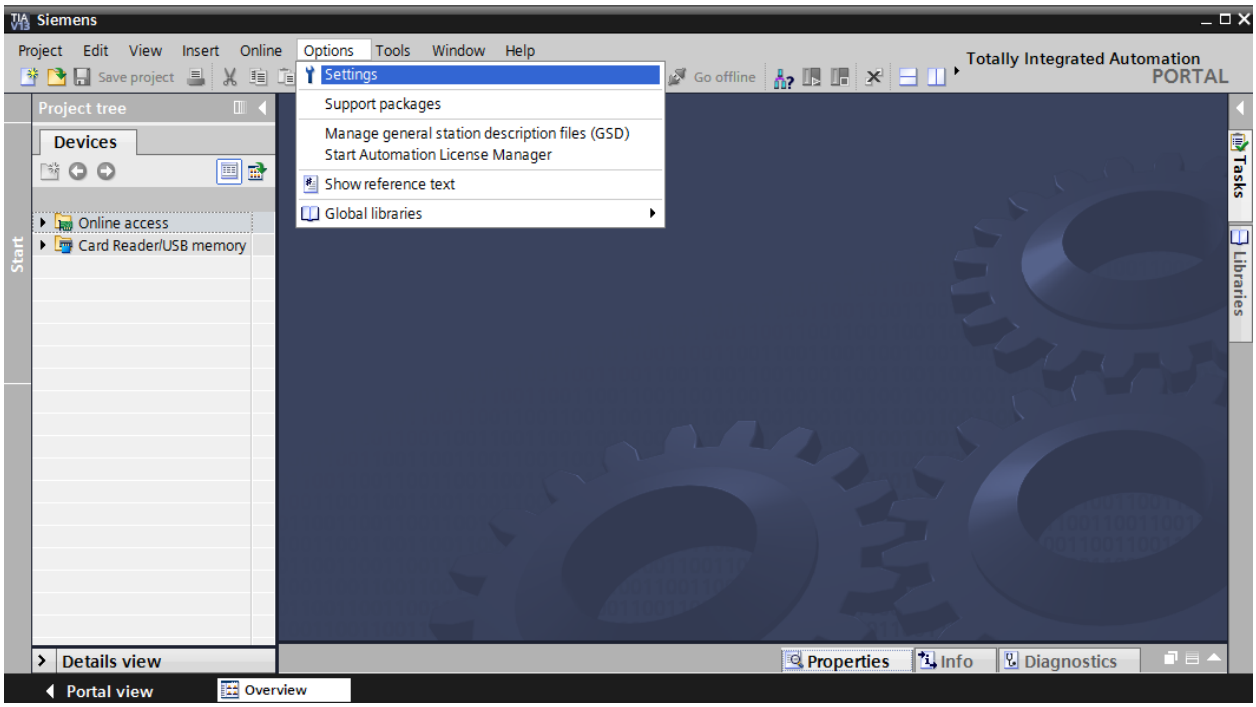


Figure 3: Project view

4.4.6 Basic settings for the TIA Portal

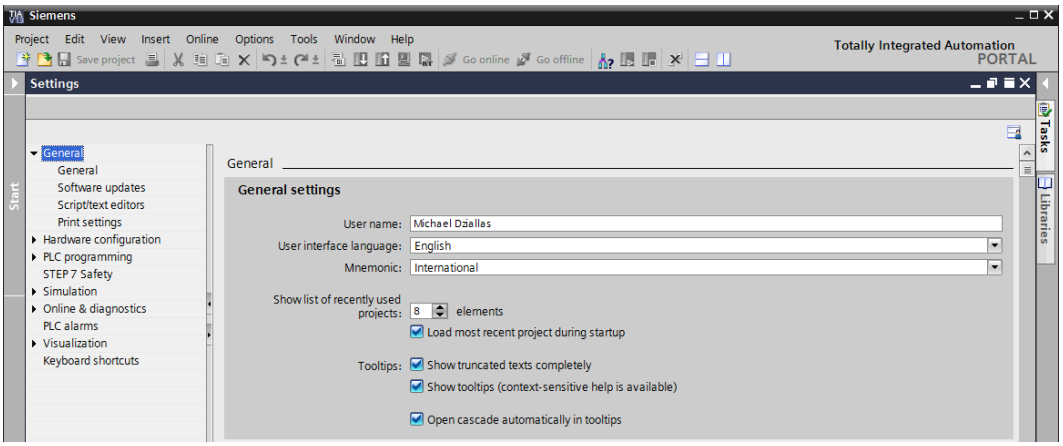
→ Users can specify their own default settings for certain settings in the TIA Portal. A few important settings are shown here.

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



→ 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.

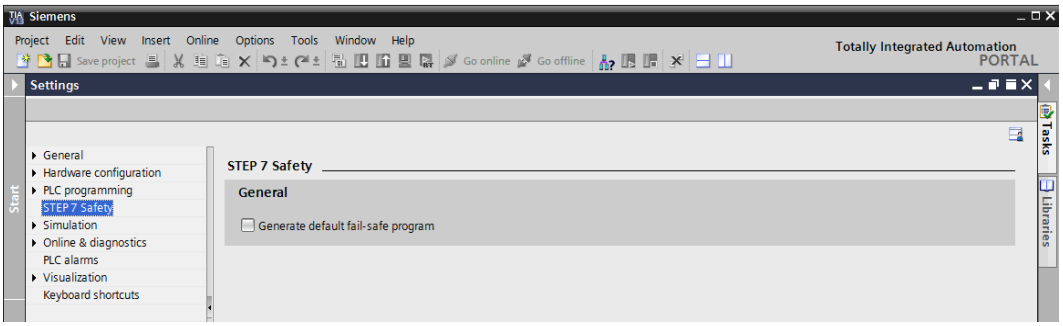
→ Under → "General" in "Settings", select "User interface language → English" and "Mnemonic → International".



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".



4.4.7 Setting the IP address on the programming device

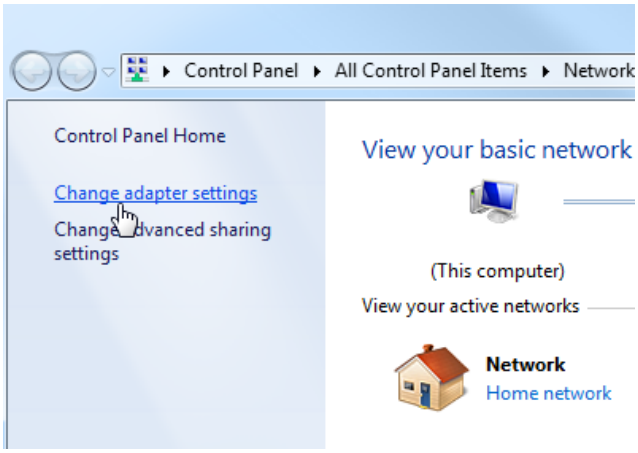
To program SIMATIC S7-1500 from the PC, the programming device or a laptop, you need a TCP/IP connection or an optional PROFIBUS connection.

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.

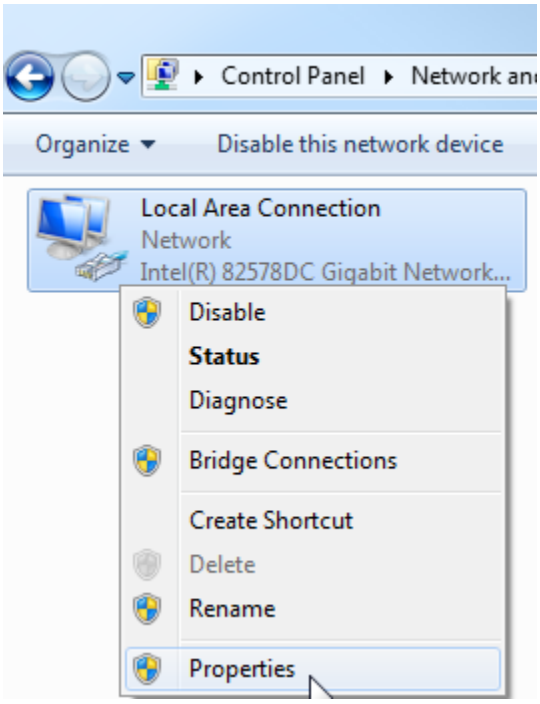
First, we show you how to set the IP address of a computer with the Windows 7 operating system.

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

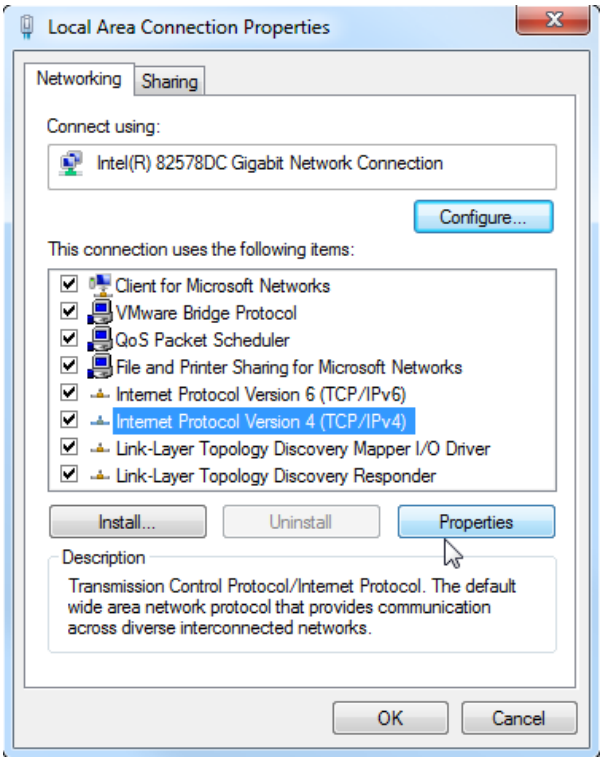
→ In the open Network and Sharing Center window, click → "Change adapter settings".



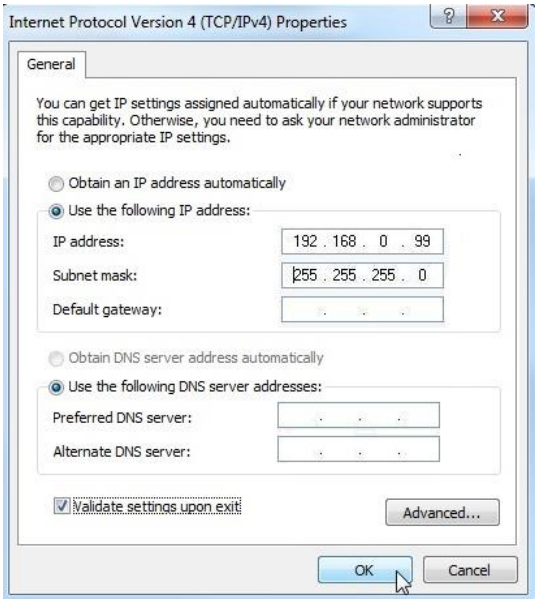
→ Select the desired → "Local Area Connection" that you want to use to connect to the controller and click → "Properties".



→ 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")

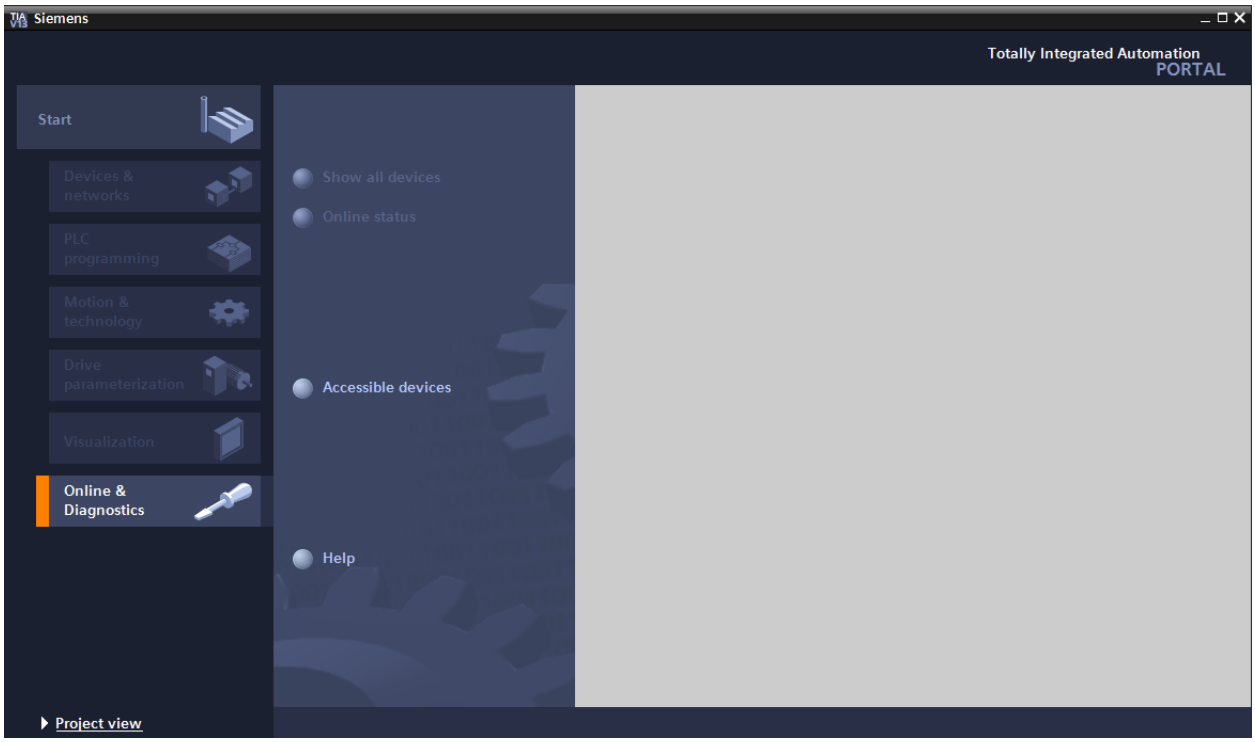


4.4.8 Setting the IP address in the CPU

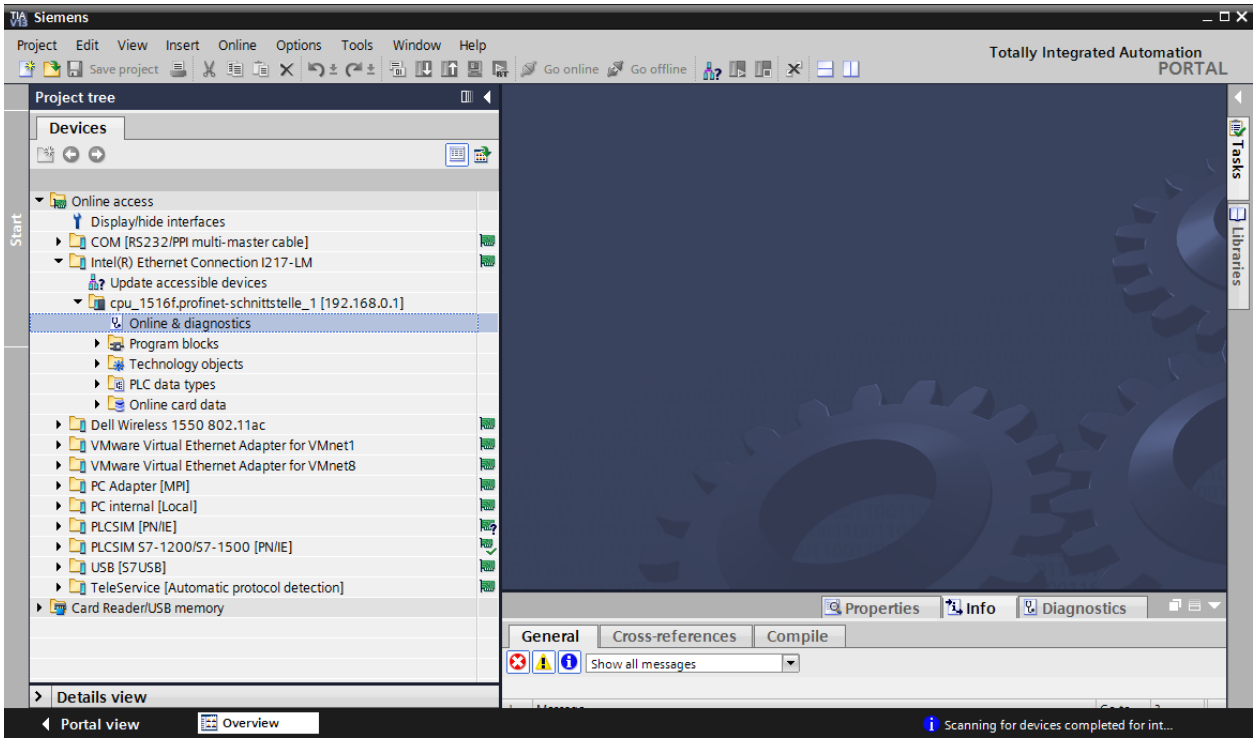
The IP address of SIMATIC S7-1500 is set as follows.

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

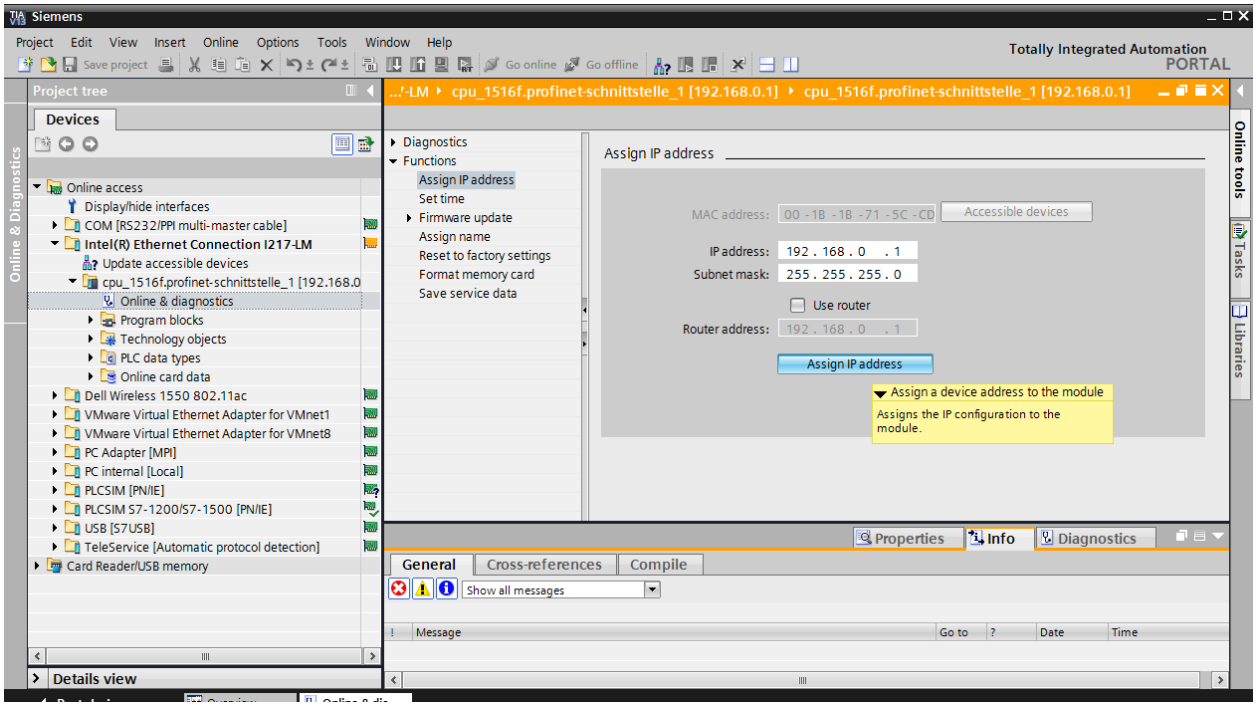
→ Select → "Online & Diagnostics" and open the →"project view".



→ 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.

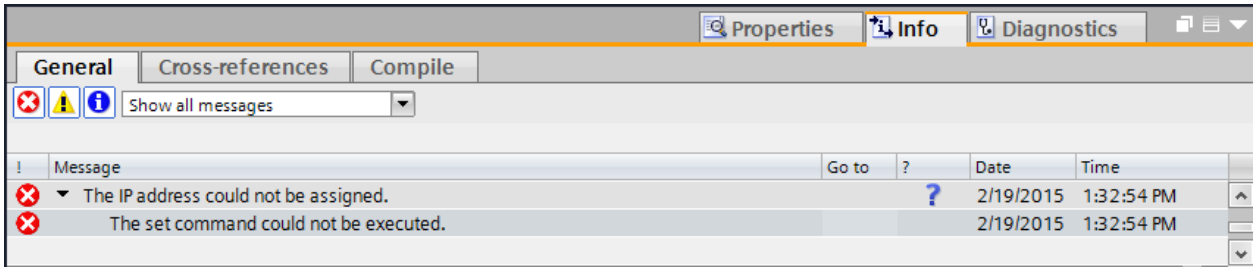


→ Under→ "Functions", you now find the → "Assign IP address" item. Enter the following IP address here (example): → IP address: 192.168.0.1 → Subnet mask 255.255.255.0. Next, click → "Assign IP address" and this new address will be assigned to your SIMATIC S7-1500.



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.*

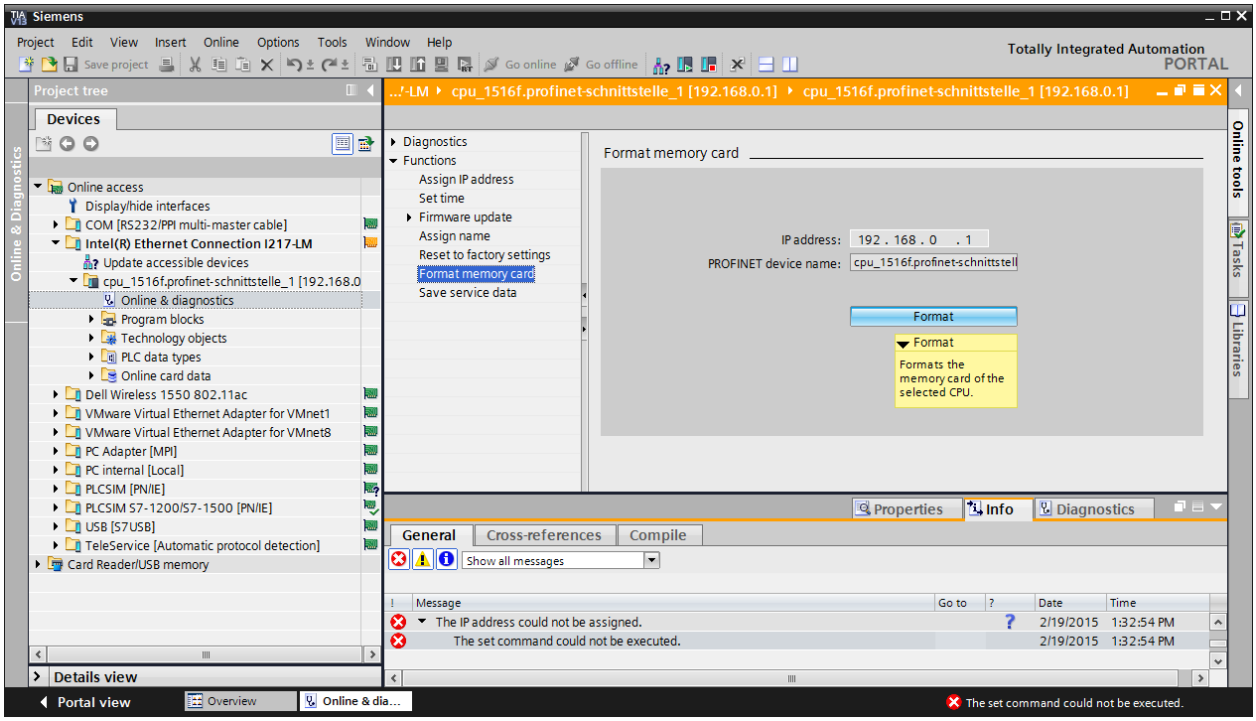
→ If the IP address was not successfully assigned, you will receive a message in the → "Info" window under → "General".



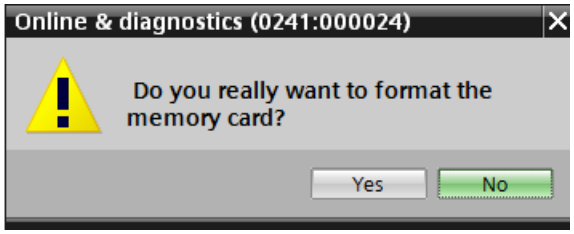
4.4.9 Formatting the memory card in the CPU

→ 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".

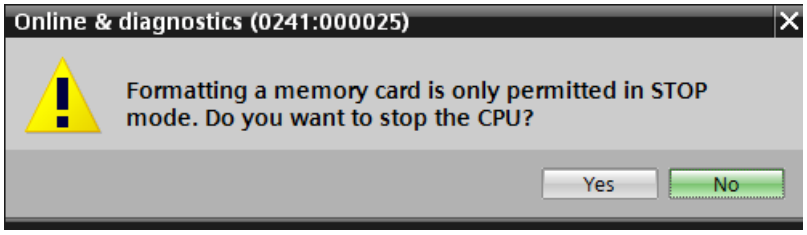
→ First, select the → "Format memory card" function and press the → "Format" button.



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

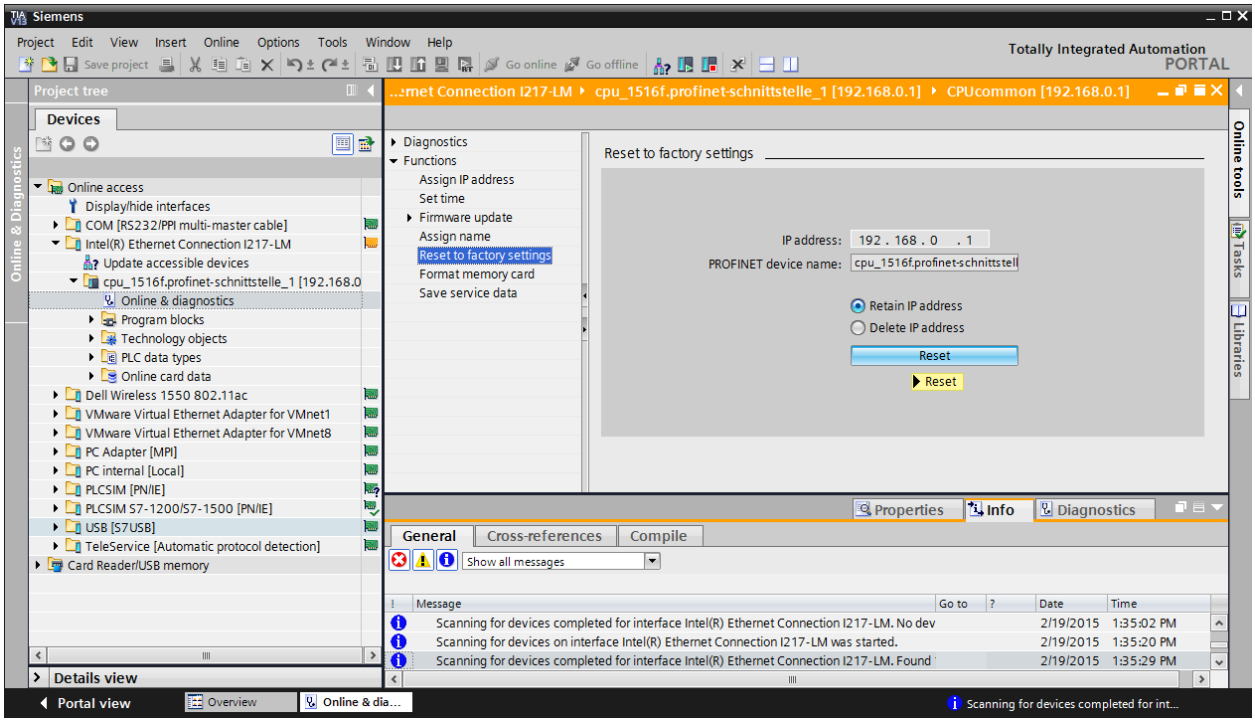


→ If necessary, stop the CPU. (→ "Yes")

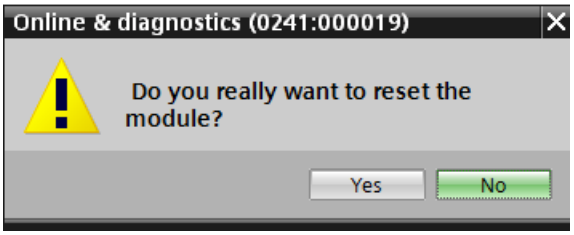


4.4.10 Resetting the CPU to factory settings

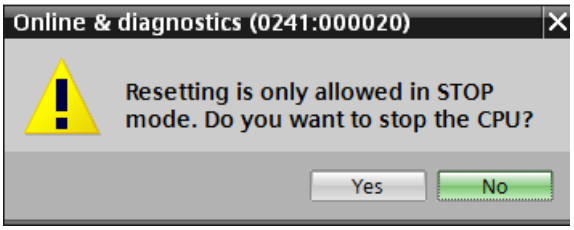
→ Before you can reset the CPU, you must wait until the formatting in the CPU has finished. Then you must select → "Update accessible devices" and → "Online & diagnostics" of your CPU again. To reset the controller, select the → "Reset to factory settings" function and click → "Reset".



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



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



5 Task

Create a project and add the modules of the existing hardware (here: Trainer Package **SIMATIC S7-1500F with CPU 1516F-3 PN/DP)** by using the automatic hardware detection of the **TIA Portal**.

The following modules must be detected:

- 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 S7-1500, DIGITAL INPUT MODULE DI 32 X DC24V, 32 CHANNELS IN GROUPS OF 16 (order number: 6ES7521-1BL00-0AB0)
- 1X SIMATIC S7-1500, DIGITAL OUTPUT MODULE DQ 32 X DC24V / 0.5A; 32 CHANNELS (order number: 6ES7 522-1BL01-0AB0)
- 1X SIMATIC S7-1500, ANALOG INPUT MODULE AI 8 X U/I/RTD/TC, 16BIT RESOLUTION 8 CHANNELS IN GROUPS OF 8 (6ES7 531-7KF00-0AB0)
- 1X SIMATIC S7-1500, ANALOG OUTPUT MODULE AQ 4 X U/I ST, 16BIT RESOLUTION, 4 CHANNELS IN GROUPS OF 4 (order number: 6ES7 532-5HD00-0AB0)

You must add the following module yourself:

- 1X SIMATIC PM 190W 120/230VAC STABILIZED POWER SUPPLY Input: 120/230 VAC output: 24 V DC / 8 A (order number: 6EP1333-4BA00)

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 (here: SIMATIC S7-1516F PN/DP Trainer Package). Therefore, a selection does not have to be made. Instead, the listed modules of the Trainer Package are detected directly. The order numbers (see Task or Table 1) can be used for checking purposes.

Module	Order number	Slot	Address area
CPU 1516F-3 PN/DP	6ES7 516-3FN01-0AB0	1	
DI 32x24VDC HF	6ES7 521-1BL00-0AB0	2	0…3
DQ 32 X DC24V / 0.5A HF	6ES7 522-1BL01-0AB0	3	0…3
AI 8 X U/I/RTD/TC, 16BIT	6ES7 531-7KF00-0AB0	4	64…79
AQ 4 X U/I ST, 16BIT	6ES7 532-5HD00-0AB0	5	64…71

Table 1: Overview of the planned configuration

The address areas must now be configured.

The power module is not automatically detected and must be manually added.

Module	Order number	Slot	Address area
PM 190W 120/230VAC	6EP1333-4BA00	0	

Table 2: Module to be manually added

As the final step, the hardware configuration must be compiled and downloaded. 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 tested project must be saved and archived.

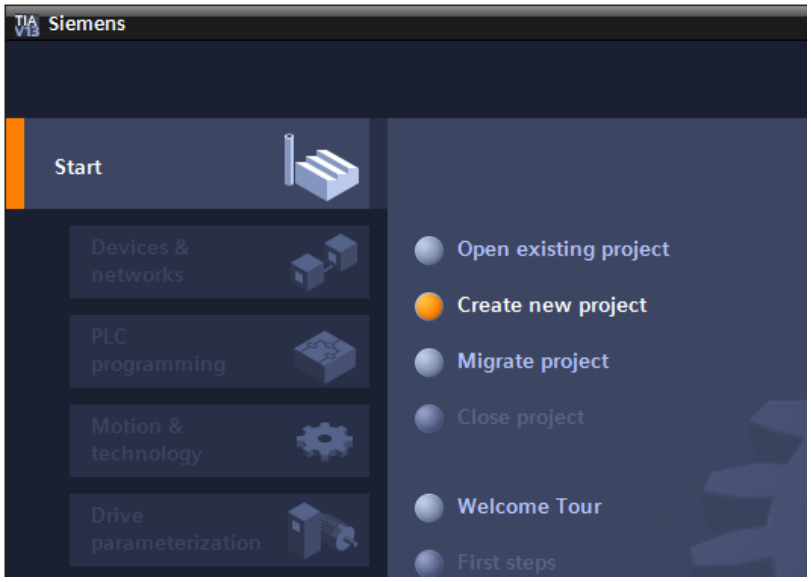
7 Structured step-by-step instructions

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.

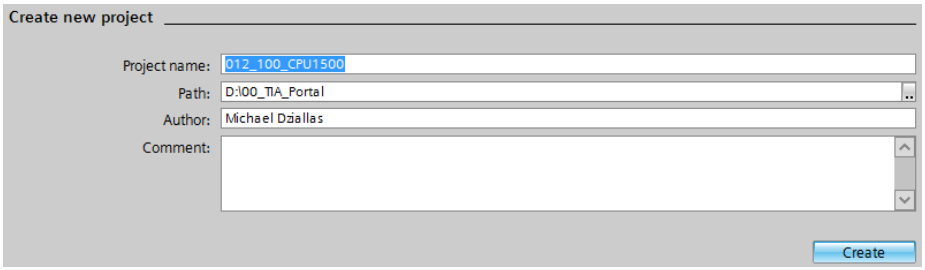
7.1 Create a new project

→ 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 the command → "Create new project".



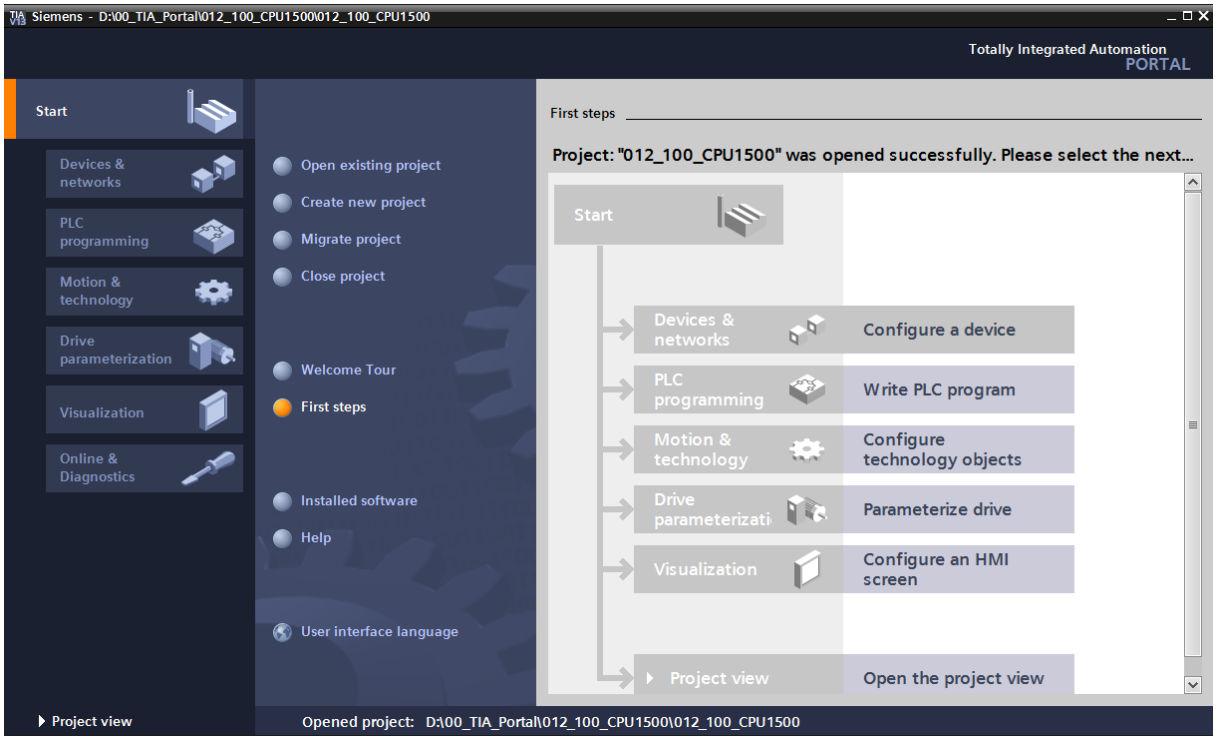
→ Modify Project name, Path, Author and Comment as appropriate and click → "Create".



→ The project will be created and opened and the menu "Start", "First steps" will open automatically.

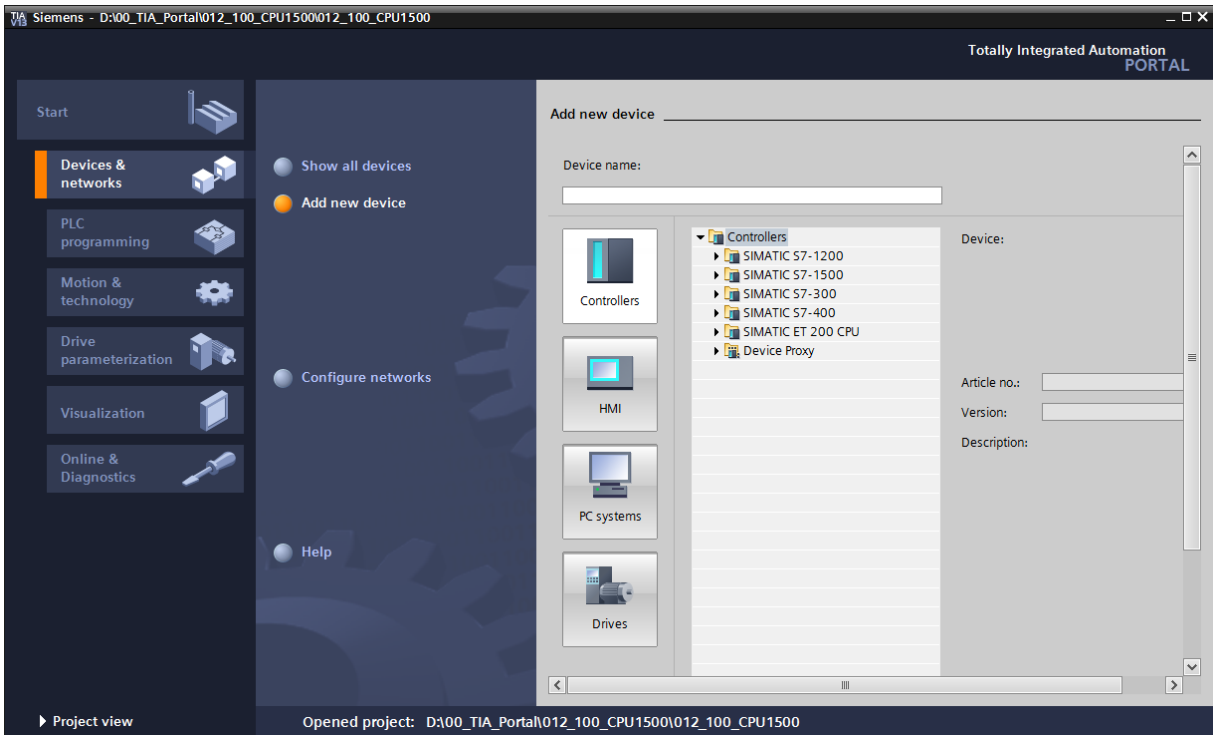
7.2 Read the hardware of the SIMATIC S7-1500

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



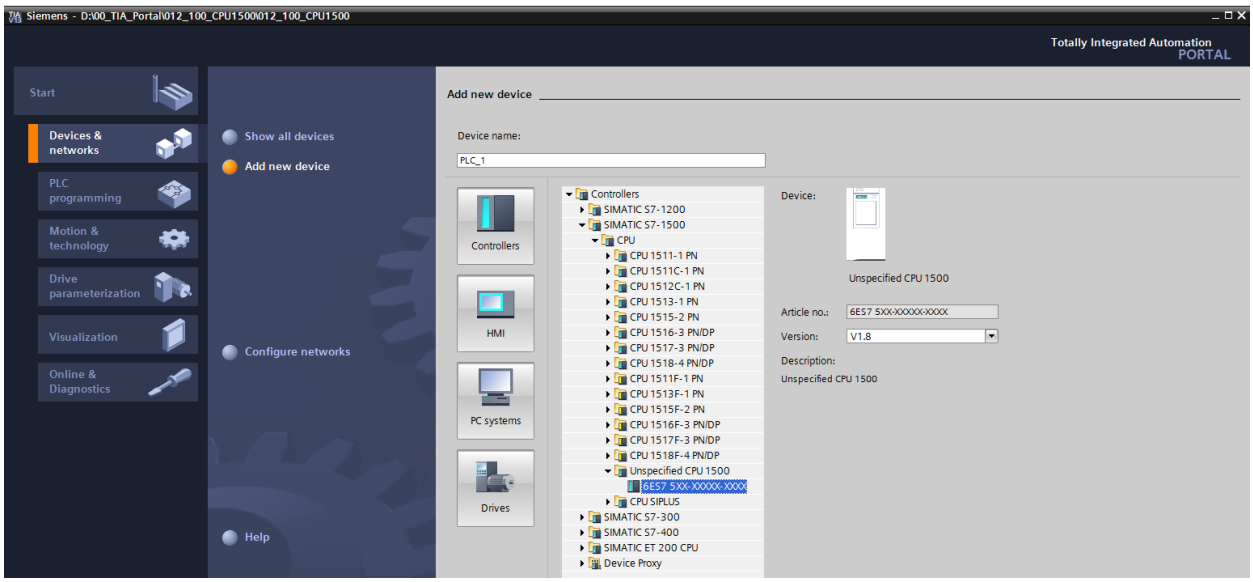
→ The "Show all devices" menu opens in the "Devices & Networks" portal.

→ Switch to the "Add new device" menu.



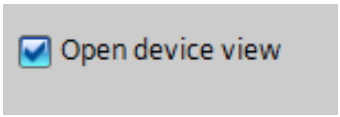
→ Create a new CPU. Use an unspecified model of the S7-1500 CPU with order number 6ES7 5XX-XXXXX-XXXX for this.

(Controllers → SIMATIC S7-1500 → CPU → Unspecified CPU 1500 → 6ES75XX-XXXXX-XXXX → V1.8)

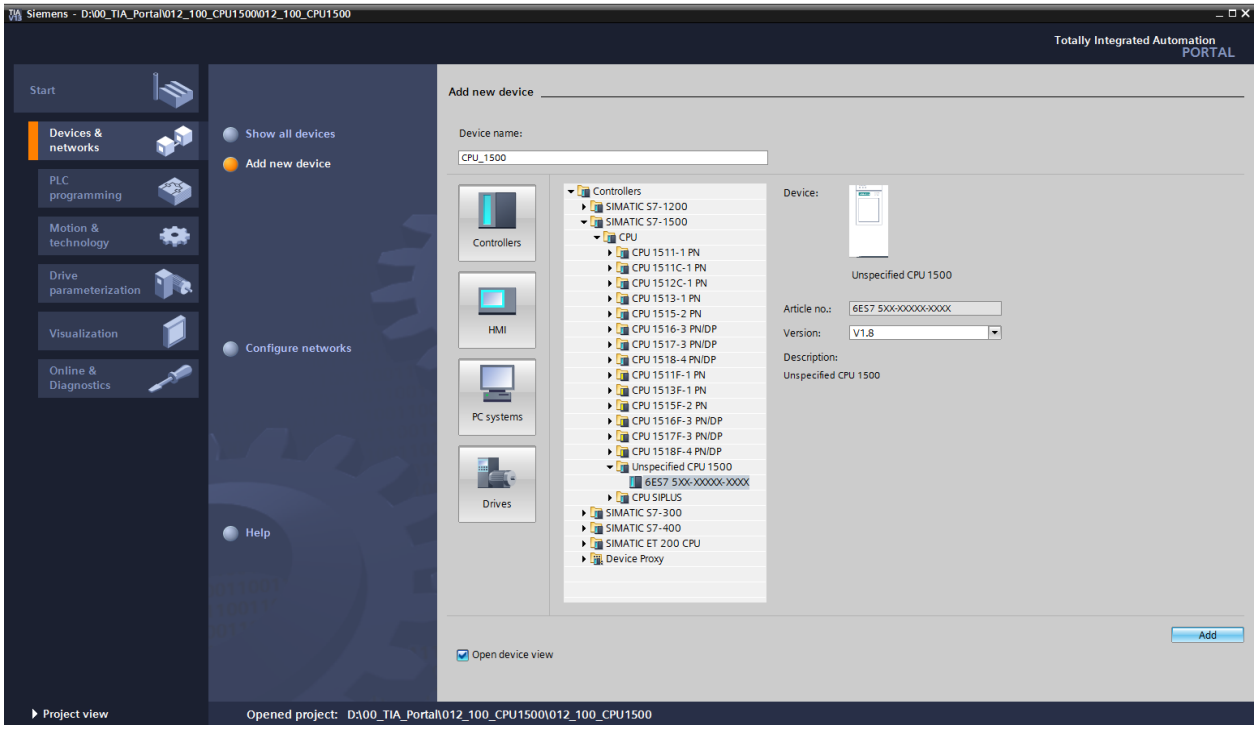


→ Assign a device name (Device name → "CPU_1500").

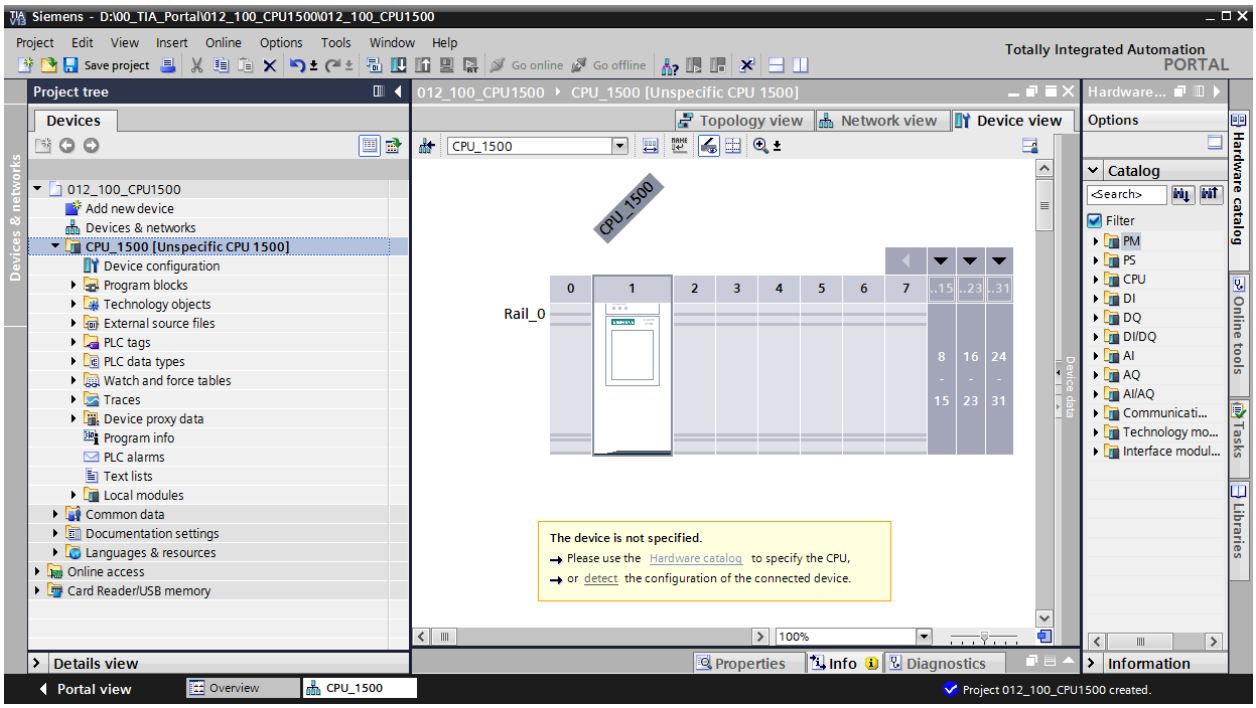
→ Select "Open device view".



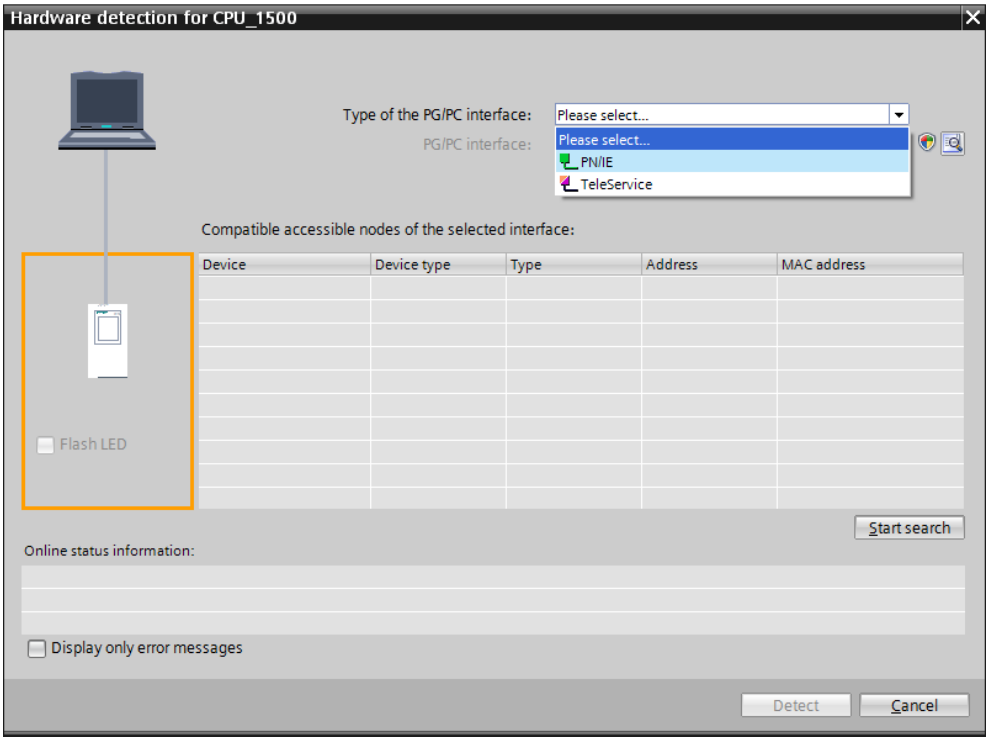
→ Click "Add".



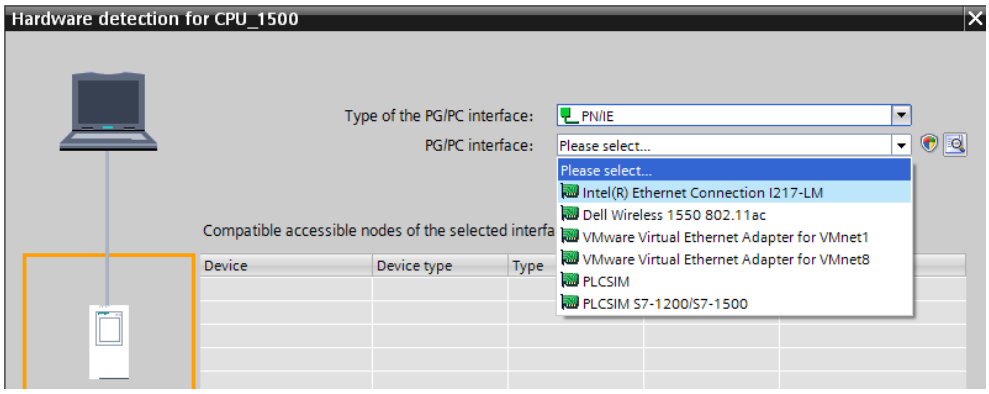
→ The TIA Portal now switches automatically to the project view and displays a notice there that this device is not specified. In order to have the hardware configuration automatically detected, start detection by clicking "detect" in the yellow information box (→ detect).



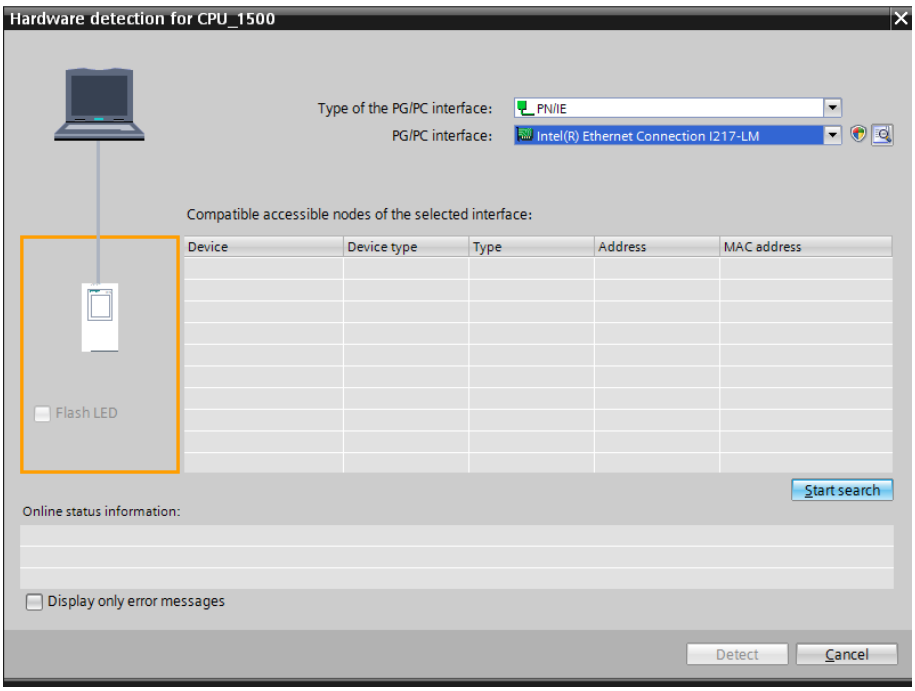
→ Select the type of your PG/PC interface. (→ Type of the PG/PC interface: PN/IE).



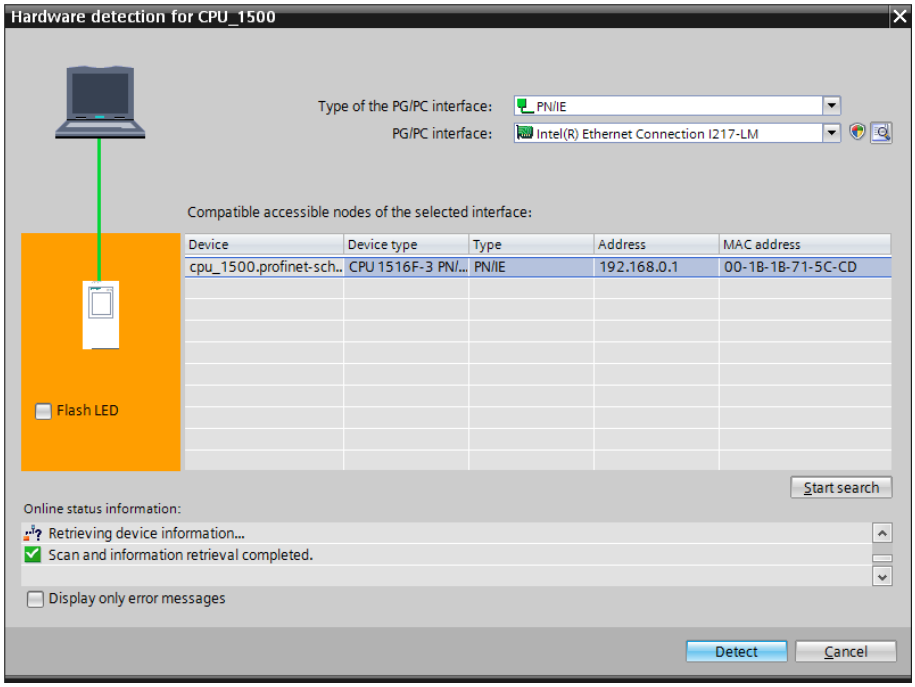
→ You can now select the network adapter you want to use to establish an Ethernet connection to the PLC. (→ PG/PC interface: Intel(R) Ethernet Connection I217-LM)



→ The search for devices in the network must be started by clicking the → Start search button.

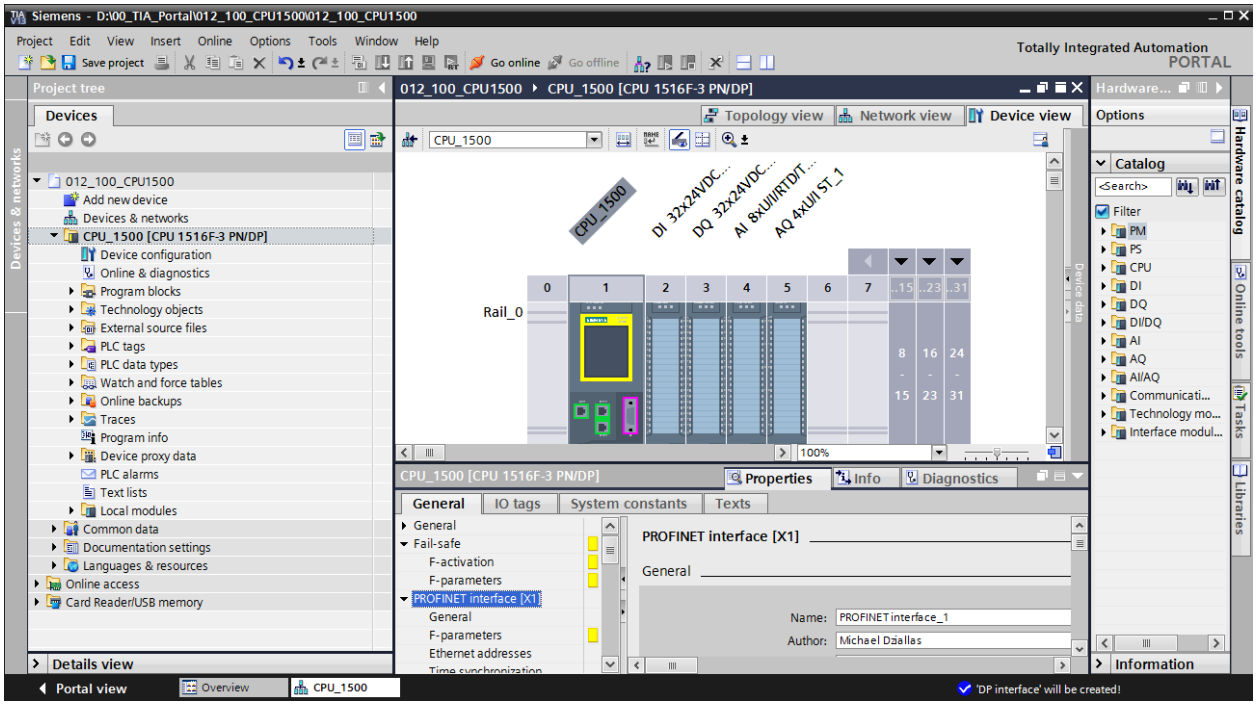


→ All accessible nodes are found and listed. If you have selected the correct CPU, the corresponding CPU and all the connected modules will be detected when you click "Detect".



Note: *If the list does not contain your CPU, ensure that you have selected the correct network adapter and established a connection between the laptop and CPU.*

→ The TIA Portal shows the complete device configuration of the selected CPU. Only the power module is lacking. This can be placed on slot 0 of the mounting rail later.

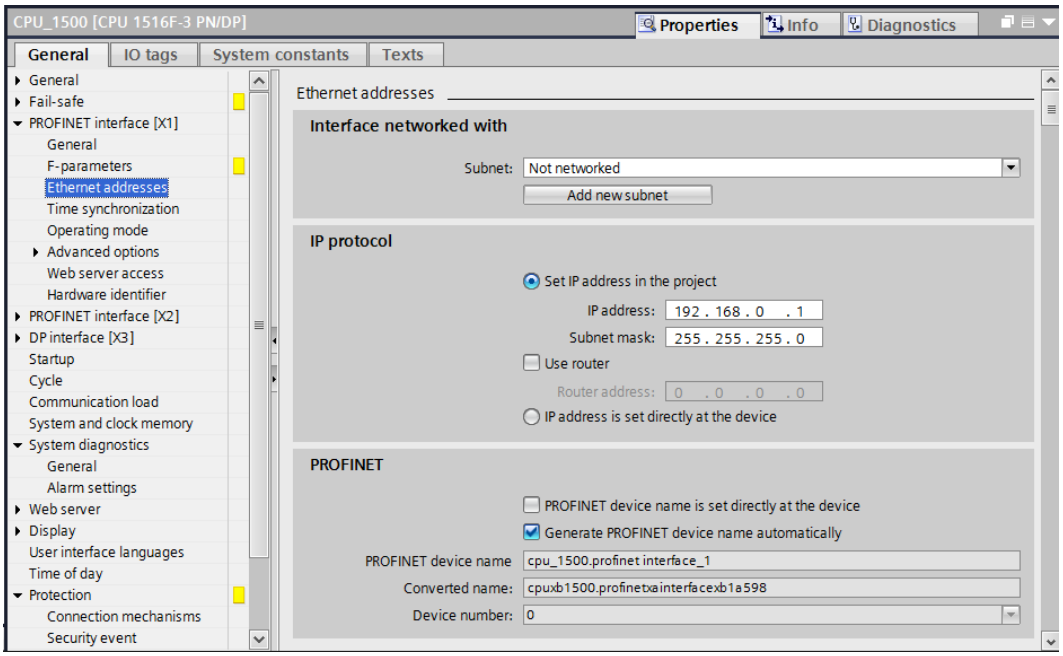


Note: *You can now configure the CPU there according to your specifications. Possible settings include the PROFINET and PROFIBUS DP interfaces, startup characteristics, cycle, password protection, communication load and many others.*

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

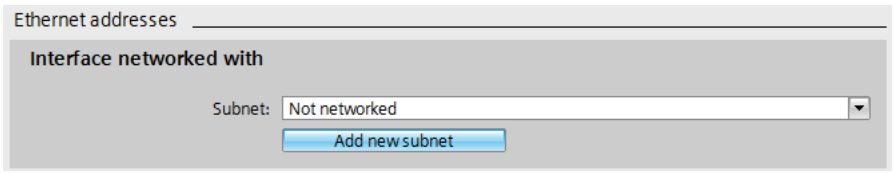
→ Select the CPU with a double-click

→ Under → "Properties", open the → "PROFINET-interface [X1]" menu and select the → "Ethernet addresses" entry there.

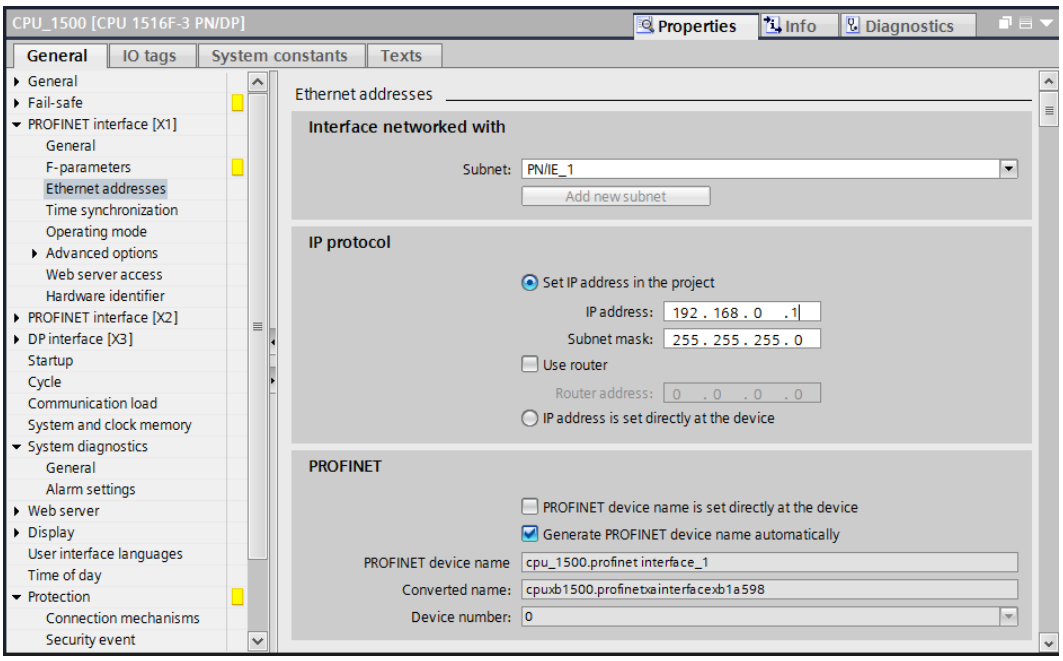


→ Under "Interface connected with", only the "Not connected" entry is available.

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

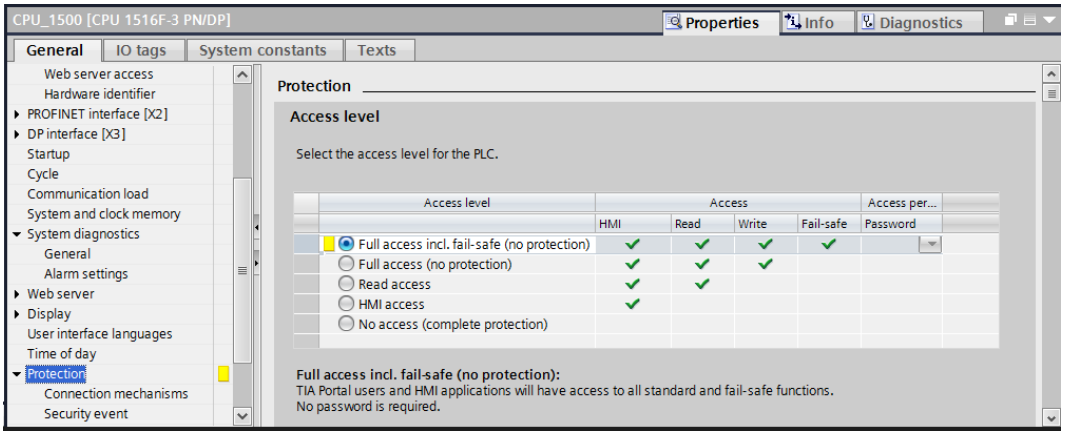


→ Keep the pre-assigned "IP address" and "Subnet mask".



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

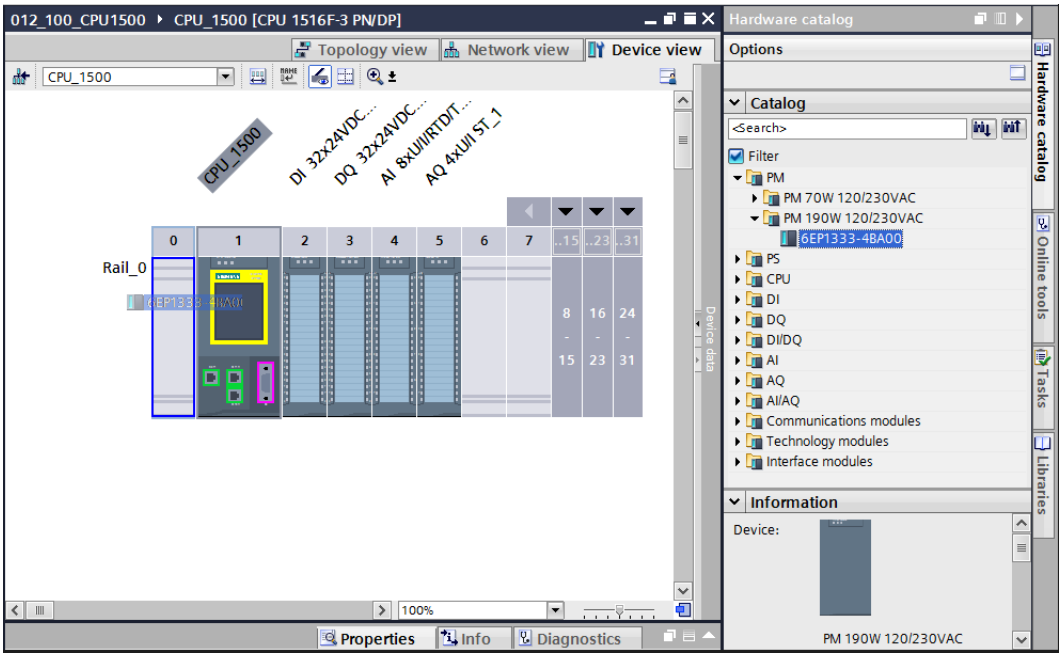
→ Switch to the → "Protection" menu and select access level → "Full access incl. fail-safe (no protection)".



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

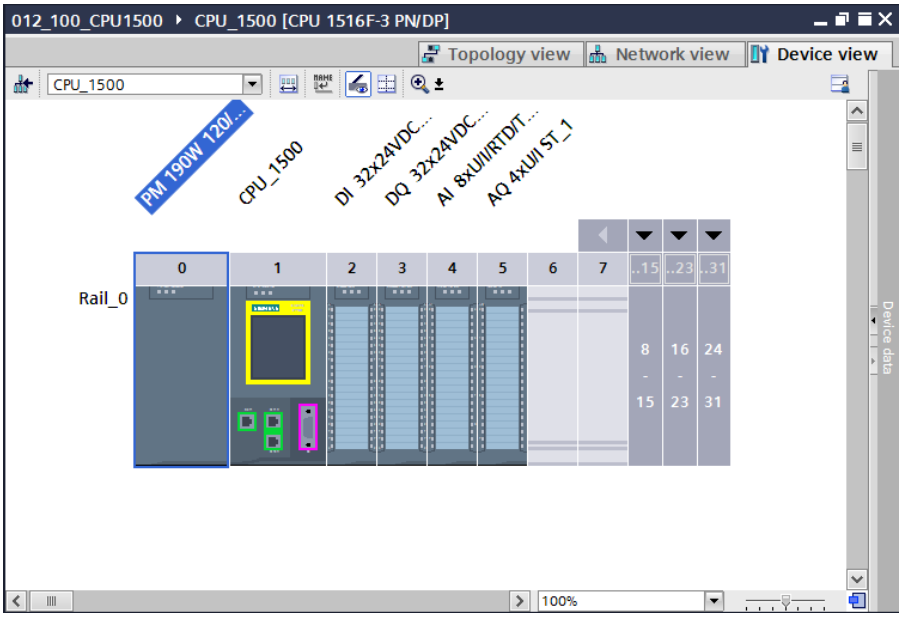
7.5 Insert power module PM 190W 120/230VAC

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



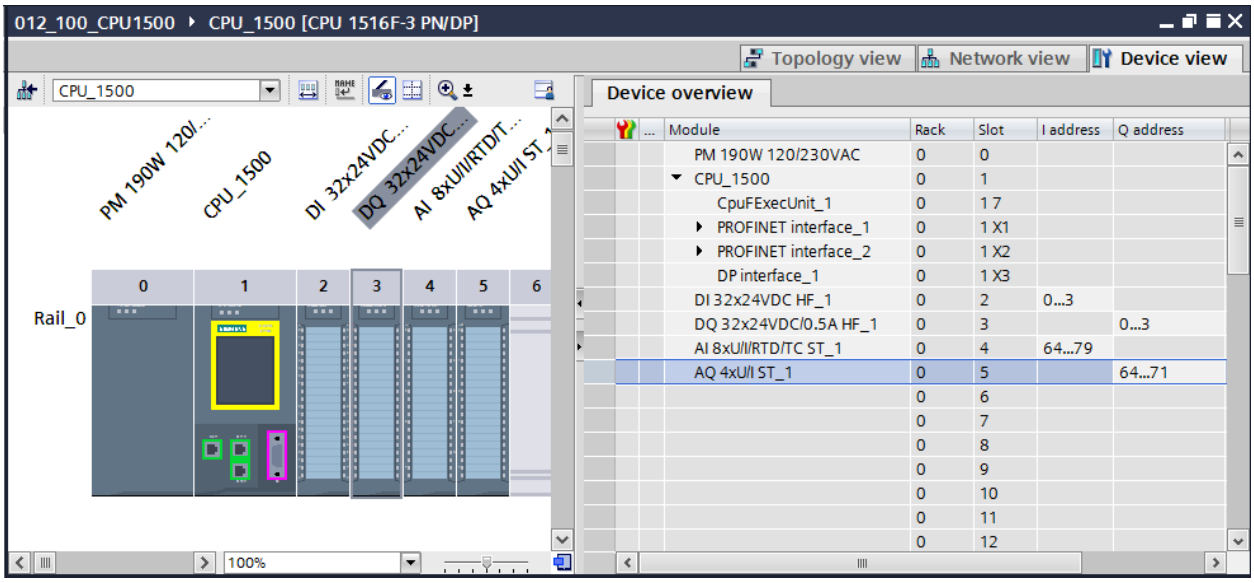
Note: *If a module as well as the power module is planned for one slot, it is not possible to place it at another position even in the device configuration.*

→ Compare your device configuration with the following figure.



7.6 Configure the address areas of the digital input and output modules

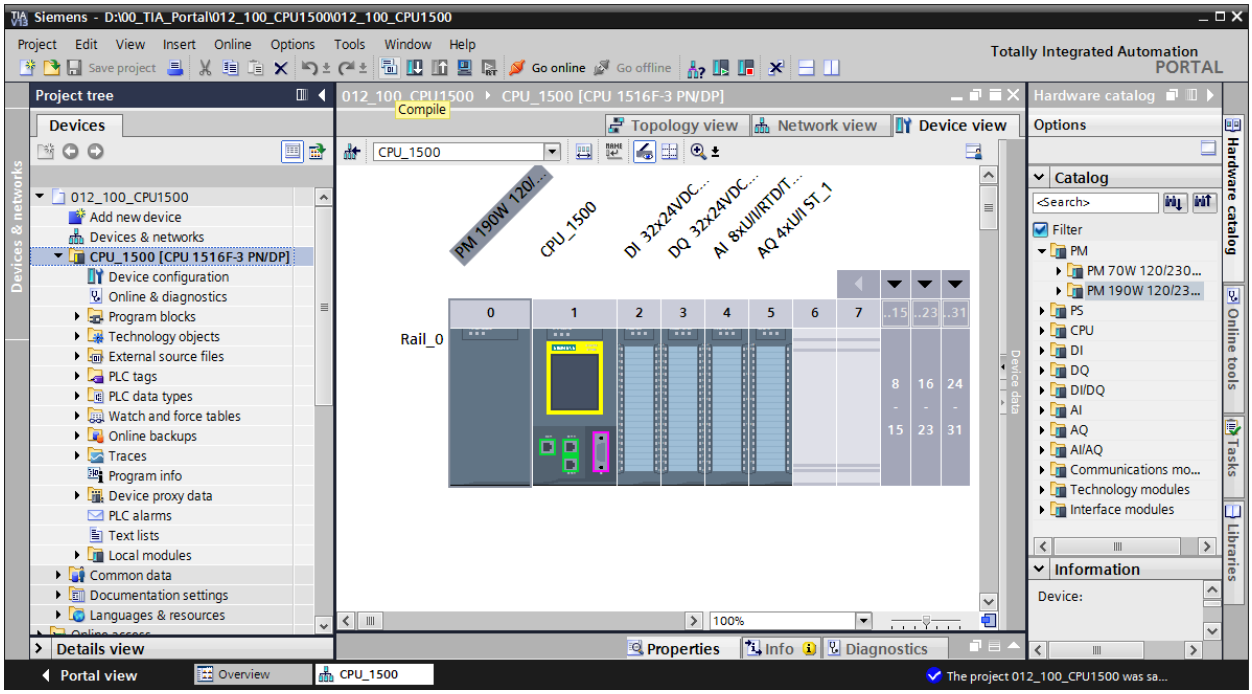
→ The next step is to check the address areas of the inputs and output cards and adapt them if necessary. DI/DO should have an address area of 0…3 and AI/AO should have an address area of 64…79 and 64…71, respectively. (→ Device overview → DI 32x24VDC HF_1 → I address: 0..3 → DQ 32x24VDC/0.5A HF_1 → Q address: 0...3 → AI 8xU/I/RTD/TC ST_1 → I address: 64…79 → AQ 4xU/I ST_1 → Q address: 64…71)



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.*

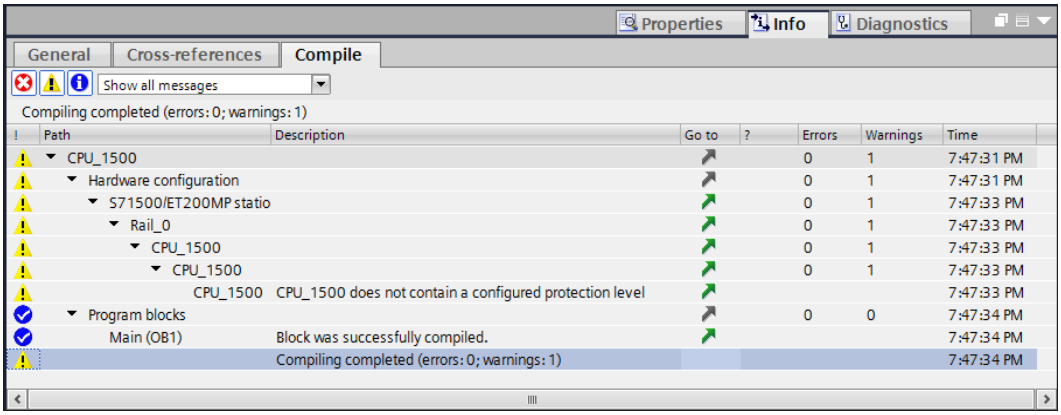
7.7 Save and compile the hardware configuration

→ 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_1500 [CPU1516F-3 PN/DP]" folder and click the → "Compile" icon.



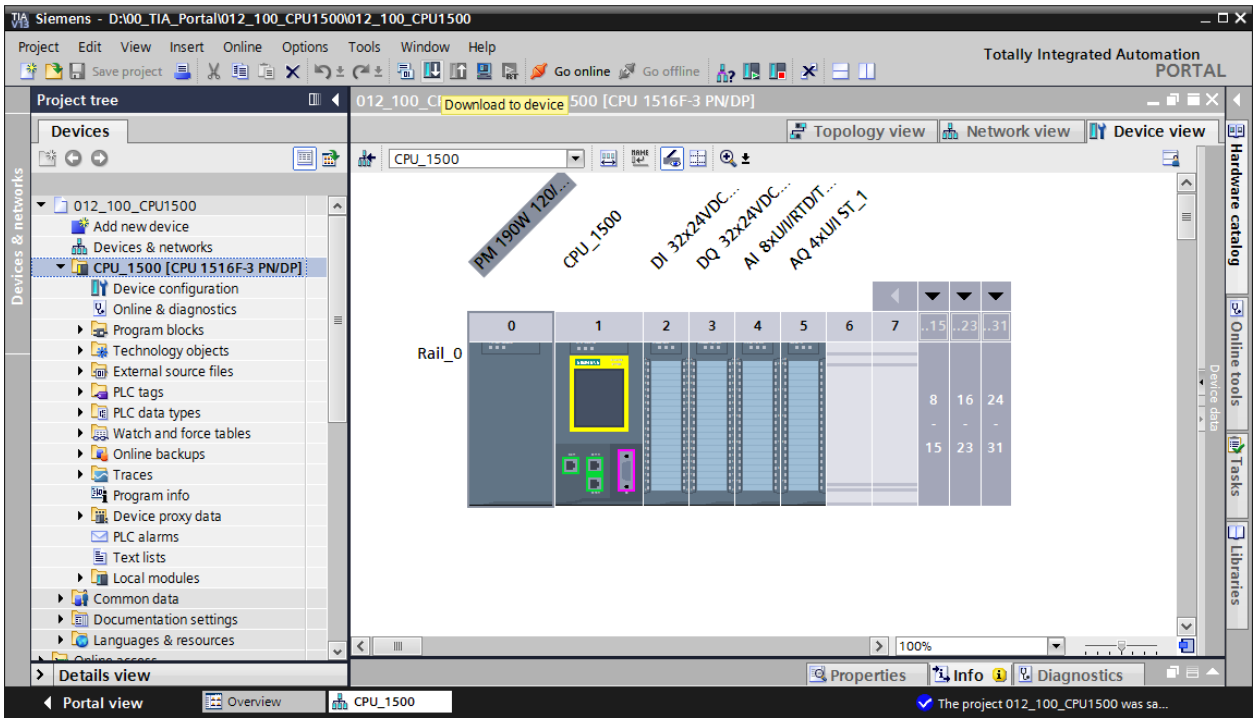
Note: *"Save project" should be used repeatedly when working on a project since this does not happen automatically. A prompt to save the project only occurs when the TIA Portal is closed.*

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

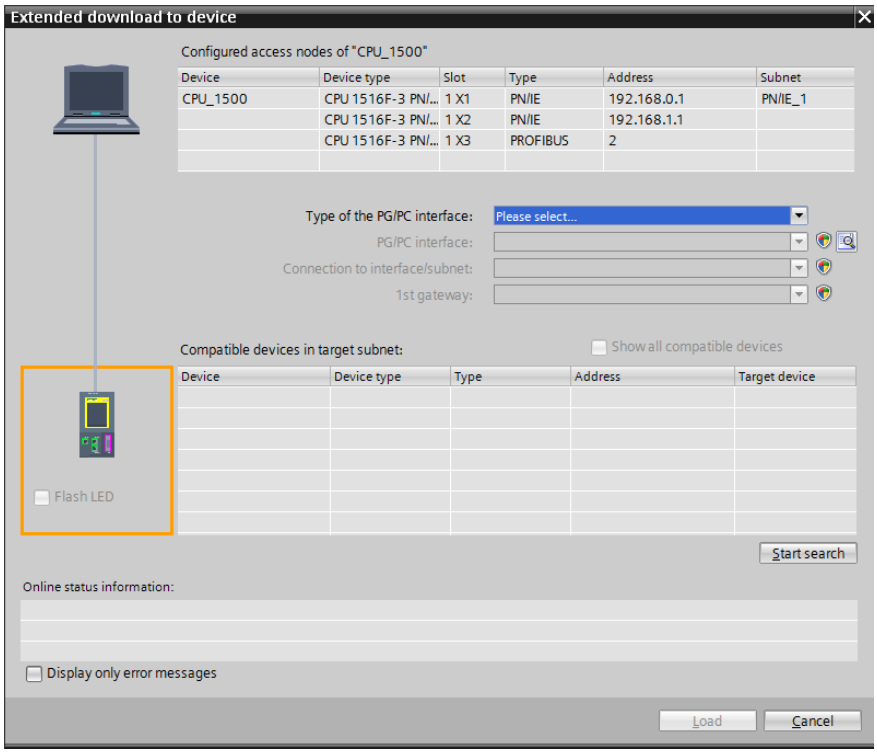


7.8 Download the hardware configuration to the device

→ To download your entire CPU, select the → "CPU_1500 [CPU1516F-3 PN/DP]" folder and click the → "Download to device" icon.

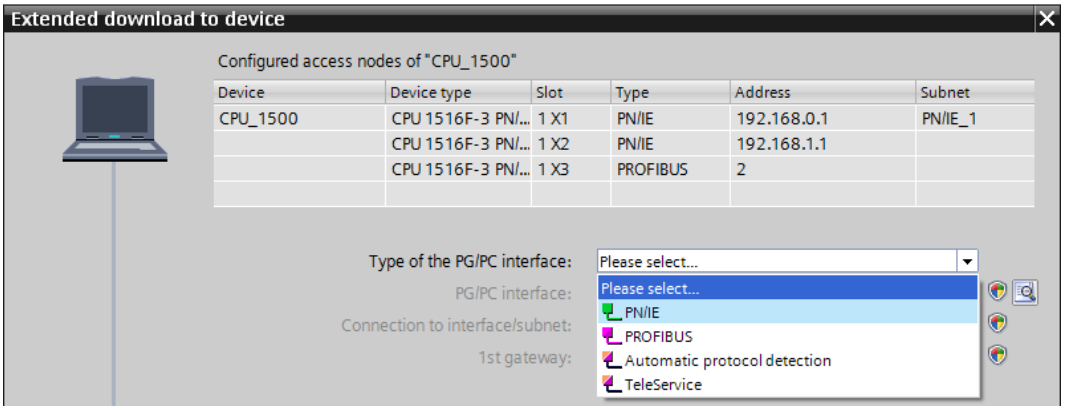


→ The manager for configuring the connection properties (extended download) opens.

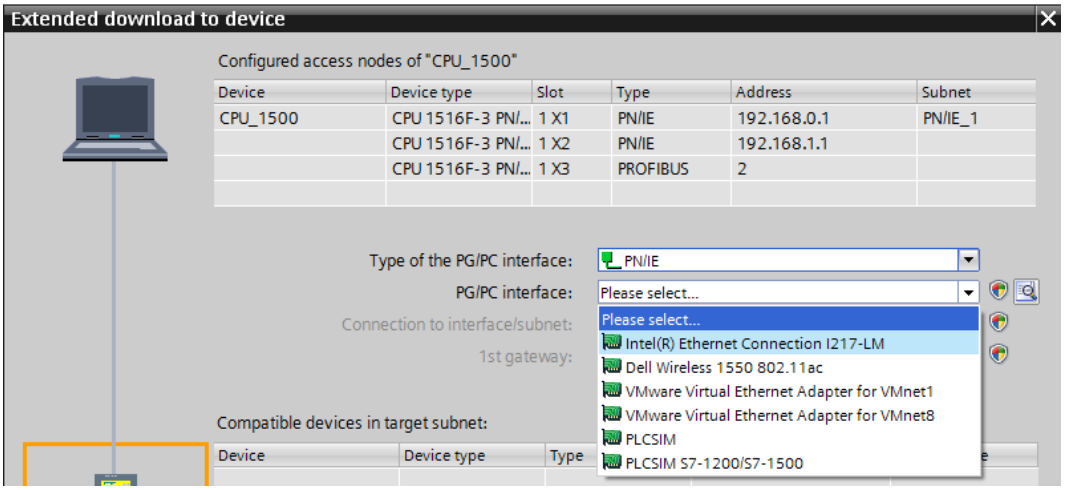


→ First, the interface must be correctly selected. This happens in three steps.

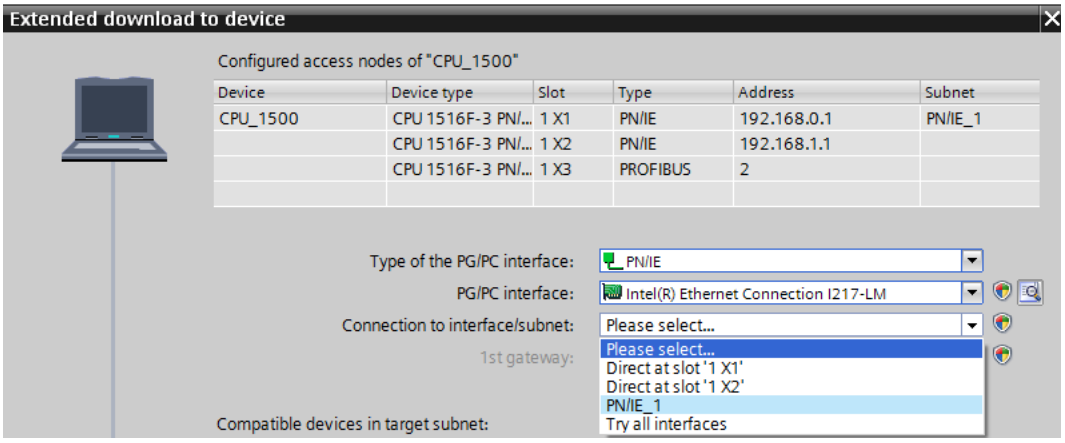
→ Type of the PG/PC interface → PN/IE



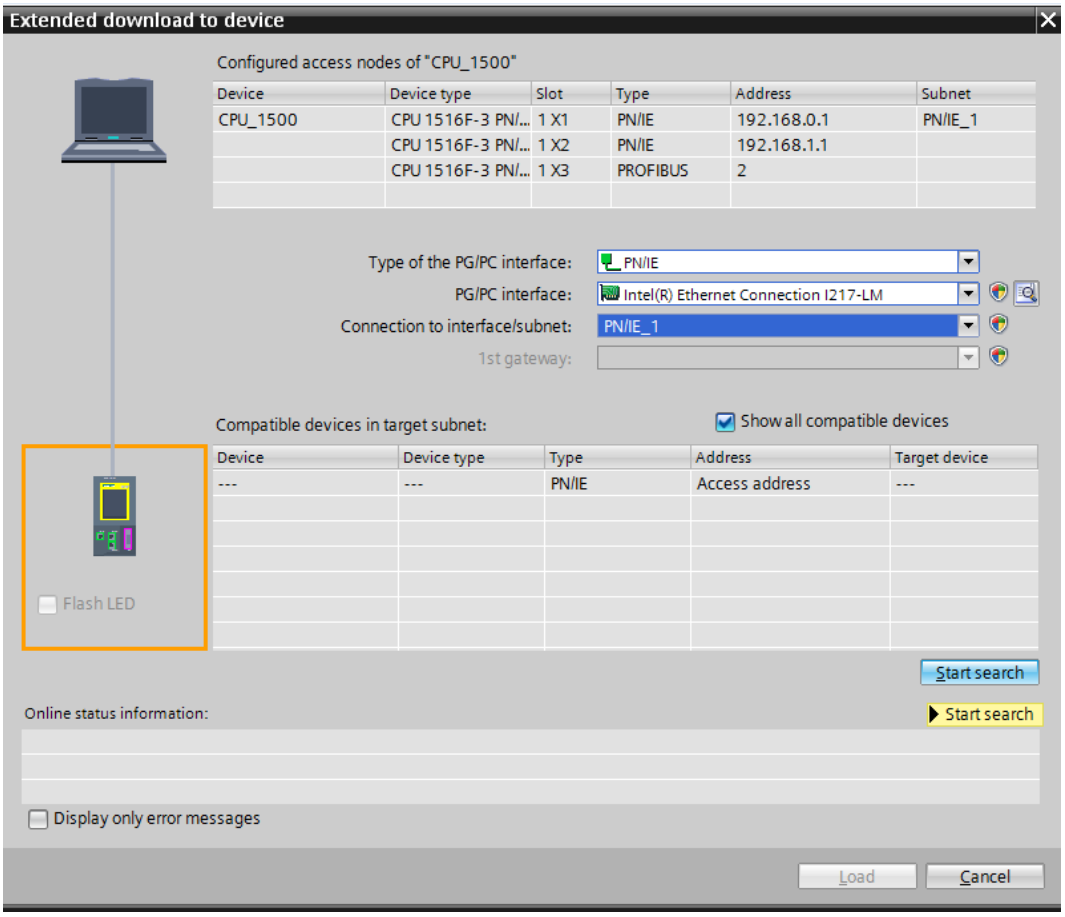
→ PG/PC interface → here: Intel(R) Ethernet Connection I217-LM



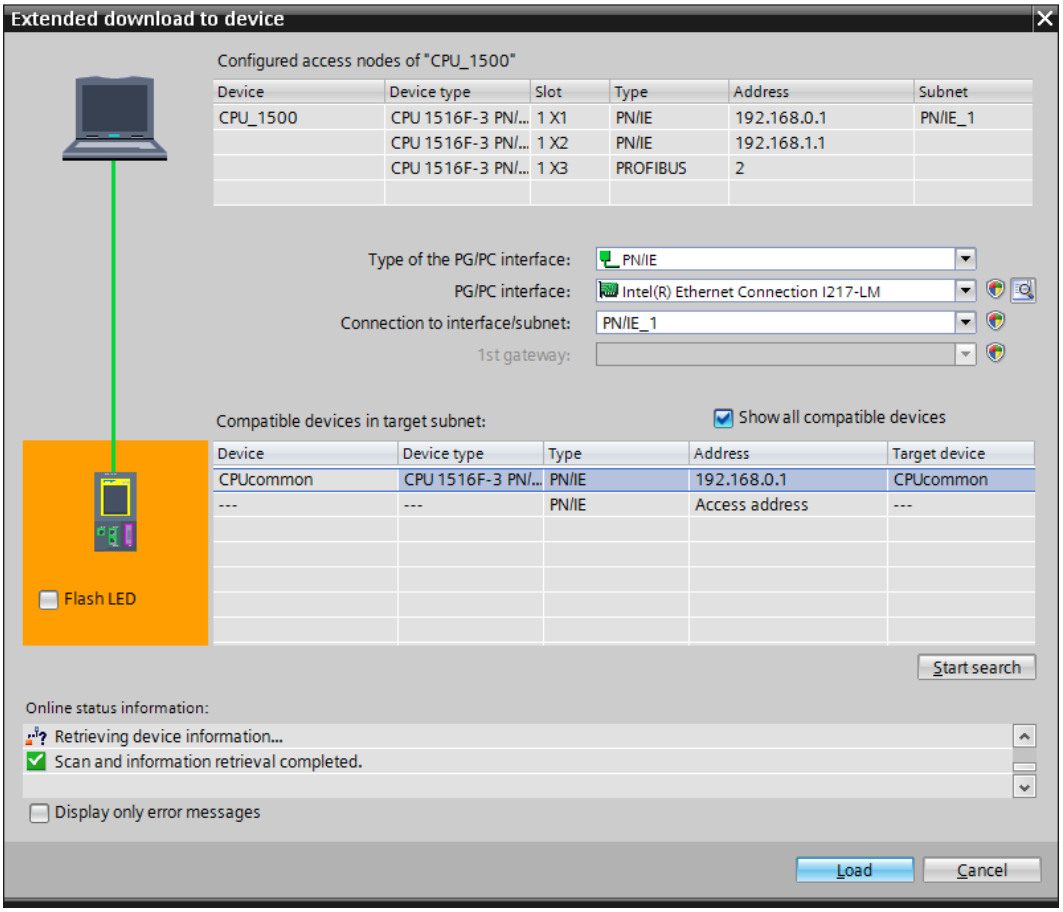
→ Connection to interface/subnet → "PN/IE_1"



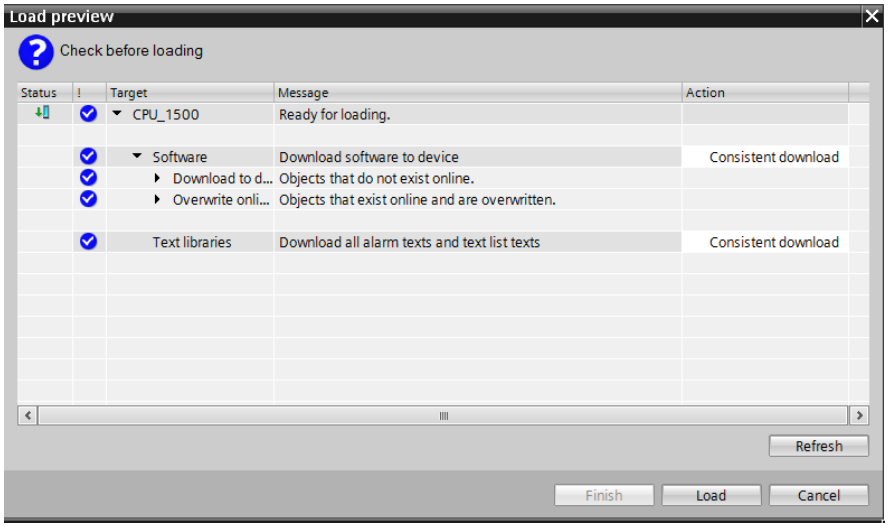
→ The → "Show all compatible devices" check box must be selected. The search for devices in the network is started by clicking the → Start search button.



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

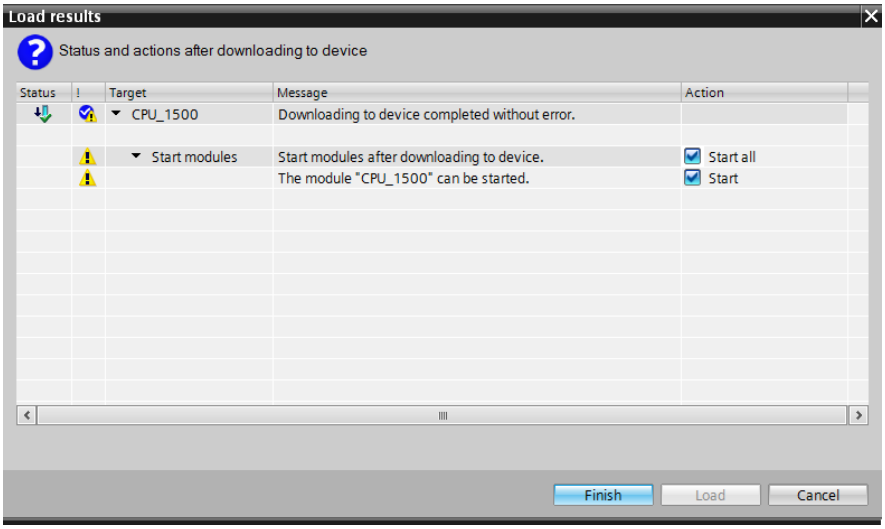


→ You first obtain a preview. Confirm the prompt → "Overwrite all" and continue with → "Load".

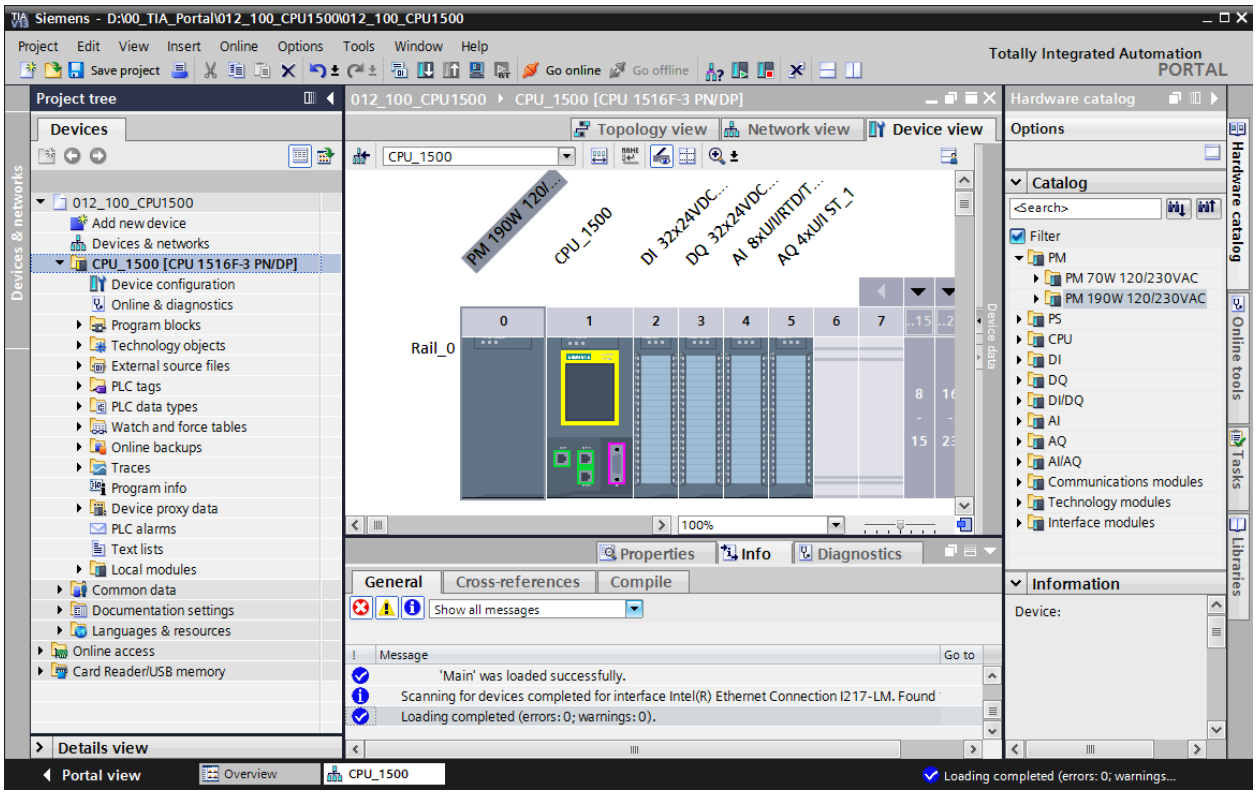


Note: *The* ✔ *symbol should be visible in every line of the "Load preview". You can find additional information in the "Message" column.*

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

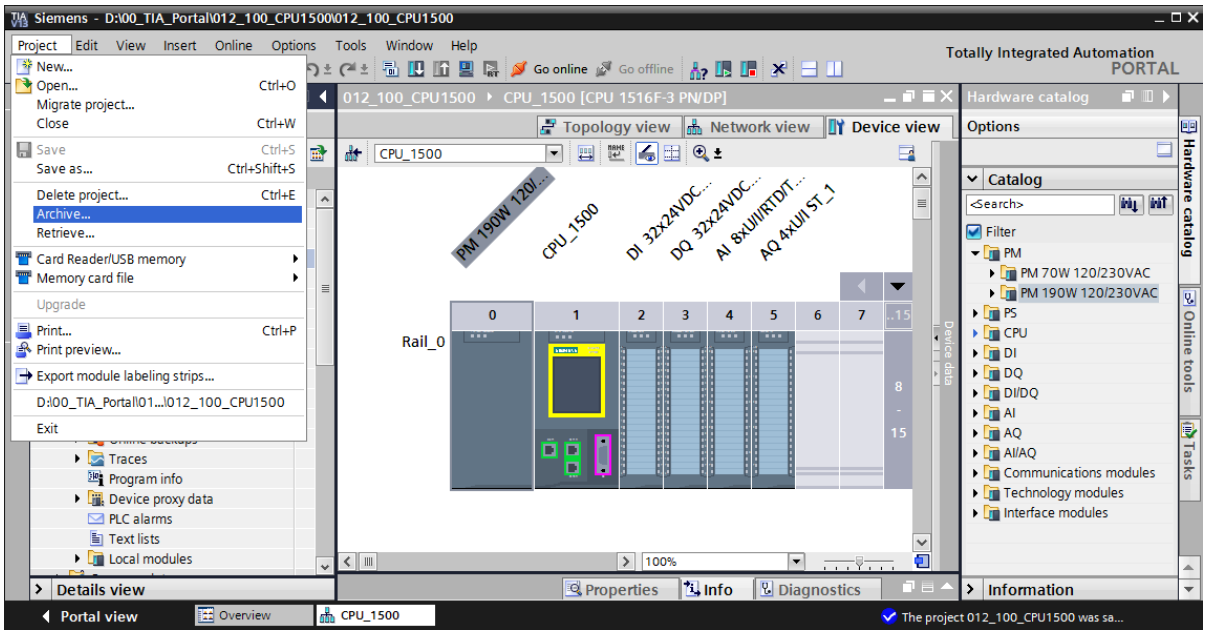


→ After a successful download, the project view will open again automatically. A loading report appears in the information field under "General". This can be helpful when troubleshooting an unsuccessful download.

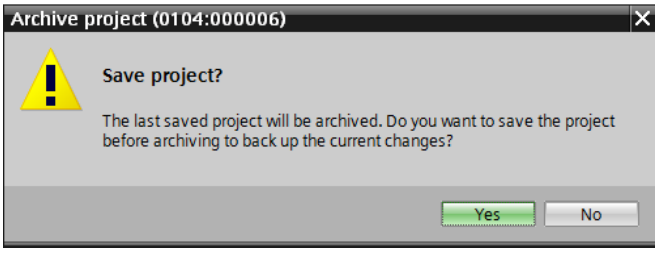


7.9 Archive the project

→ To archive the project, select the → "Archive ..." item 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 file type "TIA Portal project archive". (→ "TIA Portal project archive" → "SCE_EN_012-100_Hardware configuration_S7-1500…" → "Save")

7.10 **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	Slot 2: Digital input module with correct order number	
6	Slot 2: Digital input module with correct firmware version	
7	Address area of the digital input module is correct	
8	Slot 3: Digital output module with correct order number	
9	Slot 3: Digital output module with correct firmware version	
10	Slot 3: Address area of the digital output module is correct	
11	Slot 4: Analog input module with correct order number	
12	Slot 4: Analog input module with correct firmware version	
13	Slot 4: Address area of the analog input module is correct	
14	Slot 5: Analog output module with correct order number	
15	Slot 5: Analog output module with correct firmware version	
16	Slot 5: Address area of the analog output module is correct	
17	Hardware configuration was compiled without error message	
18	Hardware configuration was downloaded without error message	
19	Project was successfully archived	

8 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