



SIEMENS



SCE Training Curriculum

Siemens Automation Cooperates with Education | 09/2017

TIA Portal Module 012-001
Firmware Update SIMATIC S7-1500

Cooperates
with Education

Automation

SIEMENS

Matching SCE Trainer Packages for these Learn-/Training Document

- **SIMATIC S7 CPU 1516F-3 PN/DP**
Order no.: 6ES7516-3FN00-4AB2
- **SIMATIC STEP 7 Professional V14 SP1 - Single license**
Order no.: 6ES7822-1AA04-4YA5
- **SIMATIC STEP 7 Professional V14 SP1 - Classroom license (set of 6)**
Order no.: 6ES7822-1BA04-4YA5
- **SIMATIC STEP 7 Professional V14 SP1 - Upgrade license (set of 6)**
Order no.: 6ES7822-1AA04-4YE5
- **SIMATIC STEP 7 Professional V14 SP1 - Student license (set of 20)**
Order no.: 6ES7822-1AC04-4YA5

Please 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](https://www.siemens.com/sce/tp)

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Additional information regarding SCE

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Notes on use

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We wish to thank the TU Dresden, especially 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.

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Firmware Update – SIMATIC S7-1500

1 Goal

This chapter will show how the **firmware version of the CPU** of a **SIMATIC S7-1500** can be checked and upgraded using the TIA Portal.

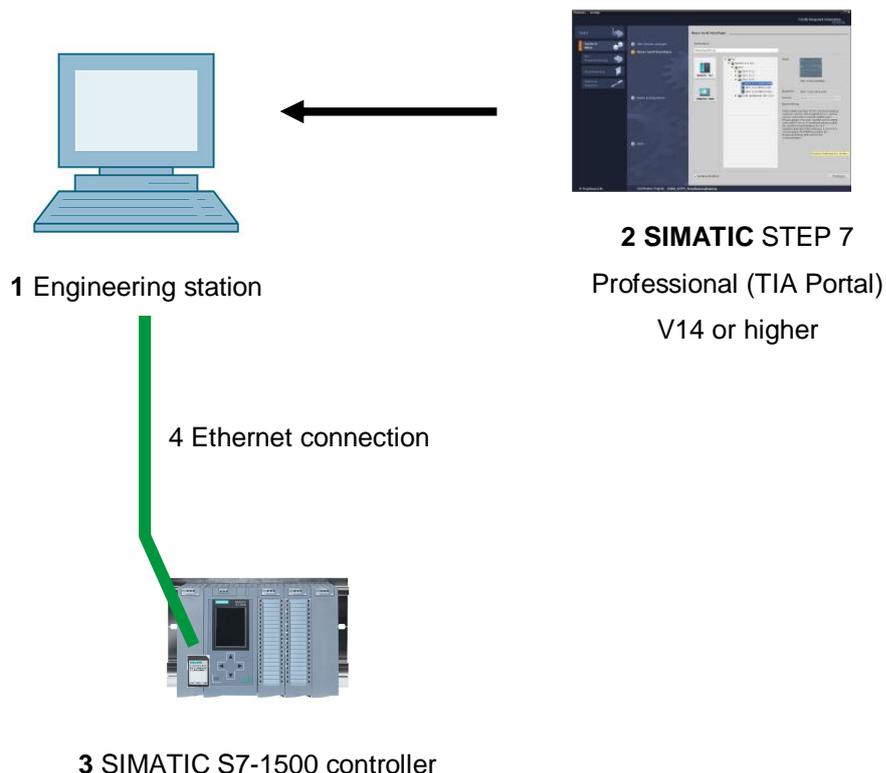
The SIMATIC S7 controllers listed in Chapter 3 can be used.

2 Requirement

No prerequisites have to be met for successful completion of this chapter.

3 Required hardware and software

- 1 Engineering station: requirements for hardware and operating system
(for additional information, see Readme on the TIA Portal Installation DVD)
- 2 STEP 7 Professional software in TIA Portal – V14 or higher
- 3 SIMATIC S7-1500 controller, e.g. CPU 1516F-3 PN/DP – Firmware V1.6 or higher with memory card
- 4 Ethernet connection between engineering station and controller



4 Theory

4.1 SIMATIC S7-1500 automation system

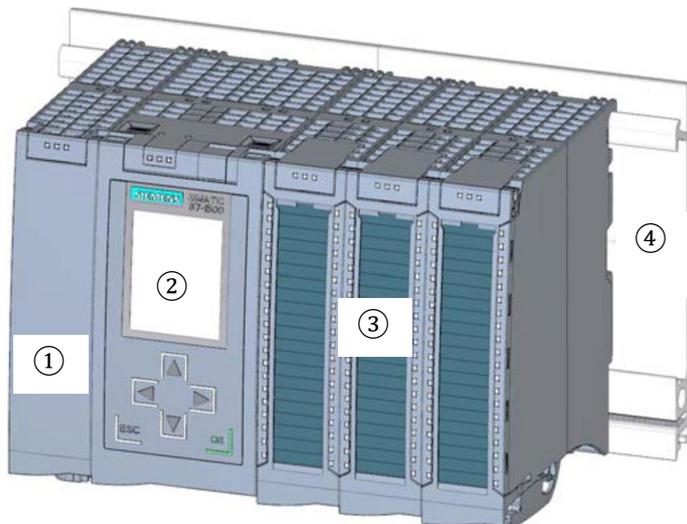
The SIMATIC S7-1500 automation system is a modular controller system for the middle to upper performance range.

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, communications processors and function modules for special tasks such as stepper motor control are also used.



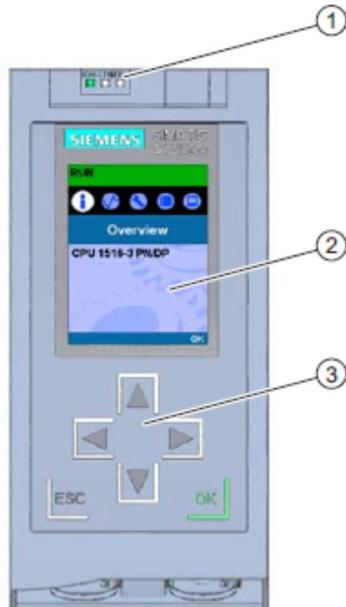
The system is programmed with the STEP 7 Professional software.

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.

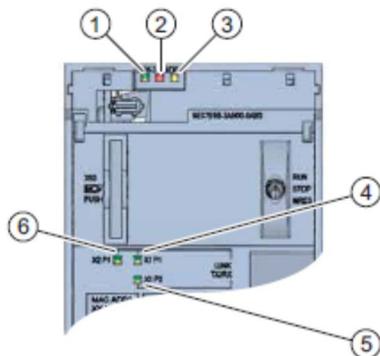
4.2.1 Front view of the CPU 1516F-3 PN/DP with integrated display



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

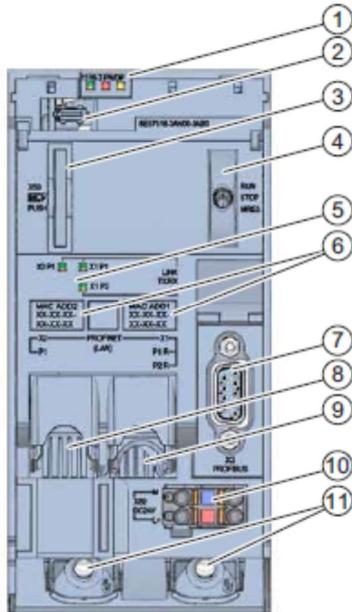
4.2.2 Status and error displays

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 X1 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 selector
- 5) LED displays for the 3 ports of PROFINET interfaces X1 and X2
- 6) MAC addresses of the interfaces
- 7) Display connection
- 8) Slot for the SIMATIC Memory Card
- 9) Mode selector
- 10) LED displays for the 3 ports of PROFINET interfaces X1 and X2
- 11) MAC addresses of the interfaces

Note: The hinged front cover with the display can be removed and inserted during operation.

4.2.4 SIMATIC Memory Card (MC)

A SIMATIC Micro Memory Card (MC) 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

For operation of the CPU, the MMC **must** be inserted because 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.

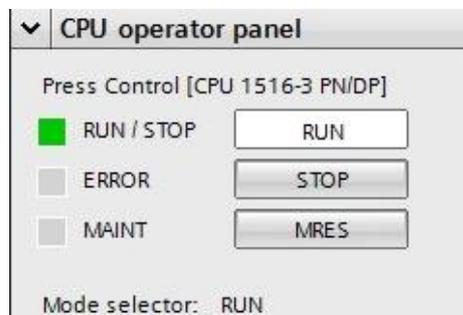
4.2.5 Mode selector

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

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

You can also use the button on the CPU operator panel of the SIMATIC STEP 7 Professional V14 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.



4.3 SIMATIC STEP 7 Professional V14 (TIA Portal V14) programming software

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

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

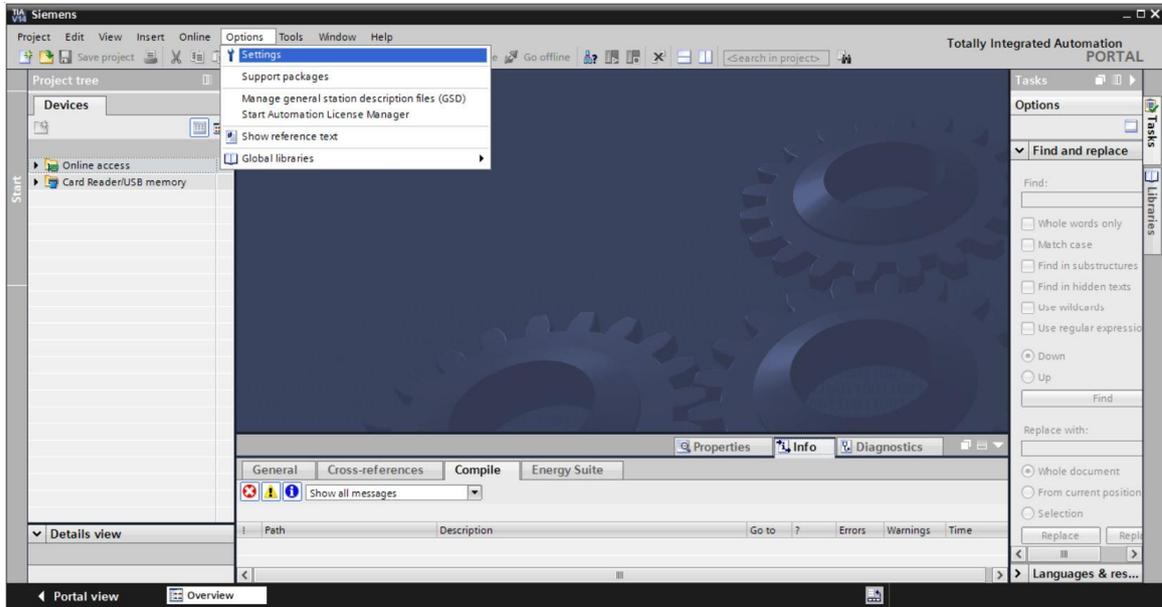
SIMATIC STEP 7 Professional provides the following functions for plant automation:

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

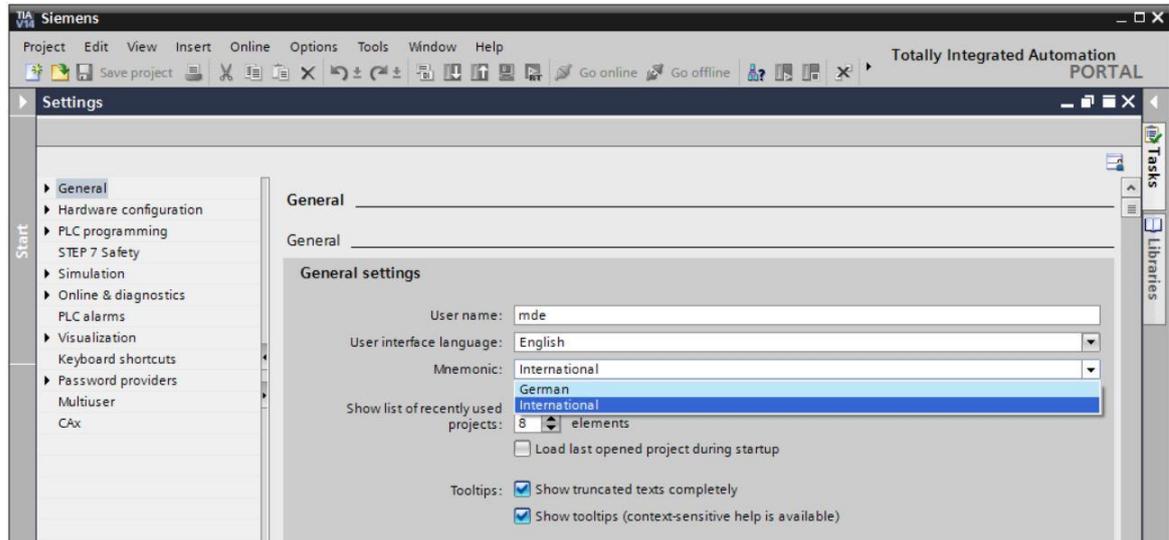
Support is provided for all functions through detailed online help.

4.3.1 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".



- ⑧ 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.
- ⑧ Under ⑧ "General" in "Settings", select "User interface language ⑧ English" and "Mnemonic ⑧ International".
- ⑧ International".



Note: These settings can always be changed.

4.3.2 Setting the IP address on the programming device

You need a TCP/IP connection in order to upgrade the CPU of a SIMATIC S7-1500 controller from the PC, the programming device or a laptop.

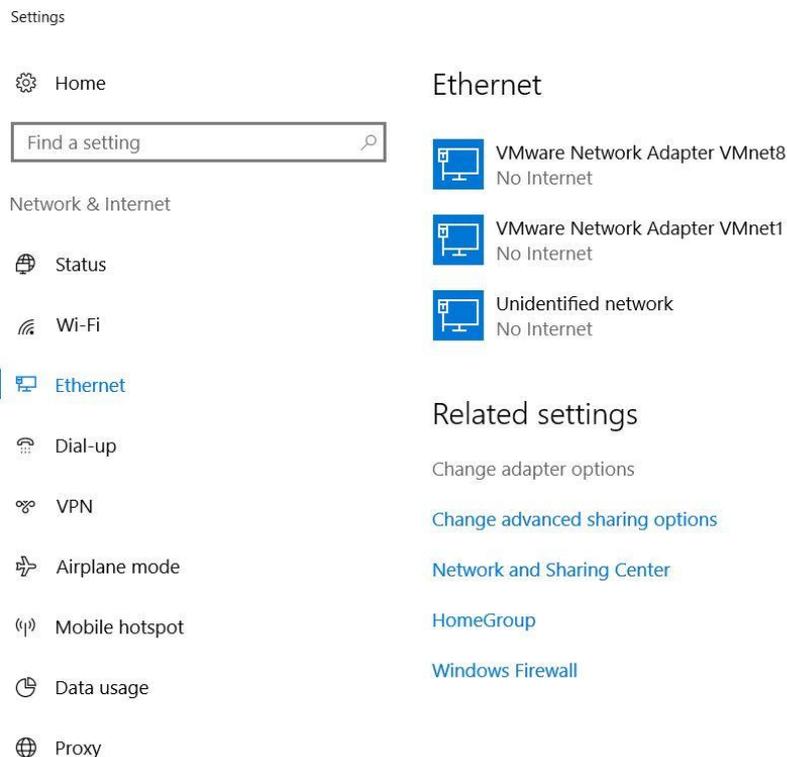
It is important that the IP addresses of both devices match for the computer and SIMATIC S7-1500 to communicate with each other via TCP/IP.

First, we will show you how to set the IP address of a computer with the Windows 10 operating system.

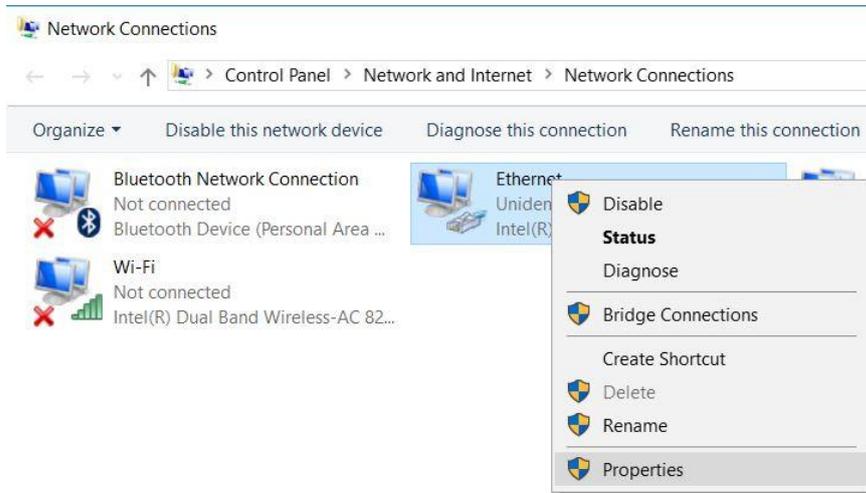
- ① Select the network icon in the taskbar at the bottom  and click ② "Network settings".



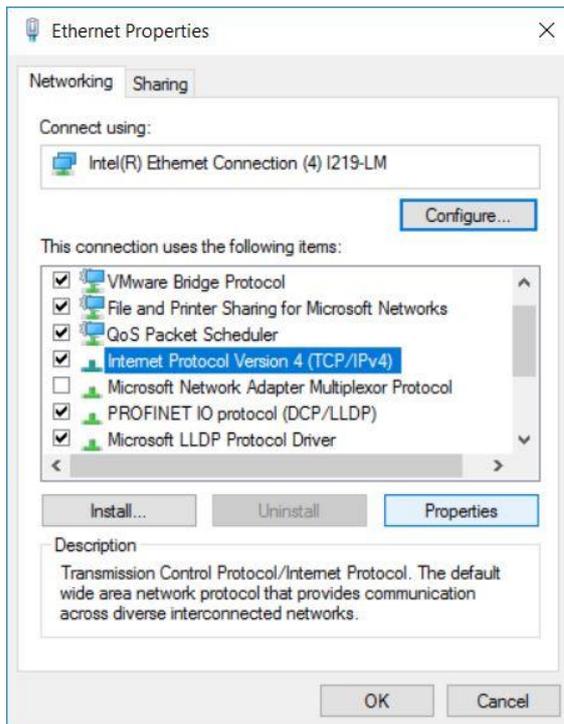
- ③ In the network settings window that opens, click ④ "Ethernet" and then on ⑤ "Change adapter options".



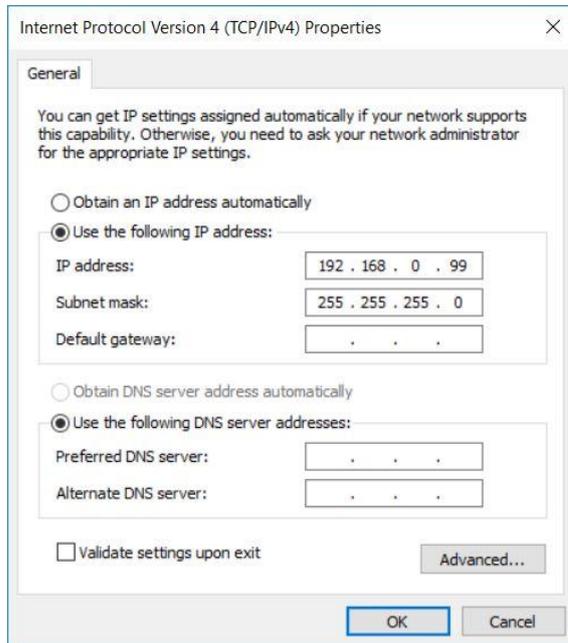
- ⑥ Select the desired ⑥ "LAN Connection" that you want to use to connect to the controller and click ⑥ "Properties".



- ⑥ Select ⑥ "Properties" for ⑥ "Internet Protocol Version 4 (TCP/IPv4)".



- ⑧ You can now use the following IP address, for example ⑧ IP address: 192.168.0.99 and enter the following ⑧ subnet mask 255.255.255.0. Accept the settings. (⑧ "OK")



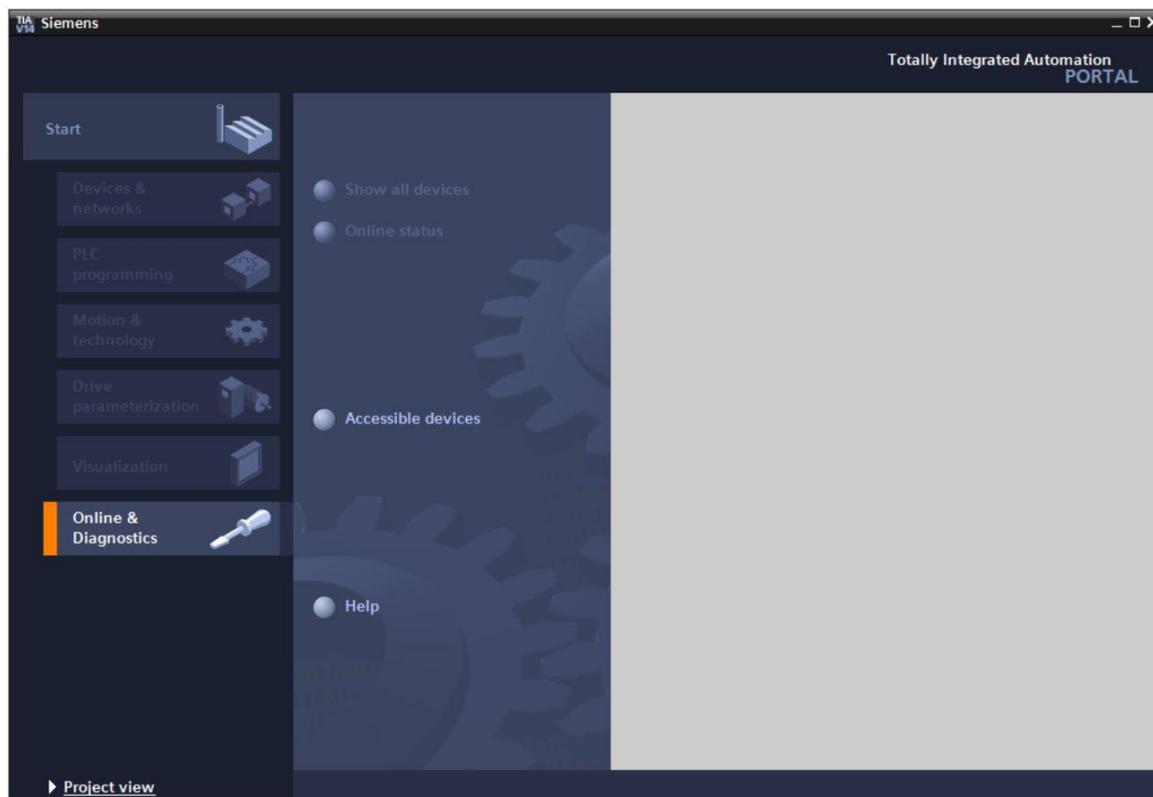
4.3.3 Setting the IP address in the CPU

Before a firmware update of the CPU can be performed, set the IP address of the SIMATIC S7-1500 correctly so that the programming device can reach the CPU via TCP (IP communication). The IP address of the SIMATIC S7-1500 is set as follows.

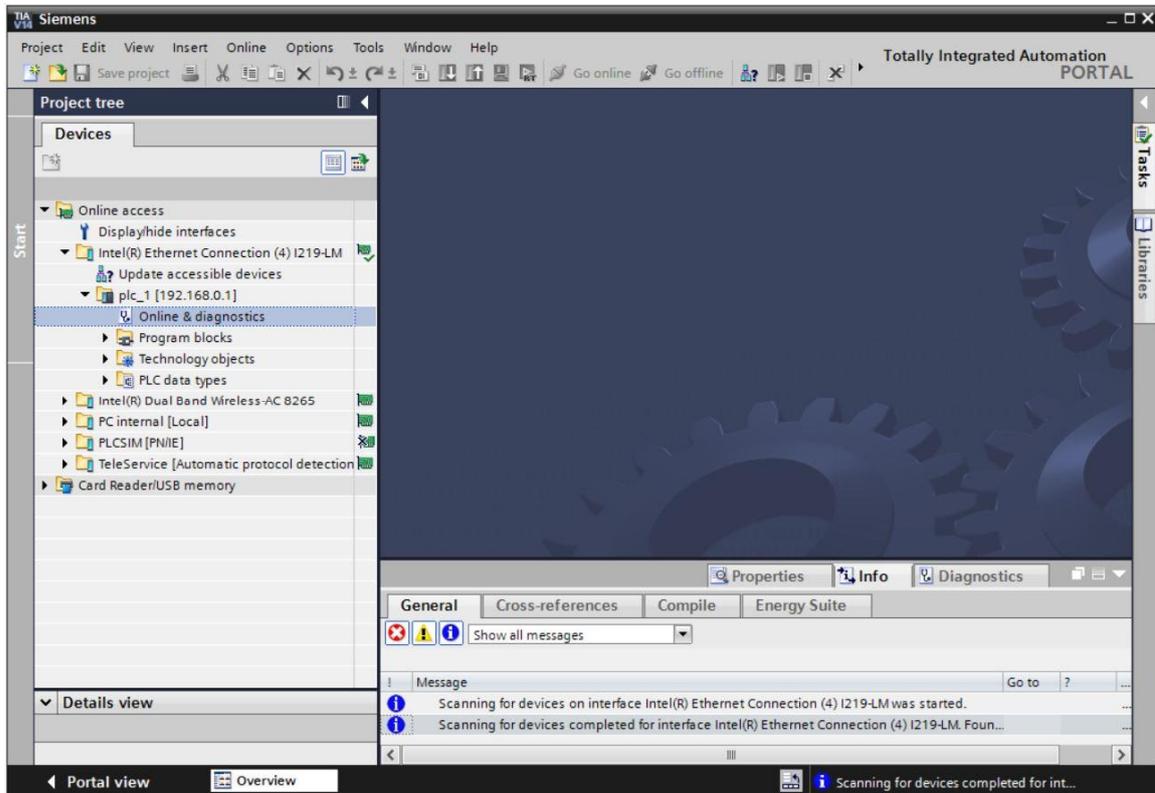
⑥ Double-click the Totally Integrated Automation Portal to select it. (⑥ TIA Portal V14)



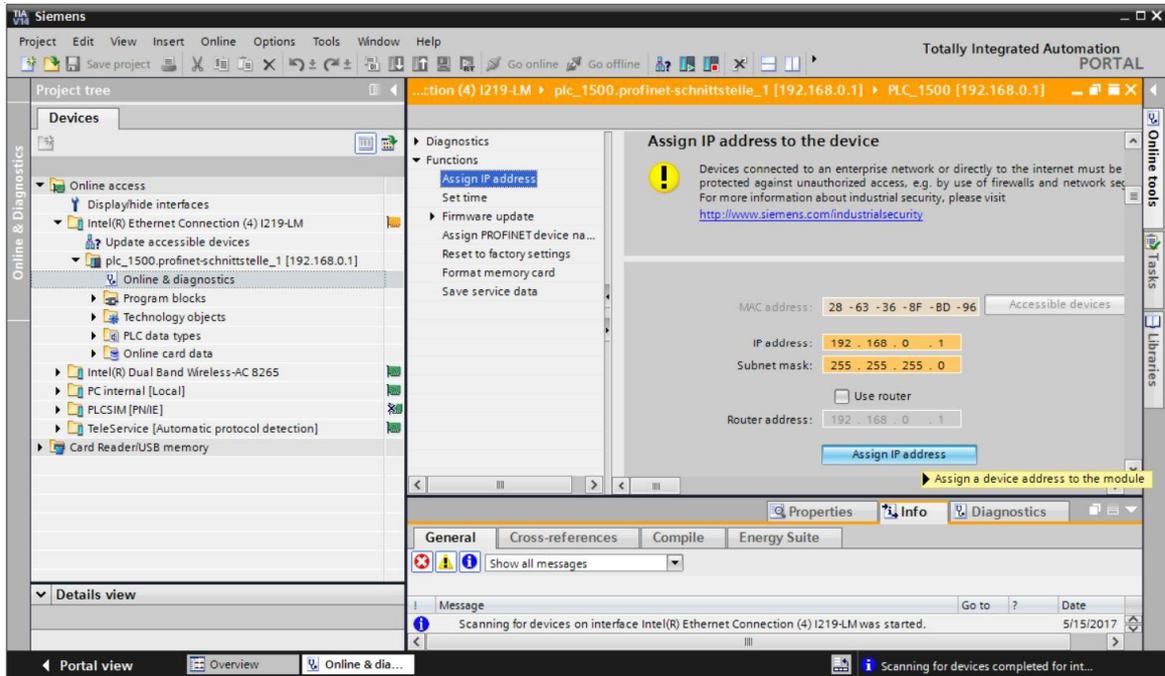
⑥ Click ⑥ "Online & Diagnostics" and open ⑥ "Project view".



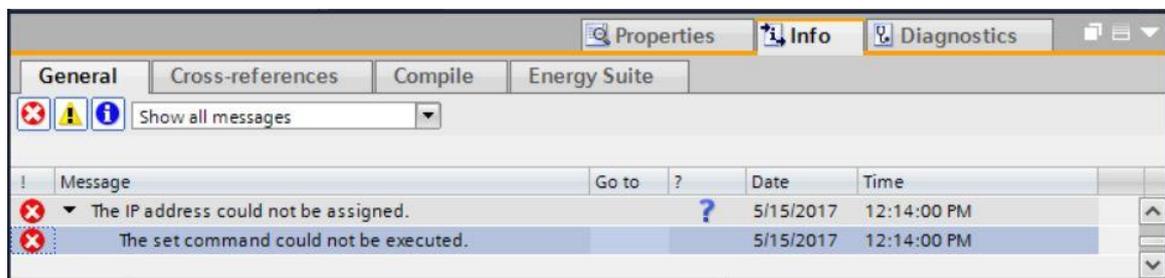
- ® In the project tree under ® "Online access", select the network adapter that was set previously. If you click ® "Update accessible devices", you will see the IP address (if previously set) or the MAC address (if IP address not yet assigned) of the connected SIMATIC S7-1500. Select ® "Online & Diagnostics".



- Ⓡ 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.



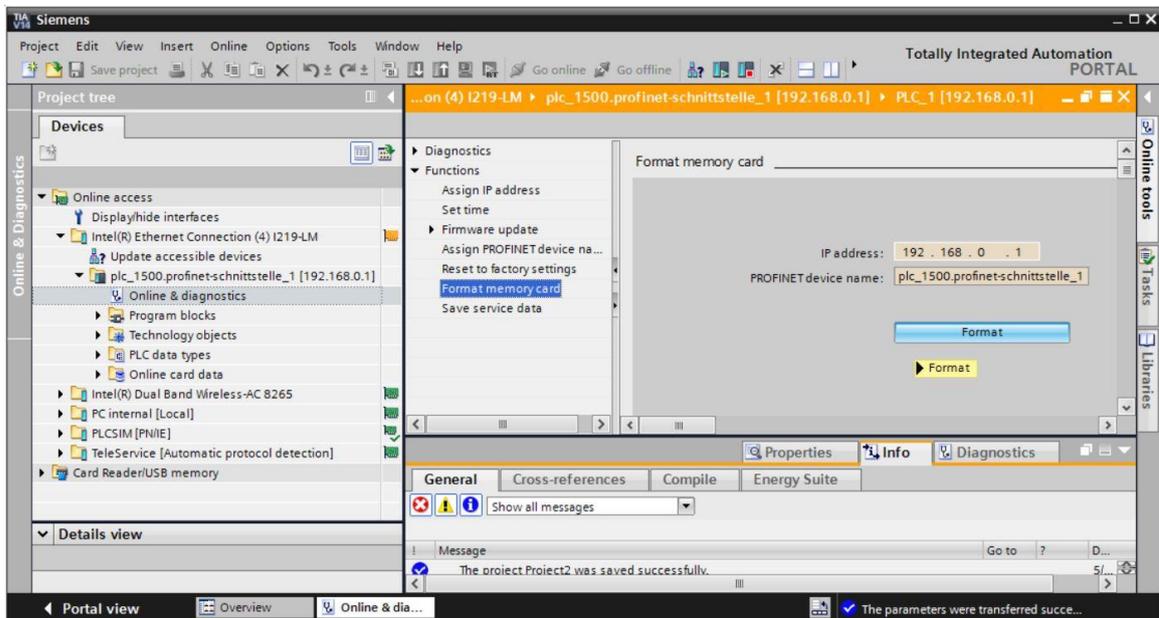
- Ⓡ If the IP address was not successfully assigned, you will receive a message in the Ⓡ "Info" window under Ⓡ "General".



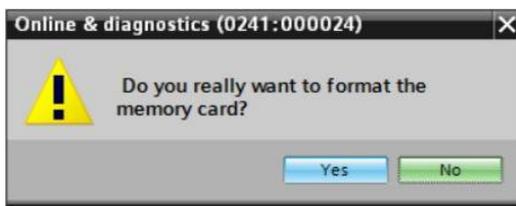
4.3.4 Formatting the memory card in the CPU

If the IP address could not be assigned, the program data on the CPU must be deleted. This is accomplished in two steps: ① "Format memory card" and ② "Reset to factory settings".

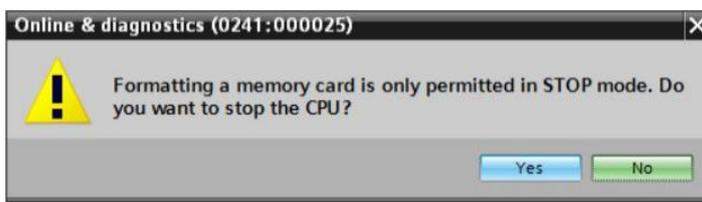
① First, select the ① "Format memory card" function and press the ① "Format" button.



② Confirm the prompt asking if you really want to format the memory card with ② "Yes".

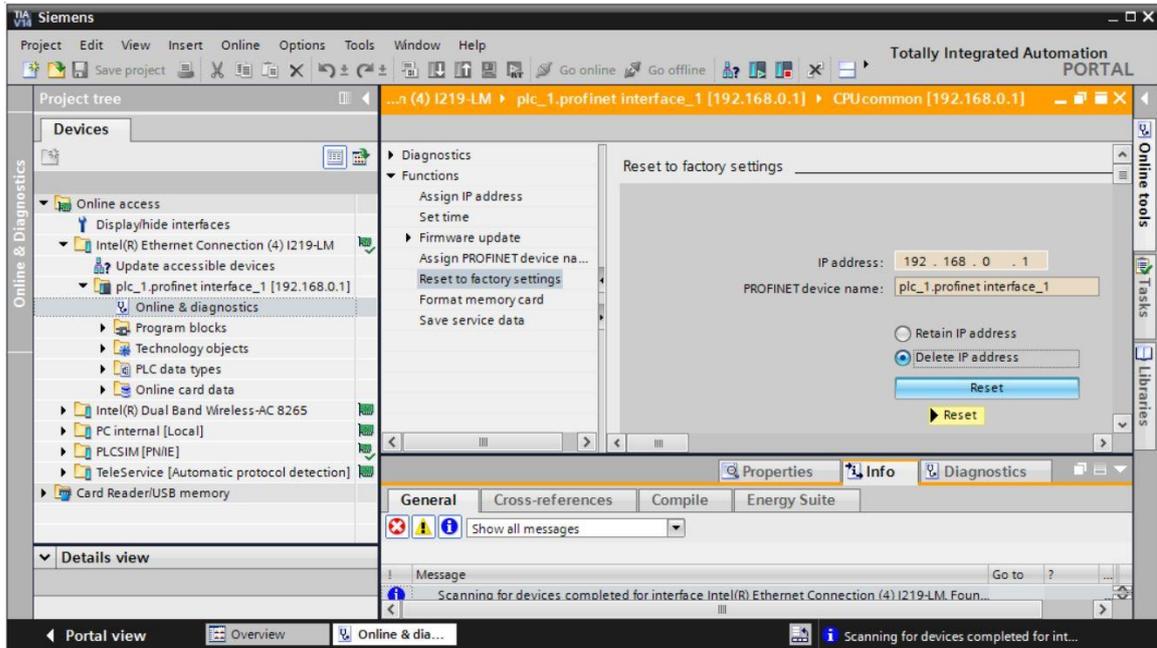


③ If necessary, stop the CPU. (③ "Yes")

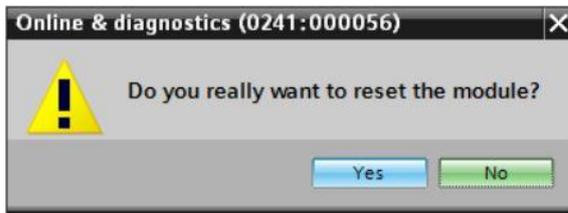


4.3.5 Restoring the factory settings of the CPU

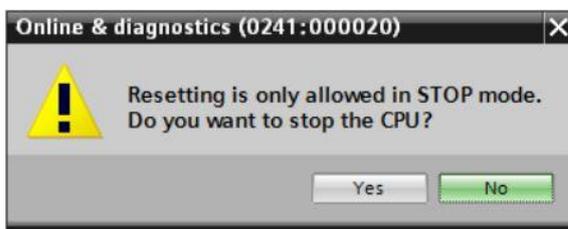
- Ⓡ Before you can reset the CPU, you must wait until the formatting of the CPU has finished. Afterwards, you must select Ⓡ "Update accessible devices" and Ⓡ "Online & Diagnostics" of your CPU again. To reset the controller, select the Ⓡ "Reset to factory settings" function and then Ⓡ "Delete IP address" and click Ⓡ "Reset".



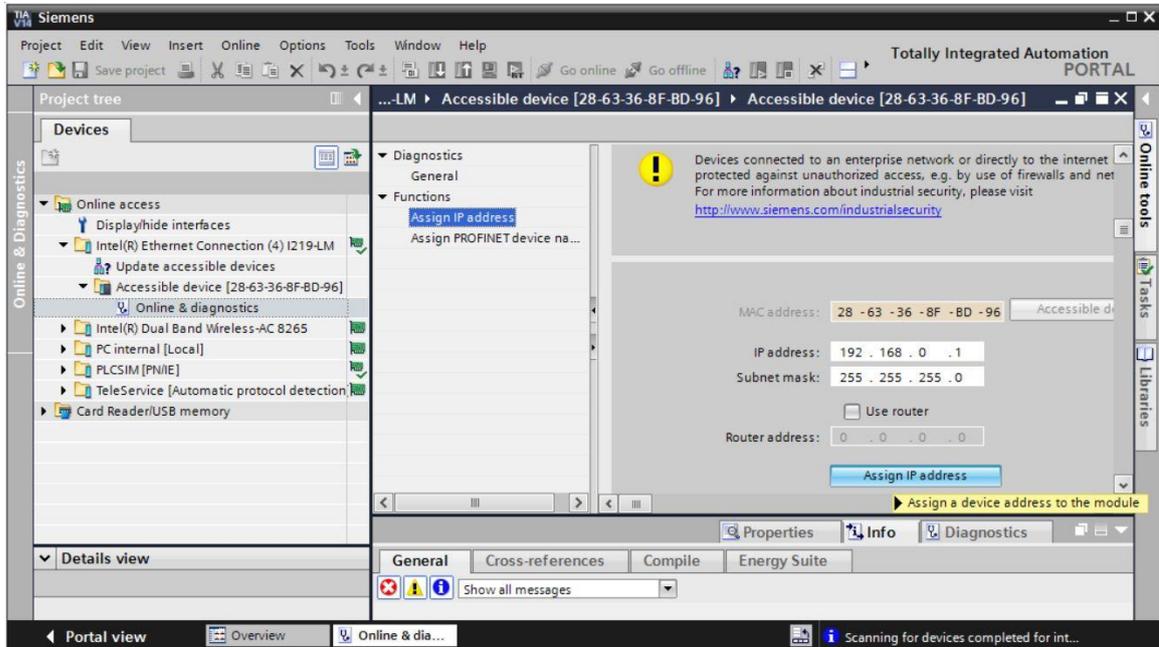
- Ⓡ Confirm the prompt asking if you really want to reset the module with Ⓡ "Yes".



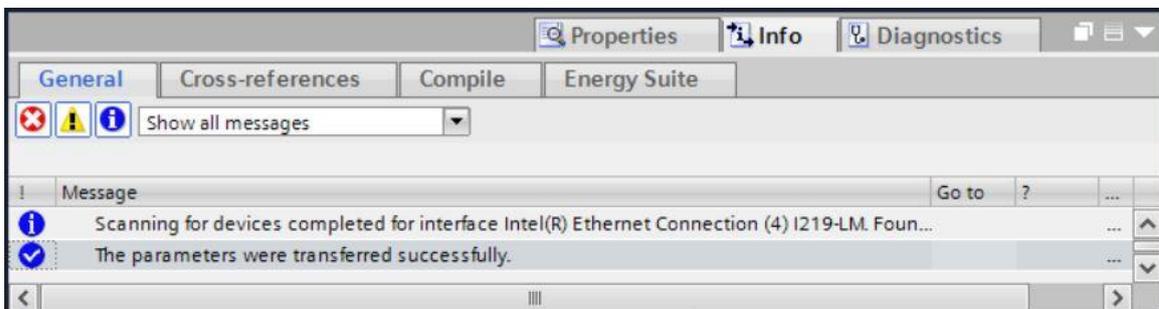
- Ⓡ If necessary, stop the CPU. (Ⓡ "Yes")



- Ⓡ Once the CPU has been reset, click Ⓡ "Update accessible devices" again. The MAC address of the connected SIMATIC S7-1500 can now be seen. Select Ⓡ "Assign IP address" under Ⓡ "Functions" in Ⓡ "Online & Diagnostics". Enter the following IP address here (example): IP address: 192.168.0.1 Subnet mask 255.255.255.0. Click "Assign IP address" and this new address will be assigned to your SIMATIC S7-1500.



- Ⓡ You will receive a message regarding successful transfer of parameters in the Ⓡ "Info" Ⓡ "General" window.



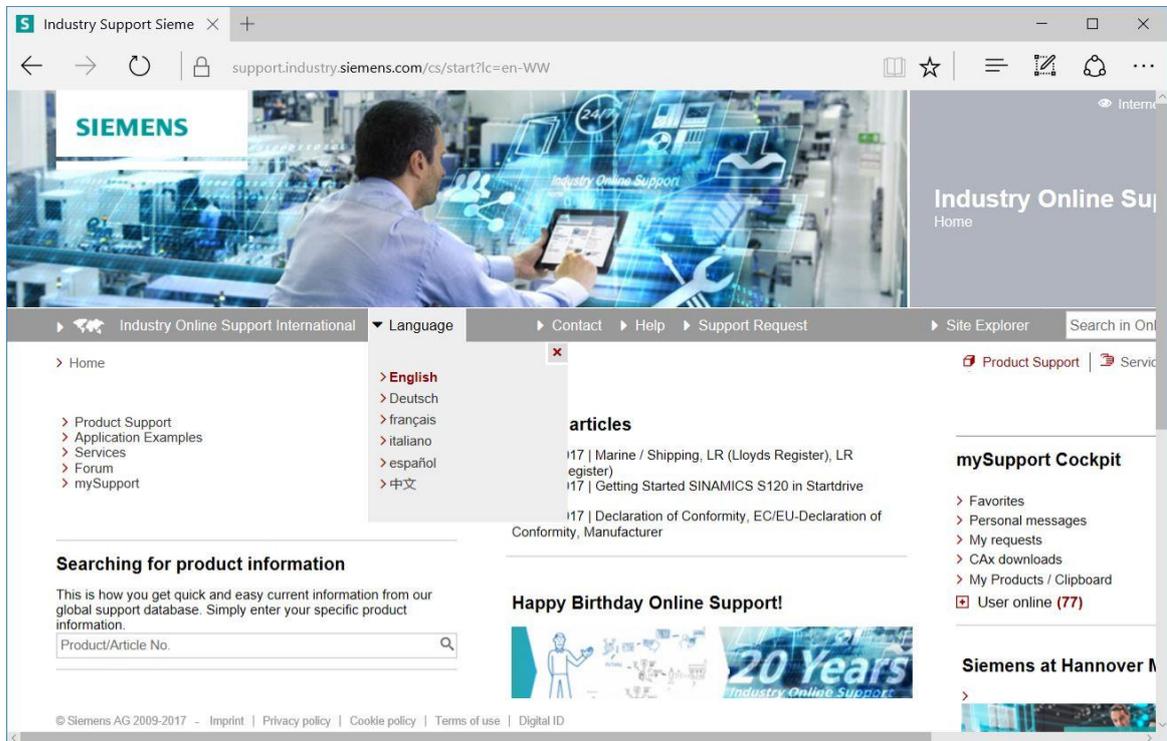
4.3.6 Downloading a firmware update from the SIEMENS Support website

You can download current firmware updates free of charge from the Industry Online Support of SIEMENS AG.

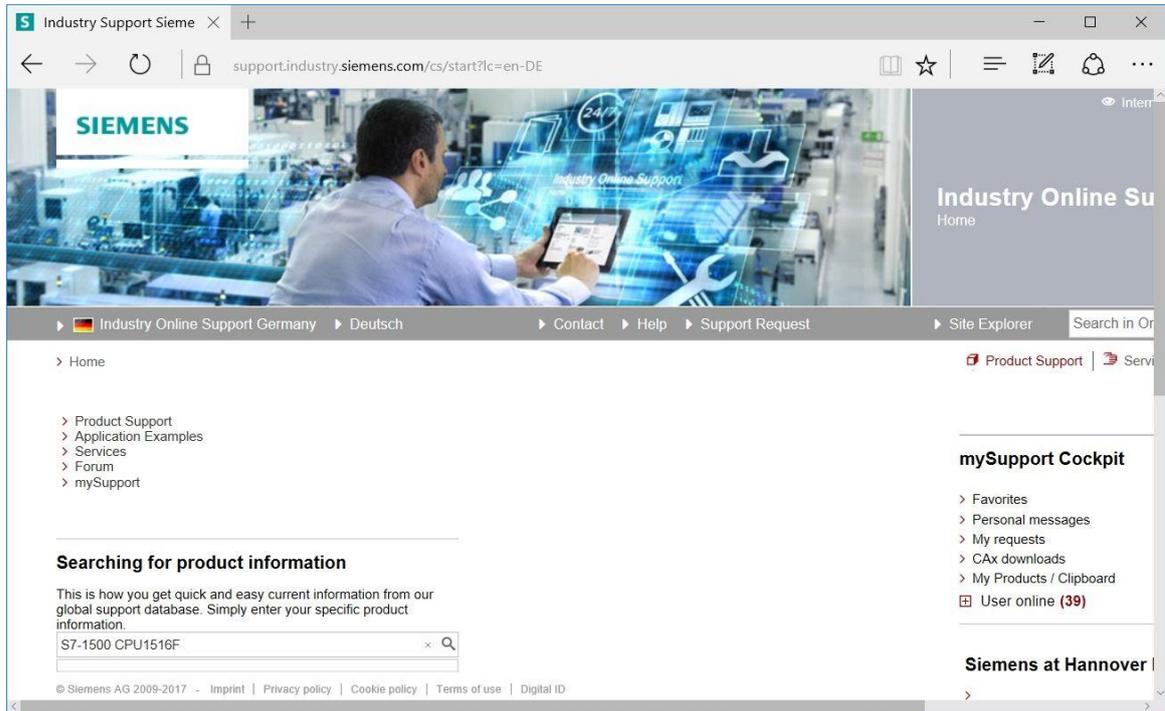
- Ⓜ Open your choice of Internet browser and enter the address Ⓜ "support.automation.siemens.com".



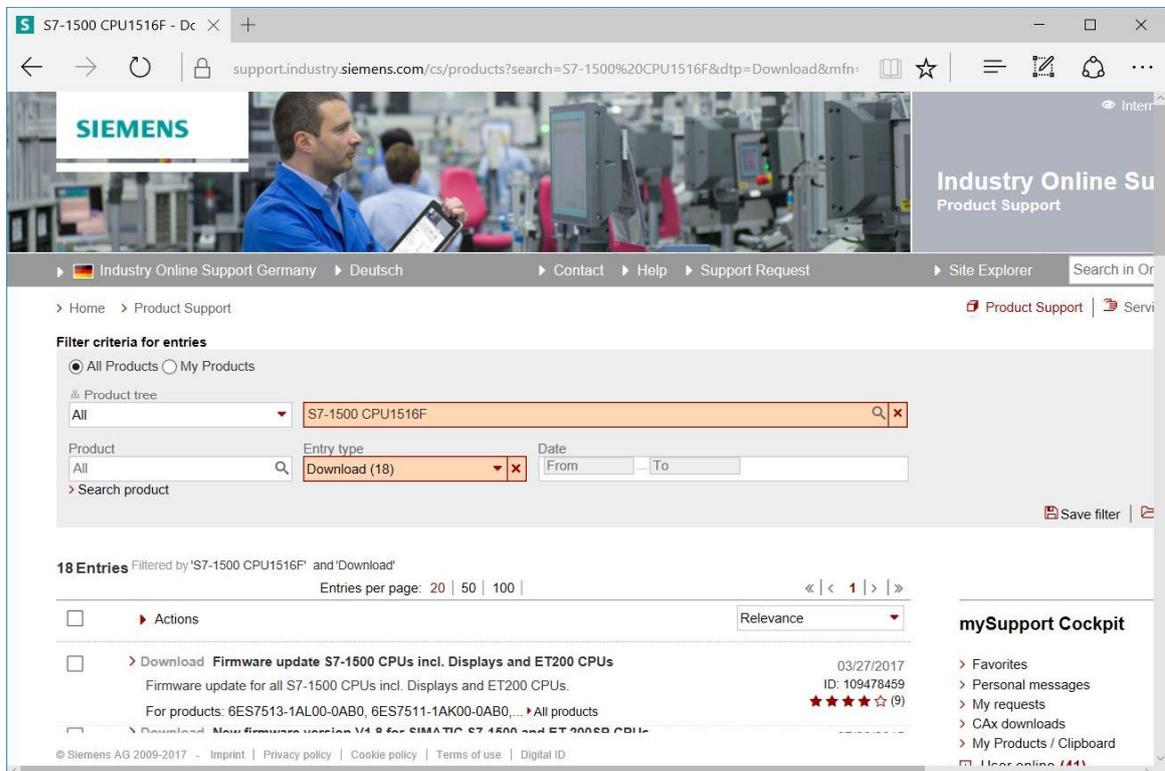
- Ⓜ Select your desired language Ⓜ "Language" Ⓜ "English".



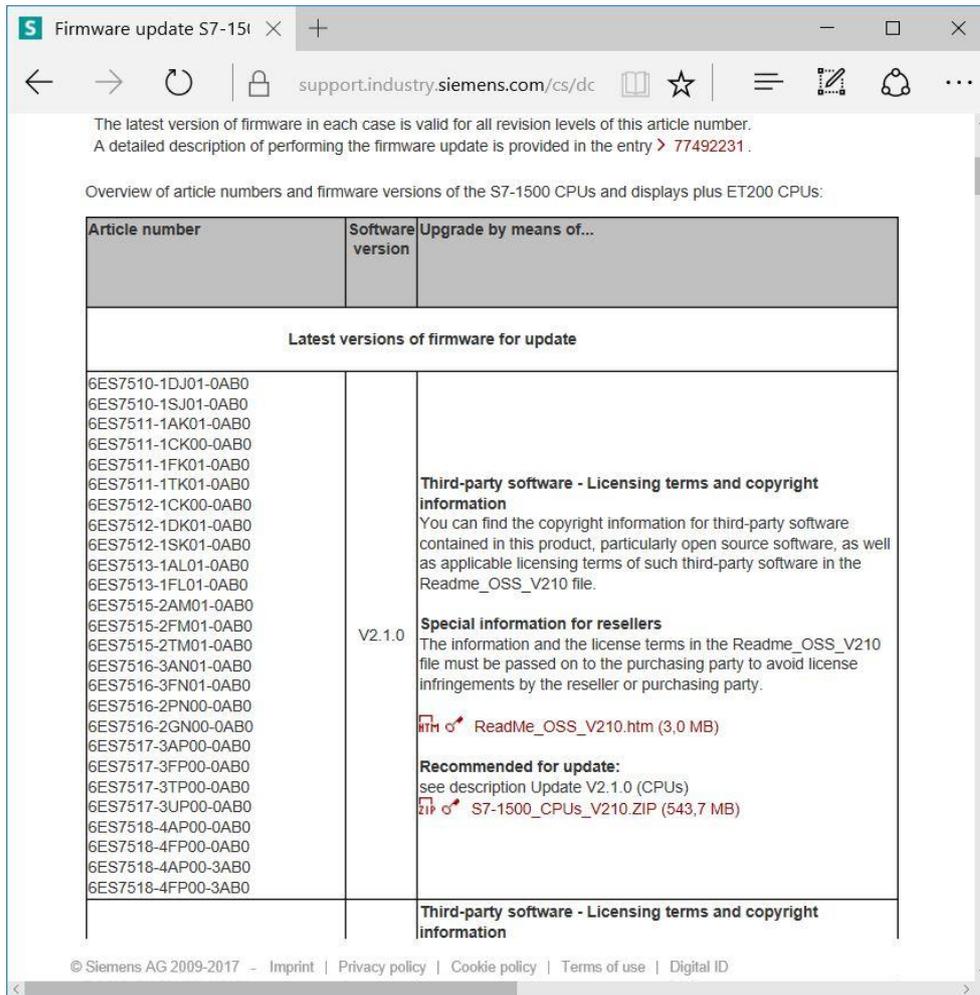
- Ⓜ In "Searching for product information", enter the CPU for which you need a firmware update.
For example:Ⓜ "S7-1500 CPU1516F"



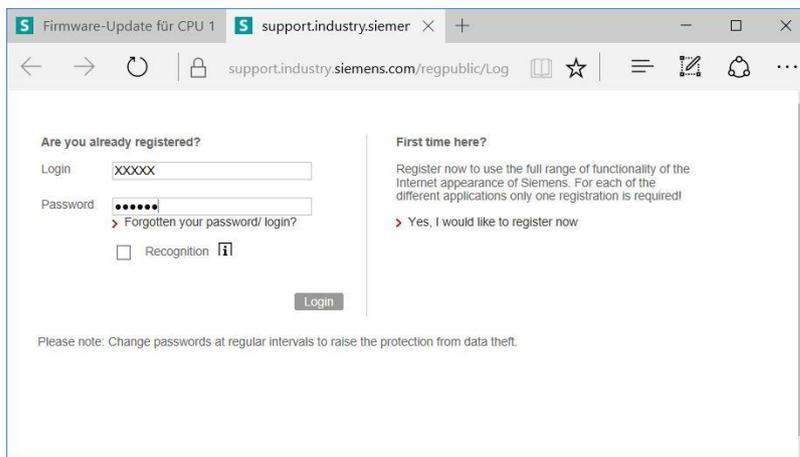
- Ⓜ Under "Filter criteria for entries" select the "Entry type" Ⓜ "Download" and click the entry with firmware updates for your CPU and the associated display in the selection list.



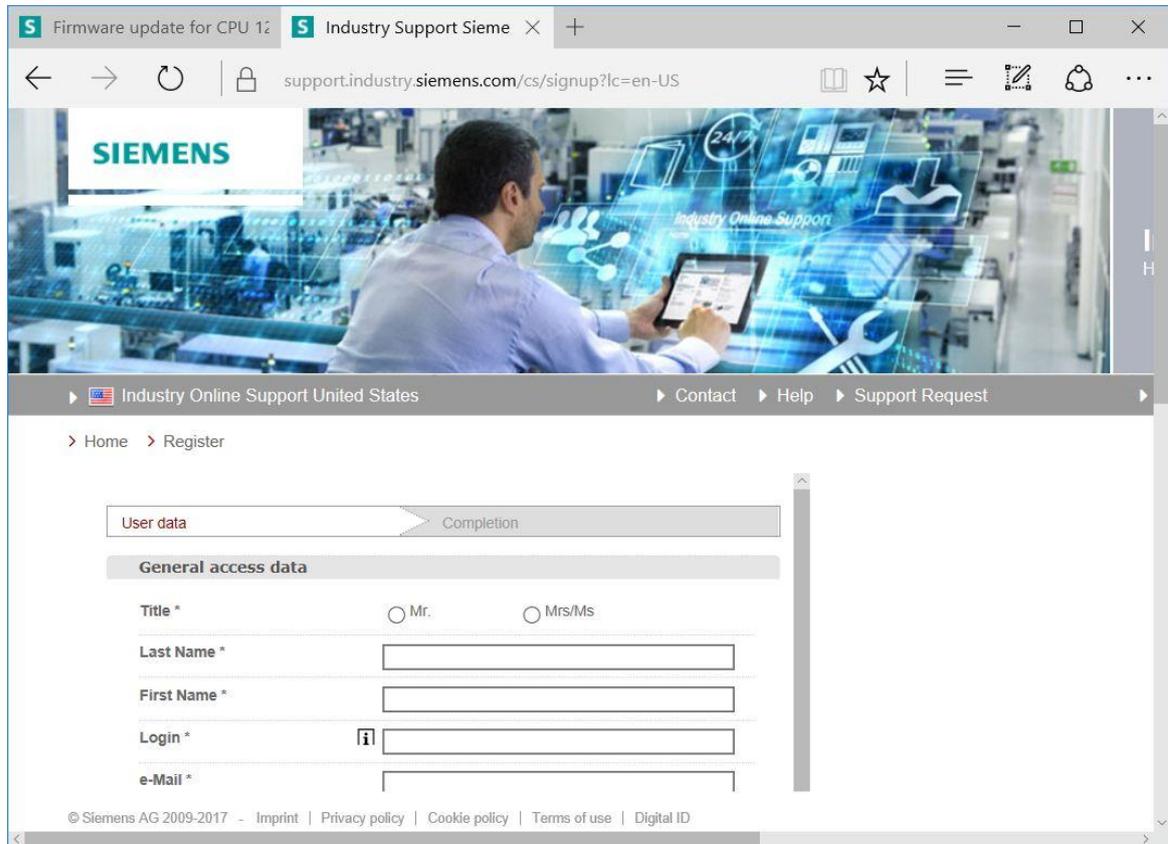
- ⑥ Various updates are offered in the next window. Select the update for your CPU that is recommended for the upgrade.



- ⑥ If you have not already registered, do so in the next window. (⑥ "Yes I would like to register now"), or if already registered – log in with your "Login" and "Password". (⑥ "Login")



- ⑥ Enter the requested data for the registration, select the option "Download of export restricted software" and then save the registration. (⑥ ⑥ "Save")



Download of export restricted software

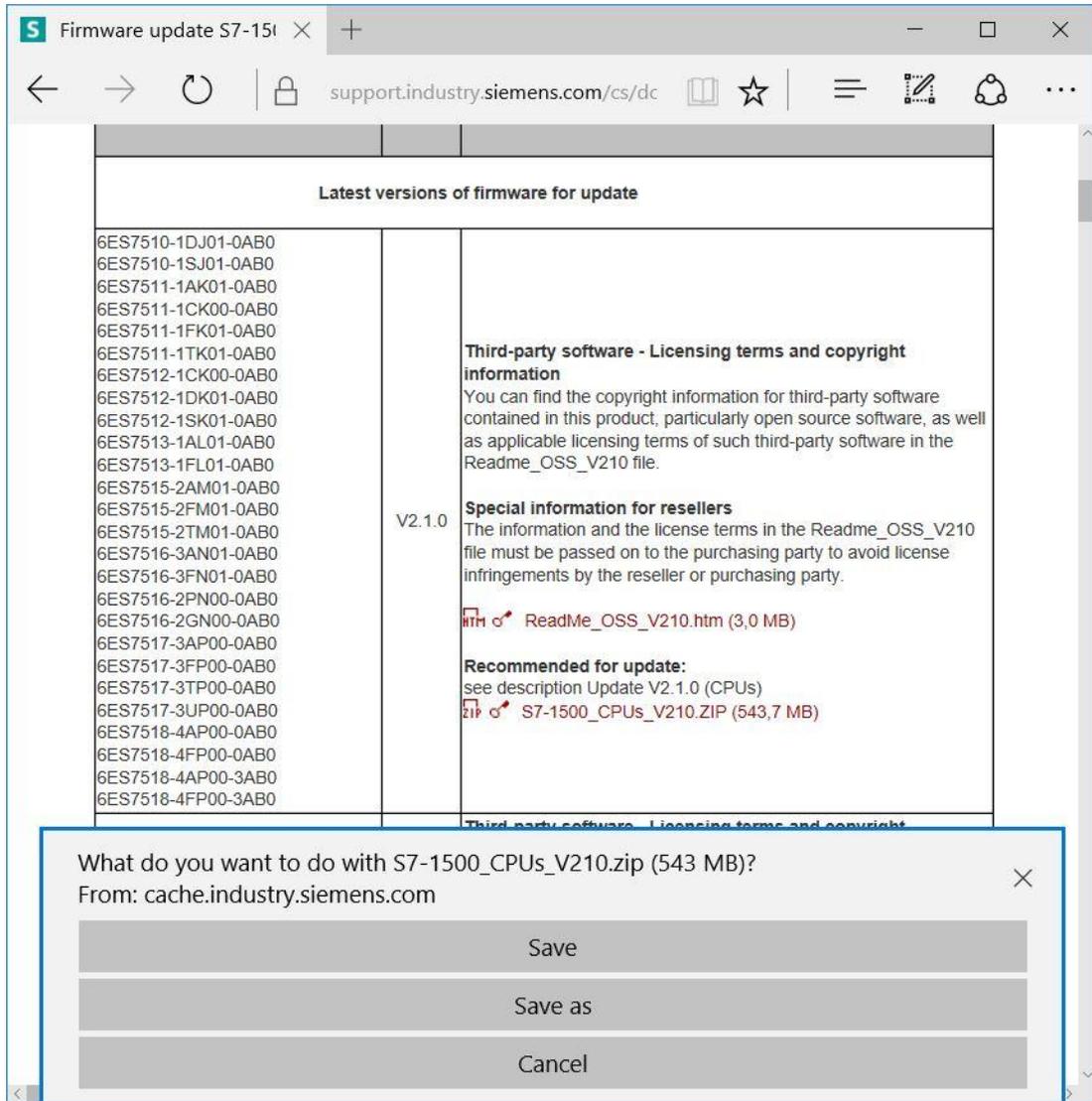
Access authorization for the download of export-restricted software
 Software that is subject to export restrictions may not be made generally
 accessible. Access authorization to export-restricted software may only be
 granted to selected, registered users.

Yes, I would like to register for access to export-restricted software

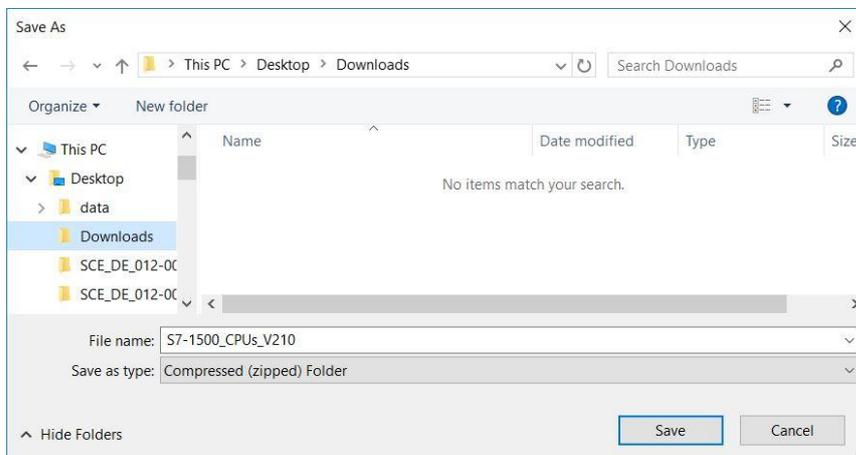
* Mandatory field

Save

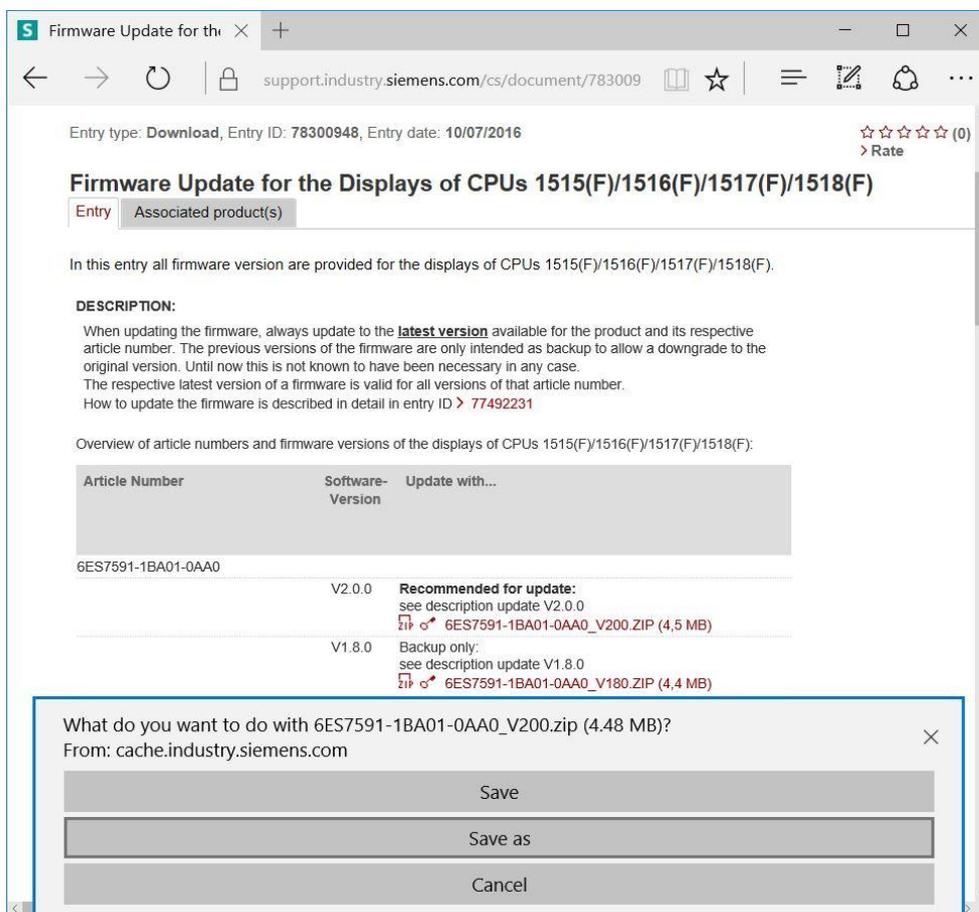
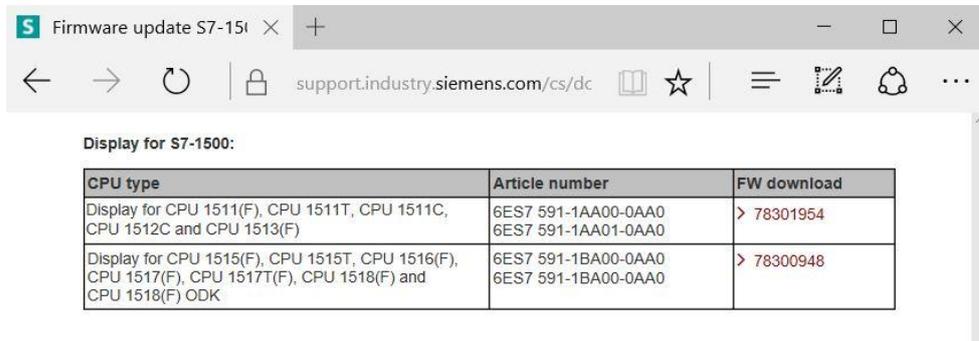
- Ⓜ Return to the login. After login you can save the firmware update on your computer.
- Ⓜ "Save as")



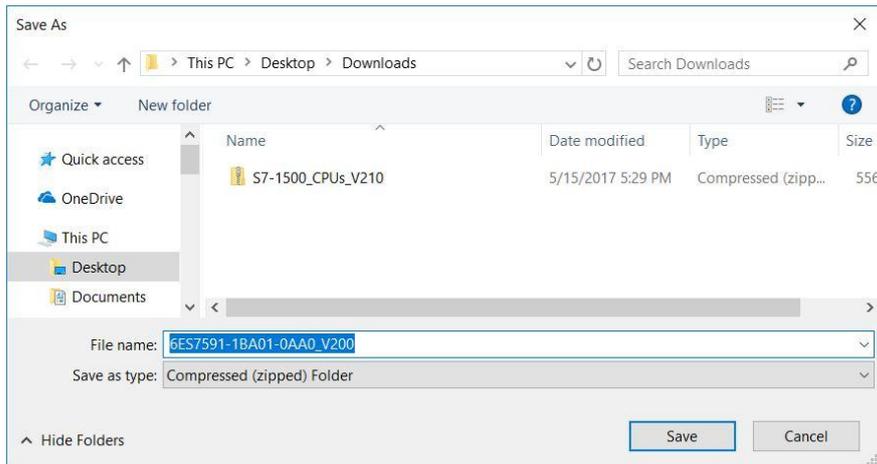
- Ⓜ Enter the desired memory location on your computer and click Ⓜ "Save".



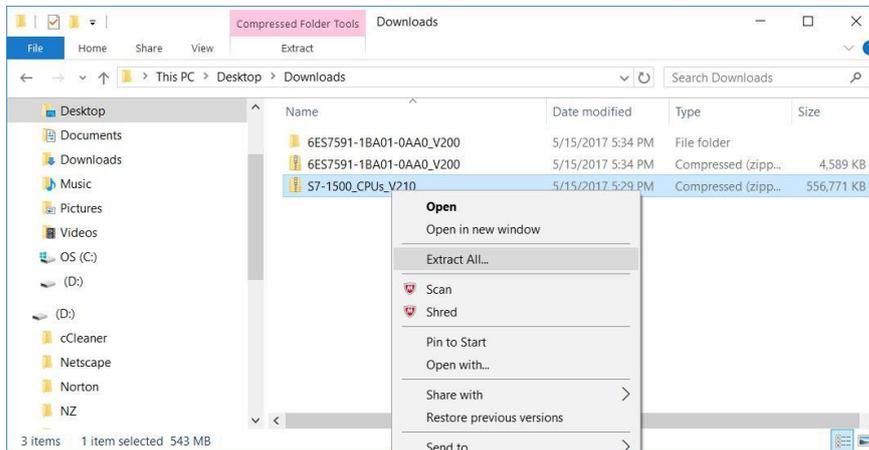
- Ⓡ Back on the Industry Online Support website of SIEMENS AG, you can select the firmware update for your display. Select the update recommended for the upgrade. You can then save the firmware update on your computer. (Ⓡ "Save as")



⑧ Enter the desired memory location on your computer and click ⑧ "Save".



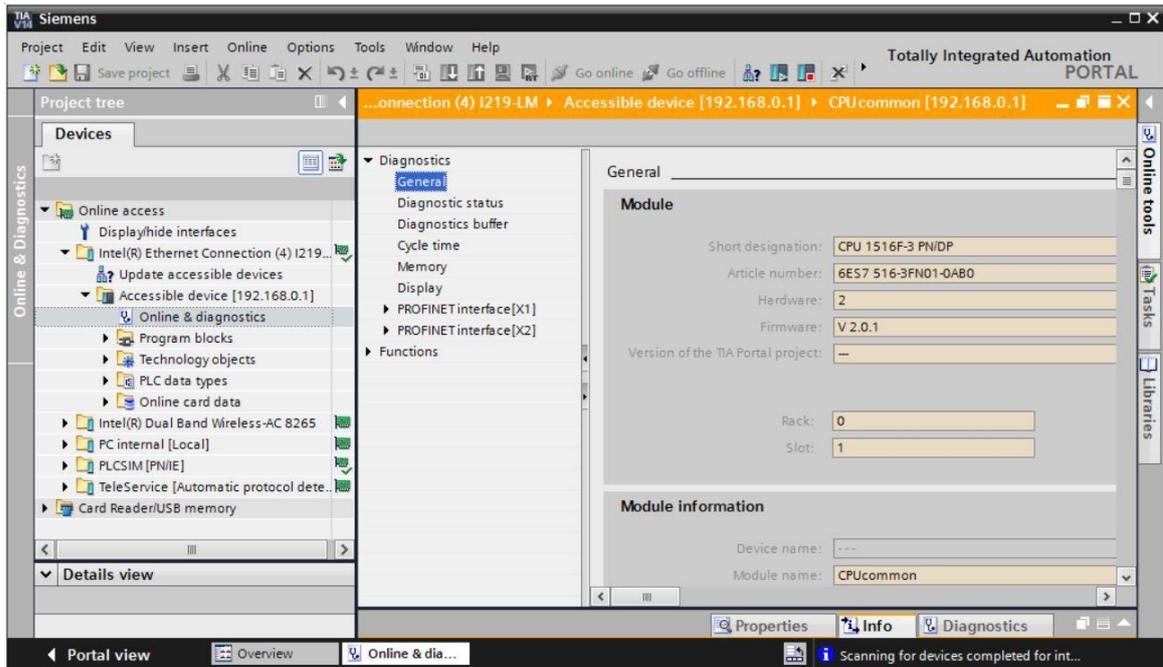
⑧ Click the downloaded compressed files for your CPU and the display in Windows Explorer and select ⑧ "Extract All" for each compressed file.



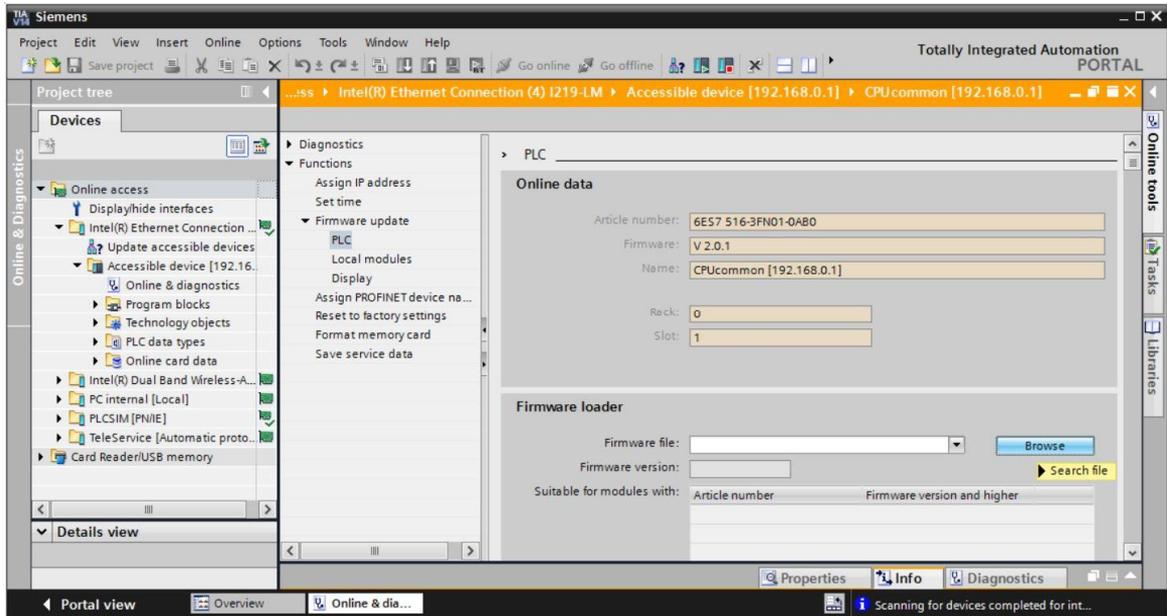
4.3.7 Firmware update of the CPU

The files with the firmware update can be imported into the SIMATIC S7-1500 CPU as follows.

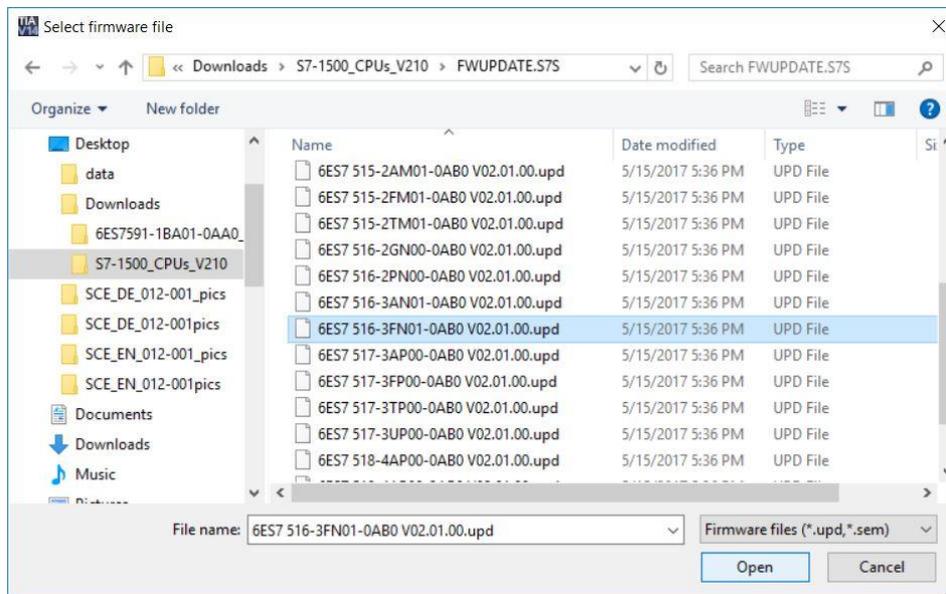
- Ⓜ In the project tree under Ⓜ "Online access", select the network adapter that was set previously. If you click Ⓜ "Update accessible devices", you will see the IP address of the connected SIMATIC S7-1500. Select Ⓜ "Online & Diagnostics". Under the "General" menu item, you can check the current firmware in your CPU in "Diagnostics".



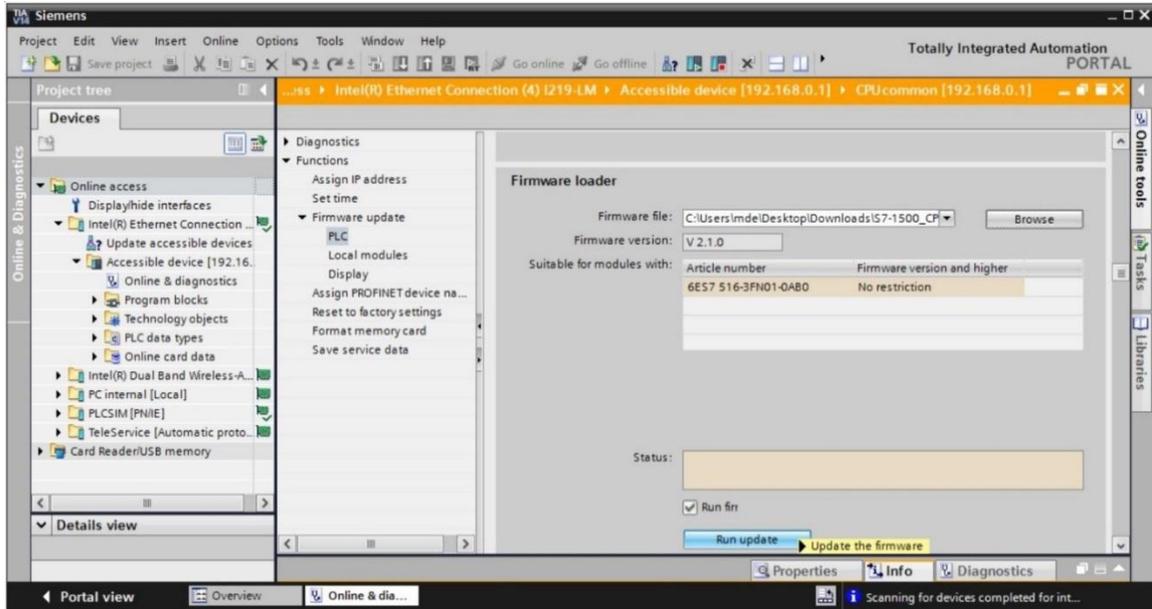
- Ⓜ In the Ⓜ "Functions" menu, change to Ⓜ "Firmware update" Ⓜ "PLC". In the Ⓜ "Firmware loader" sub-item, click Ⓜ "Browse".



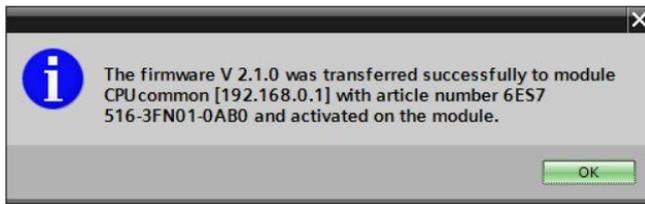
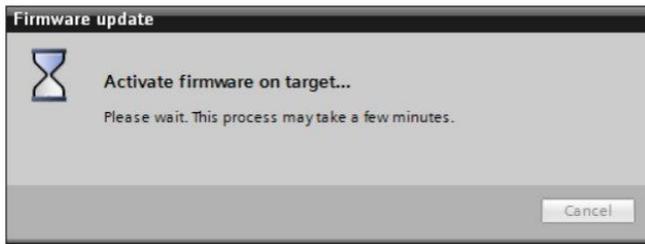
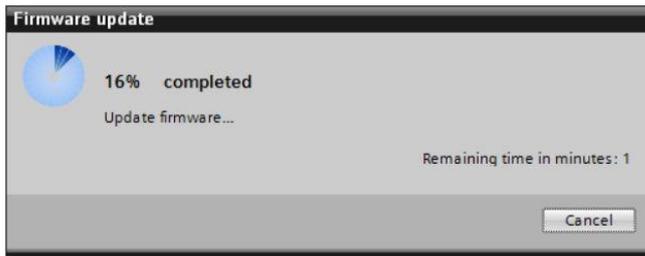
- Ⓜ Select the previously downloaded and extracted firmware file Ⓜ "6ES7 ***-****-****.upd" on your computer and click Ⓜ "Open".



- ⑥ The following dialog indicates whether your firmware file is compatible with your CPU. Now start the update. (⑥ "Run update")



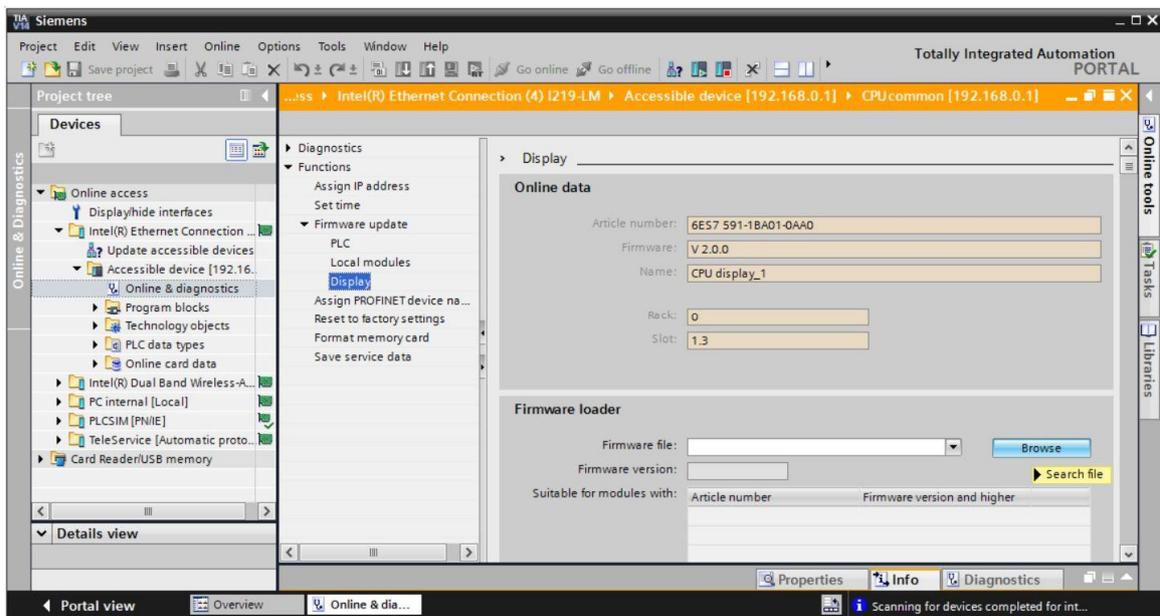
- ⑥ The progress of the update and its successful completion are indicated with the following dialogs. Click ⑥ "OK" to confirm.



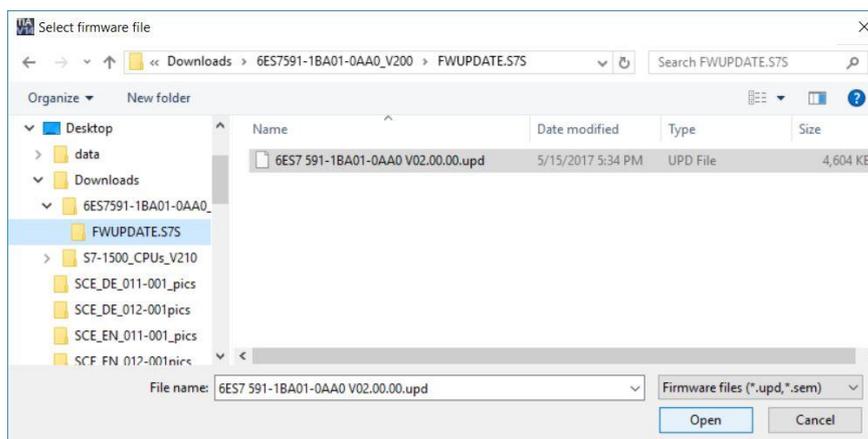
4.3.8 Firmware update of the display

Once the firmware of the SIMATIC S7-1500 CPU has been updated, it is advisable to update the firmware of the display.

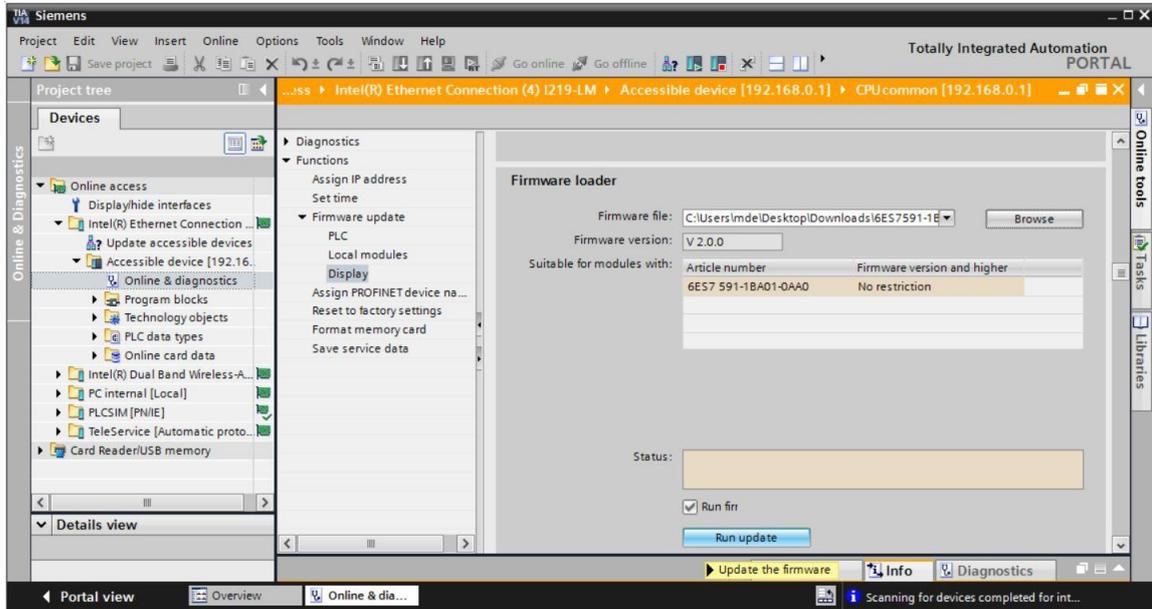
- Ⓜ In the project tree under Ⓜ "Online access", select the network adapter that was set previously. If you click Ⓜ "Update accessible devices", you will see the IP address of the connected SIMATIC S7-1500. Select Ⓜ "Online & Diagnostics" here. In the Ⓜ "Functions" menu, change to Ⓜ "Firmware update" Ⓜ "Display". In the Ⓜ "Firmware loader" sub-item, click Ⓜ "Browse".



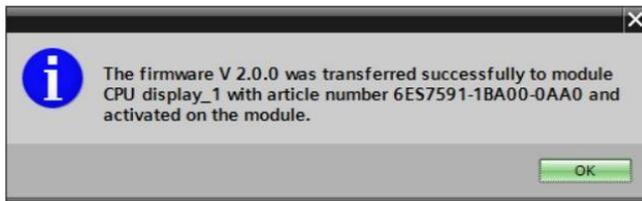
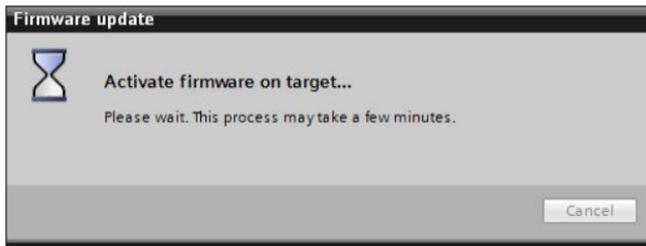
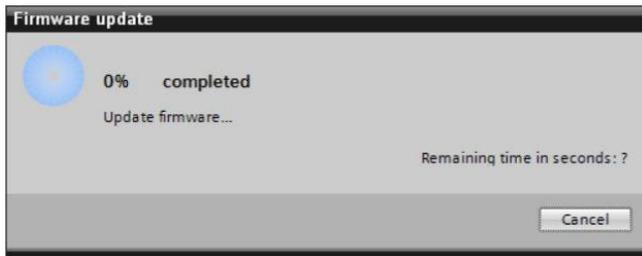
- Ⓜ Select the previously downloaded and extracted firmware file Ⓜ "6ES7 ***-****-****.upd" on your computer and click Ⓜ "Open".



- ⑧ The following dialog indicates whether your firmware file is compatible with your display. Now start the update. (⑧ "Run update")



- ⑧ The progress of the update and its successful completion are indicated with the following dialogs. Click ⑧ "OK" to confirm.



5 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:

[siemens.com/sce/s7-1500](https://www.siemens.com/sce/s7-1500)

Preview "Additional information"

Getting Started, Videos, Tutorials, Apps, Manuals, Trial-SW/Firmware

- TIA Portal Videos
- TIA Portal Tutorial Center
- Getting Started
- Programming Guideline
- Easy Entry in SIMATIC S7-1200
- Download Trial Software/Firmware
- Technical Documentation SIMATIC Controller
- Industry Online Support App
- TIA Portal, SIMATIC S7-1200/1500 Overview
- TIA Portal Website
- SIMATIC S7-1200 Website
- SIMATIC S7-1500 Website