SIEMENS

# SIMATIC

# S7-1500 Software Controller CPU 1505SP (F/T/TF), CPU 1507S (F), CPU 1508S (F) Version 21.9.7

Operating Instructions


Documentation guide 1

Safety information 2

Product overview 3

Installing 4

Commissioning 5

Operation of the CPU 6

Maintenance 7

Protection 8

Interrupts, diagnostics, error and system message 9

Technical Data A

Reference information for use with SIMATIC IPC B



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## Legal information

### Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

**⚠ DANGER**

indicates that death or severe personal injury **will** result if proper precautions are not taken.

**⚠ WARNING**

indicates that death or severe personal injury **may** result if proper precautions are not taken.

**⚠ CAUTION**

indicates that minor personal injury can result if proper precautions are not taken.

**NOTICE**

indicates that property damage can result if proper precautions are not taken.

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### Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

### Proper use of Siemens products

Note the following:

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### Disclaimer of Liability

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# Table of contents


**1 Documentation guide ..... 7**

1.1 S7-1500/ET 200MP Documentation Guide ..... 8
1.1.1 S7-1500 / ET 200MP Documentation Guide ..... 8
1.1.2 SIMATIC Technical Documentation ..... 10
1.1.3 Tool support ..... 11

**2 Safety information ..... 13**

2.1 Security information ..... 13
2.2 Security settings for IPCs ..... 13
2.3 Notes on data protection ..... 13
2.4 Change of the operating mode with critical actions ..... 14
2.5 Information about third-party software updates ..... 14
2.6 Notes on protecting administrator accounts ..... 14
2.7 Signatures and file integrity ..... 14

**3 Product overview ..... 15**

3.1 Introduction to PC-based control ..... 15
3.2 Overview of functions ..... 16
3.3 Functions ..... 20
3.3.1 Real-time concept of the CPU ..... 20
3.3.2 Memory concept of the CPU ..... 21
3.3.2.1 CPU memory areas ..... 21
3.3.2.2 Storage of retentive data ..... 23
3.3.3 Interface types ..... 25
3.3.4 PROFINET IO ..... 26
3.3.5 PROFIenergy ..... 26
3.3.6 PROFIBUS DP ..... 27
3.3.7 Central I/O ..... 28
3.3.8 Web server of the CPU ..... 28
3.3.9 Technical details of the PC Station ..... 29
3.3.10 Fail-safe ..... 29

**4 Installing ..... 32**

4.1 Delivery forms of the CPU ..... 32
4.2 System requirements ..... 33
4.3 Creation of the CPU volume ..... 35
4.4 Partitioning prior to installation ..... 36
4.4.1 Installation on PC systems with MBR partitioning and 4 primary partitions ..... 36

4.4.2 Installation on PC systems with more primary partitions (using GPT) ..... 37
4.5 Overview of the Installation Tasks..... 37
4.6 Installing the Software Controller via Online Software Delivery..... 40
4.7 Installing the Software Controller via DVD..... 40
4.8 Scripted installation without user interaction..... 42
4.9 Upgrades and updates..... 43
4.9.1 Update from a version <21.9.7 to 21.9.7..... 43
4.9.2 Upgrade to V21.9..... 46
4.10 Licensing the software controller..... 47
4.11 Uninstalling the software controller..... 49

**5 Commissioning..... 50**

5.1 Introduction..... 50
5.2 Configuring IPC..... 51
5.3 Adding software controller to configuration..... 52
5.4 Assigning interfaces for communication..... 54
5.5 Changing index..... 58
5.6 Setting storage location for retentive data..... 58
5.7 Using hardware LEDs..... 60
5.8 Configuring startup..... 62
5.9 Synchronizing time according to Windows clock..... 63
5.10 Configuring Web server for use under Windows..... 65
5.11 Load PC system..... 68
5.11.1 Downloading project to target system..... 68
5.11.2 Download complete PC system with TIA Portal Openness..... 70
5.11.3 Loading PC Station with file..... 72
5.11.3.1 Create configuration file..... 72
5.11.3.2 Export configuration file from TIA Portal project..... 73
5.11.3.3 Open existing configuration files..... 75
5.11.3.4 Import configuration file on target system..... 75
5.11.3.5 Export configuration file from a configured PC system..... 79
5.11.4 Delete configuration..... 86
5.12 Special features with CPU 1505SP..... 86
5.13 Communication..... 87
5.13.1 Using open communication over Windows interfaces..... 88
5.13.2 Using OPC UA with Windows applications..... 89
5.13.2.1 Using OPC UA locally on the same PC..... 89
5.13.2.2 Using OPC UA remotely over Windows Ethernet interfaces..... 89
5.13.3 Special features of communication interfaces..... 90

**6 Operation of the CPU ..... 95**

6.1 Operation using the display ..... 95
6.1.1 Introduction to the CPU display ..... 95
6.1.2 Operator controls and controller ..... 97
6.1.3 Manually starting and stopping the CPU via display ..... 100
6.1.4 Setting language options in the display ..... 103
6.1.5 Setting the date and time ..... 106
6.1.6 Changing the operating mode ..... 107
6.2 Operation using the command line commands ..... 110
6.3 Operating modes ..... 111
6.3.1 Basic principles of the operating modes ..... 111
6.3.2 Operating mode transitions ..... 112

**7 Maintenance ..... 114**

7.1 Status display in the notification area ..... 114
7.2 PC Station display in the notification area ..... 115
7.3 Using an uninterruptible power supply (UPS) ..... 117
7.4 BIOS update ..... 117
7.5 Firmware update of I/O modules ..... 118
7.6 Resetting the CPU ..... 120
7.6.1 Reset using the display ..... 121
7.6.2 Reset using STEP 7 ..... 122
7.6.3 Resetting via the mode switch ..... 123
7.6.4 Formatting the CPU volume ..... 123
7.7 Resetting the PC system ..... 126
7.8 Backing up the image of the PC mass storage ..... 127
7.9 Special features ..... 131
7.9.1 Use of bus adapters ..... 131
7.9.2 Error messages during installation of drivers ..... 131
7.9.3 Special situations when downloading in STEP 7 ..... 131
7.9.4 Downloaded user program is not compatible with the target system ..... 132
7.9.5 Special situations when starting or stopping the CPU ..... 132
7.9.6 CPU behavior at Windows shutdown ..... 133
7.9.7 Windows error handling and operating the CPU after Windows crash ..... 134
7.9.8 Timeouts ..... 135
7.9.9 Restarting Windows ..... 136
7.9.9.1 Restarting the operating system and CPU ..... 137
7.9.9.2 Operation of the CPU if Windows restart fails ..... 137
7.9.10 Assignment of addresses with absolute addressing ..... 138
7.9.11 "Autonegotiation" port setting ..... 138

**8 Protection ... 139**
8.1 Overview of the protective functions of the CPU ... 139
8.2 General information on protection ... 140
8.3 Protection of confidential configuration data ... 140
8.4 Access protection ... 141
8.4.1 Configuring access protection for the CPU in STEP 7 ... 141
8.4.2 Protected project - Lost password ... 145
8.4.3 Using the display to change the protection level for display access ... 146
8.4.4 Locking protection levels with the PLC program ... 150
8.5 Protecting blocks ... 151
8.6 Virus scanners and firewall ... 152
8.7 Setting up copy protection ... 153

**9 Interrupts, diagnostics, error and system message ... 154**
9.1 Status and error display of the CPU ... 155
9.2 Export of diagnostic information ... 157
9.3 Diagnostics ... 158
9.3.1 Diagnostic information via the CPU display ... 158
9.3.1.1 "Overview" and "Diagnostics" menu ... 158
9.3.1.2 Display of alarms ... 160
9.3.1.3 Display of the diagnostics buffer entries ... 162
9.3.2 Diagnostic information using STEP 7 ... 163
9.3.3 Diagnostic information using the Web server ... 164

**A Technical Data ... 165**

**B Reference information for use with SIMATIC IPC ... 166**
B.1 Windows Knowledge Base ... 166
B.2 SIMATIC IPC227E / IPC277E ... 167
B.3 SIMATIC IPC427D / IPC477D (PRO) ... 168
B.4 SIMATIC IPC427E / IPC477E (PRO) ... 169
B.5 SIMATIC IPC627D / IPC827D / IPC677D ... 171
B.6 SIMATIC IPC647D / IPC847D ... 172
B.7 SIMATIC IPC647E / IPC847E ... 173
B.8 SIMATIC IPC627E / IPC677E ... 179

**Glossary ... 187**

**Index ... 190**

# Documentation guide

1

## Purpose of the documentation

These operating instructions supplement the system manual of the S7-1500 automation system as well as the function manuals. Cross-system functions are described in the system manual.
The information provided in these operating instructions and the system manual enables you to commission the CPU.

## Basic knowledge required

The following knowledge is required to understand the documentation:

- General knowledge of automation technology
- Knowledge of the SIMATIC industrial automation system
- Knowledge of working with STEP 7

## Validity of the documentation

This documentation is valid for the following products.

| CPU | Article number |
|---|---|
| 1505SP | 6ES7 672-5DC11-0YA0 |
| 1505SP F | 6ES7 672-5SC11-0YA0 |
| 1505SP T | 6ES7 672-5VC11-0YA0 |
| 1505SP TF | 6ES7 672-5WC11-0YA0 |
| 1507S | 6ES7 672-7AC01-0YA0<br>6ES7 672-7AC01-0YG0<br>6ES7 672-7AC01-0YK0 |
| 1507S F | 6ES7 672-7FC01-0YA0<br>6ES7 672-7FC01-0YG0<br>6ES7 672-7FC01-0YK0 |
| 1508S | 6ES7 672-8AC01-0YA0<br>6ES7 672-8AC01-0YG0 |
| 1508S F | 6ES7 672-8FC01-0YA0<br>6ES7 672-8FC01-0YG0 |

### Notes

Please also observe notes marked as follows:

**NOTE**

A note contains important information on the product described in the documentation, on the handling of the product or on the part of the documentation to which particular attention should be paid.

### Definitions and naming conventions

The following terms are used in this documentation:

- **CPU** or **Software Controller**: These terms refer to the CPU 1505SP (F/T/TF), the CPU 1507S (F) and the CPU 1508S (F). If information only relates to one of these CPU versions, the version is explicitly named.
  - "CPU 1505SP" includes "CPU 1505SP F","CPU 1505SP T" and "CPU 1505SP TF".
  - "CPU 1507S" includes "CPU 1507S F".
  - "CPU 1508S" includes "CPU 1508S F".
- **Display**: This term refers to the display application of the CPU.
- **STEP 7**: We refer to the configuration and programming software as "STEP 7" in this documentation as a synonym for the version "STEP 7 V17 (TIA Portal)".
- **PC**: This term designates a SIMATIC IPC and a CPU 1515SP PC2.

## 1.1 S7-1500/ET 200MP Documentation Guide

### 1.1.1 S7-1500 / ET 200MP Documentation Guide



The documentation for the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require. Changes and supplements to the manuals are documented in a Product Information.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742691).

### Basic information



The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems.

The STEP 7 online help supports you in the configuration and programming.

Examples:

- Getting Started S7-1500
- S7-1500/ET 200MP System Manual
- Online help TIA Portal

### Device information



Equipment manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.
Examples:

- Equipment Manuals CPUs
- Equipment Manuals Interface Modules
- Equipment Manuals Digital Modules
- Equipment Manuals Analog Modules
- Equipment Manuals Communications Modules
- Equipment Manuals Technology Modules
- Equipment Manuals Power Supply Modules

### General information



The function manuals contain detailed descriptions on general topics relating to the SIMATIC S7-1500 and ET 200MPsystems.
Examples:

- Function Manual Diagnostics
- Function Manual Communication
- Function Manual Motion Control
- Function Manual Web Server
- Function Manual Cycle and Response Times
- PROFINET Function Manual
- PROFIBUS Function Manual

### Product Information

Changes and supplements to the manuals are documented in a Product Information. The Product Information takes precedence over the device and system manuals.
You can find the latest Product Information on the S7-1500 and ET 200MP systems on the Internet (https://support.industry.siemens.com/cs/de/en/view/68052815).

### Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.
You can find the Manual Collection on the Internet.
(https://support.industry.siemens.com/cs/ww/en/view/86140384)

### SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.
You can find the comparison list on the Internet
(https://support.industry.siemens.com/cs/ww/en/view/86630375).

## 1.1.2 SIMATIC Technical Documentation

Additional SIMATIC documents will complete your information. You can find these documents and their use at the following links and QR codes.
The Industry Online Support gives you the option to get information on all topics. Application examples support you in solving your automation tasks.

### Overview of the SIMATIC Technical Documentation

Here you will find an overview of the SIMATIC documentation available in SIOS:

Industry Online Support International (https://support.industry.siemens.com/cs/ww/en/view/109742705)

Watch this short video to find out where you can find the overview directly in SIOS and how to use SIOS on your mobile device:

Quick introduction to the technical documentation of automation products per video (https://support.industry.siemens.com/cs/us/en/view/109780491)

YouTube video: Siemens Automation Products - Technical Documentation at a Glance (https://youtu.be/TwLSxxRQQsA)

### mySupport

With "mySupport" you can get the most out of your Industry Online Support.

| | |
|---|---|
| **Registration** | You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace. |
| **Support requests** | Your data is already filled out in support requests, and you can get an overview of your current requests at any time. |
| **Documentation** | In the Documentation area you can build your personal library. |
| **Favorites** | You can use the "Add to mySupport favorites" to flag especially interesting or frequently needed content. Under "Favorites", you will find a list of your flagged entries. |
| **Recently viewed articles** | The most recently viewed pages in mySupport are available under "Recently viewed articles". |
| **CAx data** | The CAx data area gives you access to the latest product data for your CAx or CAe system. You configure your own download package with a few clicks:<br>• Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files<br>• Manuals, characteristics, operating manuals, certificates<br>• Product master data |

You can find "mySupport" on the Internet. (https://support.industry.siemens.com/My/ww/en)

### Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.
You can find the application examples on the Internet.
(https://support.industry.siemens.com/cs/ww/en/ps/ae)

## 1.1.3 Tool support

The tools described below support you in all steps: from planning, over commissioning, all the way to analysis of your system.

### TIA Selection Tool

The TIA Selection Tool tool supports you in the selection, configuration, and ordering of devices for Totally Integrated Automation (TIA).
As successor of the SIMATIC Selection Tools , it assembles the configuration editors for automation technology already familiar into a single tool.
With the TIA Selection Tool , you can generate a complete order list from your product selection or product configuration.
You can find the TIA Selection Tool on the Internet.
(https://support.industry.siemens.com/cs/ww/en/view/109767888)

### SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities on various SIMATIC S7 stations as bulk operations independent of TIA Portal.
The SIMATIC Automation Tool offers a wide range of functions:

- Scanning of a PROFINET/Ethernet system network and identification of all connected CPUs
- Assignment of addresses (IP, subnet, Gateway) and device name (PROFINET device) to a CPU
- Transfer of the date and the programming device/PC time converted to UTC time to the module
- Program download to CPU
- RUN/STOP mode switchover
- CPU localization through LED flashing
- Reading out of CPU error information
- Reading the CPU diagnostic buffer
- Reset to factory settings
- Firmware update of the CPU and connected modules

You can find the SIMATIC Automation Tool on the Internet.
(https://support.industry.siemens.com/cs/ww/en/view/98161300)

## PRONETA

SIEMENS PRONETA (PROFINET network analysis) is a commissioning and diagnostic tool for PROFINET networks. PRONETA Basic has two core functions:

- The "Network analysis" offers a quick overview of the PROFINET topology. It is possible to make simple parameter changes (for example, to the names and IP addresses of the devices). In addition, a quick and convenient comparison of the real configuration with a reference system is also possible.
- The "IO test" is a simple and rapid test of the wiring and the module configuration of a plant, including documentation of the test results.

You can find SIEMENS PRONETA Basic on the Internet:
(https://support.industry.siemens.com/cs/ww/en/view/67460624)

SIEMENS PRONETA Professional is a licensed product that offers you additional functions. It offers you simple asset management in PROFINET networks and supports operators of automation systems in automatic data collection/acquisition of the components used through various functions:

- The user interface (API) offers an access point to the automation cell to automate the scan functions using MQTT or a command line.
- With PROFIenergy diagnostics, you can quickly detect the current pause mode or the readiness for operation of devices that support PROFIenergy and change these as needed.
- The data record wizard supports PROFINET developers in reading and writing acyclic PROFINET data records quickly and easily without PLC and engineering.

You can find SIEMENS PRONETA Professional on the Internet:
(https://www.siemens.com/proneta-professional)

## SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and the optimal use of resources

You can find SINETPLAN on the Internet
(https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html).

# Safety information 2

## 2.1 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (https://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (https://www.siemens.com/cert).

## 2.2 Security settings for IPCs

### Recommended security settings for IPCs

Under the following link (https://support.industry.siemens.com/cs/ww/en/view/109475014) you will find the recommended security settings for IPCs to meet the highest security and reliability requirements in industrial environments.

For individual settings depending on your type of IPC, see chapter Reference information for use with SIMATIC IPC (Page 166).

## 2.3 Notes on data protection

Siemens observes the principles of data protection, in particular the principle of data minimization (privacy by design).

For this Software Controller product, this means:

The product does not process/store any personal data, only technical functional data (e.g. time stamp). If the user links this data with other data (e.g. shift plans) or stores personal data on the same medium (e.g. hard disk) and thus establishes a personal reference, the user must ensure compliance with data protection regulations.

## 2.4 Change of the operating mode with critical actions

Switch the CPU to "STOP" mode before actions that result in very high utilization of the hardware ("critical actions").

## 2.5 Information about third-party software updates

This product contains third-party software. Siemens accepts liability with respect to updates/patches for the third-party software only when these are distributed by Siemens in the context of a Software Update Service contract or officially approved by Siemens. Otherwise, updates/patches are installed at the user's own risk. You can find more information in our Software Update Service (https://www.siemens.com/sus).

## 2.6 Notes on protecting administrator accounts

A user with administrator rights has extensive access and manipulation possibilities. Therefore, make sure that the administrator account is adequately protected to prevent unauthorized changes. Use secure passwords and use a standard user account for regular operation. Other measures, such as the use of security policies, should be applied as required.

## 2.7 Signatures and file integrity

### Handling digital signatures and hashes

On the PC, the software for the Software Controller ("CPU.elf") is provided by the Windows operating system. Using administrator privileges, the software can be modified or replaced by any arbitrary software. This is intended behavior as the Windows operating system is an open platform that enables customers to tailor their individual operational, connectivity, and security requirements. The recommended operating mode is to lock administrative accounts and operate the Software Controller using low-privileged accounts, such as the default operator account.

On Windows, a mechanism is available to check the digital signatures of binary files that are signed with the Windows Authenticode Signature Format. Via the Windows power shell command "Test-FileCatalog -Detailed -CatalogFilePath C:\Boot\Siemens\CPU.cat -Path C:\Boot\Siemens" the signature of CPU.elf is checked.

For IPC variants, see the following link (https://support.industry.siemens.com/cs/ww/en/view/109478528).

For the Open Controller, see the following link (https://support.industry.siemens.com/cs/ww/en/view/109759122).

# Product overview

# 3

## 3.1 Introduction to PC-based control

### Overview

The SIMATIC S7-1500 Software Controller is a PC-based controller. The PC-based controller offers the same functionality as all CPUs of the SIMATIC S7-1500 automation system in a PC-based real-time environment.

As part of the SIMATIC series of products, the Software Controller can communicate with STEP 7 and other SIMATIC products, such as WinCC, via PROFIBUS and Industrial Ethernet networks. Communication with the distributed I/O occurs in the same way via PROFIBUS or PROFINET. The Software Controller uses distributed I/O to control the automation process. To network the CPU with the distributed I/O, you use the interfaces of your PC. In addition, the CPU 1505SP can use the centralized I/O of the ET 200SP Open Controller.

The Software Controller uses communication via programming devices and operator panels (PROFIBUS or Industrial Ethernet) for connection with STEP 7 or other programming packages on a different PC.

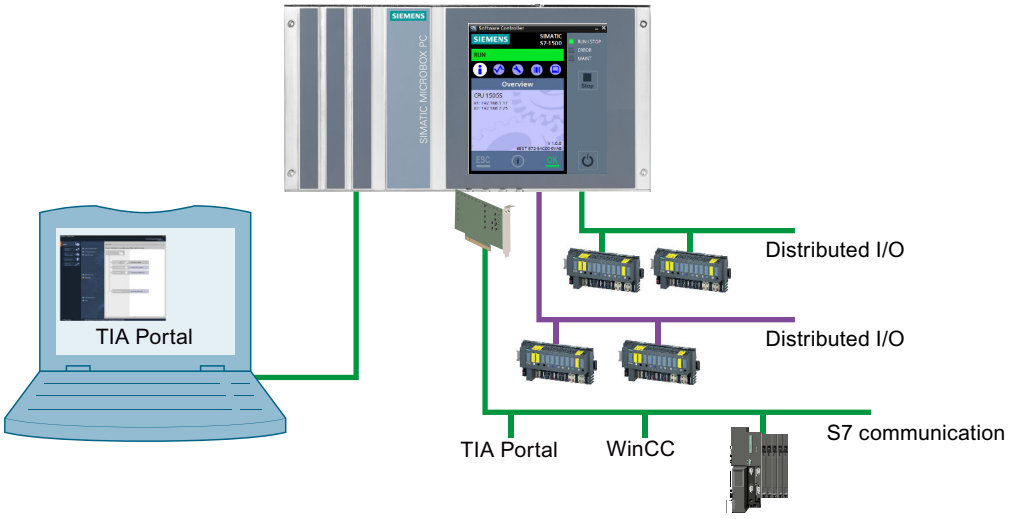



Figure 3-1 Product overview

You use the same programming languages, program structure, and programming interface (STEP 7) to develop your user programs with the PC-based controller as for hardware controllers. For the SIMATIC S7-1500 Software Controller, you can use the same user program as for a hardware controller.

The Software Controller also offers a display application that is executed under Windows on the same PC. The display application displays the Software Controller's operating mode. Similarly to a hardware CPU's display, you can use the display application to execute diagnostic and commissioning tasks.

**NOTE**

**Available operating systems**

The present manual describes Software Controllers using the Windows operating system. The latest manual for Software Controllers using Linux is available on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109808199).

## 3.2 Overview of functions

The S7-1500 Software Controller realizes the function of an S7-1500 hardware controller as software on a PC.
The Software Controller has the following technical properties.

### Configuration and programming with STEP 7 in the TIA Portal

All programming languages defined in IEC 61131-3 are supported.

### Innovative real-time system based on virtualization technology

The real-time system of the S7-1500 Software Controller enables you to operate the Software Controller in parallel with, but independent of, Windows.

- Real-time and deterministic behavior
- Operation independent of Windows: Windows can be restarted while the controller is running
- Fast power-up at Power On of the PC

### Fast program execution with multiple, priority-controlled execution levels

- Cyclically, time-controlled, isochronously with PROFINET
- Event-driven via hardware and diagnostic interrupts

### Storing of retentive data

The Software Controller ensures protection of system data even after a power failure:

- Storing of retentive data on the hard drive of the PC (UPS required)
- Backup of retentive data on the NVRAM (on SIMATIC IPCs with this option) possible in case of a power failure

### Communication

The S7-1500 Software Controller uses the interfaces of the PC for PROFINET and PROFIBUS.

- Windows-independent use of PC interfaces for PROFINET or PROFIBUS for operating distributed I/O. Depending on the interface hardware used, the following functions are possible:
  - PROFINET IO RT
  - PROFINET IO IRT
  - PROFIenergy
  - PROFIBUS DP master
  - Media redundancy
  - I-Device
  - Isochronous mode
  - MRP/MRPD
- Communication (SIMATIC Communication, Open User Communication, OPC UA) with Windows applications or external devices

### Integrated Web server

All CPUs of the SIMATIC S7-1500 automation system support querying of the CPU via the Web server. The Web server provides the following diagnostics possibilities:

- CPU mapping with LEDs and current operating mode
- Reading out entries from the diagnostics buffer
- Querying module states
- Querying current alarms
- Information on communication
- Information on the status of the topology/PROFINET devices
- Firmware updates
- Transferring user data to the load memory of the CPU and managing this data
- User-programmable web pages for support of service- and commissioning-specific machine functions
- API (Application Programming Interface) as an interface for
  - Reading/writing CPU data
  - Executing functions (e.g. backing up and restoring the CPU configuration, changing the operating state)

### Trace functionality

All CPUs of the SIMATIC S7-1500 automation system support the trace functionality. The trace functionality supports the recording of analog and digital tags for each cycle and their representation as a trend with STEP 7. It is particularly useful for motion control and closed-loop control applications.

### Integrated technology

- S7-1500 Motion Control
  - PLC Open blocks for programming motion functionality by means of PROFINET IO and PROFIdrive interface
  - The functionality supports speed-controlled axes, positioning axes, synchronous axes, external encoders, output cam, cam track and measuring inputs
- Integrated closed-loop control functionality: The CPU has three PID controllers with integrated optimization for a wide range of closed-loop control tasks:
  - PID_Compact for universal closed-loop control tasks
  - PID_3Step for valves
  - PID_Temp for closed-loop temperature control tasks

### Motion control functions of the technology CPUs

Supported technology objects:

- Speed-controlled axes
- Positioning axes
- Synchronous axes
- External encoders
- Output cams
- Cam track
- Measuring inputs

Advanced synchronization functions:

- Synchronizing with or without specification of synchronous position
- Setpoint value or actual value coupling
- Shift of master value on the following axis
- Camming

Other functions:

- A maximum of 4 encoders or measuring systems as actual position for position control
- Cyclic specification of motion vector from the application (MotionIn interface)
- Technology object for control of kinematics with up to 4 interpolating axes, e.g. Cartesian gantry, delta picker, roll picker, articulated arm, cylindrical robot, tripod, SCARA
- Support of user-defined kinematics
- Trace functions for all CPU tags, both for diagnostics in real-time as well as for sporadic error detection, can also be called via the Web server of the CPU
- Extensive closed-loop control functionalities, e.g. easy-to-configure blocks for automatic optimization of the controller parameters for optimized control quality

### Integrated system diagnostics

System diagnostics are generated automatically and displayed by:

- Programming device
- PC
- HMI
- Web server
- Display application

System diagnostics are also available when the CPU is in STOP mode.

### Integrated security

- Protection of confidential configuration data
  You have the option of assigning a password for protecting confidential configuration data of the respective CPU. This refers to data such as private keys that are required for the proper functioning of certificate-based protocols.
- Know-how protection
  Algorithms can be securely protected against unauthorized access and modification.
- Copy protection
  Copy protection links user blocks with the serial number of one or more SIMATIC memory cards, or the serial number of one or more CPUs. User programs cannot run without the corresponding SIMATIC memory card or CPU.
- Access protection
  Extended access protection provides comprehensive protection against unauthorized configuration changes. Authorization levels can be used to assign separate rights to different user groups.
- Integrity protection
  The system protects the data transferred to the CPU from unauthorized manipulation. Altered or external transmission of engineering data is reliably detected by the CPU.
- Password provider
  As an alternative to manual password input, you can connect a password provider to STEP 7. A password provider offers the following advantages:
  - Convenient handling of passwords
    STEP 7 reads in the password automatically for the blocks.
  - Optimum block protection because the users themselves do not know the password.

### Reference

You can find additional information on "Integrated security/access protection" in the S7-1500 Automation System system manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).

# 3.3 Functions

## 3.3.1 Real-time concept of the CPU

### Advantages of hypervisor technology

Due to its innovative real-time system based on hypervisor technology, the SIMATIC S7-1500 Software Controller offers the following advantages:

- Compatibility with S7-1500 hardware controllers
- Security and protection for controller applications

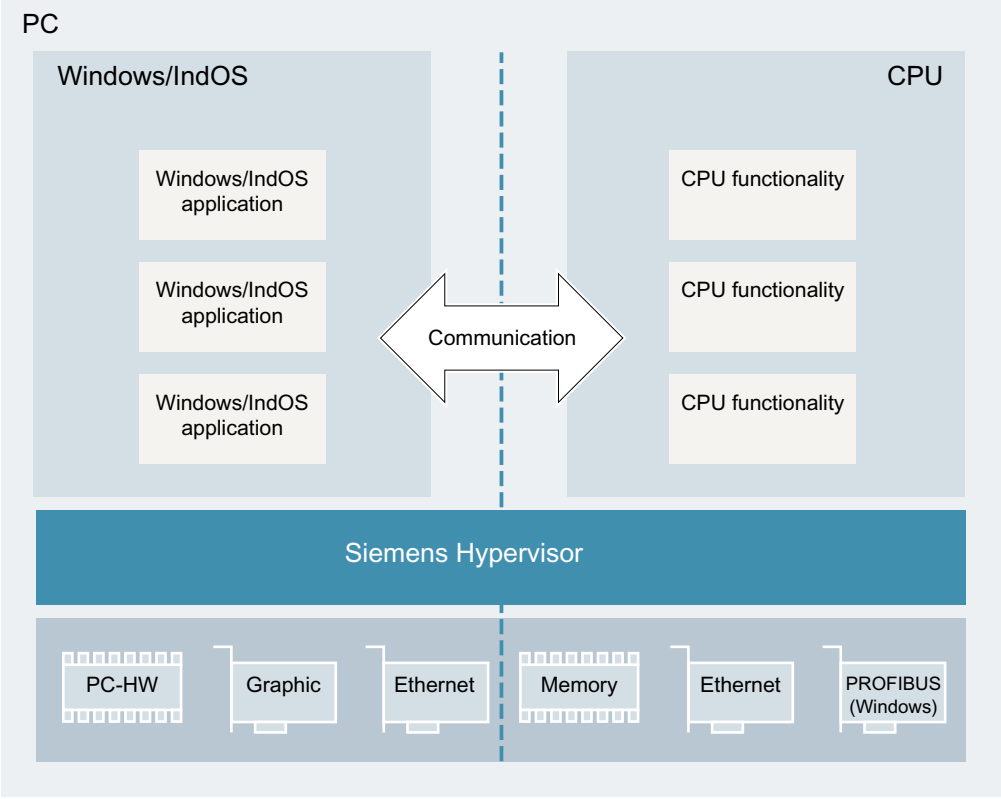



Figure 3-2 Real-time concept

### Division of the PC resources

The hypervisor technology divides the PC and assigns all resources necessary for the control task exclusively to the SIMATIC S7-1500 Software Controller. Windows and Windows applications have no access to these resources.
The communication architecture allows secure and transparent communication between Windows applications and the CPU:

- Local communication with the HMI or other Windows applications
- Controlled access to PROFINET or PROFIBUS modules for STEP 7 or HMI
- Controlled communication with external devices via Windows interfaces

The required resources are assigned during download of the STEP 7 configuration. This enables you to customize the PC-based application in STEP 7 as needed to meet the requirements of an automation solution.

## 3.3.2 Memory concept of the CPU

### 3.3.2.1 CPU memory areas

### Introduction

This section describes the structure of the memory of the CPU.

### Memory areas

The CPU makes use of the mass storage of the PC on which it is installed. During the installation, a discrete CPU volume is created in the mass storage (Page 35), in which all CPU data is stored. The load and retentive memories are integrated into this CPU volume.
The following figure shows the memory division on the PC:

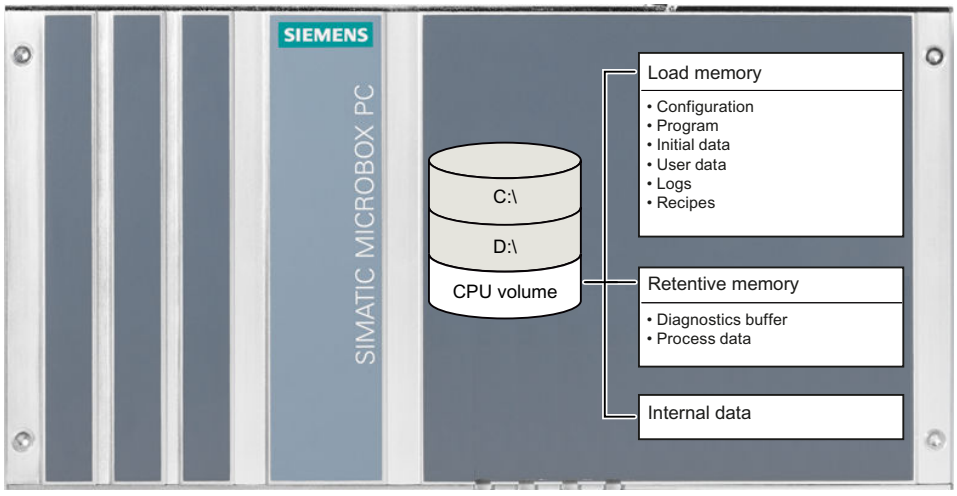



Figure 3-3 Memory division on the PC

### Work memory

The RAM of the PC is used for the work memory. A portion of the RAM memory is allocated exclusively by the SIMATIC hypervisor when the CPU starts. As a result, this RAM memory is available exclusively to the CPU. The work memory is volatile memory that contains the code and data blocks. The work memory is permanently allocated to the CPU and cannot be extended.

### Load memory

The load memory is located in the mass storage of the PC. The CPU volume contains not only the load memory, but also internal configuration data and even retentive data, depending on the configuration. The CPU volume is not assigned to Windows. This ensures operation of the CPU independent of the operating system.

| **NOTICE** |
| --- |
| **Fill level of load memory**<br>Make sure that there is still enough free memory space available in the CPU's load memory. Insufficient load memory space may have the following consequences:<br>• A project cannot be downloaded to the CPU successfully<br>• A CPU does not change into RUN operating state after project download<br>• Retentive data might be lost |

### Retentive memory

Retentive memory is non-volatile memory for saving a limited quantity of data in the event of power failure. Retentive data can be stored in two ways, depending on the resources of the PC:

- In the NVRAM of a PC (if the PC used has this option)
- On the CPU volume

The data defined as retentive is stored in retentive memory. This data is retained beyond a power-off or power failure.

If you are using PC mass storage, use a UPS to ensure a complete backup of the retentive data in case of a power failure.

### NVRAM

When NVRAM is used (on SIMATIC IPCs with this option), the storing of retentive data in the event of a power failure is also possible. The volume of data that can be stored retentively is limited and can depend upon the properties of the PC used.

### CPU memory area

The CPU volume is a partition on the mass storage of the PC used. The CPU volume is already created and has the following contents:

- Load memory
- Configuration data
- Retentive data
  If, in the configuration of category "Retentive memory", you select "PC mass storage", retentive data is saved.
  The selection "PC mass storage" can make the entire data memory retentive. Use a UPS (Page 117) to ensure complete backup of the retentive data in case of a power failure.

**NOTE**

**Enhanced write filter**

The CPU volume cannot be protected by an enhanced write filter (EWF, FBWF or UWF (with Windows 10)).

### Reference

Additional information about the memory structure and the basic meaning of these memory areas can be found in the Function Manual Structure and Use of the CPU Memory (https://support.automation.siemens.com/WW/view/en/59193101/0/en). This documentation also describes how you obtain information about the memory utilization using STEP 7.

## 3.3.2.2 Storage of retentive data

### Introduction

When you stop the Software Controller or a power failure occurs, you can store data retentively:

- In the PC mass storage
- In the onboard NVRAM

The following data is saved:

- The current data from data blocks, bit memory, timers, counters and technology objects that is marked as retentive in the TIA Portal
- Contents of the diagnostics buffer
- Contents of the message buffer
- Current operating mode (RUN/STOP)

The retentive data is stored automatically in the following situations:

- Shutdown of the CPU via the display of the CPU or using command line commands
- Shutdown of the operating system (standard or triggered by a UPS signal)
- Power failure (by using a UPS or NVRAM)

**NOTE**
**Options for storage of retentive data**
For information on the memory type and memory size of your hardware platform, check your PC system's technical specifications.

## Saving in mass storage

The Software Controller has its own CPU volume in the mass storage of your PC. The storage operation is thus independent of the operating system status and enhanced write protection (EWF/FBWF/UWF).

**NOTE**
**Preservation of retentive data when saving in mass storage**
To retain the retentive data of the original configuration, proceed as follows:

1. Copy the mass storage.
2. Start the CPU with the copied data.

When you save the retentive data on the PC's mass storage, the quantity of the retentive data that is to be stored on the mass storage differs from the quantity of memory in NVRAM.

**NOTICE**
**Uninterruptible power supply (UPS)**
A power failure without shutting down the operating system can cause damage to the file structure of the operating system. Use a UPS (Page 117) to protect the file system. You also have the option to activate the enhanced write protection functionalities (EWF/FBWF/UWF) and NVRAM.

**Deleting the data**
In order to delete the data, set the CPU 1515SP PC2 mode selector to STOP. Then select select "Memory reset" in the display settings to start a memory reset.

### Storage in NVRAM

The storage of retentive data in NVRAM protects you from losing important program data after a power failure. The storage in NVRAM has the advantage that the storage process is also possible in case of a sudden power failure. But the storage process with this method depends on the buffer capacity of the power supply of your PC. This reduces the amount of retentive data that can be saved compared to when saving in the mass storage.

**NOTE**

**Availability of NVRAM**

You must order the NVRAM with the SIMATIC IPC hardware. The reference information of the product information includes information on which IPCs support NVRAM.

In TIA Portal, the memory location "PC mass storage" is set by default in the delivery state of the SIMATIC IPC. To utilize NVRAM, you must change the storage location.

### Reference

Additional information on setting the type of storage can be found in section "Setting storage location for retentive data (Page 58)".

Additional information on setting the size of the diagnostic buffer and the retentive areas of bit memories, timers, and counters is available in the STEP 7 online help.

## 3.3.3 Interface types

The list below provides an overview of the interfaces used by your Windows-PC:

- CPU 1505SP:
  - A PROFINET onboard interface of CPU 1515SP PC2.
    Isochronous data exchange via Isochronous Real Time (IRT) is possible.
  - A PROFIBUS interface, plug-in
- CPU 1507S:
  - Two PROFINET interfaces, onboard or plug-in. One interface is IO-compatible.
    If the IPC used has a CP 1625 communications processor, isochronous data exchange over Isochronous Real Time (IRT) is possible.
  - One PROFIBUS interface, onboard or plug-in
- CPU 1508S:
  - Two PROFINET interfaces, onboard or plug-in. Both interfaces are IO-compatible.
    If the IPC used has a CP 1625 communications processor, isochronous data exchange over Isochronous Real Time (IRT) is possible.
  - One PROFIBUS interface, onboard or plug-in

Additional information on the interfaces of the PC used is available in the technical specifications for your device.

## 3.3.4 PROFINET IO

### Properties of PROFINET IO

PROFINET is a fieldbus standard of the PROFIBUS user organization that defines a cross-vendor communication and engineering model.

As part of PROFINET, PROFINET IO is a communication concept that is used to implement modular, distributed applications.

A PROFINET IO system consists of the following PROFINET devices:

- IO controller
  Device used to address the connected IO devices.
- IO device
  A distributed field device that is assigned to an IO controller.

The PROFINET IO controller operating mode enables direct access to IO devices via Industrial Ethernet.

The PROFINET IO device operating mode enables you to operate S7 stations as "intelligent" PROFINET IO devices on Industrial Ethernet.

For this purpose, the CPU uses the PC interfaces that you must assign (Page 54) during configuration.

**NOTE**

**Using the "Prioritized startup" functionality**

If you want to use the "Prioritized startup" functionality in STEP 7 for the PROFINET interface of the CPU 1507S or CPU 1508S, separate the CPU and the device must be separated with the help of a PROFINET switch.

### Reference

You can find additional information on the "PROFINET IO" topic in the STEP 7 online help and in the PROFINET (https://support.automation.siemens.com/WW/view/en/19292127) function manual.

## 3.3.5 PROFIenergy

### PROFIenergy

PROFIenergy (for PROFINET) reduces energy consumption by using PROFIenergy commands during production-free time.

### Additional information

- Function manual: PROFINET
  (https://support.automation.siemens.com/WW/view/en/19292127)
- Additional information on PROFIenergy is available on the Internet (https://www.profibus.com) under Common Application Profile PROFIenergy; Technical Specification for PROFINET; Version 1.0; January 2010; Order no: 3.802.

### 3.3.6 PROFIBUS DP

The PROFIBUS DP interface is used to connect distributed I/O. PROFIBUS DP allows you to create extensive subnets, for example.

PROFIBUS is the fieldbus network for the cell and field areas. PROFIBUS is physically implemented either as an electrical network based on shielded twisted-pair cables, or as an optical network based on fiber-optic cable.

Data transfer via PROFIBUS DP provides a standardized interface (EN 50170 Vol. 2) for the transfer of process input and process output data between SIMATIC S7 and field devices (DP devices).

Cyclic data exchange between a DP master and DP devices is a characteristic of data transfer via PROFIBUS DP.

A DP system based on the PROFIBUS DP standard (EN 50170 Vol. 2) provides the DP master device. A device of this function class handles the actual control task. The device sends and receives process input and process output signals.

When in master mode, the CPU sends its configured bus parameters on the PROFIBUS DP interface. This means, for example, that a programming device can obtain the correct parameters so that the CPU can go online with the PG without any further settings. You can activate/deactivate the transmission of the bus parameters in the configuration. As default, the CPU sends the bus parameters.

#### Properties of the PROFIBUS DP interface

The PROFIBUS DP interface provides the following properties and functions:

- PROFIBUS DP master
- PROFIBUS DP device
- Time-of-day synchronization
- S7 services

**NOTE**

**Engineering functions**

Engineering functions (load project, online functions) are not possible over the PROFIBUS interface assigned to the CPU 1507S or CPU 1508S.

**Diagnostic repeater**

The CPU 1507S and CPU 1508S does not support the diagnostic repeater and the associated DP_TOPOL block for topology detection for a selected DP master system.

**Data record routing**

The CPU 1507S and CPU 1508S does not support data record routing.

**HART modules with PROFIBUS**

The Software Controller does not support HART modules at the PROFIBUS interface.

**NOTE**

**Configuring PROFIBUS DP interface**

When configuring the address of the Software Controller PROFIBUS DP interface in TIA Portal, do not use Address 0 but use one of the addresses offered in the drop-down list (Addresses 1 to 126).

### Reference

You will find additional information on "PROFIBUS DP" in the STEP 7 online help and in the PROFIBUS with STEP 7 (https://support.automation.siemens.com/WW/view/en/59193579) function manual.

## 3.3.7 Central I/O

Centralized I/O are available when you use CPU 1505SP on CPU 1515SP PC2. You can use any commonly used ET 200SP input and output modules with the CPU.

## 3.3.8 Web server of the CPU

The CPU has an integrated Web server that enables, among other things, the display of system diagnostics information via PROFINET.

You use an Internet browser on any web client, such as a PC, multi panel, or smartphone, to access:

- Module data
- User program data
- Diagnostics data of the CPU

The Web server can only be configured using STEP 7. The following options are available for accessing the Web server of the CPU:

- Web browser on the same PC
- Web browser on an external device using (virtual) Ethernet interfaces
- Web browser on an external device using the assigned PROFINET interfaces

Access to the Web server is described in the section "Configuring the Web server (Page 65)".

### Benefits of the Web server

The Web server enables monitoring and administering of the CPU by authorized users over a network. This enables long-distance evaluations and diagnostics. Monitoring and evaluation is possible without STEP 7; all you need is a web browser. Make sure that you protect the CPU from being compromised through the use of different methods (for example, limiting network access, using firewalls (Page 152)).

### Web browser

You need a web browser to access the HTML pages of the CPU. The following web browsers have been tested for communication with the CPU:

- Internet Explorer (Version 11.0)
- Microsoft Edge (Version 100.0)
- Mozilla Firefox (Version 90.0)
- Google Chrome (Version 100.0)
- Opera (Version 85.0)
- Mobile Safari und Chrome for iOS (Version 12.5.1)
- Android Browser (Versions 7.x, 8.x and 10.x)
- Chrome for Android (Versions 7.x, 8.x and 10.x)

### Specific websites for the Software Controller

The functionalities of the Web server apply to all CPUs of the S7-1500 automation system. The Software Controller has the following special features:

- "Start page" web page
  The start page before the login provides general information about the CPU.
  The "Start page" web page also reflects the position of the mode selector. When the Software Controller is on a hardware platform that does not have a physical mode selector, the switch position of the mode selector always shows RUN mode in the Web server. When the Software Controller is working on a hardware platform that has a physical mode switch, the position of the mode switch always shows the current operating state of the hardware platform in the Web server.
- "Identification" web page
  The "Identification" web page gives you an overview of important specifications of the CPU.

### Reference

You can find additional information about the Web server in the Web Server Function Manual (https://support.automation.siemens.com/WW/view/en/59193560).

## 3.3.9 Technical details of the PC Station

The Software Controller is one of multiple components in a PC Station. You can select all external communication partners over the PC interfaces.

Each component has a unique index for communication within the PC Station and for receiving configuration data.

The Softbus takes over control of communication. For this purpose, the index for each component is stored in the Softbus after booting the PC.

If you change the index of the CPU manually, the CPU and all communication partners must be loaded again. The Softbus applies the new index which guarantees clear communication.

For information on loading the PC Station with a configuration file, refer to "Loading PC Station with file (Page 72)".

## 3.3.10 Fail-safe

### Areas of application

The F-CPU is mainly designed for personal and machine protection and burner controls. In addition to the safety program, you can also program standard applications.

You can operate the F-CPU in safety mode or in standard mode.

Information on using the F-CPU in safety mode is available in the programming and operating manual "SIMATIC Safety - Configuring and Programming (https://support.automation.siemens.com/WW/view/en/54110126)".

You can find additional information on the F-CPU in the Product Information for F-CPUs (https://support.industry.siemens.com/cs/document/109478599/simatic-s7-1200-s7-1500-f-cpus?dti=0&lc=en-WW).

When you load a project with fail-safe functionality to the CPU, it is shown on the display.

## Display

The status bar of the display shows the status of the safety mode.




Figure 3-4 Status bar

| | |
|---|---|
| | Safety mode activated |
| | Safety mode deactivated |

The display shows you the following in the "Overview" menu under "Fail-safe":

- Safety mode activated/deactivated
- Collective F-signature
- Last fail-safe change
- The version of *STEP 7 Safety* with which the safety program was compiled.
- Information on the F-runtime groups
  - Name of the F-runtime group
  - F-runtime group signature
  - Current cycle time
  - Maximum cycle time
  - Current runtime
  - Maximum runtime

The following is displayed for each F-I/O under "Fail-safe parameters":

- F-parameter signature (with address)
- Safety mode
- F-monitoring time
- F-source address
- F-destination address

The following additional menu command is displayed in the "Settings" menu under "Protection":

- Enable/disable F-password

Write access to F-blocks is not permitted.

**NOTE**

Controlling fail-safe inputs/outputs can result in an F-CPU STOP.

You can find detailed information on the individual display options, a training course and a simulation of the selectable menu commands in the SIMATIC S7-1500 Display Simulator (https://support.industry.siemens.com/cs/ww/en/view/109761758).

## Web server

On the start page, the Web server displays the following under "General:"

- The version of STEP 7 Safety with which the safety program was compiled.

On the start page, the Web server displays the following under "Fail-safe:"

- Safety mode activated/deactivated
- Collective F-signature
- Last fail-safe change

On the "Module information" web page, the following is displayed under "Details" of the respective fail-safe I/O in the "Safety" tab:

- F-parameter signature (with address)
- Safety mode
- F-monitoring time
- F-source address
- F-destination address

Write access to F-blocks is not permitted.

**NOTE**

Controlling fail-safe inputs/outputs can result in an F-CPU STOP.

You can find additional information about the "Web server" topic in the Web Server Function Manual.

# Installing

# 4

## 4.1 Delivery forms of the CPU

The CPU is delivered in different variants with different article numbers.
CPU 1505SP is pre-installed on CPU 1515SP PC2
(the CPU 1505SP Software Controller cannot be ordered separately, but only in a bundle together with the hardware)
Install the CPU 1507S/CPU 1508S on a SIMATIC IPC. This SIMATIC IPC must meet the system requirements.
The following table shows which CPUs can be installed on which IPCs:

| | CPU 1507S | CPU 1507S F | CPU 1508S | CPU 1508S F |
|---|---|---|---|---|
| **IPC227E** | ✓ | ✓ | -- | -- |
| **IPC277E** | ✓ | ✓ | -- | -- |
| **IPC427D** | ✓ | ✓ | -- | -- |
| **IPC477D (PRO)** | ✓ | ✓ | -- | -- |
| **IPC427E** | ✓ | ✓ | ✓ | ✓ |
| **IPC477E (PRO)** | ✓ | ✓ | ✓ | ✓ |
| **IPC627D** | ✓ | ✓ | ✓ | ✓ |
| **IPC827D** | ✓ | ✓ | ✓ | ✓ |
| **IPC677D** | ✓ | ✓ | ✓ | ✓ |
| **IPC647D** | ✓ | -- | ✓ | -- |
| **IPC847D** | ✓ | -- | ✓ | -- |
| **IPC627E** | ✓ | ✓ | ✓ | ✓ |
| **IPC647E** | ✓ | ✓ | ✓ | ✓ |
| **IPC847E** | ✓ | ✓ | ✓ | ✓ |
| **IPC677E** | ✓ | ✓ | ✓ | ✓ |

✓ installation is possible

-- installation is not supported

For reference information on the SIMATIC IPCs, see chapter Reference information for use with SIMATIC IPC (Page 166).

## 4.2 System requirements

In order to use the CPU, your system must meet the following requirements:

| Category | Requirement |
|---|---|
| Operating system | Windows 7 systems:<br>• Microsoft Windows 7 Ultimate, Professional, or Enterprise<br>• Microsoft Windows Embedded Standard 7 SP1<br>Note: Before you install the Software Controller update, install a new root certificate first. You will find a description on how to install the root certificate in chapter Update from a version <21.9.7 to 21.9.7 (Page 43).<br>Windows 10 systems:<br>• Microsoft Windows 10 Enterprise LTSB 2016<br>• Microsoft Windows 10 Enterprise LTSC 2019 (on IPC2x7E, IPC4x7E, IPC6x7/8x7E) |
| | **Note:** Windows error handling features like recovery options, advanced startup settings, chkdsk, memory diagnostics, antivirus offline scan or similar may only be used after the PC has been restarted in "Windows only" mode.<br>For more information on how to start the system in "Windows only" mode, see chapter Restarting Windows (Page 136). |
| Processor and memory | PC system:<br>• Systems with dual core processor, at a minimum<br>• 1.2 GHz or higher<br>• RAM memory:<br>– For CPU 1507S, at least 4 GB (32-bit and 64-bit operating systems)<br>– For CPU 1508S, at least 8 GB (64-bit operating system)<br>• BIOS must support plug-and-play (ACPI, Advanced Configuration and Power Interface)<br>**Note:** Hyperthreading systems are also supported. |
| Mass storage | • 1.6 GB free storage space on mass storage for full installation including:<br>– PC Station<br>– Automation License Manager<br>– SIMATIC device drivers<br>– .net Runtime<br>• 500 MB of temporary hard disk memory<br>• CPU 1507S:<br>401 MB of unpartitioned storage space for the CPU volume, or 450 MB of free storage space on the unencrypted hard disk D<br>• CPU 1508S:<br>1 GB for the CPU volume<br>**Note:** We recommend use on a file system of the NTFS type. The CPU cannot be operated in a mass storage with RAID technology.<br>The setup program needs at least 430 MB of free memory on drive C: (the setup files are deleted again after installation is complete). |
| Operator interface | Color monitor, keyboard and mouse or other pointing device (optional) that are supported by Windows |
| Communication interface | One or more communication interfaces for communication with STEP 7 or other S7 applications, or for communication with distributed I/O |
| Supported platforms | CPU 1515SP PC2 or SIMATIC IPC; see Reference information for use with SIMATIC IPC (Page 166). |

| Category | Requirement |
|---|---|
| BIOS settings | **Disabling memory test in the BIOS**<br>PCs provide the option of a memory test. Some hardware tests, such as the memory test, are disabled by default in the BIOS setup program and are skipped during startup of the PC. This speeds up the boot process.<br>If you are using the CPU on a SIMATIC IPC, the BIOS memory test should not be enabled.<br>**Deactivating energy-saving modes**<br>The following BIOS settings are recommended on IPCs with installed CPU:<br>• C-states deactivated<br>• P-states deactivated<br>**Disabling booting from external media**<br>The Hypervisor does not automatically prevent booting from external media.<br>**Overclocking**<br>We recommend not to install the CPU in systems in which one of the following technologies is activated:<br>• Intel Turbo Boost<br>• Intel Speed Shift<br>• Intel SpeedStep<br>These technologies can influence the real-time behavior of the CPU. We recommend that you disable these technologies.<br>For additional BIOS settings required for IPC647E, IPC847E, IPC627E and IPC677E, see section Reference information for use with SIMATIC IPC (Page 166). |

**NOTE**

**Fail-safe version**

For fail-safe IPCs supporting UEFI (IPC6x7E/8x7E), NVRAM is not a prerequisite.

**NOTE**

**NTFS compression**

If you use the Software Controller, NTFS compression must not be enabled for the following folders:

- C:\Boot\Grub2 with all included files
- C:\Boot\Siemens

**Recommended splitters for CPU 1505SP (F)**

The following display and HDMI splitters are recommended for the CPU 1505SP (F):

- Display splitter: Multi Stream Transport (MST) Hub DisplayPort™ 1.2 Quad Monitor CSV-5400
- HDMI splitter: Delock Display Port 1.2 Splitter 87720

**NOTE**

**IWLAN/PB-Link**

The Software Controller does not support the "IWLAN/PB-Link" functionality.

# 4.3 Creation of the CPU volume

## Introduction

The CPU makes use of the mass storage of the PC on which it is installed. During the installation, a discrete CPU volume is created in the mass storage, in which all CPU data is stored. The load and retentive memories are integrated into this CPU volume.

**NOTE**

**Size of the CPU volume**

To ensure reliable operation of the CPU, the CPU volume must not be reduced during operation. If you reduce the assigned mass storage area, this can lead to data loss or even a CPU crash.

## Requirement for creation of a CPU volume

The allocation and formatting of the CPU volume is carried out automatically during the installation process. The following requirements must be met:

- For IPC227E, IPC277E, IPC427D, IPC477D (PRO), IPC427E, IPC477E (PRO), IPC627D, IPC827D, IPC677D, IPC647D, IPC847D the partition style must be a "Master Boot Record (MBR)". For IPC647E, IPC847E, IPC627E, IPC677E the partition style must be a "GUID Partition Table (GPT)".

  You can find the partition style in the "Volumes" tab under "Computer Administration > Data storage medium management > Properties of the data storage medium".
- For CPU 1507S one of the following requirements:
  - At least 401 MB of unpartitioned memory on the hard drive
  - At least 401 MB available memory on the expanded partition on the hard drive
  - At least 450 MB available memory on the unencrypted drive D:
- For the CPU 1508S:
  - At least 1301 MB of unpartitioned memory on the hard drive
  - At least 1301 MB available memory on the expanded partition on the hard drive
  - At least 2400 MB available memory on the unencrypted drive D:

## Result

The CPU volume is created automatically as part of the installation process.

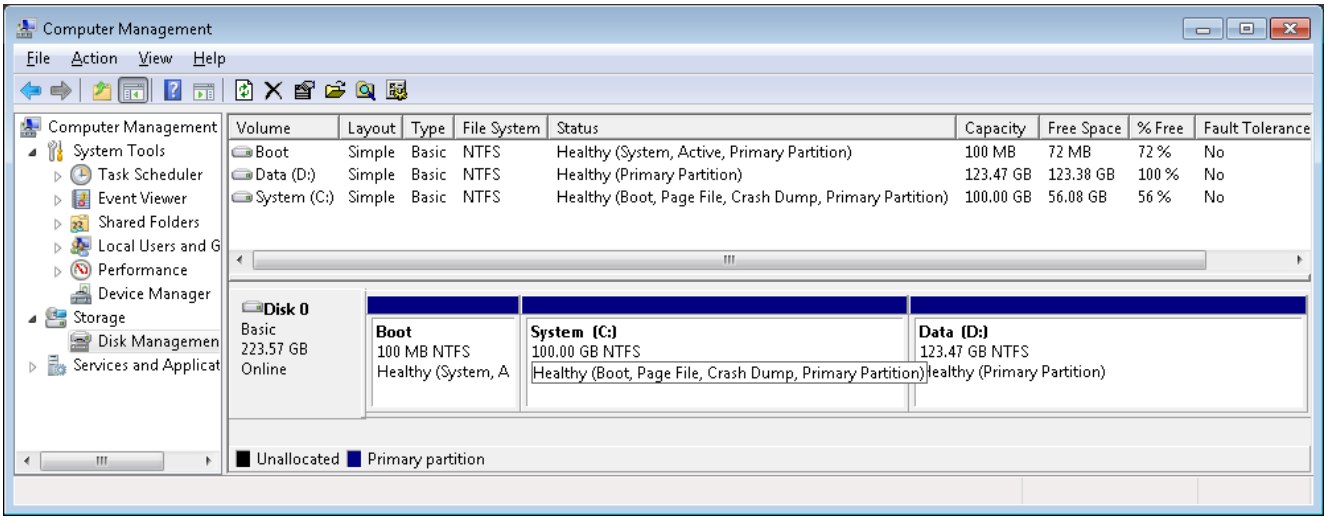
### Manual creation of the CPU volume

If the CPU volume cannot be created automatically, you have the following options available:

- The installation process outputs a message that provides you the opportunity to manually adapt the partitioning structure of the mass storage device. Alternatively, you can cancel the installation process at any time.
- You must remove files from partition D: because there is not enough memory space available to perform the partitioning of the hard drive.
- You must manually decrypt partition D:.

## 4.4 Partitioning prior to installation

The graphic below provides an overview of how the partition is ideally allocated on your PC prior to the installation of the CPU. To access this view, open the Disk Management in the Computer Management of your PC.




### 4.4.1 Installation on PC systems with MBR partitioning and 4 primary partitions

Windows with Legacy Boot (MBR partitioning) supports a maximum of 4 primary partitions. If more than three primary partitions are already set up on the mass storage device on which you want to install the Software Controller, you cannot create a CPU volume. Installation is not possible in this case.

Four primary partitions may exist for the following reasons:

- A retentive partition already exists for WinCC RT Advanced.
- A Software Controller was already installed on the system. The old CPU volume is not automatically deleted when uninstalled. In this case, delete the old CPU volume (RAW partition) manually.

You have the following options to install the CPU in such a case:

- Instead of the fourth primary partition create an extended partition of sufficient size. You can set up multiple logical partitions or drives on this extended partition, for example, the retentive partition for WinCC RT Advanced.
- Leave enough unpartitioned space available on the logical partition to set up the CPU volume.

### 4.4.2 Installation on PC systems with more primary partitions (using GPT)

IPC647E, IPC847E, IPC627E and IPC677E support UEFI (Unified Extensible Firmware Interface) and GPT (GUID Partition Table) partitioning schemes.

GPT is an advanced partitioning scheme on mass storage devices. The software controller recognizes mass storage devices partitioned with MBR and mass storage devices partitioned with GPT. GPT allows you to add as many Windows partitions as needed without having to configure extended partitions. The number of partitions is only restricted by the operating system (e.g. Windows supports a maximum of 128 partitions).

## 4.5 Overview of the Installation Tasks

You need administrator rights on your PC to install the CPU software.

**NOTE**

**Installation with multiple hard disks**

Install the CPU software on the same hard disk on which the operating system is installed.

### Requirement

Observe the following requirements for the installation:

- Your PC must meet the system requirements (Page 33).
- You must have Windows administrator (ADMIN) rights.
- DiagBase V01.05.02 or higher or DiagMon V04.05.00 or higher is recommended on your PC.
- The CPU cannot be installed on encrypted drives.

**NOTE**

Set the Windows time to the current time.

**NOTE**

**Recommended energy savings plan**

To guarantee the real-time behavior of your CPU, make sure that you are using one of the following energy saving plans set by default on your PC:

- CPU 1505SP: "SIMATIC S7" energy savings plan
- CPU 1507S/1508S: "SIMATIC IPC" energy savings plan

Do not select the "Balanced" setting recommended by Windows.

**Effect of the installation on the power saving settings of the PC**

The CPU does not allow the use of "Hibernate" or "Standby" of the operating system.

Even if your PC supports these power saving settings, they will be disabled by default after installation of the Software Controller.

## Procedure

To perform the installation properly, follow these steps:

1. Deactivate the enhanced write filter EWF, FBWF or UWF (with Windows 10).
2. If a virus scanner is installed, disable it for the installation.
3. Ensure that you have an earlier version of S7-1500 Software Controller V21.9 (<21.9.7) already installed.
   If a PC Station is installed on the IPC in a standalone setup, uninstall that station first.

   **NOTE**
   **IntervallZero RTX**
   When uninstalling WinAC RTX, IntervallZero RTX is not automatically deleted by the system.
   Uninstall IntervallZero RTX before you install the software controller.

4. Configure your PC according to the Reference information for use with SIMATIC IPC (Page 166) section and check if all conditions prior to installation are met.
5. Install the CPU software on the same hard disk on which the operating system is installed.
6. License the installation (Page 47) with the Automation License Manager.

**NOTE**
**Data loss**
An uninstallation or repair of the CPU deletes the STEP 7 user program on the controller, the configurations as well as the retentive data and all settings changed by you from the display of the CPU.

**NOTE**
**Effect of the installation on existing ODK directories**
The default value that describes the file path is:
%ProgramData%\Siemens\Automation\ODK1500S\
The SIMATIC S7-1500 Software Controller setup checks whether the file path already exists and the necessary administrator rights are stored.
If this is not the case, the directory is renamed to "ODK1500S_OLD1" or "ODK1500S_OLD2", and a new directory with the correct access rights is created.

### Users of the external NVIDIA graphics card

To prevent the NVIDIA graphics card from influencing the real-time behavior of the CPU, we recommend that you use the power management mode "Prefer consistent performance":

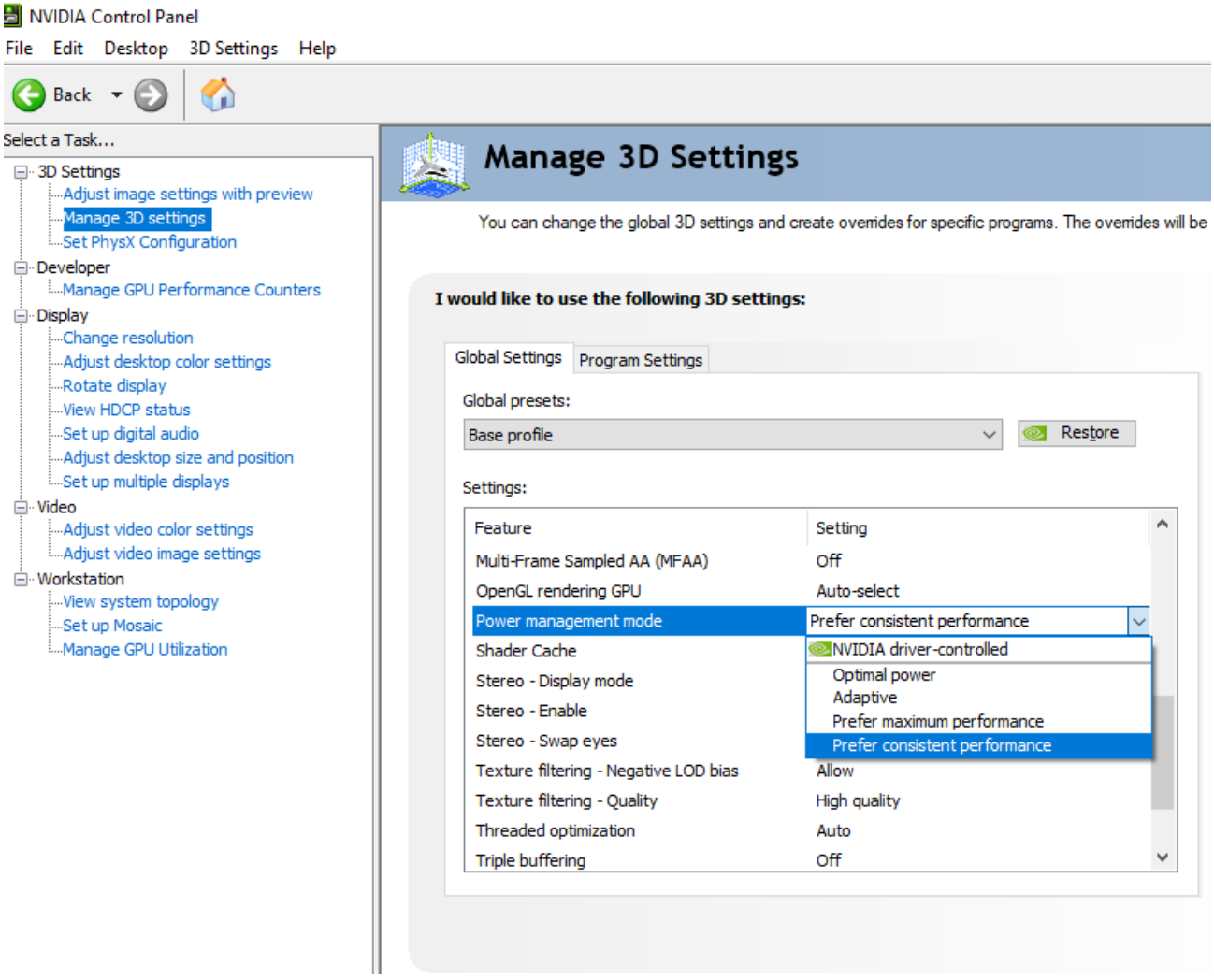



Figure 4-1 NVIDIA power management

**NOTE**

**Using NVIDIA AI cards**

Note that the following NVIDIA AI card is not supported:

AI Unit NVIDIA A2

## 4.6 Installing the Software Controller via Online Software Delivery

### Requirements

To download the software as a data packet from the Online Software Delivery (OSD) platform, enter the e-mail address to which the download link is to be sent when you place the order. You will then receive a download notification e-mail. The e-mail contains a link to the Online Software Delivery (OSD) platform.

### Procedure

1. Log in to Online Software Delivery using your login name and personal password. (You will find your access data in the download notification email)
2. Follow the download and license procedure.
   For detailed information on the Online Software Delivery (OSD) and download procedure, visit Online Software Delivery (OSD) (https://support.industry.siemens.com/cs/ww/en/view/109759444).

### Result

Depending on your purchase, the following installation files are available.

| CPU | Article number | File |
|---|---|---|
| 1507S | 6ES7672-7AC01-0YG0 | SIMATIC_CPU_1507S_V21.9.exe |
| 1507S F | 6ES7672-7FC01-0YG0 | SIMATIC_CPU_1507SF_V21.9.exe |
| 1508S | 6ES7672-8AC01-0YG0 | SIMATIC_CPU_1508S_V21.9.exe |
| 1508S F | 6ES7672-8FC01-0YG0 | SIMATIC_CPU_1508SF_V21.9.exe |

Transfer these files to your target system, e. g. with a USB stick, and execute the files to install the CPU.
For the installation, follow the installation procedure as in Installing the Software Controller via DVD (Page 40).
For a description on how to update to V21.9.7, see chapter Update from a version <21.9.7 to 21.9.7 (Page 43).

## 4.7 Installing the Software Controller via DVD

In order to install the software CPU, insert the installation DVD. Follow the instructions of the setup program.
If the setup program does not start automatically, manually start the "Start.exe" file by double clicking it.
If you are logged in with an account that does not have administrator rights, run the "Start.exe" file using the "Run as administrator" shortcut menu command.

**NOTE**
**Update version**
Note that V21.9.7 is only available via Online Software Delivery (OSD).

## Procedure

To install the Software Controller, follow these steps:

1. If a Software Controller is already installed, start the PC in the "Windows and CPU 150xS" mode and power off the Software Controller using the display.
2. Execute the installation of the Software Controller.

   **NOTE**

   **AHCI disk mode**

   For IPC647E, IPC847E, IPC627E and IPC677E, SATA mode = AHCI is required.

   If AHCI is not selected in your BIOS settings, only change the BIOS settings to AHCI during the setup. If this mode is selected in the BIOS, the setup will issue a reboot. For the setup to continue, enter the BIOS Editor during reboot and change the BIOS settings as follows:

   Advanced→PCH-IO Configuration→SATA and RST Configuration→SATA Mode Selection=**AHCI**

   A detailed description of how to change to AHCI is given in section Reference information for use with SIMATIC IPC (Page 166).

3. Select the language for performing the installation.

   **NOTE**

   **Chinese as installation language**

   To display Chinese as an installation language correctly, install the Chinese font first.

4. Read the product information.
5. Confirm with "Next".
   This installation continues.
6. Select the components to be installed in the list.
   Select an installation path.
7. Continue to follow the instructions, which guide you through the installation.
8. Choose whether you want to carry out the licensing (Page 47) during the installation or at a later time.
9. Confirm the installation dialog with the "Install" button.
10. Restart the PC after successful completion of the installation.

**NOTE**

**Installed files**

We recommend that you do not change the access rights to the installed files.

**Windows restart after installation**

Windows is usually restarted after installation of the Software Controller. If Windows updates are installed during installation of the Software Controller, these can prevent the final restart. A manual restart is necessary in such a case.

If you cannot start the Software Controller via the display, for example, restart Windows manually.

**Result**

The installation is complete. During the installation process, all product languages have been installed by default. The installation creates an entry in the Windows Start menu.
The following options appear in the boot menu when the PC is restarted, which you can choose between:

- **Windows**
  Windows is assigned all hardware resources; the hypervisor and therefore the Software Controller are not started.
- **Windows and S7-1500 Software Controller**
  Windows starts normally and you can open the display in "Power off" mode. Switch on the Software Controller using the "Power" button. The Software Controller starts in "STOP" mode.

**NOTE**

If you do not select one of the two options within five seconds, the PC starts with the option "Windows and S7-1500 Software Controller" by default.

## 4.8 Scripted installation without user interaction

To install the Software Controller without user interaction, proceed as follows:

1. Download the software as a data packet from the Online Software Delivery (OSD) platform or insert the installation DVD.

   **NOTE**
   **Installation of updates**
   Note that updates (e.g. 21.9.7 are only provided via Online Software Delivery (OSD).

2. Execute the downloaded executables and enable the option "Extract the setup files without being installed".
   The setup objects are extracted to a local temporary folder where a silent installation script is also available.
3. Run the "SilentInstall_CPU150xS.bat" file as an administrator.
   When the script runs, the Software Controller installation screen is shown without any selectable option. The script starts the installation directly. The installation language equals the operating system’s language. If the operating system's language is not supported, English will be used. After the installation finishes, the installation window closes automatically. A shortcut to the Software Controller is created on the desktop.
4. Reboot the system manually.

# 4.9 Upgrades and updates

### Definition of upgrade and update

For the Software Controller and Open Controller, we differentiate upgrades and updates.

Upgrades include new features and functionality, for example when upgrading from V21.8 to V21.9.

Updates include minor changes such as bug fixes and performance improvements, for example when updating from V21.9.4 to V21.9.7.

The following chapter describes the rules, behavior and known issues when updating/upgrading between different versions.

## 4.9.1 Update from a version <21.9.7 to 21.9.7

### Requirements

- You have disabled the write filters (EWF, FBWF or UWF) under Windows.
- You have installed a new root certificate (for Windows 7 systems).
  You will find an instruction on how to install the root certificate at the end this chapter.
- You are logged in with administrator rights on the target system.
- You have downloaded the suitable setup file for the installed version.

### Where to find the update

You can find the updates via the following links.

- Software Controller: Updates for SIMATIC S7-1500 Software Controller (https://support.industry.siemens.com/cs/ww/en/view/109478528)
  Depending on your purchase, the following installation files are available.

| CPU | File name |
|---|---|
| 1507S | SIMATIC_CPU_1507S_V21_9_Upd7.exe |
| 1507S F | SIMATIC_CPU_1507SF_V21_9_Upd7.exe |
| 1508S | SIMATIC_CPU_1508S_V21_9_Upd7.exe |
| 1508S F | SIMATIC_CPU_1508SF_V21_9_Upd7.exe |

Transfer these files to your target system, e. g. with a USB stick.

- Open Controller: Updates for SIMATIC ET 200SP Open Controller (CPU 1515SP PC / PC2) Software Controller (https://support.industry.siemens.com/cs/ww/en/view/109759122)
  Depending on your purchase, the following installation files are available.

| CPU | File name |
|---|---|
| 1505SP | SIMATIC_CPU_1505SP_V21_9_Upd7.exe |
| 1505SP F | SIMATIC_CPU_1505SPF_V21_9_Upd7.exe |
| 1505SP T | SIMATIC_CPU_1505SPT_V21_9_Upd7.exe |
| 1505SP TF | SIMATIC_CPU_1505SPTF_V21_9_Upd7.exe |

  Transfer these files to your target system, e. g. with a USB stick.

**NOTE**

**Update rules**

The Software Controller supports updates from any 21.9.x version to V21.9.7.

## Update to Software Controller V21.9.7

To update the Software Controller to version 21.9.7, follow these steps:

1. If the system is running in "Windows and CPU150xS" mode, then power off the Software Controller using the panel.
2. Start the installation of the new CPU version.
3. Reboot the PC.

**NOTE**

**PC Station installed on an IPC in a standalone setup**

For an update from V21.9 or V21.9.4 to version 21.9.7 it is not necessary to manually uninstall the PC Station.

**NOTE**

**Installing the Software Controller update on IPCs running Windows 7**

IPCs running the following Windows 7 operating systems no longer receive updates:

- Microsoft Windows 7 Ultimate, Professional and Enterprise
- Microsoft Windows Embedded Standard 7 SP1

Before you install the Software Controller update, install a new root certificate first. To install the root certificate, proceed as follows:

1. Download the root certificate from the following link (https://cacerts.digicert.com/DigiCertTrustedRootG4.crt).

   For more information on the root certificate, see the following link (https://www.digicert.com/kb/digicert-root-certificates.htm).
2. Open a command prompt with elevated administrator rights and execute the following command:

   CertUtil.exe -AddStore -f "Root" "CertificateLocationandName", for example:

   CertUtil.exe -AddStore -f "Root" "D:\Certificate\DigiCertTrustedRootG4.crt"

## Result

After the update is completed, no configuration or retentive data will be lost.

## 4.9.2 Upgrade to V21.9

### Requirements

- You have disabled the write filters (EWF, FBWF or UWF) under Windows.
- You are logged in with administrator rights on the target system.
- You have downloaded the suitable setup file for the installed version.

### Upgrade to Software Controller V21.9

To upgrade the Software Controller to version 21.9, follow these steps:

1. If the system is running in "Windows and CPU150xS" mode, then power off the Software Controller using the panel.
2. Start the installation of the new CPU version.
3. Reboot the PC.

**NOTE**

**Known issue when upgrading from V2x.y to V21.9**

In "Windows and CPU 150xS" mode, upgrading from 20.8 to 21.9 or 21.8 to 21.9 may lead to a blue screen during system reboot. However, the installation is carried out correctly.

If Windows does not recover from the blue screen, restart the PC. Afterwards, you can use the upgraded version as expected.

**NOTE**

**Recommendation after upgrading from V20.8 or V21.8**

We strongly recommend that you update to the latest 21.9 version after upgrading from V20.8 or V21.8.

### Result

After the upgrade is completed, no configuration or retentive data will be lost.

## 4.10 Licensing the software controller

The software requires a product-specific license key that you install with the Automation License Manager. Each SIMATIC software product for automation (e.g. STEP 7) has its own license key. You must install the license key for each product.

You do not require a license key for CPU 1505SP and CPU 1505SP F.

### Working with the Automation License Manager

The Automation License Manager is a product of Siemens AG and is used for managing license keys. The Automation License Manager is supplied on the installation data medium of the software controller by default and is transferred automatically during the installation process.

Software products that require license keys for operation register the requirement for license keys automatically in the Automation License Manager. If the Automation License Manager finds a valid license key for this software, the software can be used according to the conditions of use associated with this license key.

### Certificate of license

A Certificate of License is included in the scope of delivery. The Certificate of License contains your unique license number that matches the license number of the license key. The license certificate serves as proof that you have a valid license key. Keep this certificate in a safe place that is easily accessible from the platform on which the Software Controller is running.

**NOTE**

**Resellers**

Note that resellers must deliver the Certificate of License together with the purchased solution or machine.

**NOTE**

**Obtaining a replacement license key**

You must have a valid Certificate of License to get a replacement license key.

The Certificate of License of e.g. Version 3.0 also allows the operation of a CPU Version 20.8, 21.8 or 21.9.

### License key

The license key for the CPU is located on a USB device that is included in the scope of delivery. If you obtain the software via a download, the license key is provided using the download link.

The license key of Version 2 (or higher) is valid for V21.9.

If the USB device with the license key is lost or damaged, contact your Siemens representative (https://www.siemens.com/automation/service&support). You need the Certificate of License to receive a replacement license key from Siemens.

## Transferring the license key

The license key can be transferred during the installation or afterwards.

**NOTE**

The license key must be installed on a file system of the type NTFS.

If the USB device with the relevant license key is inserted in the USB port of the PC at the start of installation, the license key will be transferred automatically during the installation. If necessary, the following options are available for installing the license key subsequently:

- To transfer the license key **manually** from a network computer or other storage medium, select the "Manual license transfer" button.
- Insert the USB device with license key, and select the "Retry license transfer" button. The Automation License Manager opens to transfer the license key.

If you do not want to install a license key for the time being, select the "Skip license transfer" button.

**NOTE**

**Working with the CPU without a license key**

For legal reasons, a valid license key is required for this product.

If no license key is present on your PC, the CPU will continue running. However, a message will inform you at regular intervals that a valid license key has not been found.

## Manually transferring the license key subsequently

When you start the CPU without a transferred license key, a message is displayed on the screen. Ensure that the Automation License Manager is installed on your computer.

To **manually** transfer the license key for the CPU subsequently, use one of the following two possibilities:

1. Transfer the license locally via the Automation License Manger from an USB device.
2. Transfer the license remotely via the Automation License Manger over the network.

For a detailed description on how to transfer licenses, refer the Automation License Manager (https://support.industry.siemens.com/cs/ww/en/view/102770153).

## Recovering the license key in case of defective mass storage

If an error has occurred on the mass storage or USB flash drive containing your license key file, contact your Siemens representative (https://www.siemens.com/automation/service&support). Make sure you have your Certificate of License available when you contact the hotline.

## 4.11 Uninstalling the software controller

### Procedure

To uninstall the software CPU on your PC, follow these steps:

1. In the "Control Panel > Programs > Uninstall program" menu, select the entry "SIMATIC CPU 1505SP", "SIMATIC CPU 1507S" or "SIMATIC CPU 1508S".
   A dialog for the uninstallation opens.
2. Select the CPU.
3. Follow the rest of the steps for the uninstallation.
4. Restart the PC system.

**NOTE**

**Uninstallation when the CPU display is open**

When you uninstall the CPU, the CPU display is closed automatically if it was still open.

### Result

The software for the CPU and the CPU display are uninstalled. The CPU volume is formatted, CPU-specific data and links are deleted.

The CPU volume is formatted but is retained. In case of a new installation, the CPU volume is reused.

The Automation License Manager is not uninstalled automatically with the uninstallation of the software for the CPU. If necessary, uninstall the Automation License Manager separately.

# Commissioning

# 5

## 5.1 Introduction

This section describes the configuration example of a STEP 7 project with a CPU 1507S/1508S on a SIMATIC IPC.

**NOTE**

**Special features with a CPU 1505SP**

If you add a CPU 1515SP PC2, the configuration steps are different (Page 86).

**PLCSIM**

PLCSIM cannot simulate any SIMATIC Software Controller projects.

### Requirement

You can use your project that you created with an older firmware version with a newer software controller version. The table below shows the compatibility between the versions:

| TIA version | Selected firmware version of the config-uration | SWCPU Software version on the target device | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | V1.7 | V1.8 | V2.0 | V2.1 | V2.5 | V2.6 | V2.7 | V20.8 | V21.8 | V21.9 | V30.0 |
| V13 SP1 to V14 SP1 | CPU V1.7 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| V13 SP1 to V14 SP1 | CPU V1.8 | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| V14 | CPU V2.0 | -- | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| V14 SP1 | CPU V2.1 | -- | -- | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| V15 HSP | CPU V2.5 | -- | -- | -- | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| V15 SP1 | CPU V2.6 | -- | -- | -- | -- | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| V15.1 HSP | CPU V2.7 | -- | -- | -- | -- | -- | -- | ✓ | ✓ | ✓ | ✓ | ✓ |
| V16 | CPU V20.8 | -- | -- | -- | -- | -- | -- | -- | ✓ | ✓ | ✓ | ✓ |
| V16 HSP | CPU V21.8 | -- | -- | -- | -- | -- | -- | -- | -- | ✓ | ✓ | ✓ |
| V17 | CPU V21.9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | ✓ | ✓ |
| V18 | CPU V30.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | ✓ |

✓ = compatibility

-- = no compatibility

### Configuration steps

The following steps summarize the configuration and link to the sections where these steps are explained in detail:

1. Configuring IPC (Page 51)
2. Adding software controller to configuration (Page 52)
3. Assigning interfaces for communication (Page 54)
4. Changing index (Page 58)
5. Setting storage location for retentive data (Page 58)
6. Using hardware LEDs (Page 60)
7. Configuring startup (Page 62)
8. Synchronizing time according to Windows clock (Page 63)
9. Configuring Web server for use under Windows (Page 65)
10. Downloading project to target system (Page 68)

## 5.2 Configuring IPC

For an error-free download, the following must match:

- The PC type on which the software controller is installed with the configured PC type from the hardware catalog
- The interface configuration of the IPC

# 5.3 Adding software controller to configuration

## Requirement

- You have created a project in STEP 7 with a SIMATIC IPC for the CPU 1507S/1508S.
- You are in the device view.

## Procedure

To create a configuration in STEP 7, follow these steps:

1. Open the hardware catalog.

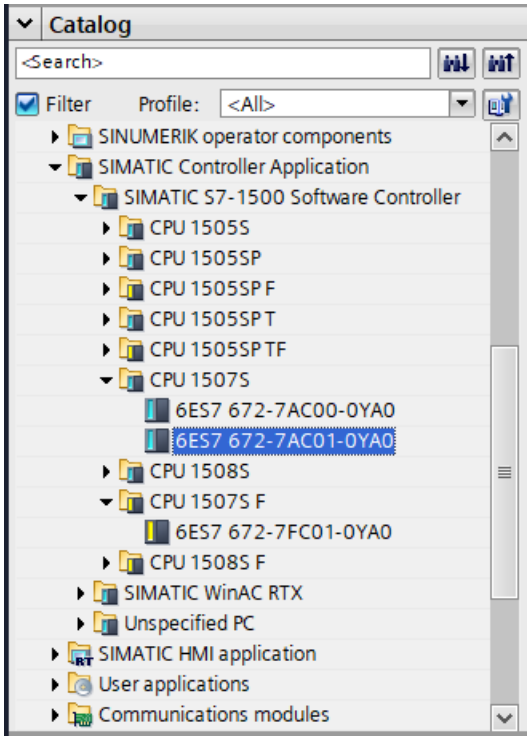



Figure 5-1 Hardware catalog opened

2. Using a drag-and-drop operation, move the article number from the CPU subfolder to the SIMATIC IPC.
   The CPU is inserted in an available free software slot.

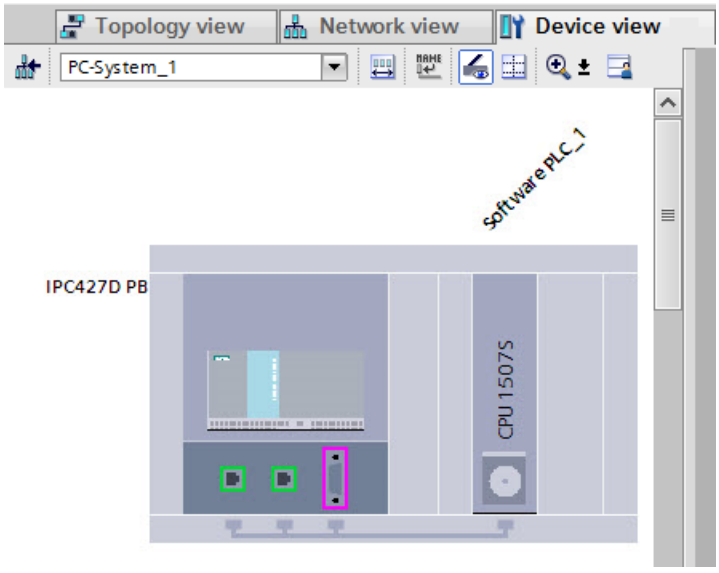



Figure 5-2 Adding the CPU

3. If required, change the properties of the CPU in the Inspector window of STEP 7.

**NOTE**

**Special characters in the name of the CPU**

Do not use slashes "/" and "\" in the name of the CPU

# 5.4 Assigning interfaces for communication

Interfaces can be used by the software controller. Only these exclusively assigned interfaces enable connection of distributed I/O. In addition, SIMATIC communication is also possible.

## Communication between devices

The basis of all types of communication is always a previously configured network. In order to configure a network for the CPU, you must assign the interfaces for communication to the CPU or PC system beforehand. An interface is:

- A communications processor such as CP 5622/CP 5623 for PROFIBUS or Intel Springville I210/CP 1625 for PROFINET
  Please see the technical specifications or product information (https://support.industry.siemens.com/cs/ww/en/view/109766674) for a list of communications processors that can be used with the CPU.
- An Industrial Ethernet card
- An integrated PROFIBUS or PROFINET interface on a Siemens Box, Rack, or Panel PC, or on CPU 1515SP PC2
- Any card or service that is supported for the purpose of communication

---

**NOTE**

**Use of two PROFINET interfaces**

With the CPU 1507S, you can use two PROFINET interfaces in your configuration. In this case, one of the PROFINET interfaces acts as a PN IO controller for the PROFINET IO communication concept and other communication services. You use the second PROFINET interface for the available communication services.

With the CPU 1508S, both interfaces are IO-compatible.

---

A detailed list of the supported interfaces and on-board interfaces of the IPC is available in the Product Information.

## Requirement

- STEP 7 is open.
- The project view is open.
- The device view is open.

## Procedure

To assign the interfaces for the communication to the CPU, follow these steps:

1. Select the integrated interface in the device view.

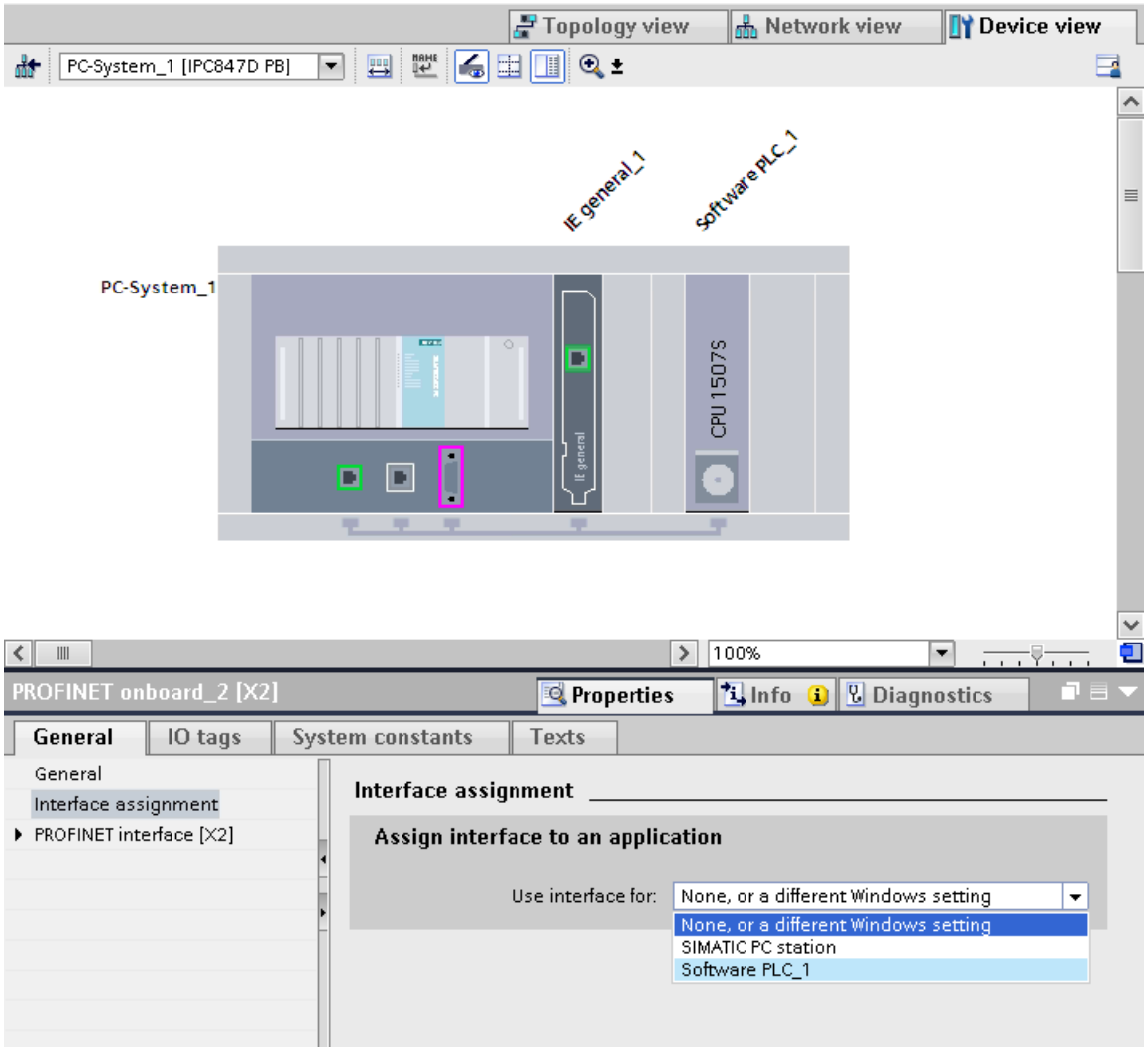



Figure 5-3 Assign interface to the CPU

2. Assign the interface in the properties of the CPU.

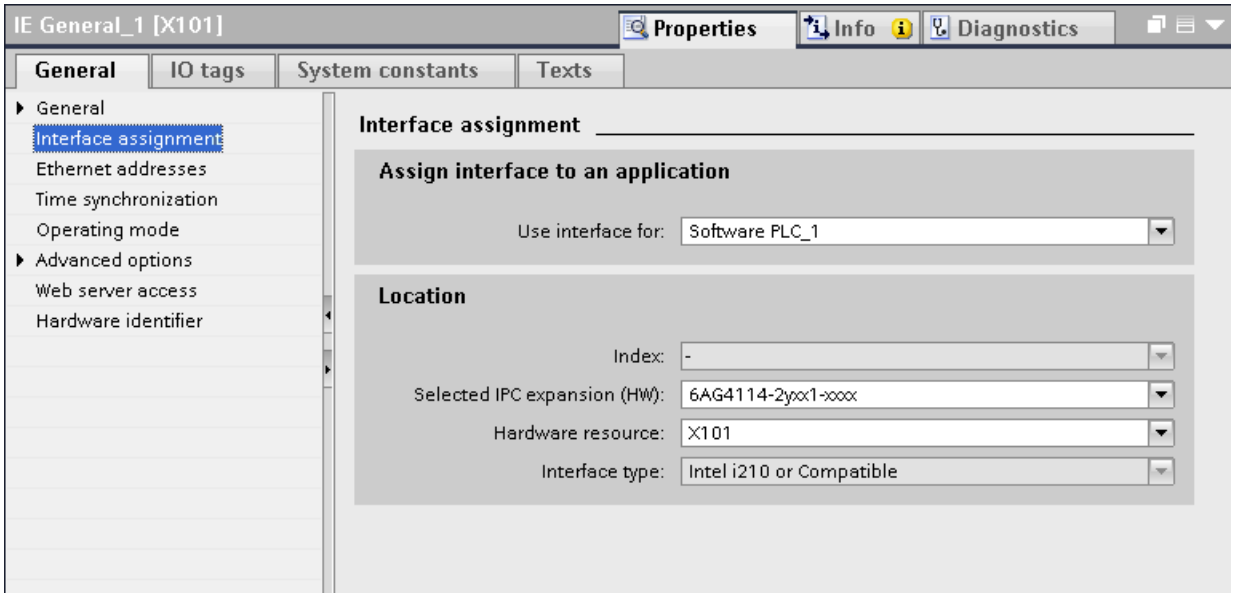



Figure 5-4 Select the interface

Depending on the interface and PC type, the following properties are available:
- Index: fixed
- Selected IPC extension (HW): PCI/PCIe slot configuration
- Hardware resource: Slot on PC
- Interface type: Interface type for standard Ethernet interfaces, fixed

3. Add the desired PN/IE communication processor from the catalog.

**NOTE**

You can only assign a CP 1625 to the CPU 1507S and the CPU 1508S.

4. Assign the communication processor in the CPU properties.
5. Compile the project with "Edit > Compile".

**NOTE**

Assign the first interface to the PC Station.

When you change the assignment of interfaces, you must load the entire PC system and all communication partners.

The PC system is booted during the loading process, and the existing configuration is deleted.

**Reference**

You can find more information on the topic "Assigning interfaces" in the STEP 7 online help.

## Ethernet addresses

Among other options, this section offers the possibility of obtaining the IP address from a DHCP server.

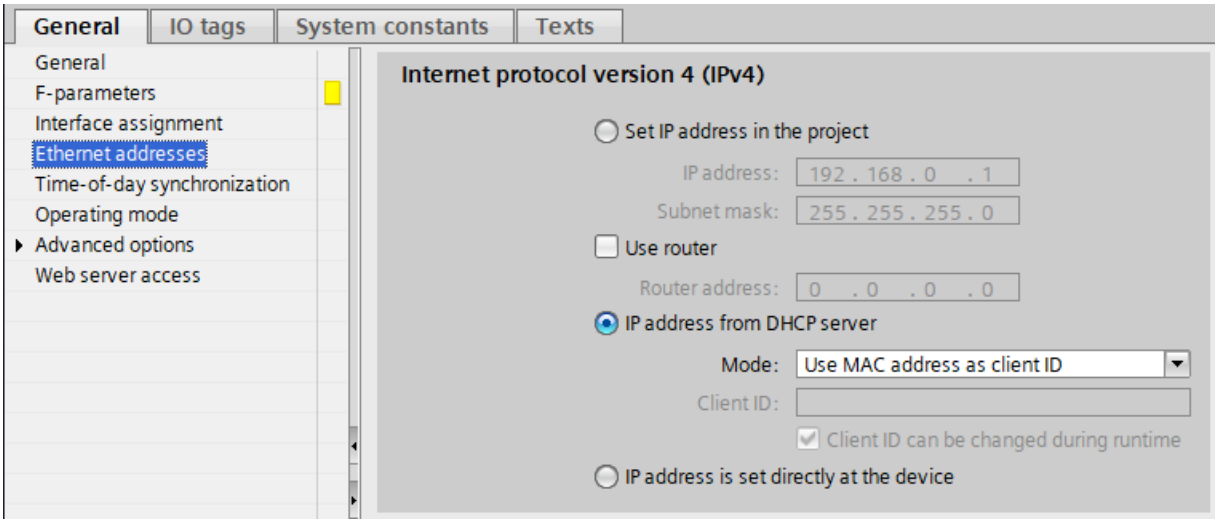



Figure 5-5 Ethernet addresses

**NOTE**

**Runtime communication interface**

If you want to use the option "IP address from DHCP server", the DHCP server must be installed on the Windows side of the device (IPC or CPU1515SP PC2) used.

If the DHCP server is installed outside of the device, the IP address cannot be set.

**Reference**

You can find information on all the other options of the category "Ethernet addresses" in the STEP 7 online help.

## 5.5 Changing index

The CPU index is assigned automatically. You can change the index for specific situations.

### Procedure

To change the index of the CPU, follow these steps:

1. Select the CPU in the device view.
2. In the properties under "Advanced configuration" select the "Index" area.
3. Change the index by selecting it.

The changed index is applied.

**NOTE**

**Download after changing the index**

When you change the index manually, you must load the entire PC system and all communication partners.

The PC system is booted during the loading process.

It is possible that the download was not performed when Windows restarts.

To successfully complete the download, restart Windows.

## 5.6 Setting storage location for retentive data

The CPU provides the option of storing data retentively in the PC mass storage or in the onboard NVRAM when the CPU is stopped or a power failure occurs. You set the type of data storage in the CPU properties in STEP 7.

**NOTE**

**Data loss when changing the storage type**

The current retentive data and the contents of the diagnostic buffer are deleted when you change the storage type.

### Procedure

To configure the type of storage, follow these steps:

1. Select the CPU.
2. Select the "Advanced configuration" area on the "Properties" tab of the Inspector window.
   - Select the "PC mass storage" option button to store the retentive data in the mass storage of your PC.
   - Select the "NVRAM of the PC system" option button to save the retentive data in the onboard NVRAM of your PC.

**NOTE**

**SIMATIC IPC with NVRAM**

"PC mass storage" is activated by default in a SIMATIC IPC. To select NVRAM as retentive memory, select the option button "NVRAM of the PC system".

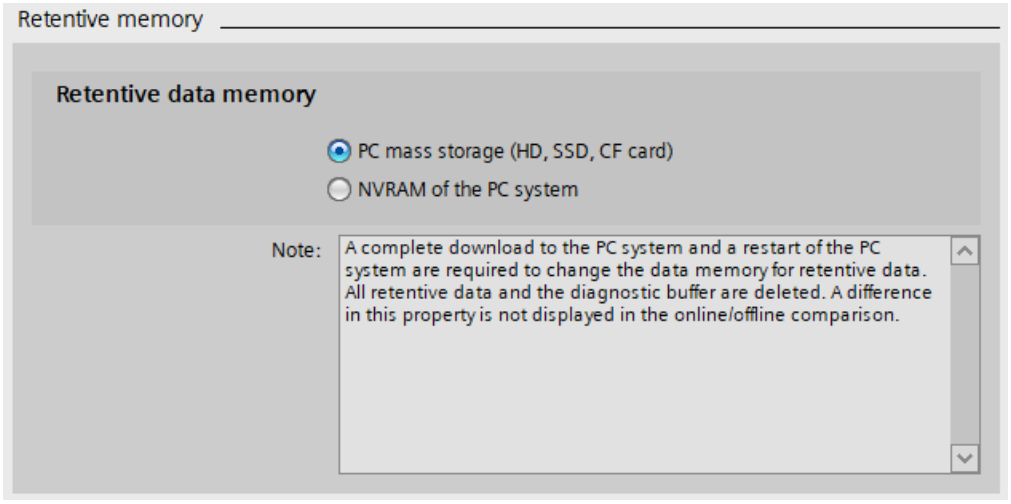



Figure 5-6 Properties for storage of retentive data in STEP 7

3. To complete a change in the type of data storage in STEP 7, download the project to the target device again.

**NOTE**

When you change the storage location for retentive data, you must load the entire PC system. The PC system is booted during the loading process, and the existing retentive data is deleted.

## Reference

Additional information on setting the size of the diagnostic buffer and the retentive areas of bit memories, timers, and counters is available in the STEP 7 online help.

## 5.7 Using hardware LEDs

The CPU provides the functionality of displaying its status on the LEDs of the hardware platform on which it is installed. You set this functionality in the CPU properties in STEP 7.

**NOTE**

**Simultaneous access by multiple components**

Take care that multiple competing components (for example DiagBase and CPU) do not have simultaneous access to the hardware LEDs.

### Procedure

To use the LEDs of the hardware platform, follow these steps:

1. Open the network view or device view.
2. Select the CPU.
3. Select the "Advanced configuration > Use of hardware LED" area on the "Properties" tab of the Inspector window.

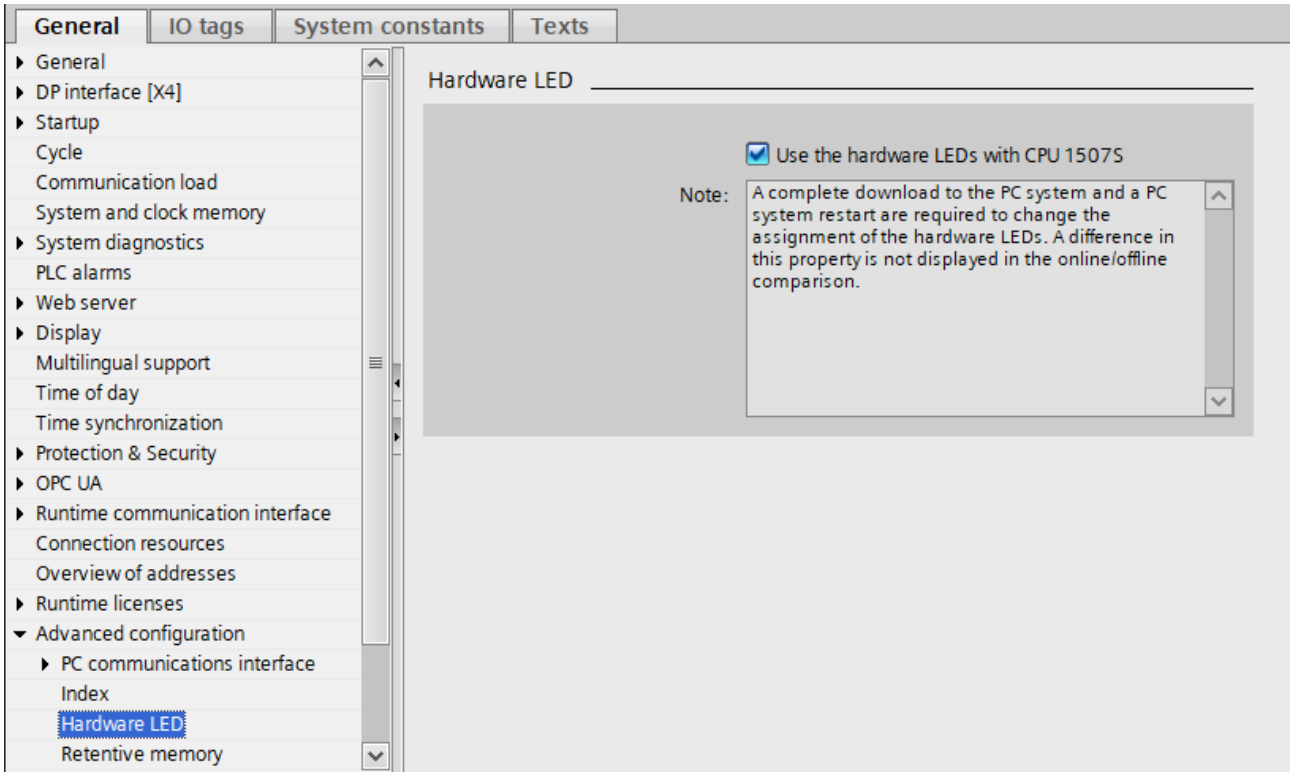



Figure 5-7 Using LEDs

4. Select the "Use the hardware LEDs with CPU 150xS" option.
5. Select the complete PC System in the network view of the hardware network editor.
6. Download the project to the target device.

**Result**

The PC is stopped, the project is downloaded and the PC will be restarted automatically. The CPU starts in "STOP" mode. The download is continued.

**NOTE**

When you change the assignment of the LEDs, you must load the entire PC system. The PC system is rebooted during the loading process.

# 5.8 Configuring startup

The CPU can be started (POWER ON) in two different ways. You must configure the start type in STEP 7.

- Manual start with "Power" button on the CPU display (Page 100) or by executing the command "CPU_Control/PowerOnCPU" (Page 110)
- Automatic start during PC start
  The "Automatic start after booting the PC" option is selected by default in STEP 7 with CPU 1505SP. If you deselect the option, you must start the CPU manually via the CPU display.

### Setting the startup type

To set the startup type, follow these steps:

1. Start STEP 7.
2. Open your project.
3. Change to the project view.
4. Open the device view.
5. Select the CPU.
6. On the "Properties" > "General" tab of the Inspector window, select the "Startup" area.
7. Configure the startup characteristics of your CPU.

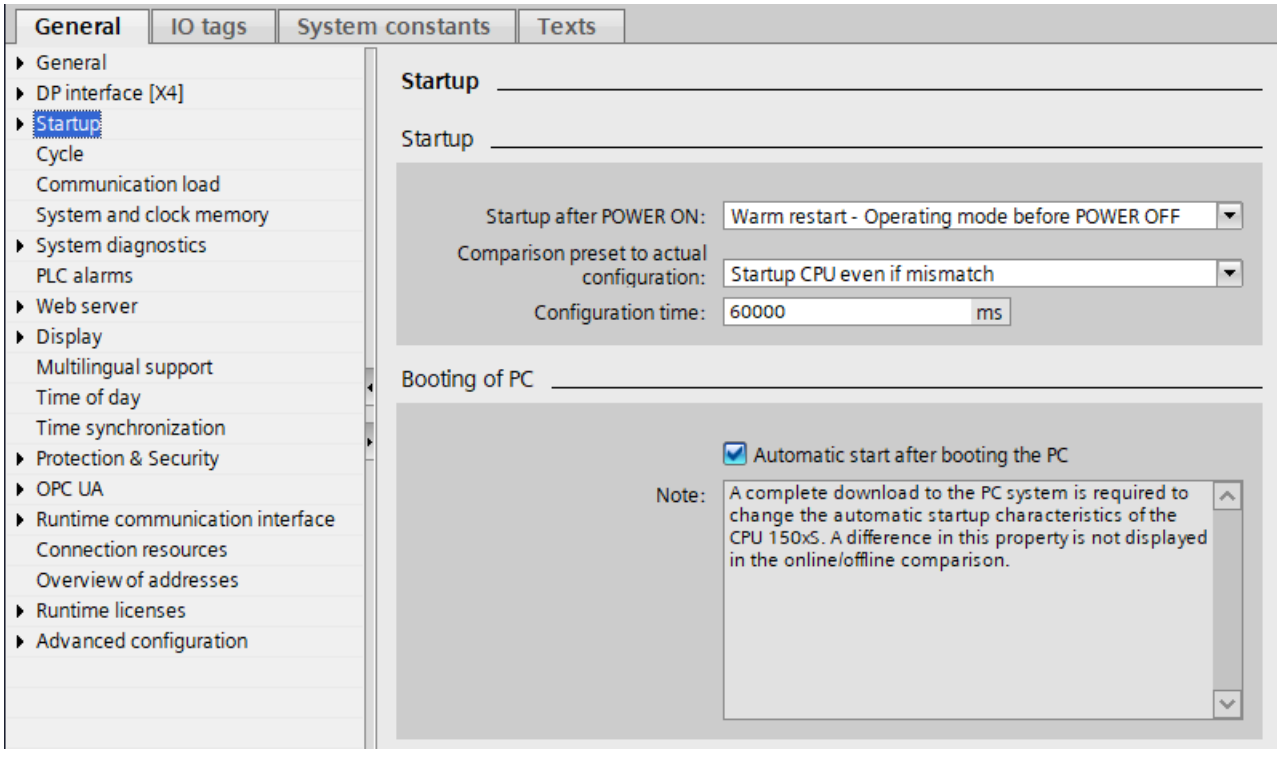



Figure 5-8 Setting the startup characteristics

8. Download the project to the CPU by selecting the PC system before you start the download.

### Result

If, in addition to the settings for the startup type, you also change the "Automatic start after booting the PC" option, the CPU is stopped automatically before the download. At the beginning of the download, the CPU starts again in STOP mode.
The project is downloaded. The new settings for the startup type are active.

**NOTE**

When you change the startup characteristics, you must download the entire PC system.

### Reference

You can find additional information on setting the startup type in the STEP 7 online help.

## 5.9 Synchronizing time according to Windows clock

### Introduction

The CPU supports various time sources, including the internal system clock and the Windows clock. This time information can be different, especially in the case of extended operating times. To prevent this, perform a time synchronization at regular intervals.

**NOTE**

**Time synchronization based on Windows and NTP**

Time synchronization based on Windows and NTP cannot be configured at the same time.

**Time synchronization via PROFIBUS**

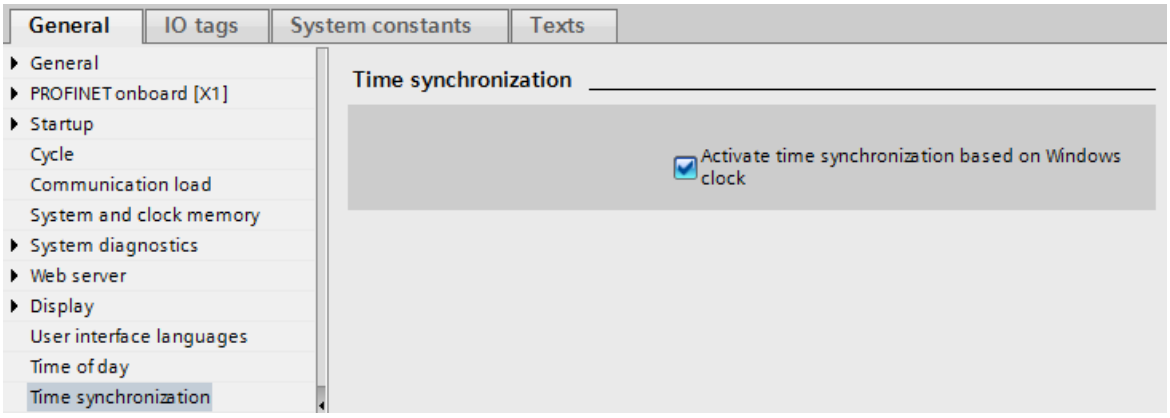
Time synchronization of the CPU 1505SP (F/T/TF) using the ET 200SP CM DP is possible. Time synchronization of the CPU 1507S or CPU 1508S using CP 5622 or CP 5623 is not possible

With STEP 7, you have the option of configuring time synchronization based on Windows for your CPU.

## Procedure

To configure time synchronization based on Windows, follow these steps:

1. Select the CPU.
2. On the "Properties" > "General" tab of the Inspector window, select the "Time synchronization" area.




3. Select the "Activate time synchronization based on Windows clock" check box.
   A period of 10 seconds is the default setting for the synchronization cycle.
4. Download the program to the PC Station.

## Result

As soon as the configuration of the time synchronization has been downloaded to the CPU, the internal system clock of the CPU is synchronized with the Windows clock every 10 seconds.

# 5.10 Configuring Web server for use under Windows

## Using the Web server on Windows and via the Windows interfaces

You can use the Web server of the CPU via Windows and via the Windows interfaces. This means you can, for example, use the diagnostic functions of the Web server on the screen of the PC system. Enable the Web server access in STEP 7 for this purpose.

## Configuring the Web server

To configure the Web server in STEP 7, follow these steps:

1. Select the CPU.
2. Open the "Properties" tab in the Inspector window.
3. Select the entry "Web server" in the "General" area navigation.
   The "Web server" area is displayed.

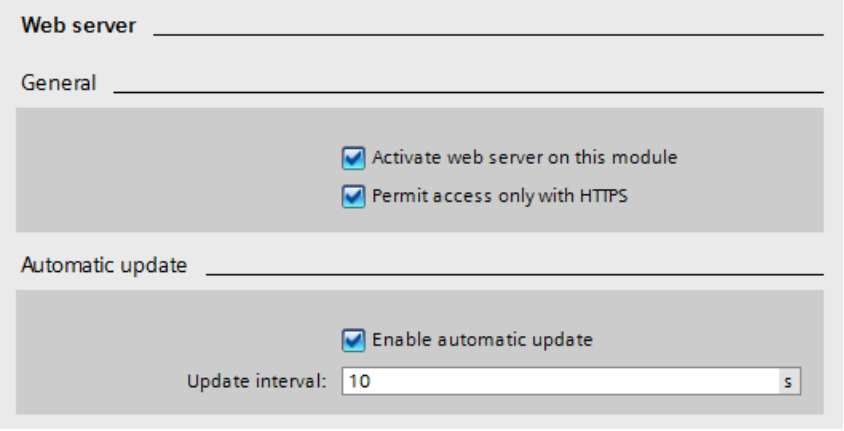



Figure 5-9 Enabling the Web server

4. Select the check box "Activate Web server on this module".
   Automatic updating is activated in the basic setting of a configured CPU.

5. Activate the Web server also for each interface by which you want to access the Web server. Select the respective interface. Open the "Properties" tab in the Inspector window and select the entry "Overview of interfaces" in the "General" area navigation.

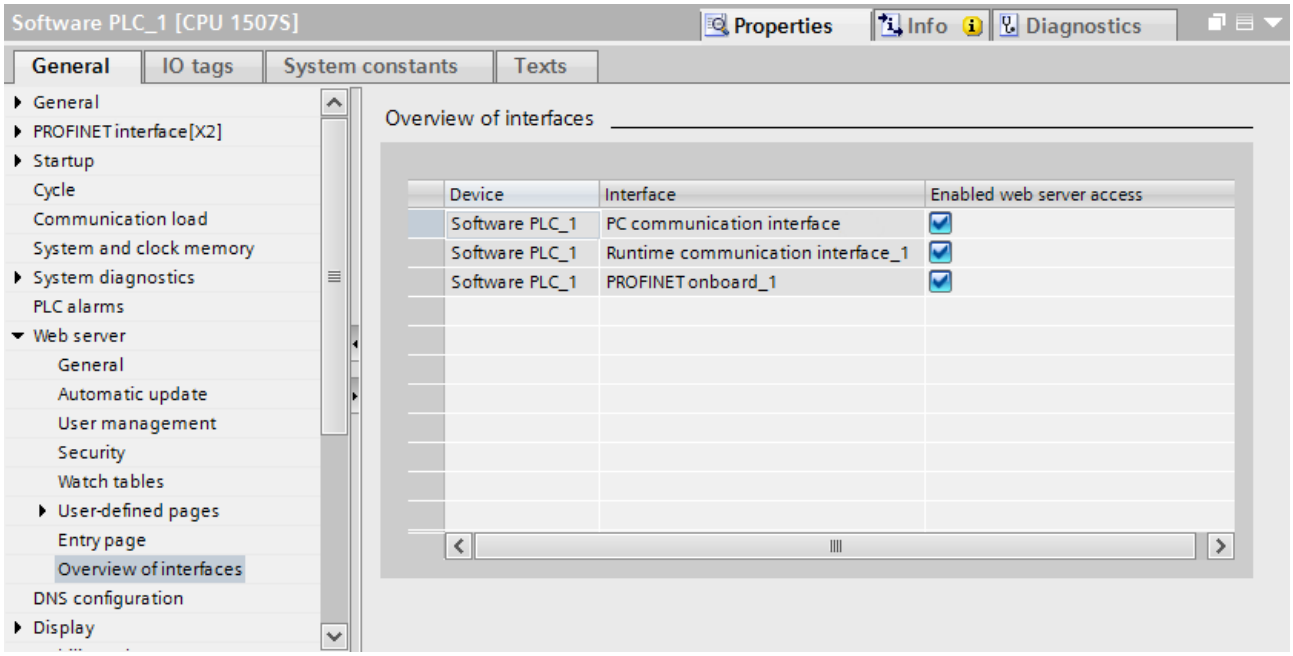



Figure 5-10 Enabling interfaces for Web server access

6. Select the "Enable Web server access" check box for each interface via which the Web server is to be accessible.
   Use the "PC communication interface" for use with Windows.
7. Download the project to its target device.
8. Connect the client to a PROFINET interface of the CPU or to a communication processor.
   If you are using a web browser over Windows, the Web server can be accessed over all Ethernet interfaces.

**NOTE**

**Managing access rights**

In STEP 7, you can create users, define access rights, and assign passwords in the "Web server > User management" area. Users only have access to the options that are permanently linked to the access rights.

For further information on managing access rights, please refer to "Configuring the Web server" in the Web server function manual (https://support.automation.siemens.com/WW/view/en/59193560).

## Configuring the port number in the CPU display

After downloading the configuration to the CPU, the HTTP port 81 and HTTPS port 343 are entered by default in the CPU with access over the Windows Ethernet interface. The Web server does not use ports 80 or 443 as default setting, because they are typically already used by the Windows IIS. In order to solve any potential conflicts with other Windows software that uses ports 81 or 343, you can change the port numbers. To change the port number, follow these steps:

1. Open the CPU display.
2. Select the "Settings > Web server" menu.
3. The "Web server" menu opens.

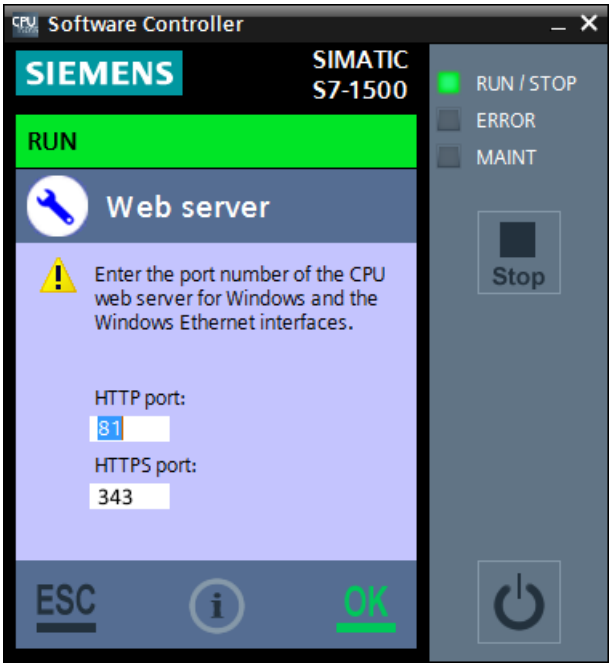



Figure 5-11 Changing the port number

4. Enter the desired port number.
5. Confirm your entry with "OK".
6. Also configure this port number in the firewall settings (Page 152).

## Web server of the PC Station

The functionality of the Web server is available with PC Station V2.1 and higher. The Web server is used when the URL address contains /simatic or /simatic/.

Examples of how to reach the Web server:

- http://IP address/simatic/ or http://IP address/simatic
- http://computer name/simatic/ or http://computer name/simatic

More information on PC Station Web server settings can be found in the STEP 7 online help.

### Reference

You can find additional information about the "Web server" topic in the Web Server Function Manual (https://support.automation.siemens.com/WW/view/en/59193560).

## 5.11 Load PC system

### 5.11.1 Downloading project to target system

### Requirement

- The SIMATIC IPC hardware component is physically connected via Ethernet to the PC on which STEP 7 is installed.
- The interface settings on the SIMATIC IPC and in STEP 7 match.

**NOTE**

**Recommended interfaces**

With a SIMATIC IPC, use the interface "X1". Use the "X2" interface with a CPU 1515SP PC 2.

This interface must be assigned to the PC Station in the project.

- The UWF and FBWF write filters are disabled on the "C:" partition.
  To e.g. disable the UWF filter, enter the following commands in the Windows Command Prompt:
  ```
  uwfmgr filter disable
  uwfmgr volume unprotect c:
  ```
  After loading, activate the protection again. To e.g. activate the UWF filter, enter the following command:
  ```
  uwfmgr filter enable
  uwfmgr volume protect c:
  ```

### Procedure

To download the STEP 7 project, follow these steps:

1. Select the complete PC system in the device view.
2. Select the "Download to device" shortcut menu command.
   The "Extended download to device" dialog opens.
3. Configure the settings for the interface.
4. Click the "Download" button to start the download.

## Result

The project is downloaded. A dialog shows the download progress.
During initial download of the project, or in case of specific changes (e.g. change to interfaces, LED, NVRAM or index), STEP 7 shows a message indicating that a restart of the target system is required. The target system is restarted automatically.

**NOTE**

**Situations which require a complete download process**

When you make the following changes in the STEP 7 project, select the complete PC system with all potential communication partners and perform a download:

- Changing index
- Setting storage location for retentive data
- Configuring LEDs of the hardware
- Changing the name of the CPU
- Configuring Autostart
- Adding or removing a PROFINET or PROFIBUS interface
- After replacing the current CPU by a new CPU using the module replacement function "Change device"

When you change the hardware configuration in STEP 7, you must not download the project over the interface assigned to the CPU.

The CPU starts in STOP mode in order to ensure the continuation of the download.
STEP 7 establishes a connection to the CPU automatically. Click the "Download" button again to complete the download.

**NOTE**

**Downloading a safety program to an S7-1500 F Software Controller**

When downloading a safety program to an IPC647E, IPC847E, IPC627E or IPC677E, in very rare cases the S7-1500 F Software Controller needs to be restarted. Repeat the download after restart for the download to be carried out successfully.

## Checking the result of the download

Once the download is successfully completed, the CPU link appears in the Windows Start menu with the name you have assigned in the CPU settings in STEP 7.
The name assigned in STEP 7 is also visible in the CPU display.

### 5.11.2 Download complete PC system with TIA Portal Openness

To download a complete PC system, you can use "TIA Portal Openness".
Additional information and application examples on "TIA Portal Openness" can be found on the Internet (https://support.industry.siemens.com/cs/products?search=Tia%20Portal%20Openness&mfn=ps&o=DefaultRankingDesc&lc=en-WW).

#### Requirement

A PC system with a PC Station V2.0 or higher is configured in the STEP 7 project.

#### Procedure

1. Download the configuration of the PC Station and the CPU separately from each other. To do this, specify the respective device as "Download Provider".
   Example of the call of the download provider:

```
DeviceItem stationManager = dev.DeviceItems.First(p =>
p.PositionNumber == 0).DeviceItems.First(a => a.PositionNumber ==
125);
DownloadProvider downloadProviderStationManager =
stationManager.GetService<DownloadProvider>();
DeviceItem swCpu = dev.DeviceItems.First(p => p.Name == "Software
PLC_1");
DownloadProvider downloadProviderSwCpu =
swCpu.GetService<DownloadProvider>();
```

2. Configure the network settings.
   Example code for the network settings:

```
ConnectionConfiguration connConfig =
downloadProviderStationManager.Configuration;
ConfigurationMode configurationMode =
connConfig.Modes.Find("PN/IE");
ConfigurationPcInterface pcInterface =
configurationMode.PcInterfaces.Find("ASIX AX88179 USB 3.0 to
Gigabit Ethernet Adapter", 1);
ConfigurationTargetInterface targetInterface =
pcInterface.TargetInterfaces.Find("2 X2");
IConfiguration targetConfiguration =
pcInterface.TargetInterfaces[0];
bool isConfigured =
connConfig.ApplyConfiguration(targetInterface);
if (isConfigured)...
```

3. The target system is restarted after download of the PC Station. To automatically download the CPU after rebooting, select the option "WaitOnReboot".
   Example code for the option "WaitOnReboot":

```
//Post Download Configuration Delegate
DownloadConfigurationDelegate postDownloadForPcStation =
downloadConfiguration =>
{
  WaitOnReboot waitOnReboot = downloadConfiguration as
WaitOnReboot;
  if (waitOnReboot != null)
  {
    //In case user does not want to wait...
```

```
    waitOnReboot.CurrentSelection =
WaitOnRebootSelections.NoAction;
    //In case user wants to wait... This is the default option
anyway...
    //waitOnReboot.CurrentSelection = WaitOnRebootSelections.Wait;
return;
  }
};
```

4. Continue the download process of the CPU.
   With the following code you ensure that the download process of the PC Station is completed:

```
DownloadResult downloadResult = null;
try
{
  //WE FIRST DOWNLOAD PC-STATION
  downloadResult =
downloadProviderStationManager.Download(targetConfiguration,
preDownloadForPcStation, postDownloadForPcStation,
DownloadOptions.Hardware);
  if (DownloadResultState.Error != downloadResult.State)
  {
    Console.WriteLine("The download is successful for pc-
station");
  }
}
catch (EngineeringTargetInvocationException e)
{
  Console.WriteLine("Exception Thrown, Message: " +
e.Message.ToString());
}
downloadResult = null;
try
{
  downloadResult =
downloadProviderSwCpu.Download(targetConfiguration,preDownloadFor-
SwCpu, postDownloadForWinac, DownloadOptions.Hardware
|DownloadOipftions.Software);
  if (DownloadResultState.Error != downloadResult.State)
  {
    Console.WriteLine("The download is successful for SW-CPU");
  }
}
catch
{
  Console.WriteLine("Exception Thrown, Message: " +
e.Message.ToString());
}
```

## Result

The PC system has been downloaded and the target system was automatically rebooted.

## 5.11.3 Loading PC Station with file

The possibility to save and transport the system configuration of the PC system in a configuration file offers the following advantages:

- Update of large plants without the TIA Portal
- Simple provision of program and configuration updates
- Plant-level update no longer necessary
- No special software required

### 5.11.3.1 Create configuration file

#### Create configuration file

The entire configuration of your PC Station is saved in a configuration file from the TIA Portal. The data may be re-used and distributed. The configuration file has the extension *.psc.

To create a configuration file, follow these steps:

1. Select the "New > PC system configuration file (.psc)" command in the "Project > Memory Card-File" menu.
2. Enter the file name in the "Create memory card file" dialog that opens. To avoid error messages, make sure that the entries are correct:
   - Use a short, unique name
   - Name may not contain more than 255 characters
   - Name may not contain spaces
   - Only use permitted characters; these are letters and digits, and the special characters '-' and '_'.
3. Select the desired directory in which you want to create the file. To avoid error messages, also make sure that the entries are correct, as in 2.
4. Confirm with "Create".

| NOTICE |
| --- |
| **Secure data against access by third parties**<br>The customer is fully responsible for the secure transport of data. |

**NOTE**

**Characters for importing and exporting PC configuration**

Note that for the path and the name of the .psc file only ASCII characters are allowed for file import and export.

### Result

The "Memory card file" folder is created in the project tree under "Card Reader/USB memory" with the following structure:

- PC system configuration file
  This file contains the PC system configuration file. The information indicates the file name and path information, for example: "Drive:\PC-SystemConfiguration01.psc"
  - Icon "PC-Systeminformation.psc"
    Double-clicking the icon displays all project-, device- and module-relevant information about the loaded configuration. If more data is loaded, you can use the "Update" button to display the latest metadata.
  - Folder with station name already assigned in the project navigation, for example, PC-System_1.
    This folder contains the configuration of the PC system.

**NOTE**

**Storage of retentive data in PC system configuration files (.psc)**

Note that retentive data and current process data of variables are not retained in .psc files. Current values are initialized to the start values after applying the .psc file.

## 5.11.3.2 Export configuration file from TIA Portal project

To load data into the PC system configuration file, you have the following options:

- Load project data to a memory card using drag and drop or copy and paste
- Write project data to a memory card

### Requirement

- A PC System with a PC station V2.2 or higher is configured in the STEP 7 project.
  For fail-safe systems, a PC system with a PC Station V2.3 or higher is configured.
- A .psc file is created and opened in the project tree.

**NOTE**

**Special feature**

An individual software CPU cannot be copied to the .psc file.

### Loading project data to a memory card file

To load project data to a memory card file, follow these steps:

1. Drag the project data that you want to load from the project tree to the memory card.
   If necessary, the project data is compiled.
2. Then, the "Load preview" dialog opens. This dialog displays messages and recommends actions necessary for loading.
3. Check the messages and enable the actions in the "Action" column if necessary. As soon as loading is possible, the "Load" button is enabled.
4. Click the "Load" button.
   The loading is performed.

or:

1. Select the "PC system" folder in the project tree.
2. Right-click on the selection and select the "Copy" command from the shortcut menu.
   Alternatively, you can also use the shortcut <Ctrl+C>.
3. Right-click on the "*.psc" file level in the memory card file and select the "Paste" shortcut menu command. Alternatively, you can also use the shortcut <Ctrl+V>.
   All other levels are locked. If necessary, the project data is compiled.
4. Then, the "Load preview" dialog opens. This dialog displays messages and recommends actions necessary for loading.
5. Check the messages and enable the actions in the "Action" column if necessary. As soon as loading is possible, the "Load" button is enabled.
6. Click the "Load" button.
   The loading is performed.

or:

1. Select the "PC system" folder in the project tree.
2. In the "Project" menu, select the command "Card Reader / USB memory > Write to memory card".
   The "Select memory card" dialog opens.
3. Select a Memory Card.
   Click on the "*.psc" box below the memory card to enable the button with the green check mark.
4. Click on the button with the green check mark.
   If necessary, the project data is compiled.
5. Then, the "Load preview" dialog opens. This dialog displays messages and recommends actions necessary for loading.
6. Check the messages and enable the actions in the "Action" column if necessary. As soon as loading is possible, the "Load" button is enabled.
7. Click the "Load" button.
   The loading is performed.

### Result

The .psc file contains the configuration for all components in corresponding subfolders. The name of the subfolder is changed to the current PC system name.

**NOTE**

**Check that file is complete**

Check the .psc file in your TIA Portal to make sure it is complete, for the file can only be edited in the TIA Portal.

## 5.11.3.3 Open existing configuration files

### Open configuration file

To view a configuration file in the project tree, follow these steps:

1. In the menu, select "Project > Memory Card-File > Open > PC system configuration file (.psc)".
2. Select the directory containing the .psc file.

The memory card file appears with the mentioned content under "Card Reader / USB memory" in the project tree.

## 5.11.3.4 Import configuration file on target system

The following lists the tools with which you can commission the target system without TIA Portal:

- Command line tool
- PC Station display in the information area (Page 115)

You will find an application example for "Loading a PC Station using configuration file import" on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109759142).

### Requirements

- You have administrator rights.
- A Software Controller, version 2.5 or higher, is installed.
- Access to the Open Controller CPU 1515SP PC2 and/or an IPC is possible.
- The .psc file is located in a local directory or is available on a medium such as a USB flash drive.
- For fail-safe systems: The Windows Account of the person performing the action has administrator rights and is incorporated in the Windows user group "Failsafe Operators".

### Overview of the supported command line commands

The following table provides an overview of the supported command line commands:

| Command | Explanation |
|---|---|
| PCSystem_Control.exe /Help | Displays the help text in the command line editor. |
| PCSystem_Control.exe /HelpExitCode | Displays the help text for the error codes in the command line editor. |
| PCSystem_Control.exe /PrintConfig <file.psc*> | Displays the information about the components; output format: Standard |
| PCSystem_Control.exe /PrintConfig <file.psc>* /xml | Displays the information about the components; output format: XML format |
| PCSystem_Control.exe /ImportConfig <file.psc>* | The call starts the full import of the .psc file. |
| PCSystem_Control.exe /GetStatus /ImportConfig | Displays the current status of all the components, the import process; output format: XML format |
| PCSystem_Control.exe /GetStatus /SimaticComponents | Displays information on all installed SIMATIC components; output format: XML format |

* The <file.psc > parameter stands for the full path and file name, for example, C:\Data\Test.psc

### Result

The data is imported in the background.

If a restart is configured, this is performed automatically once the import is completed. If software CPU is contained in the imported configuration, it remains in STOP after the restart.

### Procedure for error messages

If an error occurs with a command, you can determine the bit number of the error and obtain an accurate description of it.

Proceed as follows:

1. To obtain the error code, enter the command "echo% errorlevel%" in the command line tool.
2. This command gives you the following result:
   - If error code = 0, there is no error.
   - If error code > 0, there is an error and it is output as a decimal number.
   - For fail-safe systems: Error code 20899 or 0x51A3, import successful.
3. The decimal number must be converted into a binary number.
4. To get an overview of the bit number describing the error, enter the command line command "HelpExitCode".

## Example

Example of conversion of number systems:

- Decimal number: 288
- Binary number: 100100000

Bit number with the corresponding error description:
Result: You can read the error at bit number 5 "Err_Net_45_Full=1" and bit number 8 "Err_IIS_Running=1".

## Confidential configuration data

The .psc file does not include the password for confidential configuration data or any other security data.
Before you import configuration data, exported from a password-protected SWCPU, you need to set the same password for the CPU, the data will be imported to. You can set the new password by initially downloading the project to the CPU.

**NOTE**

**Initial download**

For the .psc file import to be successful, carry out the initial download to the Software Controller via TIA Portal.

For the Software Controller, it is also possible to download configurations having a password for confidential configuration data into a project with no/a different password. In such cases, TIA Portal displays the following error message in the "Load preview" window:

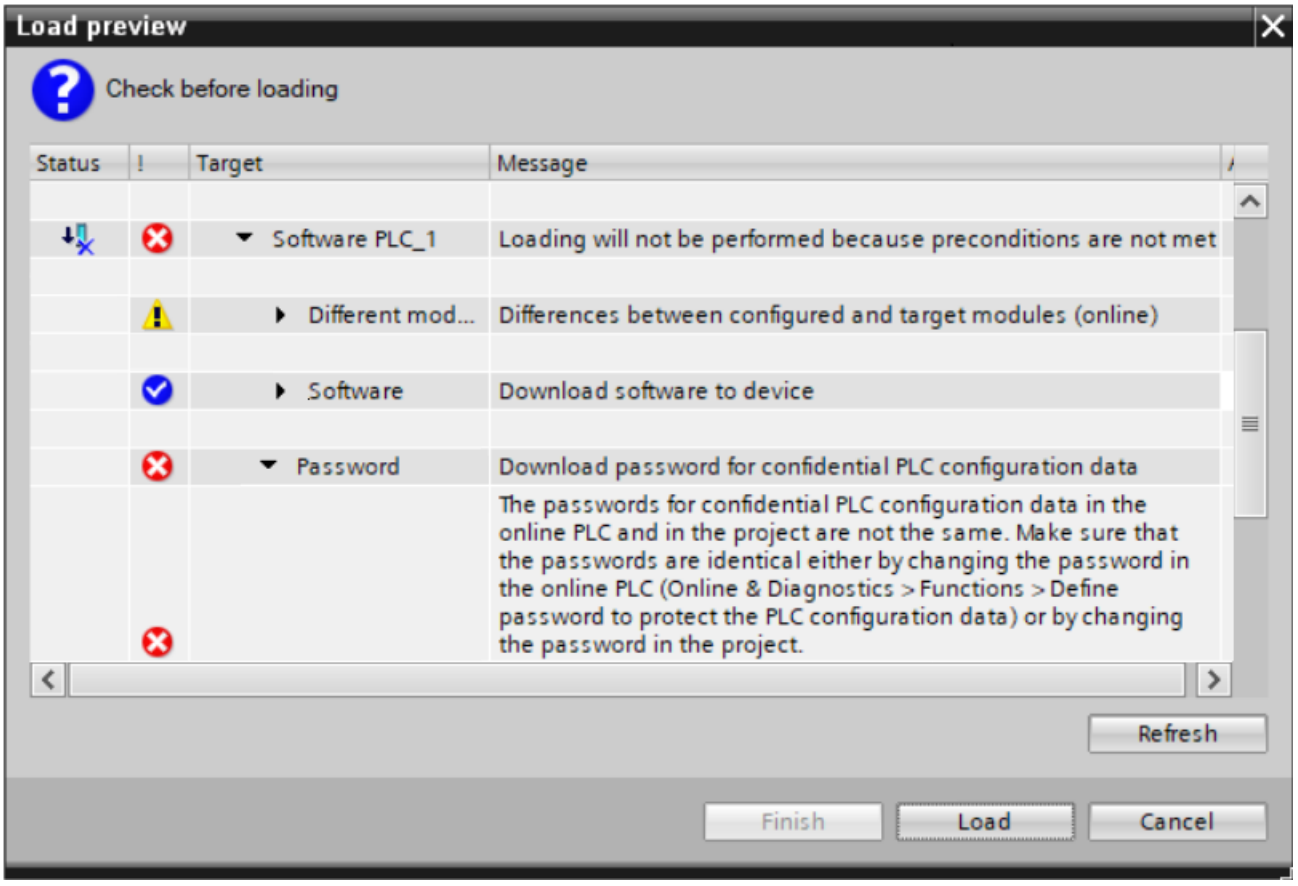



Figure 5-12 Load Preview

**NOTE**

**Memory card evaluation error**

If you receive the error message "Memory card evaluation error" while performing a .psc file import, delete the current SIMATIC software configuration of the controller. To do this, select the command "Delete the current SIMATIC software configuration" in the shortcut menu of the PC Station icon in the Info area of the taskbar.

If the error still persists, carry out a repair installation.

### 5.11.3.5 Export configuration file from a configured PC system

You have the possibility of exporting configuration files from a source to a target system without having to use a connected TIA Portal. The file export function is useful in the following cases:

- Backup and restore
  You may make changes in the operation of your plant. For example, you may add new devices, update devices, replace existing ones or adapt the user program. If these changes result in undesirable behavior, you can fall back on the previously exported configuration file to restore the plant to its earlier state.
- Setting up serial machines
  You may have serial machines in operation at different locations. You want to store the project configuration at one particular plant and export the same configuration to other plants.

#### Requirements

To be able to use the export function, the following requirements apply:

- A Software Controller, Version 21.9 or higher, is installed
- You have administrator rights
- A configuration has been downloaded to the source device
- There is enough free space for the used CPU load memory size on the disk drive which holds the configuration data
  (default is C:\ProgramData\Siemens\Automation\PCStation\Config)

### Exporting files via PC System Control Tool

To export the configuration from the source to a target system, you can use the command prompt of the PC System Control Tool:

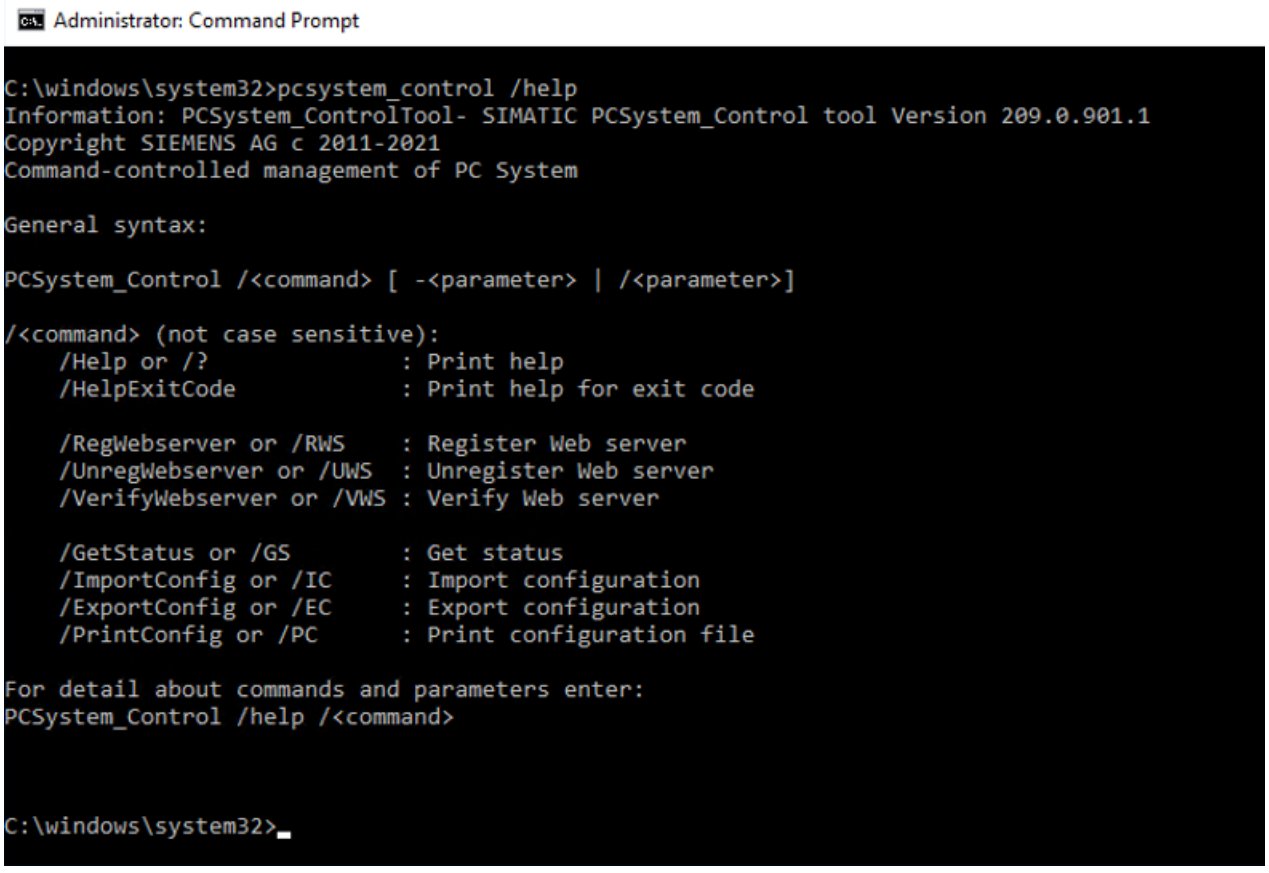



Figure 5-13 PC System Control Tool

The start screen shows you the available commands (not case sensitive).
To start exporting the configuration, enter the command `/ExportConfig` or `/EC`, followed by the path to the desired storage location of the .psc file, for example:

```
/exportconfig d:\test\myconf.psc
```

If you want to verify the current status, use the command `/GetStatus` or `/GS`, for example:

```
/getstatus /exportconfig
```

If you want to print some or all of the exported files, use the command `/PrintConfig` or `/PC`, for example:

```
/printconfig d:\test\myconf.psc /xml
```

## Exporting files via PC Station panel

Apart from the PC System Control Tool, you can also use the PC Station panel for exporting files. To export files, proceed as follows:

1. Right-click on the PC Station panel on the task bar and select "Export > Export configuration".
2. In window "Enter PC System configuration file name", specify the file name and the path to the desired storage location of the .psc file and click "Save".

The window "Export of PC System configuration" shows you the status and progress. When the operation has finished, click "Close" to confirm.

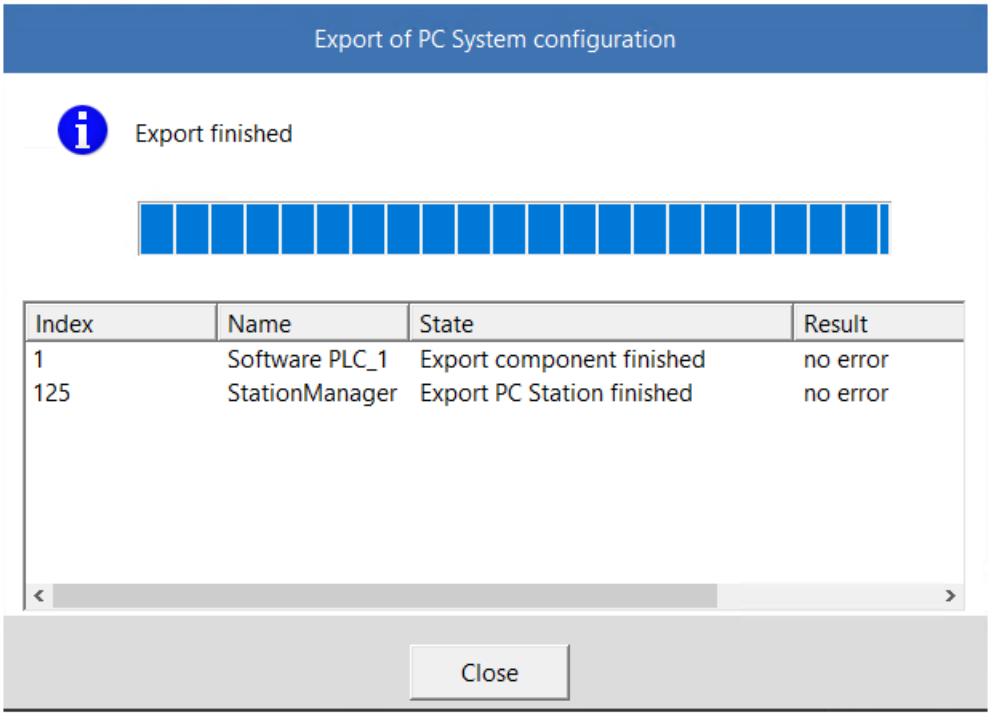



Figure 5-14 Export progress bar

## Export in RUN operating state

The export function is also available while the CPU is in RUN operating state. While the file is exported, the CPU maintains its operating state.

**NOTE**

**Data consistency**

During export, the system verifies the consistency of the configuration data. However, to ensure consistency, do not change the configuration data during export.

If the system shows an inconsistency error, export the file again. If the system keeps showing the same error after multiple export attempts, you might be using a user program which is permanently changing its configuration. In this case, carry out the export in STOP operating state.

### Result

After exporting the configuration successfully, you can import the .psc file to your desired target system.
For information on file import, refer to chapter Import configuration file on target system (Page 75).

### Differences between file export in TIA Portal and PC System Control Tool/PC Station panel

With a few exceptions, the contents of the files "PCSystemMeta.xml" and "<index>.xml" are the same.
The following table compares the structure of the "PCSystemMeta.xml" file according to the different export methods:

| File export without TIA Portal (using PC System Control Tool or PC Station panel) | File export using TIA Portal |
|---|---|
| <Project> | <Project> |
| <Name>---</Name> (does not indicate project name) | <Name>Project Name</Name> |
| <ProjectLastModification>2021-02-12T08:56:55</ProjectLast-Modification> | <ProjectLastModification>2021-02-12T08:56:55.0126447Z</ ProjectLastModification> |
| <ProjectVersion/> | <ProjectVersion /> |
| <ESVersion>V17.0.0.0</ESVersion> | <ESVersion>17.0.0.0</ESVersion> |
| <FileCreationDate>2021-02-12T08:56:55</FileCreationDate> | <FileCreationDate>2021-02-12T08:56:55.8659301Z</FileCre-ationDate> |
| <Description>Exported on Fri Feb 12 08:56:55 2021</Descrip-tion> (indicates time stamp of exported file) | <Description /> |
| <Author>PC-System User</Author> (indicates logged in user) | <Author>TIA User</Author> |
| <LastModifiedBy>PC-System User</LastModifiedBy> | <LastModifiedBy>TIA User</LastModifiedBy> |
| <Family/> | <Family /> |
| <Copyright/> | <Copyright /> |
| </Project> | </Project> |
| <Device> | <Device> |
| <Type>CPU 1515SP PC2</Type> | <Type>CPU 1515SP PC2</Type> |
| <StationName>PC-System_1</StationName> | <StationName>PC-System_1</StationName> |
| <PcComputerName>DESKTOP-A6T3U9H</PcComputerName> (indicates the name of the computer the file was exported from) | <PcComputerName /> |
| <Author>PC-System User</Author> | <Author>TIA User</Author> |
| <Comment/> | <Comment /> |
| <IuM> | <IuM> |
| <Manufacturer>Siemens AG</Manufacturer> | <Manufacturer>Siemens</Manufacturer> |
| <OrderId>6ES7 677-2DB40-0AA0 </OrderId> | <OrderId>6ES7 677-2DB40-0AA0 </OrderId> |
| <HardwareRevision>1</HardwareRevision> | |

| File export without TIA Portal (using PC System Control Tool or PC Station panel) | File export using TIA Portal |
|---|---|
| <SoftwareRevision>V.2.9.0</SoftwareRevision> | <SoftwareRevision>V2.9</SoftwareRevision> |
| <FunctionDesignation></FunctionDesignation> | <FunctionDesignation /> |
| <LocationDesignation></LocationDesignation> | <LocationDesignation /> |
| </IuM> | </IuM> |
| </Device> | </Device> |
| </Metafile> | </Metafile> |

The following table compares the structure of the "<index>.xml" file (e.g. "1.xml") according to the different export methods:

| File export without TIA Portal (using PC System Control Tool or PC Station panel) | File export using TIA Portal |
|---|---|
| <Component> | <Component> |
| <Index>1</Index> | <Index>1</Index> |
| <Name>Software PLC_6</Name> | <Name>Software PLC_6</Name> |
| <Id>a59970cf-5289-4276-b803-5b48a0d1b69a</Id> | <Id>a59970cf-5289-4276-b803-5b48a0d1b69a</Id> |
| <TypeId>844549</TypeId> | <TypeId>844549</TypeId> |
| <Author>DESKTOP-Q7AJK42\pt1</Author><br>(indicates the user who runs the file export on the device) | <Author>z0025cks</Author><br>(indicates the user of TIA Portal) |
| <Comment>Exported on Wed May 19 13:08:10 2021</Comment><br>(indicates the time stamp of the file export on the device) | <Comment>my comment</Comment><br><br>(indicates the comment made in the comment section under "Project information" in TIA Portal) |
| <TextList></TextList> | <TextList>FA 70 E8 75 1D 5A 8E 29</TextList><br>(indicates the text list checksum in TIA Portal) |
| <Software></Software> | <Software>A5 3E D7 7E 3C 3A E9 2B</Software><br>(indicates the software checksum in TIA Portal) |
| <IuM> | <IuM> |
| <Manufacturer>Siemens</Manufacturer> | <Manufacturer>Siemens</Manufacturer> |
| <OrderId>6ES7 672-5DC11-0YA0</OrderId> | <OrderId>6ES7 672-5DC11-0YA0</OrderId> |
| <SoftwareRevision>V21.9.2</SoftwareRevision><br>(indicates the current CPU firmware version) | <SoftwareRevision>V21.9</SoftwareRevision><br>(indicates the configured device version on TIA Portal) |
| <FunctionDesignation>my plant designation</FunctionDesignation> | <FunctionDesignation>my plant designation</FunctionDesignation> |
| <LocationDesignation>my location identifer</LocationDesignation> | <LocationDesignation>my location identifer</LocationDesignation> |
| <InstallationDate>2021-05-19T10:32:00</InstallationDate><br>indicates the seconds as "00" | <InstallationDate>2021-05-19T10:32:25.242046Z</Installa-tionDate><br>indicates fractional seconds with 6 digits |
| <AdditionalInfoText>Additional information</AdditionalInfoText> | <AdditionalInfoText>Additional information</AdditionalInfoText> |
| </IuM> | </IuM> |
| </Component> | </Component> |
| </Metafile> | </Metafile> |

## Confidential configuration data

The .psc file does not include the password for confidential configuration data or any other security data.
Before you import configuration data, exported from a password-protected CPU, you need to set the same password for the CPU to which the data will be imported. You can set the new password by initially downloading the project to the CPU.

**NOTE**

**Initial download**

For the .psc file import to be successful, carry out the initial download to the Software Controller via TIA Portal.

It is also possible for the Software Controller to download configurations having a password for confidential configuration data into a project with no/or a different password. In such cases, TIA Portal displays the following error message in the "Load preview" window.

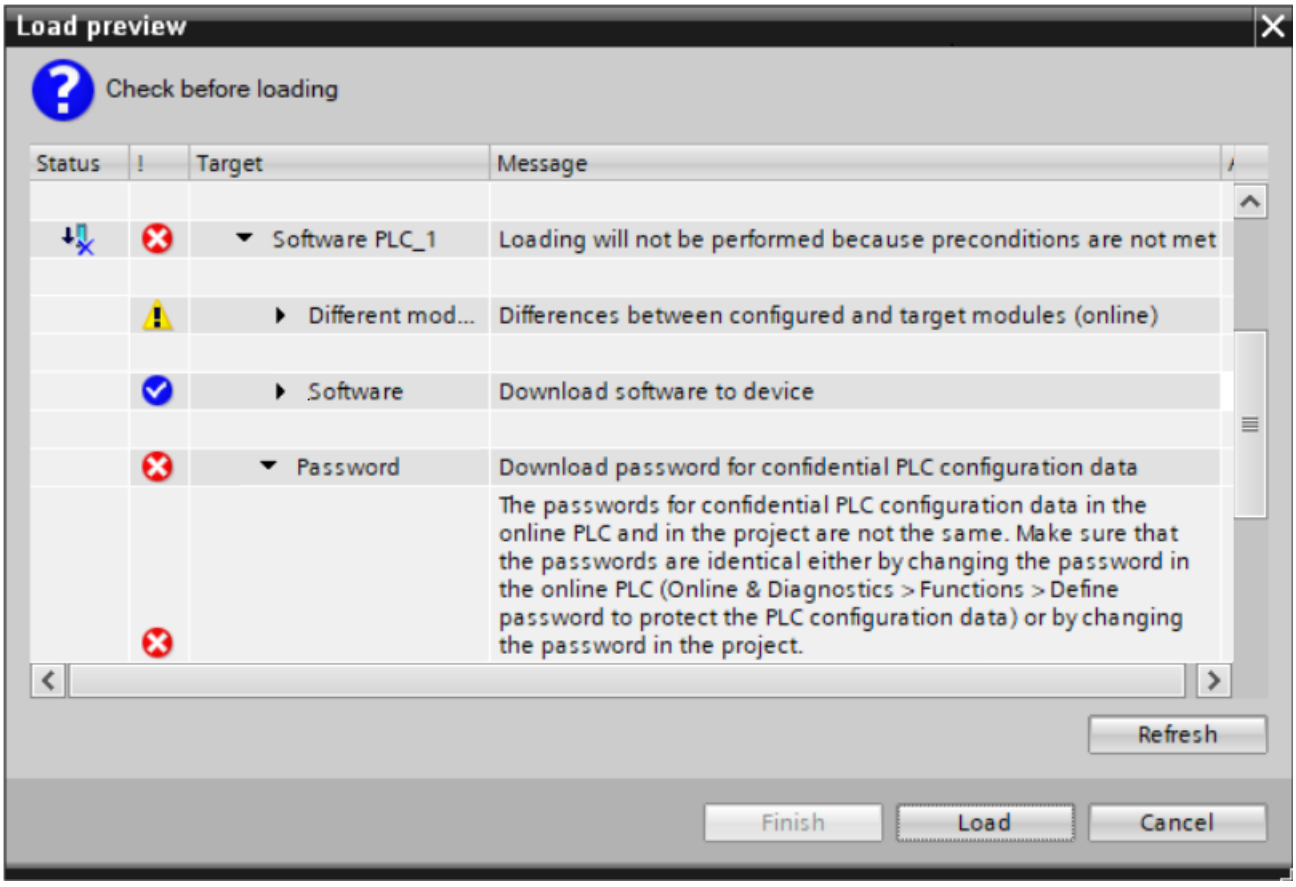



Figure 5-15 Load Preview

### Special features for fail-safe configuration data

The export function also supports configurations from fail-safe CPUs. After exporting fail-safe configuration data, an internal checksum and the collective F signature is written into the metadata of the .psc file for identification of the safety program. Before importing the fail-safe configuration, you can display the F signature via the panel or query the F signature via a script.

You can also decide who is allowed to export fail-safe CPU configuration data. Exporting files is only possible for users who are members of the Windows user group "Failsafe Operators". If the current user is not a member of this group, the export command is rejected and an error message appears.

### Error, status and diagnostic messages

The following table gives you an overview of possible error, status and diagnostic messages displayed on the PC System Control Tool, Computer Management Event Viewer or TIA Portal:

| Message | Comment |
|---|---|
| Error: GetStoreStatus - PC Station not available or version not suitable | To solve this issue, right-click on the PC Station panel and select "Restart > Restart all PC Station services" |
| Error: PCSystem_ControlTool- Current user does not have administrator right! | To solve this issue, run the command prompt as administrator |
| Error: ExportConfig- command rejected: The current user is not member of the user group "Failsafe Operators". | To solve this issue, add the user to the group of "Failsafe Operators" |
| Error: ExportConfig- File already exists. | To solve this issue, use a different file name or rename/delete the old .psc file |
| Export PC Station not started | Export has not started yet |
| Export component not started | Export of component has not started yet |
| Export PC Station started | Export is running |
| Export PC Station finished | Export has finished successfully |
| Export PC Station failed | Export has finished with error |
| Export Station Manager started | Export of Station Manager has started |
| Export Station Manager finished | Export of Station Manager has finished |
| Export Station Manager failed | Export of Station Manager failed |
| Export component started | Export of component has started |
| Export component finished | Export of component has finished |
| Export component failed | Export of component failed |
| Configuration not found | PC Station is not configured |
| Internal error | Export operation failed with unknown error |
| Component not configured | Component is not configured |
| Component not registered | Component is not registered |
| Component not finished in time | The component did not finish the export in time |
| Invalid path | The configuration could not be stored in the specified folder |
| Unknown | Unknown result code |
| Not enough free disk space | There is not enough free disk space available |

| Message | Comment |
|---|---|
| File path too long | The file path is too long |
| Configuration changed during export | The exported configuration is inconsistent |
| Export of fail-safe configuration failed | Fail-safe import failed with internal (unknown) error |
| Because the user is not a member of the Windows user group “Failsafe Operators”, user is not authorized to start an export for fail-safe protected SWCPUs. | Add the user to the group of "Failsafe Operators" |

### 5.11.4 Delete configuration

You need to delete the configuration of the entire PC under the following circumstances:

- When you load a project with firmware version V2 on a target device on which a project with firmware version < V2 is installed.
- When you load a new PC Station V2.0 configuration.
- When you copy an existing project and load it onto a modified device.
- When you want to change and load a configured PC system with Software Controller version 2 to version 1.8.

To do this, select the command "Delete the current SIMATIC software configuration" in the shortcut menu of the PC Station icon in the Info area of the taskbar.

**NOTE**

If you run this command, the entire configuration of the Software Controller is deleted, including the hardware configuration and the program. The CPU is in a state similar to after the installation. To be able to continue to operate the software controller, load the PC system to the target system.

You have the following options for downloading the PC system:

- Using "Download to device" command in the shortcut menu
- Using the display of the PC Station
- Using the PCsystem_Control.exe command "/ImportConfig"

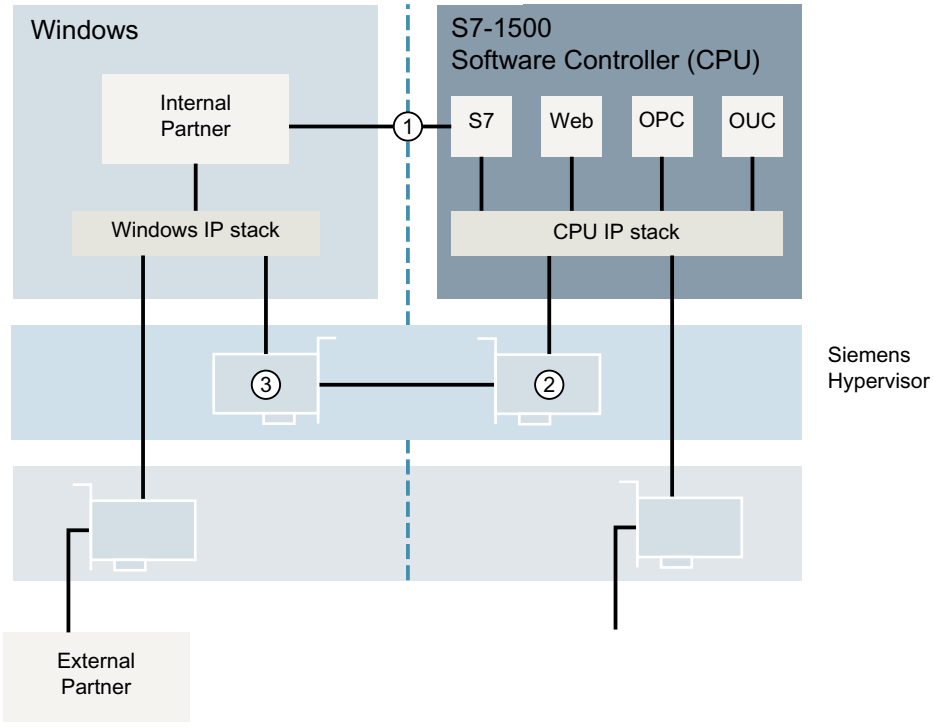
## 5.12 Special features with CPU 1505SP

This section describes the differences between configuration of a STEP 7 project with a CPU 1505SP and configuration with a CPU 1507S/1508S.

- If you add the CPU 1515SP PC2 as a new device, the CPU 1505SP is already preconfigured.
- The interfaces have already been completely assigned.
- The NVRAM has already been activated as the storage location for retentive data.
- The CPU 1505SP is configured for automatic start during booting of the PC.
- The LEDs are activated.

## 5.13 Communication

The CPU has a virtual Ethernet network via which the CPU can communicate with Windows applications, and in particular with OPC UA. Two interfaces are available.
On the CPU, the "runtime communications interface" is used as the interface for communication. The interface is displayed on Windows as "SIMATIC RT VMM Network Adapter".




① PC communication interface
② Runtime communications interface
③ SIMATIC RT-VMM network adapter

Figure 5-16 Overview of interfaces

The following options are available for using OPC UA:

- Using OPC UA locally on the same PC (Page 89)
- Using OPC UA remotely over Windows Ethernet interfaces
  - Establishing a connection with IP routing
  - Establishing a connection using port forwarding (Page 90)

**NOTE**

**Output of the client IP address in the diagnostic buffer**

The CPU cannot determine the IP address of the Windows interface. The client IP address output in the diagnostic buffer is only an internal address and can be ignored.

**Timeout input in "Modbus_Client" program block has no effect**

The timeout is approx. 38 seconds, regardless of the value entered under "Blocked_Proc_Timeout".

## 5.13.1 Using open communication over Windows interfaces

### Introduction

The S7-1500 Software Controller supports open communication (OUC) via the assigned PROFINET interfaces.

In addition, the S7-1500 software controller supports open communication with Windows applications, and with communications partners via Windows Ethernet interfaces with the following protocols:

- TCP
  With a passive TCP/IP connection where you are only receiving and not sending data, you will not be informed about a loss of connection.
- UDP

The usual program blocks for open communication can be used for this purpose:

- TSEND_C, TRECV_C
- TMAIL_C
- TCON/TSEND/TRCV/TUSEND/TURCV

**NOTE**

**Use of ISO on TCP**

Use of ISO on TCP is not available via Windows Ethernet interface (HW_ID 59). Use a programmed TCP/UDP communication.

**NOTE**

**T_CONFIG instruction**

Do not use an all-zero address for calls over NTP. Calls with all-zero addresses result in error "C080_D200".

### Utilized interface

The CPU uses the "PC Communication Interface" (HW_ID 59) for configuration of OUC connections. For this purpose, enter the system constant <PC Communication Interface> in the relevant location in the data block for the connection data.

## 5.13.2 Using OPC UA with Windows applications

### 5.13.2.1 Using OPC UA locally on the same PC

Before you can use the virtual Ethernet network for OPC UA communication, the IP settings of the two virtual Ethernet interfaces must match. All virtual Ethernet interfaces must be located in the same IP subnet.
Use the following settings:

- Runtime communications interface:
  The address is set in the properties of the CPU in the hardware configuration in STEP 7.
- SIMATIC RT-VMM network adapter:
  You set the IP address and subnet mask under "Control Panel > Network and Internet > Network and Sharing Center > Change adapter settings".
  Make the setting before commissioning; setting via STEP 7 is not possible.

### 5.13.2.2 Using OPC UA remotely over Windows Ethernet interfaces

IP routing makes the runtime communications interface accessible through an external network. This allows an external OPC UA client to access the OPC UA server of the CPU or the client of the CPU to access an external server.

**Procedure**

Proceed as follows to implement external access to the OPC UA server over a routed TCP/IP connection:

1. In STEP 7, configure the runtime communications interface of the CPU for routed IP connections.
   Enter the IP address of the SIMATIC RT VMM network adapter as the default router address.
   You can find additional information in the STEP 7 online help.
2. Configure the Windows IP router and enter the IP route to the interface.
   For the runtime communication interface and the SIMATIC RT VMM network adapter, assign IP addresses that are located in the same IP subnet.

You can configure port forwarding using command line commands. An OPC UA request from an external OPC UA client is then forwarded straight to the OPC UA server of the CPU via the runtime communications interface.

### Procedure

1. To open the command prompt, enter "cmd.exe" in the search field in the start menu, and then under the options for the app, click "Run as administrator".
2. Enter the following command with the corresponding port numbers and IP addresses:
   ```
   netsh interface portproxy add v4tov4 listenport=<Port number>
   connectaddress=<IP address> connectport=<Port number>
   listenaddress=<IP address> protocol=tcp
   ```
3. Confirm with the Enter key.
   The port under "listenport" is forwarded to the port under "connectport".

**NOTE**

- Port number 4840 is set by default.
- Enter the parameters "ServerEndPontUrl" and "ServerUri" manually in the configuration data block of the client interface.

### Result

- The runtime communications interface is not visible in the external network; the CPU can be accessed directly over the IP address of the Windows interface.
- Other OPC UA servers cannot be accessed on Windows.
- If you are using OPC UA Security, you will have to connect the certificates to the IP address or computer name in Windows.

## 5.13.3 Special features of communication interfaces

### Internal partner

| S7 Engineering (internal) | Special features |
|---|---|
| TIA Portal, STEP 7 | Not supported |

| S7 HMI (internal) | Special features |
|---|---|
| WinCC RT Advanced V15.1 (or higher) | Configuration in STEP 7 including connection configuration |
| WinCC RT Professional V15.1 (or higher) | see application example (https://support.industry.siemens.com/cs/ww/en/view/109750290) |
| WinCC V7.4 Service Packs (or higher) | see application example (https://support.industry.siemens.com/cs/ww/en/view/109750290) |
| WinCC flexible | Not supported |

| S7 SIMATIC NET OPC (internal) | Special features |
|---|---|
| | Local operation is not possible |

| S7 communication to SIMATIC controllers (internal) | Special features |
|---|---|
| | Not supported |

| S7 communication to third-party applications (internal) | Special features |
|---|---|
| Other libraries for various high-level languages (e.g. LibNoDave) | • Supported communication methods<br>– Data access to non-optimized data<br>• Requirement<br>– You have enabled "PUT/GET".<br>– The index of the CPU is 1.<br>• Addressing the CPU<br>– Passive<br>• Addressing the CPU via the internal partner<br>– IP address: IP address of runtime communication interface<br>– Port number: 102<br>– Rack = 0, slot = set index = 1 |

| Web browser (internal) | Special features |
|---|---|
| Any browser | Requirements<br>• You have enabled the Web server.<br>• You have enabled operation over the respective interface.<br>Via PC communication interface<br>• IP address: Local Host (127.0.0.1)<br>• Port number: As configured in the display application (default: 81/343)<br>Via runtime communication interface<br>• IP address: IP address of the runtime communication interface<br>• Port number: Default |

| OPC UA (internal) | Special features |
|---|---|
| OPC UA client application | • Supported communication methods<br>– Data access to any (configured) data<br>– Method call<br>• Requirement<br>– You have enabled OPC UA.<br>• Addressing the CPU via internal OPC UA client application<br>– IP address: IP address of the runtime communication interface<br>– IP port: Default |
| OPC UA server application | • Supported communication methods<br>– Data access to any (configured)<br>– DataMethod Call<br>• Requirement<br>– You have enabled OPC UA.<br>• Addressing internal server application via CPU<br>– IP address: IP address of the SIMATIC RT-VMM network adapter<br>– IP port: Default |
| OPC "classic" client (DA, DCOM-based) | Via OPC Wrapper applications under Windows (products from other manufacturers are available) |

| OUC (internal) | Special features |
|---|---|
| Any partner | Via PC communication interface<br>• Supported communication methods<br>– TCP programmed<br>– UDP programmed<br>– **Note:** Secure OUC communication is not possible over the PC communication interface.<br>• Addressing the internal partner via the CPU<br>– HW ID: 59 (PC communication interface)<br>– IP address: IP address of one of the Windows Ethernet interfaces (not "local host")<br>– Port number: As defined<br>• Addressing the CPU via the internal partner<br>– IP address: IP address of one of the Windows Ethernet interfaces<br>– Port number: As defined |
| | Via runtime communication interface<br>• Supported communication methods<br>– TCP programmed<br>– UDP programmed<br>– ISOonTCP programmed<br>• Addressing the internal partner via the CPU<br>– HW ID: 0 and 140<br>– IP address: SIMATIC RT-VMM network adapter<br>– Port number: As defined<br>• Addressing the CPU via the internal partner<br>– IP address: Runtime communication interface<br>– Port number: As defined |

## External partner

| S7 Engineering (external) | Special features |
|---|---|
| TIA Portal, STEP 7 | Can be configured over any Windows Ethernet interface |

| S7 HMI (external) | Special features |
|---|---|
| SIMATIC Panel | Configuration in STEP 7 including connection configuration (S7 routed connection) |
| WinCC RT Advanced V15.1 (or higher) | Configuration in STEP 7 including connection configuration (S7 routed connection) |
| WinCC RT Professional V15.1 (or higher) | Configuration in STEP 7 including connection configuration (S7 routed connection) |
| WinCC V7.4 Service Packs | see application example (https://support.industry.siemens.com/cs/ww/en/view/109750290) |
| WinCC flexible | Via unspecified connection<br>• Requirement<br>– You have enabled "PUT/GET".<br>• Addressing<br>– IP address: Windows interface in use<br>– Rack = 0; slot = index |

| S7 SIMATIC NET OPC (external) | Special features |
|---|---|
| SIMATIC NET V14 and higher | Configuration in STEP 7 including connection configuration (S7 connection) |

| S7 communication to SIMATIC controllers (external) | Special features |
|---|---|
| S7-1200 Controller | Configuration in STEP 7 including connection configuration (add S7 routed connection) |
| S7-1500 Controller | Configuration in STEP 7 including connection configuration (add S7 routed connection) |
| S7-1500 Software Controller | Configuration in STEP 7 including connection configuration (add S7 routed connection) |
| S7-300 Controller | Not supported |
| S7-400 Controller | Not supported |
| WinAC | Not supported |

| S7 communication to third-party applications (external) | Special features |
|---|---|
| Other libraries for various high-level languages (e.g. LibNoDave) | • Supported communication methods<br>– Data access to non-optimized data<br>• Requirement<br>– You have enabled "PUT/GET".<br>– The index of the CPU is 1.<br>• Addressing the external partner via the CPU<br>– Not supported<br>• Addressing the CPU via the external partner<br>– IP address: IP address of one of the Windows Ethernet interfaces<br>– Port number: 102<br>– Rack = 0, slot = set index = 1 |

| Web browser (external) | Special features |
|---|---|
| Any browser | Requirements<br>• You have enabled the Web server.<br>• You have enabled operation over the respective interface.<br>Via PC communication interface<br>• IP address: As the connected Windows Ethernet interface<br>• Port number: Configure as in the display application (default: 81/343)<br>Via runtime communication interface<br>• With IP Routing or NAT Routing set up under Windows<br>– IP address: IP address of the runtime communication interface<br>– Port number: Default<br>• With port forwarding set up under Windows<br>– IP address: IP address of the Windows Ethernet interface<br>– Port number: Default |

| OPC UA (external) | Special features |
|---|---|
| Any OPC UA client device | Supported communication methods<br>• Data access to any (configured) data<br>• Method call<br>Requirement<br>• You have enabled OPC UA. |

| OPC UA (external) | Special features |
|---|---|
| | Addressing the CPU via external client<br>• With IP Routing or NAT Routing set up under Windows<br>– IP address: IP address of the runtime communication interface<br>– IP port: Default<br>• With port forwarding set up under Windows<br>– IP address: IP address of the connected Ethernet interface<br>– IP port: Default<br>– **Note:** Some OPC UA clients do not support operation via port forwarding. |
| Any OPC UA server device | Addressing the external server via CPU client<br>• With IP Routing or NAT Routing set up under Windows<br>– IP address: IP address of the external client<br>– IP port: Default<br>• With port forwarding set up under Windows<br>– IP address: IP address of the SIMATIC RT-VMM network adapter<br>– IP port: Default |

| OUC (external) | Special features |
|---|---|
| Any partner | Via PC communication interface<br>• Supported communication methods<br>– TCP programmed<br>– UDP programmed<br>– **Note:** Secure OUC communication is not possible over the PC communication interface.<br>• Addressing the external partner via the CPU<br>– HW ID: 59 (PC communication interface)<br>– IP address: IP address of the external partner<br>– Port number: As defined<br>• Addressing the CPU via external partner<br>– IP address: IP address of the connected Windows Ethernet interfaces<br>– Port number: As defined |
| | Via runtime communication interface<br>• Supported communication methods<br>– TCP programmed<br>– UDP programmed<br>– ISOonTCP programmed<br>• With IP Routing or NAT Routing set up under Windows<br>– Addressing the external partner via the CPU<br>HW ID: 0 and 140<br>IP address: IP address of the external partner<br>Port number: As defined<br>– Addressing the CPU via external partner<br>IP address: Runtime communication interface<br>Port number: As defined<br>• With port forwarding set up under Windows<br>– Addressing the external partner via the CPU<br>HW ID: 0 and 140<br>IP address: IP address of the SIMATIC RT-VMM network adapter<br>Port number: As defined<br>– Addressing the CPU via external partner<br>IP address: IP address of the connected Windows Ethernet interface<br>Port number: As defined |

# Operation of the CPU

# 6

## 6.1 Operation using the display

### 6.1.1 Introduction to the CPU display

The CPU display is designed to resemble the removable display of a hardware controller. The CPU's display is a Windows program on your PC, with which you can operate the CPU. Detailed information on the individual options, a training course and a simulation of the selectable menu items is available in the SIMATIC S7-1500 Display Simulator (https://support.industry.siemens.com/cs/ww/en/view/109761758).

#### Functions of the display

Starting or closing the display has no effect on the status of the CPU. The screen position of the display on your monitor is saved when the display is closed.
The display shows you various menu and submenu items.




Figure 6-1 CPU in RUN mode

With the display, the following functions and elements, among other things, are available to you for working with the CPU:

- Start or stop the CPU without shutting down the PC
- Change the operating mode of the CPU
- Status displays for the CPU
- Menus for operation of the CPU
- Display of diagnostic information
- Password assignment for operator input on the display is possible via STEP 7

## Advantages

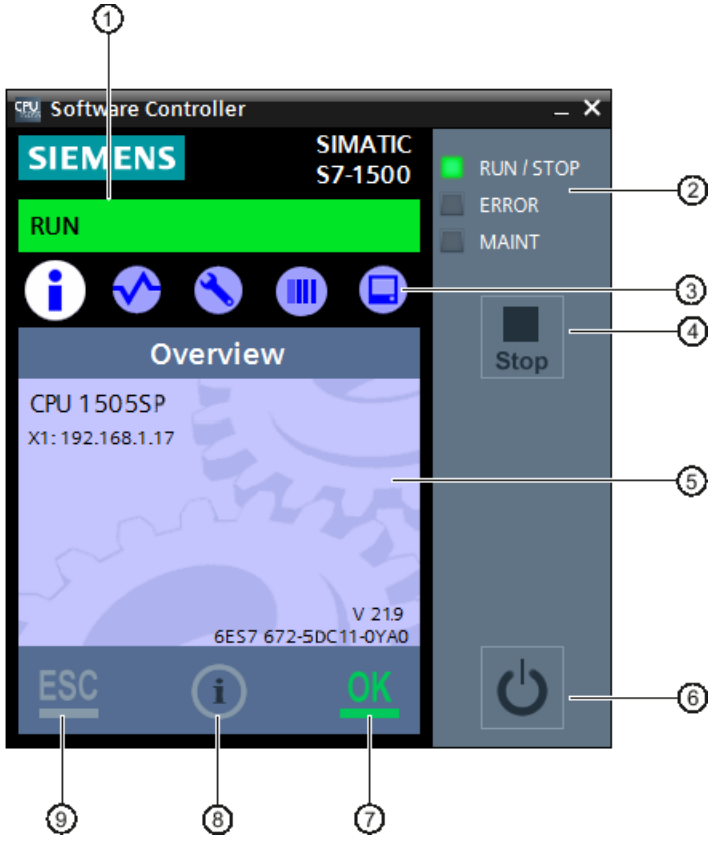
The display offers the following advantages:

- Reduced downtimes through diagnostics alarms in plain text
- Changing of the interface settings on site without programming device

## 6.1.2 Operator controls and controller

### Layout of the CPU display

The display offers a task-oriented view of the menus and the operating mode of the CPU. Here, you can quickly decide what you want to do and call up the tool for the task at hand. The figure below shows an example view of the CPU display:




① CPU status information
② LED displays for the current operating mode and diagnostic status
③ Menu selection
④ "RUN/STOP" button (mode selector)
⑤ Information display field
⑥ "Power" button
⑦ "OK" (acknowledge) button
⑧ "Help" button
⑨ "ESC" (Cancel/Back) button

Figure 6-2 Layout of the user interface

**NOTE**

**Operability with access protection**

The selected access protection may limit the operability of the display and the display of menu items.

Observe the information on the Access protection (Page 141).

## Menu overview

The table below shows the available submenus of the display:

| Main menu items | Meaning | Description |
|---|---|---|
|  | Overview | The "Overview" menu contains information about the properties of the CPU, such as the device name or software version. |
|  | Diagnostics | The "Diagnostics" menu contains information about diagnostics alarms, the diagnostics description, and the display of alarms. There is also information about the network properties of each of the CPU interfaces. |
|  | Settings | In the "Settings" menu, you assign IP addresses of the CPU, set the date, time of day, time zones, operating modes (RUN/STOP), and protection levels, perform a memory reset or a reset to factory settings of the CPU, and display the status of firmware updates. |
|  | Module | The "Modules" menu contains information about the modules that are used in your configuration. The modules can be used as central modules and/or as distributed modules.<br>Distributed modules are connected to the CPU via PROFIBUS or PROFINET.<br>Here, you have the option of setting the IP addresses for a communication interface. |
|  | Display | In the "Display" menu, you make all settings involving the CPU display, such as the language setting. |

## Control

Several options are available to control the display:

- Mouse
- Keyboard
- Touch screen (for SIMATIC IPC)

The following function keys and shortcut keys are available with the CPU display:

- **Arrow buttons**: For navigation in a menu
- **Enter**: Access to the menu command, confirmation of input, and exiting from edit mode
- **ESC**: Restoration of the original content, and navigation back to the previous menu command
- **F1**: Calls the online help
- **F2**: Puts an editable field into the processing status
- **F5**: Updates list entries that are not updated automatically
- **Ctrl + P**: Corresponds to the "Power on/off" button
- **Ctrl + M**: Changes the CPU operating mode to RUN or STOP

### Functions of the "OK" and "ESC" buttons

- For menu commands in which an entry can be made:
  - OK → valid access to the menu command, confirmation of input, and exit from the edit mode
  - ESC → restore original content (which means changes are not saved) and exit edit mode

    A note is displayed in case of changes to the settings "PROFINET device name" and "IP address" after pressing the "ESC" button. Press the "ESC" button once again to discard the changes. Press the "OK" button to apply the changes.
- For menu commands in which no entry can be made:
  - OK → to next submenu item
  - ESC → back to previous menu item

### Tool tips for support of usability

The CPU display provides tool tips for the most important buttons.

**NOTE**

**What is a tool tip?**

A tool tip is a small pop-up window in application programs or on web pages. It displays a description for an element of the graphical user interface. Tool tips either display the text that the element itself contains or contain supplementary information about the related element.

A tool tip appears only when the button is active.
The CPU display contains buttons that have different functionalities. These buttons have different tool tips depending on the functionality. These buttons include:

- "RUN/STOP" button (mode selector)
- "Power" button
- "OK" button
- "ESC" button

### Starting help

You can open the online help for the CPU directly from the opened display in two ways:

- Click . This button is always active in the CPU display. This button always opens the start page of the help.
- Press the "F1" key to open the help for a specific context. The help opens in a separate dialog. The start page of the help opens by default.

  Some menus and submenus in the CPU display are linked to a specific help topic. In this case, the "F1" key opens the relevant help.

**NOTE**

**Language of the help**

The help opens in the same language that you have selected for the CPU display.

### Reference

You will find additional information on the topic of the "CPU's display" in the S7-1500 Automation System (https://support.automation.siemens.com/WW/view/en/59191792) system manual.

## 6.1.3 Manually starting and stopping the CPU via display

### Starting via the CPU display

After the start of the CPU display, the CPU can have one of the following statuses:

- The CPU is not running and can be started manually.
- The CPU is already running and indicates the status "Connecting" while the connection is being established. Afterwards, the CPU starts automatically with the current operating mode.

The CPU display lets you manually start or stop the CPU without shutting down the PC. Starting or closing the display has no effect on the status of the CPU.

**NOTE**

**Operating mode in the case of manual start via the display**

If you start the CPU manually via the display, it is always in STOP mode.




Figure 6-3 Display of the CPU in "POWER OFF" state

### Functionality in the powered-off "POWER OFF" state

When the CPU is in "POWER OFF" state, the following functionalities are active:

- LED displays indicate the "POWER OFF" state
- "Start CPU" button to start the CPU
- "Settings > Restore > "Format volume" menu and "Settings > Web server" menu
- "Display" menu for changing the language of the display and the help
- "Show help" button to open the help

### Starting the CPU

To start the CPU, follow these steps:

1. Open the CPU display.
   Only specific functionalities of the display are activated.
2. Click on the "Start CPU" button .
   The status bar of the display initially shows the status "Connect". Once the start process has been successfully completed, the status bar shows the current operating mode of the CPU. The CPU is always in STOP mode with the described manual start.




Figure 6-4 CPU started

### Procedure to power off

To power off the CPU, follow these steps:

1. Open the CPU display.
   All functionalities of the display are active.
2. Click .
   The display shows an acknowledgment query to power off the CPU.




Figure 6-5 Power off CPU

3. Confirm the prompt with "OK".

### Result

The CPU is stopped. The display remains open. The status bar of the display shows the "POWER OFF" status.

**NOTE**
**Using central backplane bus modules on a CPU 1515SP PC2**
When central backplane bus modules are used on a CPU 1515SP PC2, the central output modules use default values or the preconfigured substitute values when the CPU is stopped.

**NOTE**
**Retentive memory when powering off the CPU**
When powering off the CPU while the retentive memory is filled to capacity (100MB), an error message appears prompting you to restart windows.
Make sure that there is free retentive memory space available, before powering off the CPU.

## 6.1.4 Setting language options in the display

The CPU display can be displayed in various user interface languages. The language setting is not made in STEP 7. Rather, it is made directly in the display using the corresponding menu. In addition, the language for alarms is displayed. The two language settings are independent of one another. The language for alarms depends on your operating system's current setting.

**NOTE**

**Language of the online help and the Web server**

A change of the language setting for the display:

- **also** changes the language for the online help
- does **not** change the language for the Web server

### Changing the display language

To change the language setting in the display, follow these steps:

1. Start the CPU.
2. Double-click on the "Display" menu.
   The "Display" menu opens.

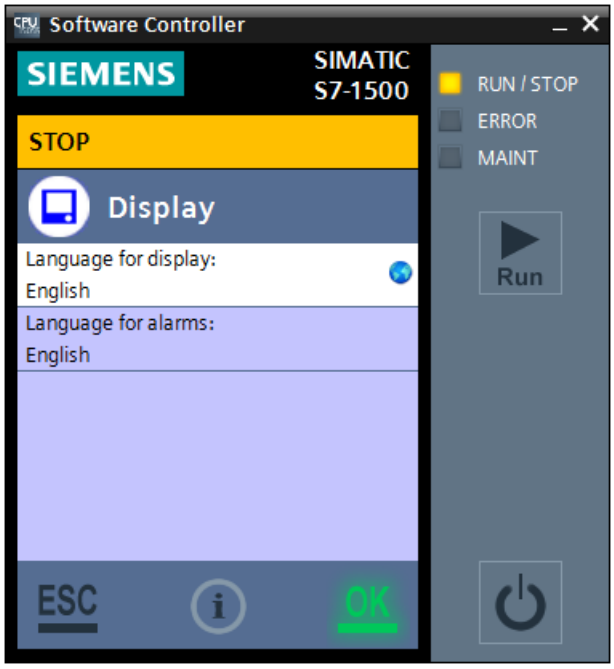



Figure 6-6 Language changeover for display and alarms

3. To change the display language, double-click the "Language for display" entry.
   The language selection opens.




Figure 6-7 Language selection

4. Select the appropriate language.
5. Confirm your selection with "OK".

## Result

The required language settings are applied.
The language settings are stored when the display is closed.

## Explanation of the available languages

The display supports the following language settings:

| Language | Meaning |
|---|---|
| Operating system | The display applies the language of the operating system of your PC. If your operating system uses a language that the display does not support, the display is automatically opened with the English user interface.<br>If you change the language of your operating system later, that also affects the language of the display. |
| English | The display supports English (USA).<br>This language setting is independent of the language of the operating system of your PC. |
| French | The display supports French (France).<br>This language setting is independent of the language of the operating system of your PC. |

| Language | Meaning |
|---|---|
| German | The display supports German (Germany).<br>This language setting is independent of the language of the operating system of your PC. |
| Italian | The display supports Italian (Italy).<br>This language setting is independent of the language of the operating system of your PC. |
| Spanish | The display supports Spanish (Spain).<br>This language setting is independent of the language of the operating system of your PC. |
| Chinese | The display supports Chinese (Simplified).<br>This language setting is independent of the language of the operating system of your PC.<br>**Note:** If you want to use Chinese, use the Windows Embedded Standard 7 (P) or Windows 7 Ultimate operating system. |

## 6.1.5 Setting the date and time

### Introduction

The CPU display uses the date and time information of Windows by default. These can also be changed manually.

### Changing the date and time in the CPU display

To change the date and time in the display, follow these steps:

1. Open the CPU display.
2. Select the "Settings > Date & Time > General" menu.
3. Change the desired settings.
   The format of the date and time information is dependent on the language setting for the CPU display.
   You can only change the time zone when you have downloaded a project.

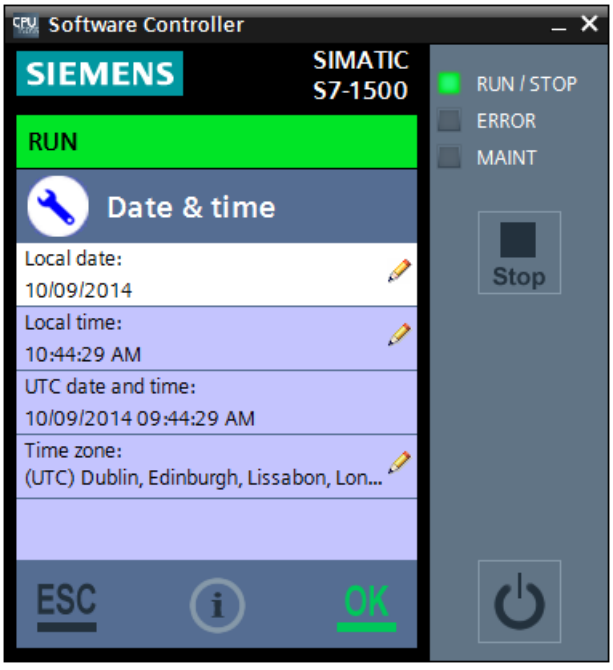



Figure 6-8 Settings for date and time

### Result

The settings for date and time are applied.
Three other methods are available for changing the date and time:

- With the online and diagnostics function "Set time"
- In the CPU properties in STEP 7
- Using instructions in the user program

**NOTE**

**Change of setting with time synchronization**

When you use the time synchronization functionality, each change is overwritten via the CPU display during the next synchronization.

## 6.1.6 Changing the operating mode

### General

The CPU display gives you the option of changing the operating mode of the CPU between RUN and STOP and reading off the current operating mode using the "RUN/STOP" button. Start the CPU first.
The LED display and its color show the current operating mode.
The "RUN" or "STOP" button always shows the operating mode that will be active after clicking the button.

**NOTE**

**Setting of the mode selector of a CPU 1515SP PC2**

The "RUN/STOP" button on the CPU display only controls the software.

If you are using the CPU in conjunction with a CPU 1515SP PC2, the position of the hardware mode selector takes priority. If the mode selector of CPU 1515SP PC2 is in STOP position, for example, the CPU cannot be put into RUN mode via the display.

The table below provides an overview of the available operating modes and their meaning:

Table 6-1 Display of the "RUN/STOP" button (mode selector)

| Mode | Meaning | Explanation |
|---|---|---|
| RUN | RUN mode | The CPU is executing the user program. |
| STOP | STOP mode | The CPU does not execute the user program. |

The status bar in the display shows the current operating mode. Different colors and texts are displayed for visualization. The status bar is visible in any menu view.




Figure 6-9 CPU status information shows RUN mode

## Procedure

To change the operating mode, follow these steps:

1. Open the CPU display.
2. Start the CPU.
   The status bar and the LED display shows the current operating mode (in this case STOP).
3. To set the CPU to RUN mode, click the button .
   The status bar changes to RUN mode.
   The button changes its display to "STOP".
4. To set the CPU to STOP mode again, click the button .
   The status bar changes back to STOP mode.
   The button changes its display to "RUN".

### The different mode displays and mode symbols

The CPU status information can display the following statuses:

- CPU is in "RUN" mode.

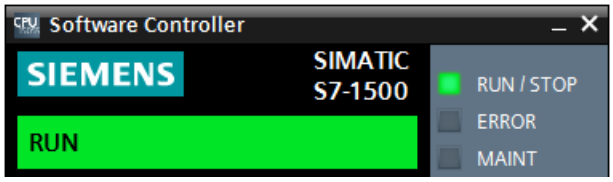



Figure 6-10 "RUN" mode

- CPU is in "STOP" mode.

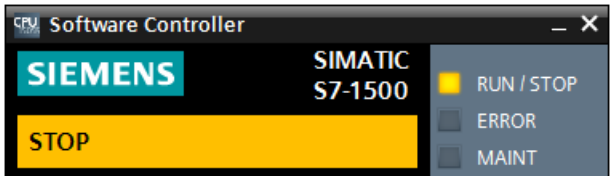



Figure 6-11 "STOP" mode

- CPU is in "FAULT" mode.

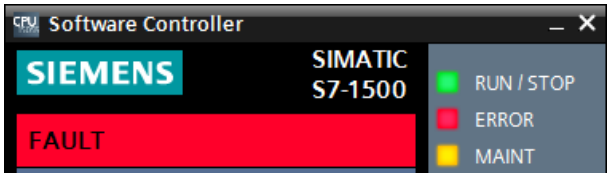



Figure 6-12 "Fault" mode

Various additional symbols can also be displayed in the CPU status information:

| Additional symbol | Meaning |
|---|---|
|  | Indicates whether a configured password has been entered or not (Page 146). |
|  | Notifies you of an interrupt. |
|  | Notifies you of the "Force Mode". |

## 6.2 Operation using the command line commands

The CPU can be controlled in various ways. In addition to operation via the display application, it is also possible to control operation using command line commands. You can also use command line commands in an automated way in batch files or scripts.

In the following situations, it may make sense to control the CPU with command line commands:

- You are using the CPU in the event of a power failure with a UPS (Page 117) and would like to safely stop the CPU.
- You are using functionalities of the CPU display as an HMI application, which occupies the screen.

In this case, the command line is available for controlling the CPU using special commands.

### Commands for controlling the operating mode of the CPU

The following table provides an overview of the command line commands supported by the CPU:

| Command | Explanation |
|---|---|
| CPU_Control /PowerOnCPU | Starts the CPU in "STOP" mode. |
| CPU_Control /PowerOnCPU -Auto | Starts the CPU with the configured startup type. |
| CPU_Control /PowerOffCPU | Stops the CPU. |
| CPU_Control /PowerOffCPU -Terminate | Forces the CPU to stop in any situation. Retentive data could not be stored with this operation. |
| CPU_Control /AllowReboot | Permits a complete restart of the PC. The CPU prevents the PC restart and by default only restarts the Windows operating system to continue monitoring the automation process. To prevent loss of retentive data, you must manually stop the CPU **beforehand**. |
| CPU_Control /DisallowReboot | Disables the CPU_Control/AllowReboot function if it was executed beforehand. |
| CPU_Control/Dumpservicedata -path <path> | Allows service data to be saved in a file after "FAULT" mode. SIEMENS AG can provide this file upon request by the SIEMENS Customer Support for diagnostic purposes. |
| CPU_Control /RUN | Sets the CPU to "RUN". |
| CPU_Control /STOP | Sets the CPU to "STOP". |
| CPU_Control /Help | Displays the help text in the command line editor. |
| CPU_Control /MemoryReset | Resets the CPU memory.<br>When the CPU is in "RUN", you are prompted for a confirmation before the control tool continues. |
| CPU_Control /MemoryReset -Force | Resets the CPU memory regardless of the current state. |
| CPU_Control /FactoryReset | Resets the CPU to the factory setting.<br>When the CPU is in "RUN", you are prompted for a confirmation before the control tool continues. |
| CPU_Control /FactoryReset -Force | Resets the CPU memory regardless of the current state. |

**NOTE**

**No CPU reset from the command line under Windows**

Note that under a Windows operating system it is not possible to reset the CPU to factory settings or to reset the CPU memory using the command line.

The following table provides an overview of the feedback messages based on the supported command line commands:

| Feedback | Code | Explanation |
|---|---|---|
| CPU_Control tool operation result: SUCCESS | 0 | The command was executed successfully. |
| CPU_Control tool operation result: FAIL | 1 | Error occurred when executing the command. |
| Invalid parameters. See help for more information | 64 | The parameters of the command were invalid. The help opens automatically. |
| Too many parameters. See help for more information | | |

**NOTE**

**Changing the operating state of a CPU**

The Windows user group "Software Controller Operators" in the computer administration is authorized to change the operating state of a CPU. The user with whose user rights the command is executed must be part of this user group.

This user group is not available by default; it needs to be created.

The command can also be executed when a protection level is configured for the CPU.

# 6.3 Operating modes

## 6.3.1 Basic principles of the operating modes

### Introduction

Operating modes describe the states of the CPU. The following operating modes can be set via the CPU display:

- RUN
- STOP

In these operating modes, the CPU can communicate, e.g., via the PN/IE interface.

The status LEDs indicate the current operating mode.

### Reference

You can find additional information in the STEP 7 online help.

## 6.3.2 Operating mode transitions

### Operating modes and operating mode transitions

The following figure shows the operating modes and the operating mode transitions:

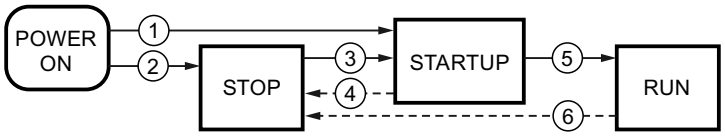



Figure 6-13 Operating modes and operating mode transitions

The following table shows the conditions under which the operating modes change:

Table 6-2 Operating mode conditions

| No. | Operating mode transitions | Conditions |
|---|---|---|
| ① | POWER ON → STARTUP | After switching on, the CPU goes to "STARTUP" mode if:<br>• The hardware configuration and program blocks are consistent.<br>• The start-up type "Warm restart - RUN" is set<br>or<br>the start-up type "Warm restart - mode before POWER OFF" is set and RUN mode was active before POWER OFF.<br>Non-retentive memory is cleared, and the content of non-retentive DBs is reset to the start values of the load memory. Retentive memory and retentive DB contents are retained. |
| ② | POWER ON → STOP | After switching on, the CPU goes to "STOP" mode if:<br>• The hardware configuration and program blocks are not consistent<br>or<br>• the "No restart" startup type is set or<br>• if the CPU is manually started from the display.<br>Non-retentive memory is cleared, and the content of non-retentive DBs is reset to the start values of the load memory. Retentive memory and retentive DB contents are retained. |
| ③ | STOP → STARTUP | The CPU goes to "STARTUP" mode if:<br>• The hardware configuration and program blocks are consistent.<br>• The CPU is set to "RUN" by the programming device or via the display and the mode selector is in the RUN position<br>or<br>• the mode selector is switched from STOP to RUN.<br>Non-retentive memory is cleared, and the content of non-retentive DBs is reset to the start values of the load memory. Retentive memory and retentive DB contents are retained. |
| ④ | STARTUP → STOP | The CPU returns from "STARTUP" mode to "STOP" mode in the following cases:<br>• An error is detected during start-up.<br>• The CPU is set to "STOP" from the programming device.<br>• A STOP command is executed in the Startup OB. |

| No. | Operating mode transitions | Conditions |
|---|---|---|
| ⑤ | STARTUP → RUN | The CPU goes to the "RUN" mode in the following cases of "START-UP":<br>• The CPU has initialized the PLC tags.<br>• The CPU has executed the startup blocks successfully. |
| ⑥ | RUN → STOP | The CPU returns from "RUN" mode to "STOP" mode in the following cases:<br>• An error is detected that prevents continued processing.<br>• A STOP command is executed in the user program.<br>• The CPU is set to "STOP" mode via the programming device, the display, or the mode selector. |

# Maintenance 7

## 7.1 Status display in the notification area

An icon is displayed in the notification area of the Windows taskbar during operation of the CPU. The icon indicates, among other things, the current operating mode of the CPU and special diagnostic information.

Double-click the icon in the notification area to open the display of the CPU.

### Displaying the notification area icon permanently

Windows displays only certain icons in the notification area permanently by default. By default, the CPU icon is displayed only when there is a change of operating mode and is then hidden again. You can enable permanent display of the CPU icon.

To enable permanent display of the CPU icon, follow these steps:

1. Select the "Change notification icons" shortcut menu command in the notification area. The Control Panel opens.
2. Select the CPU icon.
3. Change the behavior to "Show icon and notification".

### Functionality of the notification area icon

The notification area icon provides the following functionalities and information:

- Double-click the icon in the notification area to open the CPU display.
- Different operating modes of the CPU are represented differently.
- Message window for special information , such as a missing license key
- Tool tips for identification of the corresponding CPU instance

### States of the notification area icon

The status of the icon for the CPU in the notification area of the taskbar changes as soon as the CPU mode changes.
The notification area icon can display the following states:

| RUN | STOP | Fault |
|---|---|---|
|  |  |  |

**NOTE**

**Created link**

Only the symbols automatically created during setup show the correct operating modes. Any links you have created may not always show the current mode.

### Displaying the notification area icon in the active area of notification area

The icon for the CPU in the notification area of the taskbar can automatically be moved to the inactive area of the Windows notification area after a time period specified by the operating system. Change the visibility settings in the settings for the notification area of the taskbar.

## 7.2 PC Station display in the notification area

An icon for the PC Station's service is also displayed in the notification area of the Windows taskbar during operation of the CPU. Among other things, the icon indicates the current state of the PC Station's service and provides you with the opportunity to do configurations.
Right clicking the icon in the notification area opens the PC Station's shortcut menu

### States of the notification area icon

The state of the icon for the PC Station's service in the taskbar's notification area changes as soon as the mode of the PC Station changes.
The notification area icon can display the following states:

| RUN | STOP |
|---|---|
| | |

### Configuration options using the "Station Manager" service's icon

The icon for the PC Station's service in the taskbar's notification area gives you the following configuration options via the shortcut menu:

- Import > Import configuration
  This shortcut menu command opens and displays the metadata of a selected PC system configuration file. You also start the import process of the .psc file with this command.

  **NOTE**

  For an F-CPU, this function is only available if the current user is in the Windows user group "Failsafe Operators".

- Configuration
  - Delete the current SIMATIC software configuration
    Administrative rights are required for this configuration option.
    If you have assigned a protection level for the PC system and want to reset the password, you must delete the entire configuration. Stop the CPU, in order that the CPU's configuration will also be deleted.
    If you have deleted the PC system's software configuration, the protection level is also removed. Then you can download a project with a new protection level configuration.

    **NOTE**

    For an F-CPU, this function is only available if no passwords have yet been set or if the current user is in the Windows user group "Failsafe Operators".

    You can find additional information about deleting the configuration under "Resetting the PC system (Page 126)".
  - Change the configuration data directory
    Administrative rights are required for this configuration option.
    If you protect a partition with an enhanced write filter (EWF/FBWF/UWF), for example, the configuration and diagnostics data is protected, as well.
    Save the diagnostic data in an area of the hard disk that is not write-protected. You can also store the configuration data that contains the configuration in an area of the hard disk that is not write-protected.
- Restart all of the PC Station's services
  Administrative rights are required for this configuration option.
  This shortcut menu command causes all of the PC Station's services to be restarted.
- Exit
  This shortcut menu command causes the PC Station panel to be closed. The icon for the PC Station's service in the notification area of the taskbar is hidden. Start the PC Station panel again with the following entry in the Windows Start menu:
  Siemens Automation > SIMATIC > PC Station > "PC Station"

## 7.3 Using an uninterruptible power supply (UPS)

A UPS system can help to ensure that the CPU shuts down correctly and saves the current state in case of a power failure. Siemens recommends the use of a UPS for operation with the Windows operating system.

### Setting up the UPS for your PC

The CPU provides two options for using a UPS:

- Connect the UPS to the PC via USB. The UPS notifies Windows.
  The PC detects a power failure and sends a power failure signal to the CPU. The CPU can then trigger a quick shutdown and back up the retentive data, if such a configuration was made. Systems that use a Compact Flash or CFast file system that is protected with the EWF are stable in the event of an unexpected power failure.
  Enter the command "CPU_Control /PowerOffCPU" in the shutdown script of the UPS.
- Connect the UPS to the CPU via a digital input. Windows can be shut down in the CPU's user program by means of the "SHUT_DOWN: Shutdown target system" instruction.

### Consequences of a power loss without an operating system shutdown

A power failure without shutting down the Windows operating system with deactivated EWF/FBWF/UWF can damage the file systems of the operating system. Use a UPS system to protect the file systems.

## 7.4 BIOS update

To guarantee correct operation, update the BIOS to ≤ the version specified in section Reference information for use with SIMATIC IPC (Page 166).

**NOTE**

**BIOS settings lost after BIOS update**

The BIOS update will reset the BIOS to its default settings. After having updated the BIOS, choose the correct BIOS settings again.

For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305).

# 7.5 Firmware update of I/O modules

## Introduction

During operation, it may be necessary to update the firmware (for example, due to functional enhancements).

**NOTE**

**Firmware update of I/O modules**

The firmware of an I/O module can be updated centrally or distributed.

## Requirement

- You have downloaded the file(s) for the firmware update from the Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/ps).
  On this web site, select: Automation technology > Automation systems > Industrial Automation Systems SIMATIC > PLC > Software Controller > S7-1500 Software Controller.
  From there, navigate to the specific type of module that you want to update. To continue, click on the link for "Software downloads" under "Support". Save the desired firmware update files.
- Before installing the firmware update, ensure that the modules are not being used.

## Options for the firmware update

A firmware update is performed using STEP 7 (online) or the Web server.

## Installation of the firmware update

**⚠ WARNING**

**Impermissible plant states possible**

Due to the installation of the firmware update, the CPU enters the STOP mode, which can impact the operation of an online process or a machine.

Unexpected operation of a process or a machine can lead to fatal or severe injuries and/or to material damages.

Ensure before installing the firmware update, that the CPU is not executing any active process.

### Procedure using STEP 7

Proceed as follows to perform an online firmware update via STEP 7:

1. Select the module in the device view.
2. Select the "Online & diagnostics" command from the shortcut menu.
3. Select the "Firmware update" group in the "Functions" folder.
4. Click the "Browse" button in the "Firmware update" area to select the path to the firmware update files.
5. Select the matching firmware file. The table in the firmware update area lists all modules for which an update is possible with the selected firmware file.
6. Click the "Start update" button. If the selected file can be interpreted by the module, the file is downloaded to the module. If the operating mode of the CPU needs to be changed for this purpose, you will be prompted to do this by means of dialogs.

**NOTE**

**Updating the firmware**

The "Run firmware after update" check box is always activated.

### Procedure using the Web server

The procedure using the Web server is described in the function manual for the Web server. You can find the function manual on the Internet (https://support.industry.siemens.com/cs/ww/en/view/59193560).

### Reference

Further information on firmware updates can be found in the S7-1500 Automation System (https://support.automation.siemens.com/WW/view/en/59191792) system manual and the STEP 7 online help.

# 7.6 Resetting the CPU

During a reset, the CPU is set to the "delivery state". This means that all data stored in the CPU is deleted.

The following reasons may require a data reset:

- A restart with the original data (cold restart)
- Reset all internally persistent settings (e.g., IP address) for a defined status
- Use a cleaned state of the CPU for new projects

## Reset options

You have the following options to reset the CPU.

- **Memory reset**: The CPU is reset to the project settings configured by default. You can run this function as follows:
  - In the CPU display (Page 121)
  - Via the mode selector of the utilized hardware platform (Page 123)
- **Factory settings**: CPU is reset to the default factory settings. You can run this function as follows:
  - In the CPU display (Page 121)
  - Using STEP 7 (Page 122)

  **NOTE**
  **Date and time**
  After the reset, the Windows time is applied as local date and local time.

- **Format the CPU volume**: The CPU volume is cleaned (Page 123). You run this function in the CPU display.
  With an F-CPU, this function is not available via the display.

## Conditions for reset

For resetting the CPU, make sure that the following conditions are met:

- CPU is in STOP mode
  The CPU must be in STOP mode to be reset.
- Sufficient retentive memory available
  When the retentive memory is filled to capacity (100MB), it is no longer possible to perform a memory or factory reset of the CPU. Make sure that there is free retentive memory space available, before performing a memory reset using the display or STEP 7.

## Reference

Additional information on the topic "Resetting to factory settings" can be found in the Structure and Use of the CPU Memory (https://support.automation.siemens.com/WW/view/en/59193101) Function Manual, section on memory areas and retentivity, and in the STEP 7 online help.

## 7.6.1 Reset using the display

The following procedures are available to reset the CPU to factory settings or to perform a memory reset using the display.

### Procedure using the display

To reset the CPU using the display, follow these steps:

1. Open the CPU display.
2. Start the CPU (if CPU is in "Power Off" state).
3. Select the "Settings" menu.
4. Confirm your selection with "OK".
   The "Settings" menu opens.
5. Select "Reset".
6. Confirm your selection with "OK".
   The "Reset" item opens.




Figure 7-1 Reset options

7. Select one of the options to reset the CPU.
   The requested function opens.

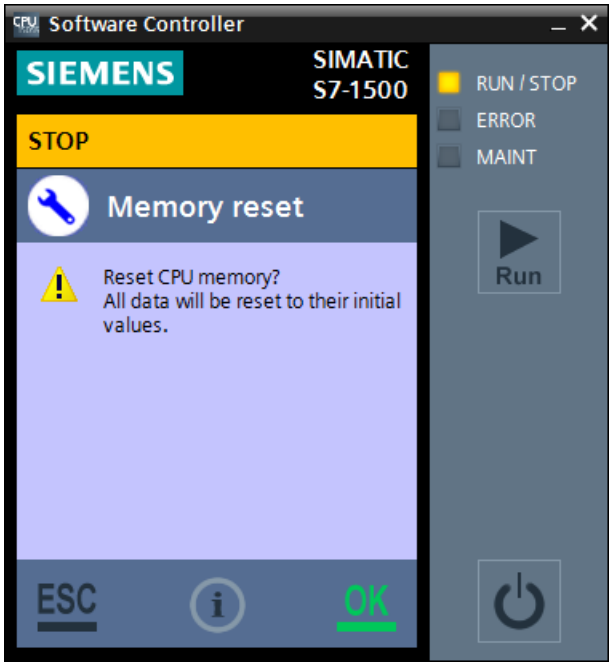



Figure 7-2 Confirmation prompt prior to reset

8. Acknowledge the confirmation prompt with "OK".

### Result

The CPU performs the reset. The RUN/STOP LED flashes yellow. When the RUN/STOP LED lights up yellow, then the CPU has been reset, and is in STOP mode. The corresponding event is entered in the diagnostics buffer.
The project is retained since the load memory is not erased.

## 7.6.2 Reset using STEP 7

The following procedures are available to reset the CPU to factory settings using STEP 7.

### Procedure using STEP 7

To reset the CPU using STEP 7, follow these steps:

1. Make sure there is an online connection to the CPU that is to be reset to the factory settings.
2. Open the online and diagnostics view of the CPU.
3. Select the "Reset to factory settings" group in the "Functions" folder.
4. Select the "Keep IP address" option button if you want to keep the IP address or the "Reset IP address" option button if you want to delete the IP address.
5. Click the "Reset" button.
6. Acknowledge the confirmation prompt with "OK".

### Result

The CPU is set to STOP mode and is reset to factory settings.
The project is retained since the load memory is not erased.

## 7.6.3 Resetting via the mode switch

### Procedure using the mode selector

This procedure is possible only for operation on the CPU 1515SP PC(2) (F).
Make sure that the CPU is in STOP mode (the CPU display shows STOP mode or RUN/STOP LED lights up yellow).

**NOTE**

A memory reset of the CPU via the mode selector also deletes the CPU's IP address.

To reset the CPU memory using the mode selector, follow these steps:

1. Set the mode selector to the STOP position.
   Result: The RUN/STOP LED lights up yellow.
2. Set the mode selector to the MRES position. Hold the mode selector in this position until the RUN/STOP LED lights up for the second time and remains continuously lit (after three seconds). After this, release the switch.
3. Within the next three seconds, switch the mode selector back to the MRES position, and then back to STOP again.

### Result

The CPU executes the memory reset, while the RUN/STOP LED flashes yellow. When the RUN/STOP LED lights up yellow, then the CPU has been reset, and is in STOP mode. The corresponding event is entered in the diagnostics buffer.

## 7.6.4 Formatting the CPU volume

The CPU volume is a non-volatile memory for configuration data, user programs and data, initial data, and archives. When these objects are downloaded to the CPU, they are first stored in the load memory. The load memory is located in the CPU volume in the mass storage of your PC.
During the setup, the load memory is formatted automatically and, as a result, all data and files from the prior installation are deleted.
If the CPU volume is damaged (e.g., due to voltage failure while the CPU volume is being written) or is to be cleaned for a new use, you can format the CPU volume using the "Format the CPU volume" function in the CPU display.

**NOTE**

The "Format the CPU volume" function is not supported by F-CPUs.

## Requirement

- A CPU volume is created in the current configuration.
- The user of the PC has administrator rights.

## Procedure

To format the CPU volume, and thus the load memory of the CPU using the CPU display, follow these steps:

1. Open the CPU's display using the shortcut menu command "Run as administrator".
2. Select the "Format the CPU volume" command in the "Settings > Reset" menu.




Figure 7-3 Formatting the CPU volume

3. Confirm with OK.
   Another confirmation message appears.

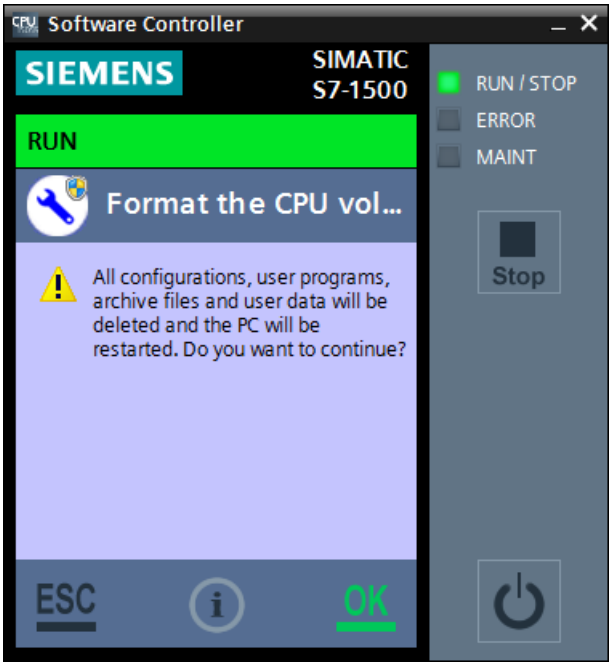



Figure 7-4 Confirming the CPU volume formatting

4. Confirm with OK.

**NOTE**
**CPU in "POWER OFF" state**
You can also execute this command when the CPU is in "POWER OFF" state.

## Result

The CPU is stopped and shows the status of the formatting with the help of a progress bar.
The formatting deletes the following data and values:

- The complete load memory
- Retentive data
- User programs and configurations
- Archives and user data
- Web server directories

The following internal CPU data are restored:

- Module name
- Index
- Assigned interfaces
- Retentive data memory
- Position of the mode selector
- Use of the LEDs

The startup type setting is retained. When you switch on the CPU the next time, the load memory is preset with default settings. The CPU is in STOP mode.

## 7.7 Resetting the PC system

### Requirements

- You have administrator rights.
- For fail-safe systems: You are a member of the Windows "Failsafe Operators" user group.

### Procedure

Proceed as follows to carry out a complete reset:

1. Disable the enhanced write filter EWF, FBWF (with Windows 7) or UWF.
2. Select the PC Station display in the information area via the symbol .
3. To delete the configuration, use the shortcut menu command "Delete the current SIMATIC software configuration".

### Result

The configuration is deleted. You can load a new project.

# 7.8 Backing up the image of the PC mass storage

## Overview

Once you have configured the computer for your application, you can create an image of your system. An image can include the following:

- The CPU volume
- The Windows partitions and the CPU volume

You can use this image to restore your user-specific application to your system at a later time, if necessary. A system image is helpful for restoring all files and registry entries for your application.

You should back up an image of your configuration for these reasons:

- To save a fixed intermediate status of the configuration
- Create a backup of the current configuration in case of hardware problems and when the PC must be replaced
- Create a master image to download the configuration to other PCs
  Note the Microsoft license condition for Windows in this regard.

**NOTE**

**Observe consistency**

- The image must always be consistent with the installed version of the CPU.
- The images depend on the computer on which they were created. They may not be used on different computer types.
- A CPU volume may only be restored on a device with NVRAM.
- The CFast card on which the image is restored requires the same or more capacity than the CFast card on which the image was created.

**NOTE**

**Master Boot Record (MBR)**

On systems with an MBR, the image must include the MBR.

## SIMATIC IPC Image & Partition Creator

Use the "SIMATIC IPC Image & Partition Creator" to back up your configuration.

"SIMATIC IPC Image & Partition Creator" is used to back up and restore files, directories, partitions and entire hard drives. By creating backup images, "SIMATIC IPC Image & Partition Creator" prevents data loss caused, for example, by hardware failure, installation problems, operating errors or external influences (viruses).

**NOTE**

**Restoration of images on a larger CFast card**

If you want to restore an image from a smaller CFast card on a larger CFast card, do not change the size of the partitions proportionally.

**Restoring images with Image & Partition Creator V3.6**

If you are using Image & Partition Creator V3.6, the default restore option is to restore from volume to volume. To avoid booting problems after the restore, do not use this default restore type. Change from "Select volumes" to "Select disks" instead and restore as complete disks.

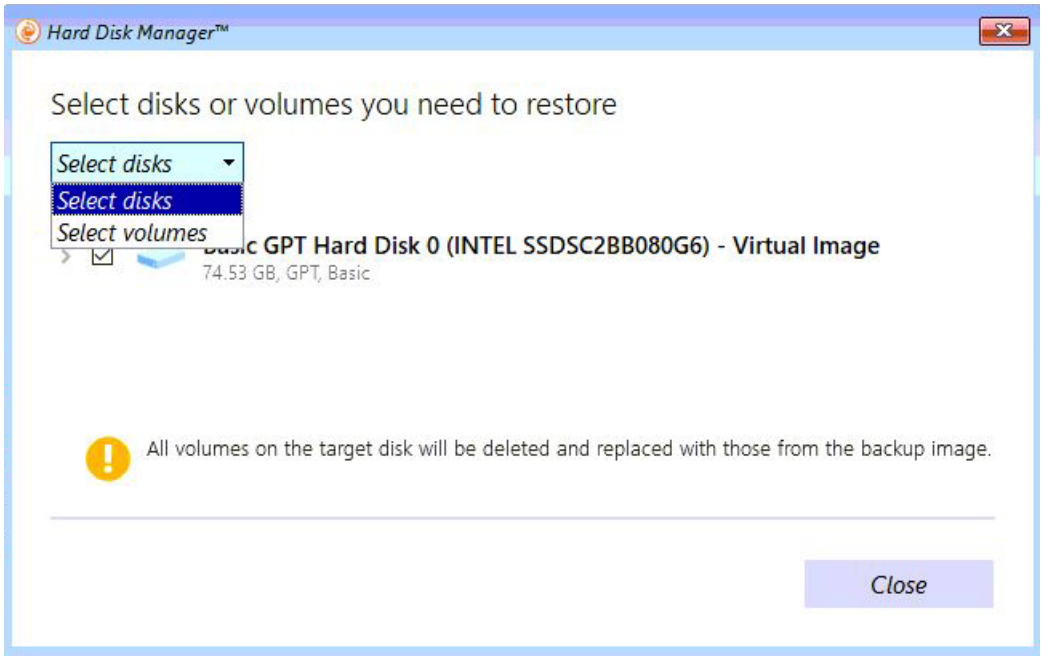



Figure 7-5 Changing the default restore type

After changing the restore type and clicking "Close", the following window appears. On this window, click on "Restore now".

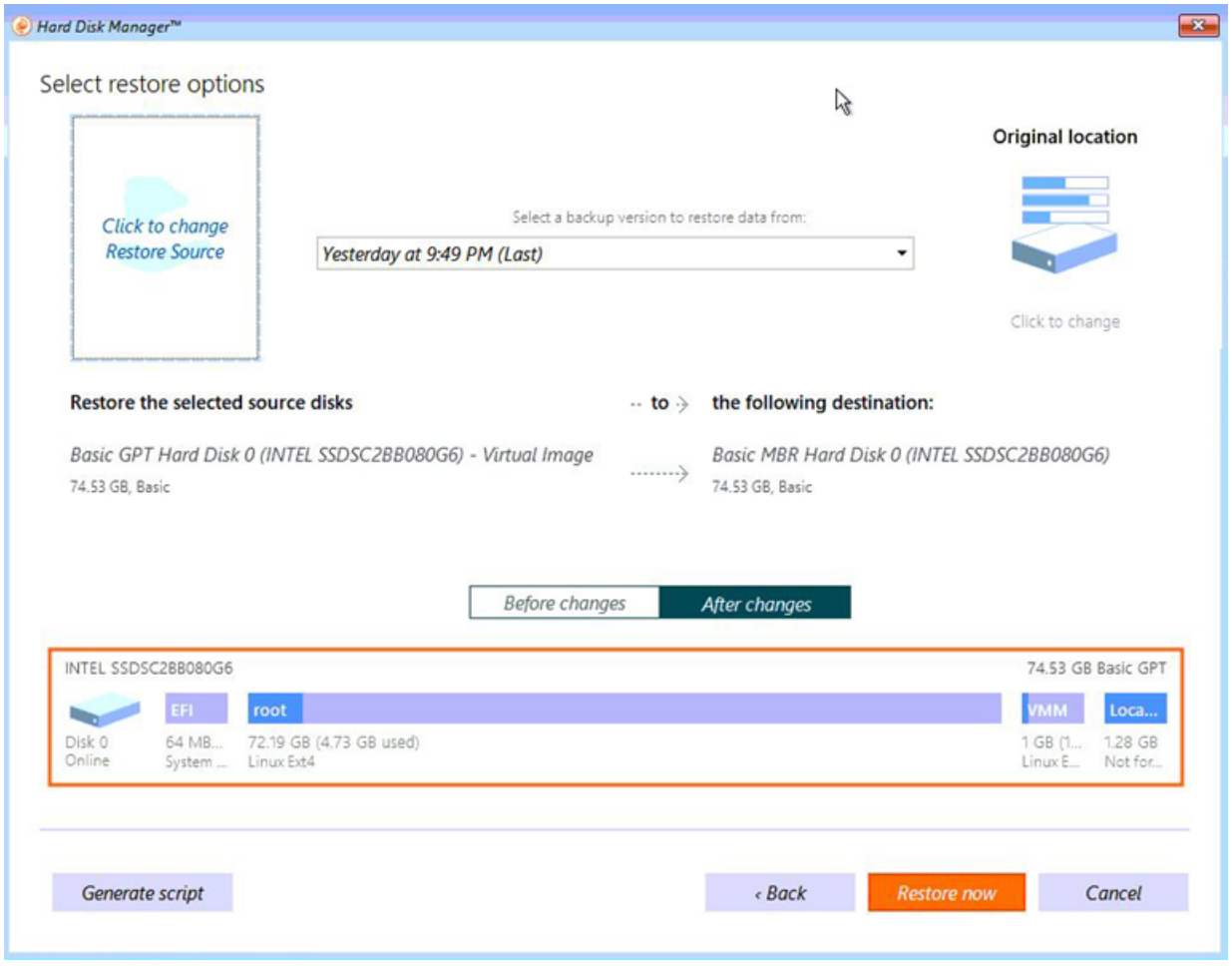



Figure 7-6 Disk to disk restore dialog

## Reference

For additional information on backing up an image, see the documentation on the "SIMATIC IPC Image & Partition Creator" (https://support.automation.siemens.com/DE/view/en/21766418).

You also have access to topic-related FAQs (https://support.automation.siemens.com/DE/view/en/19422936/133000).

## Backup and restore of installation on mass storage devices

You have the possibility to create a backup of your Software Controller installation from a mass storage device and to restore this backup on another mass storage device.
To avoid boot failures after an uninstallation or upgrade of the Software Controller, the utility BootSect.exe is automatically installed in the C:\Windows\System32\ directory during the installation of an IPC using Windows 10.

**Installing BootSect.exe in Windows 7**

If you use Windows 7 (Windows Embedded Standard or Windows Ultimate), we recommend that you install BootSect.exe manually in the C:\Windows\System32 directory of your IPC. This utility is available, for example, in the following additional software: "Windows Automated Installation Kit (AIK) for Windows 7" from the official Microsoft Download Center.
Install this software on your IPC. The default installation directory is:
C:\Program Files\Windows AIK\
Locate BootSect.exe in this directory and copy it to:
C:\Windows\System32\
Before uninstalling or upgading the Software Controller, proceed as follows:

1. Execute the following command:
   C:\> bootsect.exe /nt60 C: /mbr
2. Then, locate the file mbr.bin in either directory:
   C:\Program Files\Common Files\Siemens\SIMATIC_RT_VMM\bin\
   C:\Program Files (x86)\Common Files\Siemens\SIMATIC_RT_VMM\bin\
3. Delete the file.
4. Uninstall or upgrade the Software Controller.

**Repairing boot failures in Windows 7**

The absence of the BootSect.exe utility may cause boot failures in Windows 7 after an uninstallation or upgrade of Software Controller (affected versions are all versions ≤ 21.8). In this case, you can use the SIMATIC IPC Image & Partition Creator to repair the Software Controller installation as follows:

1. Create a bootable USB stick with the content of the SIMATIC IPC Image & Partition Creator V3.6.1 or later.
2. Boot the IPC with that USB stick.
3. Start the Hard Disk Manager 17 Suite in the menu.
4. Select the option "Correct boot".
5. Execute functions "Correct the Master Boot Record (MBR)" and "Correct boot parameters (boot.ini, BCD)" one by one.
6. Remove the USB stick and boot the IPC again.

# 7.9 Special features

## 7.9.1 Use of bus adapters

The CPU 1505SP > V2.7 does not support the following bus adapters:

- BA 2xSCRJ (article number 6ES7193-6AP00-0AA0)
- BA SCRJ/RJ45 (article number 6ES7193-6AP20-0AA0)
- BA SCRJ/FC (article number 6ES7193-6AP40-0AA0)

If you are using one of these bus adapters, use version CPU 1505SP V2.7.

## 7.9.2 Error messages during installation of drivers

All necessary drivers are installed automatically by default when the software for the CPU is installed. Additional dialogs and messages regarding installation of drivers do not appear. The supplied drivers are certified by Microsoft and have a digital signature that indicates SIEMENS AG as the supplier.

If warning messages concerning the driver software are displayed during installation, you must assume that the installation files have been altered.

Check whether the utilized installation files are identical to those on the installation DVD supplied by SIEMENS AG.

## 7.9.3 Special situations when downloading in STEP 7

### No connection possible

In order to download the project to the target system, an online connection must be established.

If an online connection to the target system is not possible, check the interface settings, such as the IP address. You also have the option of establishing an online connection via the IE General interface.

### Download aborts

If the download aborts for unidentifiable reasons, you may need to reset the CPU to factory settings using the display (Page 121).

## 7.9.4 Downloaded user program is not compatible with the target system

You must download new or modified project data to the CPU.

If you download your user program to the wrong CPU, the pre-configured project data is not compatible with the target system. This situation can occur if the DiagBase software is disabled on the SIMATIC IPC or CPU 1515SP PC2.

If your target system does not react as expected, the following options are available to you:

- Check whether your loaded project data is compatible with the hardware type of the target system.
- Check whether the configuration of the interfaces matches the hardware interfaces of the PC.
- Download the entire PC system.

## 7.9.5 Special situations when starting or stopping the CPU

### Possible situations

The following special situations can occur when starting or stopping the CPU:

- The CPU indicates the "Faulted" status.
- The CPU display cannot establish a connection to the CPU.
- The PC booted up in "Windows" mode.
- The CPU has been started or stopped using a command line command.

### CPU in "Faulted" status

The "Faulted" status can occur in the following cases:

- While the CPU is starting
  The CPU remains in "Faulted" status until the user selects one of the functions in the "Restore" menu.
- While the CPU is running
  The display changes automatically to the "Restore" menu. The CPU restarts automatically after 10 seconds in STOP mode.

### No connection to the CPU

If the display cannot establish a connection to the CPU, the display automatically opens the "Restore" menu. You can choose from the following options:

- Restart PC
  The entire PC is restarted.
  Restart the PC using the "Windows and S7-1500 Software Controller" mode, otherwise the message "Wrong Boot Option" will be shown on the display.
- Terminate CPU
  The CPU is stopped. Retentive data are lost.

### PC start in "Windows" mode

If you start the CPU display after the PC was booted in "Windows" mode, the display automatically opens the restore menu to restart the PC. The message "Wrong boot option" will be shown in the display.

### Starting or stopping the CPU using command line commands

The CPU can be controlled in various ways. In addition to operation via the display application, it is also possible to control operation using command line commands. You can also use command line commands in an automated way in batch files or scripts.

For an overview of available command line commands, see chapter Operation using the command line commands (Page 110).

## 7.9.6 CPU behavior at Windows shutdown

When you switch off your PC, the Windows operating system is shut down automatically, and all active applications are closed.

You can shut down the Windows operating system using the following actions:

- PC is switched off via the Start menu
- PC is switched off with the on/off button
- Triggered by an uninterruptible power supply (UPS) (Page 117)
- PC can be shut down in the CPU's user program by means of the "SHUT_DOWN: Shutdown target system" instruction. The instruction is available in TIA Portal in the "Instructions" task card under Basic instructions > Program control > Runtime control.

  A restart is advisable, however, in the following situations:
  - An industrial UPS (uninterruptible power supply) reports a power failure via a digital input.
  - Too many error OBs are called in the user program.
  - Windows stops responding or shows a "blue screen".

  You can find more information on the "SHUT_DOWN: Shut down target system" in the STEP 7 online help.

When the Windows operating system shuts down, the CPU is stopped properly. The CPU stores the retentive data and all CPU-specific files.

When you restart the PC, the CPU starts as previously configured.

### Reference

Additional information about the CPU behavior during starting or stopping can be found in the sections Configuring startup (Page 62) and Manually starting and stopping the CPU via display (Page 100).

## 7.9.7 Windows error handling and operating the CPU after Windows crash

### Introduction

The CPU is a PC-based controller. It is installed for use on a PC with the Windows operating system. A crash of the Windows operating system may affect the operation of the CPU.

### Reaction of the CPU to a Windows crash

The CPU continues to run even when the operating system crashes. Configure Windows so that it automatically restarts after a crash. The Windows restart has no effect on the performance of the CPU. The CPU remains in RUN mode and controls the automation process even during the crash. Because increased drive accesses by the operating system can occur during the Windows restart, the drive accesses of the CPU may become slower temporarily. Once Windows has been started up again, the user program of the CPU is notified about the restart of the operating system.

If Windows does not automatically restart after a crash, restart the PC with one of the following options:

- Use the instruction "SHUT_DOWN: Shutdown target system".
- Switch off the PC using the "Power" switch or by briefly removing the power supply (remove and insert the connector). The CPU is stopped. If you have configured the storing of retentive data in the onboard NVRAM of your PC, the retentive data are retained during this operation. If you have configured the storing of retentive data in the mass storage of your PC, the retentive data are deleted during this operation. The CPU starts in unbuffered state.

**NOTE**

**Windows restart with external graphics card**

For the "Windows restart" functionality to be supported, configure the Intel graphics card as the primary graphics card.

**NOTE**

**Windows restart with NVIDIA graphics card**

Note that automatic restart after a Windows crash is not supported for devices using an NVIDIA graphics card.

**NOTE**

**Diagnostics on Windows availability**

A diagnostic buffer entry is generated when Windows starts, stops or crashes and a diagnostic interrupt (OB 82) is started.

To get detailed information about the Windows status via the OB82, open the instructions "RALRM" (SFB54).

It may be the case that Windows can no longer send a signal to the CPU in the event of a blue/"frozen" screen. OB82 is not called in this case and no diagnostic entry is created.

To get more information, call the "RDREC" instruction (SFB52) with a cyclic OB (e.g. OB1).

You can find further information about the diagnostics and the instructions with the parameters in the Diagnostics Function Manual (https://support.automation.siemens.com/WW/view/en/59192926) and in the STEP 7 online help.

### Windows restart

To ensure real-time capability during the reboot phase of the system, the USB ports are disabled during the Windows reboot process. Input devices such as mouse and keyboard that are connected via USB port are also disabled.

### Windows error handling features

Windows error handling features like recovery options, advanced startup settings, the "chkdsk" command, memory diagnostics, antivirus offline scan, or similar may only be used after the PC has been restarted in "Windows only" mode.

For more information on how to restart Windows in "Windows only" mode, see chapter Restarting Windows (Page 136).

## 7.9.8 Timeouts

The following processes on the PC can affect the Software Controller cycle:

- The PCI Express bus of the PC is shared by all applications on the PC. A high PCI Express bus load can therefore lead to runtime influences between applications. To keep the number of timeouts as low as possible, use a high send clock for isochronous mode in particular and avoid large loads (for example: 3D graphics).
- If you are using the Software Controller in isochronous mode, cycle times may be exceeded during Windows restarts. Check the return values of the isochronous SFCs (126 and 127).
- Windows restarts on a SIMATIC IPC with TPM module.

**NOTE**

**Hiding TPM module in BIOS settings**

The BIOS of most of the supported IPCs allow hiding the TPM module in the BIOS settings. Hiding the TPM module will decrease jitter on Windows restart. For this reason, we recommend hiding the TPM module on all IPCs supporting this option to avoid timeouts.

- Windows restarts on a SIMATIC IPC using System Management Interrupts (SMI).
- Windows restarts on a SIMATIC IPC configured with the hardware RAID option.

## 7.9.9 Restarting Windows

### Windows restart during operation of the Software Controller

Only Windows is restarted by default. Restarting Windows while the Software Controller is running might have a negative impact on the timing behavior of the Software Controller.

Note the following if you reboot Windows during Software Controller operation:

- The PC does not start via BIOS. Rather, only the Windows operating system is restarted. Some components require a system restart via BIOS, for example if the TPM module requests a restart. In this case, restart the complete system. You can find additional information in the section "Restarting the operating system and CPU (Page 137)".
- Increased jitter occurs during the Windows restart, for example as a result of hardware with a TPM module.
- If the PC is switched off/restarted via iAMT (Intel Active Management Technology), the retentive data is lost.

### Windows restart in "Windows only" mode

Windows needs to be restarted in "Windows only" mode, if, for example, you want to run Windows error handling features. To restart the system in "Windows only" mode, you have the following options:

Option 1:

1. Set the CPU to STOP mode.
2. Execute the command "CPU_Control /AllowReboot" in the command line editor ("cmd") or by using a batch file.
3. Restart Windows.
   **Note:** The CPU will restart, as well.
4. Select the "Windows only" mode in the boot menu of the CPU shown during system boot.

Option 2:

1. Shut down Windows.
2. Power on the IPC again.
3. Select the "Windows only" mode in the boot menu of the CPU shown during system boot.

Now you can use the Windows functionality desired.

To start Windows and the CPU again, reboot Windows and select the "Windows and CPU 150xS" mode in the boot menu of the CPU.

### Windows reboot on SIMATIC IPCs

If you use additional PCI/PCIe plug-in cards in the SIMATIC IPC, a Windows reboot may not be supported. Test the function before using in productive operation.

#### 7.9.9.1 Restarting the operating system and CPU

To perform a complete restart of the PC with the operating system and CPU, follow these steps:

Shut down the PC using the appropriate command in the Windows Start menu. Restart the PC using the "Power" switch, or remove and insert the connector.

If neither the "Power" switch nor the connector is accessible due to the location of the PC, or if the PC must be restarted via a remote connection, the command line (Page 110) provides you the possibility of completely restarting the PC. You must explicitly stop the CPU beforehand.

To restart the complete PC, create a small batch file with the following command sequence in the command line:

```
CPU_Control /AllowReboot
CPU_Control /PowerOffCPU
shutdown /r /t 1
```

This command sequence can be created as batch processing in a batch file.

#### 7.9.9.2 Operation of the CPU if Windows restart fails

If Windows does not start successfully after a restart, or if (HMI) communication with the controller is disturbed, you can continue to operate the software controller for as long as necessary until a brief shutdown is possible from the point of view of your application. Remedy the situation with a power off/on of the complete PC (Windows and Software Controller).

Depending on the state of the Windows system, proper restarting of Windows is not possible in rare cases. You should therefore avoid Windows restarts of a machine or plant during productive operation.

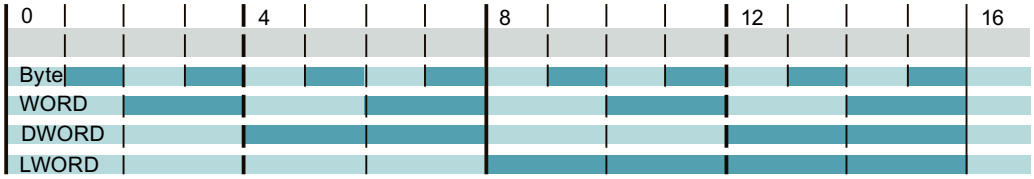
A Windows restart is not supported in the following cases:

- If you use remote management, e.g. iAMT, for your IPC.
- When a hardware RAID is configured in the system after a blue screen.
- If you have configured a different graphics card than the onboard Intel graphics card as the primary graphics card.

Use the instruction "SHUT_DOWN": Shut down target system" to reset a crashed Windows session only in the case of a blue screen.

## 7.9.10 Assignment of addresses with absolute addressing

To ensure optimum runtime during access to tags, the tags must be located at addresses that match their length. In the figure below, this means either in the light blue or in the dark blue area.




- ≤ 1-byte tags (e.g. Bool, BYTE, Char) can be created at any addresses.
- 2-byte tags (e.g. WORD) must always be created at even addresses.
- 4-byte tags (e.g. DWORD, Int, REAL) must always be created at addresses that can be divided by four.
- 8-byte tags (e.g. LInt, ULInt, LWord, LReal, LTime, LDT, LTOD) must always be created at addresses that can be divided by eight.

## 7.9.11 "Autonegotiation" port setting

### Optimizing port settings on the IO device and IO controller

The transfer medium and the duplex option are checked during startup of the IO device for control unit wiring. These checks take time. You can shorten the time the check requires with specific presets of these options. Make sure that the settings made correspond to the actual conditions (using the correct cables).

To synchronize the settings for the local port and partner port, clear the "Start autonegotiation" check box for the CPU under "Port options" for both ports.

If you have disabled the autonegotiation setting including autocrossing, the time for negotiating the transmission rate during startup is saved.

### Reference

You can find more information on the topic "Cabling rules with disabled autonegotiation" in the STEP 7 online help.

# Protection

# 8

## 8.1 Overview of the protective functions of the CPU

### Introduction

This section describes the functions for protecting the S7-1500 automation system against unauthorized access. The following functions are available:

- Configuring access protection
- Using complex passwords
- Using virus scanners and firewall
- Protection against unauthorized operation (deactivating or restricting remote access)
- Copy protection
- Know-how protection
- Using Windows user rights management
- Using allowlisting tools

### Further measures for protecting the CPU

The following measures additionally increase the protection against unauthorized access to functions and data of the CPU from outside and via the network:

- Deactivation of the Web server
- Deactivation of the OPC UA server (you can find additional information on the security mechanisms for OPC UA server in the Communication Function Manual (https://support.automation.siemens.com/WW/view/en/59192925))
- Deactivation of the time synchronization via an NTP Server
- Deactivation of the time synchronization via Windows clock
- Deactivation of the PUT/GET communication

**NOTE**

**Functionalities disabled by default**

These functionalities are deactivated by default. To use the functionalities, you enable them in STEP 7.

### Reference

For additional information on the protection functions of the S7-1500 automation system, see the section on protection in the S7-1500 Automation System System Manual (https://support.automation.siemens.com/WW/view/en/59191792).

## 8.2 General information on protection

### Configuration for the Web server

A user with the name "Any" is created by default in the user list of the Web server. This user has minimal access rights such as read-only access to the introduction and home page. Because the user "Any" does not have a password assigned in STEP 7, pay close attention to the access rights you assign to this user. Individual authorizations, such as the option to change the operating mode, may represent a security risk.

To assign safety-related authorizations, configure a new user and always assign a password in STEP 7. Assign secure passwords to users during configuration. An example of a secure password is one which is only used for a single application, is more than 8 characters long, and consists of lower-case and upper-case letters as well as special characters and numbers (?!+%$1234...).

Whenever possible, select the option "Permit access only with HTTPS" as soon as you have assigned a password to at least one user.

### Data blocks for PUT/GET instructions

The PUT/GET instructions are suitable for connections configured at one end or both ends.

When using the PUT/GET instructions, you can only use data blocks with absolute addressing. Symbolic addressing of data blocks is not possible.

### Reference

You will find more information on the configuration of the Web server in the Web Server (https://support.automation.siemens.com/WW/view/en/59193560) Function Manual.

You will find more information on the PUT/GET and NTP instructions in the Communication (https://support.automation.siemens.com/WW/view/en/59192925) Function Manual.

## 8.3 Protection of confidential configuration data

As of STEP 7 V17, you have the option of assigning a password for protecting confidential configuration data of the respective CPU. This refers to data such as private keys that are required for the proper functioning of certificate-based protocols.

You can find detailed information on protecting confidential configuration data in the Communication function manual (https://support.automation.siemens.com/WW/view/en/59192925).

# 8.4 Access protection

## 8.4.1 Configuring access protection for the CPU in STEP 7

### Introduction

The CPU offers four access levels, in order to limit access to specific functions.

By setting up the access levels and the passwords for a CPU, you limit the functions and memory areas that are accessible without entering a password. The individual access levels, as well as the entry of their associated passwords, are specified in the object properties of the CPU.

### Access levels of the CPU

The following table provides you with an overview of the access levels of the CPU:

| Access levels | Access restrictions |
|---|---|
| Full access including fail-safe (no protection) | Every user can change fail-safe blocks. |
| Complete access (no protection) | Every user can read and change the hardware configuration and the blocks. The writing of fail-safe modules is excluded. |
| Read access | With this access level, read-only access to the hardware configuration and the blocks is possible without entering a password, which means you can upload the hardware configuration and blocks to the programming device. In addition, HMI access and access to diagnostics data, display of offline/online comparison results, changing the operating state (RUN/ STOP), and setting time-of-day is possible.<br>No blocks or hardware configuration can be downloaded into the CPU without first entering the password. In addition, the following is not possible without a password: Writing test functions and firmware updates (online). |
| HMI access | With this access level, only HMI access and access to diagnostics data is possible without entering the password.<br>Without entering the password, you can neither load blocks nor the hardware configuration into the CPU, nor load blocks and hardware configuration from the CPU into the programming device.<br>In addition, the following is not possible without a password: Test functions, changing the operating mode (RUN/STOP), firmware update and display of online/offline comparison status. |
| No access (complete protection) | When the CPU has complete protection, no read or write access to the hardware configuration and the blocks is possible (without access authorization in the form of a password). HMI access is also not possible.<br>The server function for PUT/GET communication is disabled in this access level (cannot be changed).<br>Authentication with the password will again provide you full access to the CPU. |

Each access level allows unrestricted access to certain functions without entering a password, e.g. identification using the "Accessible devices" function.

The default of the CPUs is "No access (complete protection)". In the default access level, the user may neither read nor change the hardware configuration and the blocks. To obtain access to the CPUs, use an alternative parameter assignment in the properties of the CPU:

- A password for the protection level "No access (complete protection)"
- A different protection level, for example "Full access (no protection)"

Communication between the CPUs (via the communication functions in the blocks) is not restricted by the protection level of the CPU, unless PUT/GET communication is deactivated.
Entry of the right password allows access to all the functions that are allowed in the corresponding level.

**NOTE**
**Configuring an access level does not replace know-how protection**
Configuring access levels prevents unauthorized changes to the CPU, by restricting download privileges. However, blocks are not write- or read-protected. Use know-how protection to protect the code of blocks.

## Assigning access protection parameters in STEP 7

The access protection parameters are assigned using the properties of the PC station assigned to the CPU.

**NOTE**
**Parameter assignment for access protection for the entire PC system**
Unlike for a hardware CPU, parameter assignment for access protection is not done directly in the CPU's properties. This ensures that consistent protection level passwords are configured for all of a PC system's components.

To assign the access levels for the CPU, follow these steps:

1. Select the PC system that is assigned to the CPU.
2. Open the properties of the PC station in the Inspector window.
3. Open the "Protection" entry in the area navigation.
   A table with the possible access levels appears in the Inspector window.

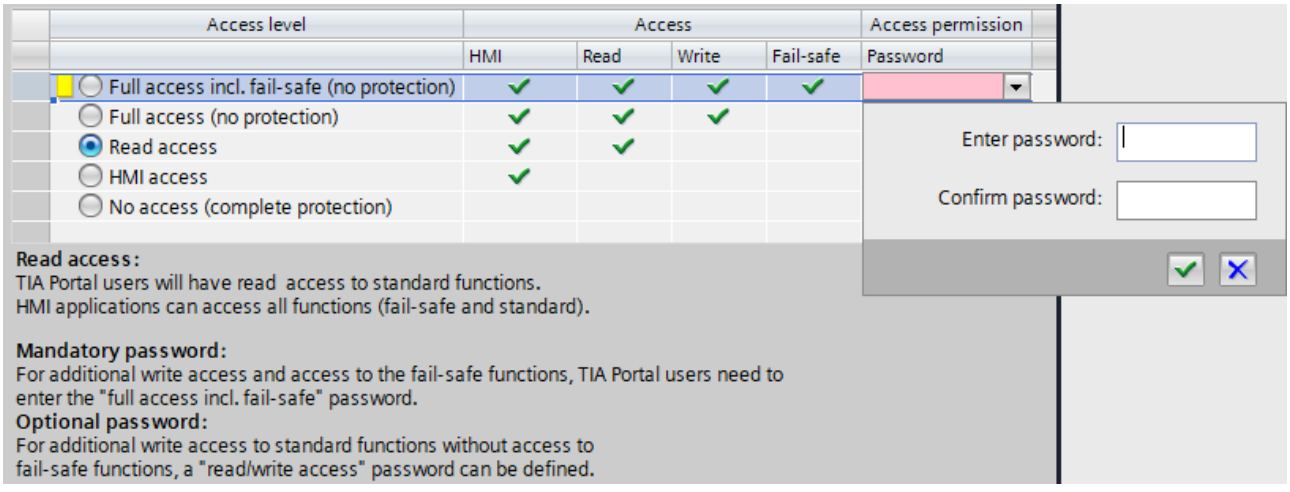



Figure 8-1 Possible access levels

4. Activate the desired protection level in the first column of the table. The green checkmarks in the columns to the right of the respective access level show you which operations are still available without entering the password.

5. In the "Enter password" field, specify a password for the selected access level. In the "Confirm password" field, enter the selected password again to protect against incorrect entries.

   **NOTE**

   **Secure password**

   Ensure that the password is sufficiently secure, in other words, that it does not follow a pattern that can be recognized by a machine.

   You must enter a password in the first row ("Full access" access level). This enables unrestricted access to the CPU for those who know the password, regardless of the selected protection level.
6. Assign additional passwords as needed to other access levels if the selected access level allows you to do so.
7. Download the hardware configuration to the CPU, so that the access level will take effect.
   The configured protection level and the password become effective as soon as the data is downloaded to the CPU. The CPU display indicates the current protection status with an additional icon in the status bar. The operation of the display is restricted depending on the selected protection level. The mode selector, for example, or some of the submenus are deactivated.

**Access level for F-CPUs**

For the fail-safe CPUs, there is the additional access level "Full access incl. fail-safe (no protection)". For additional information on this access level, refer to the description in SIMATIC Industrial Software SIMATIC Safety - Configuring and Programming (https://support.industry.siemens.com/cs/ww/en/view/54110126).

### Behavior of a password-protected CPU during operation

The CPU protection takes effect after the settings are downloaded in the CPU.
Validity is checked before the online function is executed. In the event of password protection, a password prompt appears on the display.

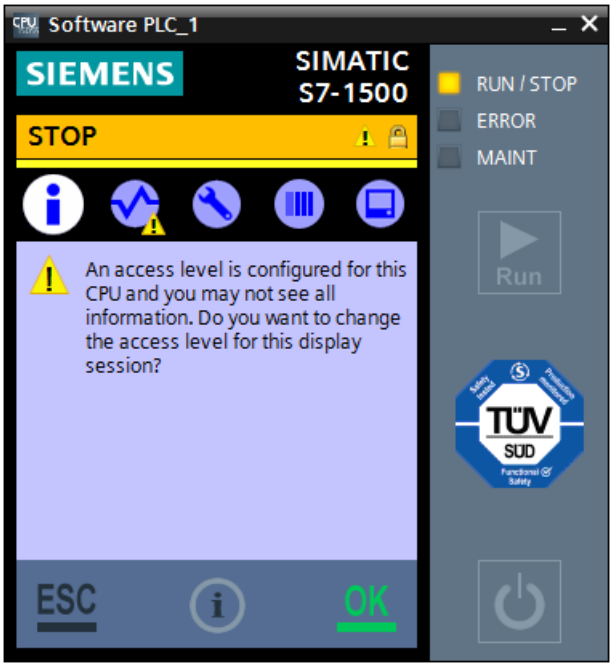



Figure 8-2 CPU display with password setup

Click "OK" to proceed straight to the password input page.
The functions protected by a password can only be executed by one programming device/PC at any one time. Another programming device/PC cannot log on.
Access authorization to the protected data is in effect for the duration of the online connection or until the access authorization is manually rescinded with "Online > Delete access rights".
Access to a password-protected CPU in the RUN mode can be limited locally in the display so that access with a password is also not possible.

## 8.4.2 Protected project - Lost password

### Procedure

If you have forgotten the password for your STEP 7 project when access protection is activated, you must completely reset the PC Station including CPU.

Proceed as follows to carry out a complete reset:

1. Select the PC Station display in the information area.
2. To delete the configuration, use the shortcut menu command "Delete the current SIMATIC software configuration".
   Administrative rights are required for this configuration option.

   **NOTE**

   **Special features of an F-CPU**

   The delete functions are only available for a fail-safe CPU if you are a member of the "Failsafe Operators" Windows user group.

3. Open the CPU display.
4. To clear the load memory of the CPU manually, use the command "Settings > Reset > Format the CPU Volume" in the CPU display.

### Result

Access protection is reset. The load process is possible without a password. You can load a new project.

## 8.4.3 Using the display to change the protection level for display access

Unlike the SIMATIC S7-1500 hardware CPU, the CPU cannot be protected from unauthorized access with a separate display password. Because the CPU can also be controlled by remote access, it uses the access protection passwords from STEP 7 to ensure access protection for the display.

### Displaying access protection on the display

Once you have assigned the access protection parameters in STEP 7 and have downloaded the program to the CPU, the access protection becomes effective.

You recognize the current protection level in the display by the lock symbol in the status information of the CPU.

The table below shows the meaning of the status information:

| Status information | Meaning |
|---|---|
|  | No access protection configured |
|  | The CPU is in the configured protection level, which can be on of the following:<br>• Write protection configured<br>• Read/write protection configured<br>• Complete protection (no access) configured |
|  | The CPU is in one of the following weaker protection levels due to a password having been entered:<br>• Write protection configured<br>• Read/write protection configured<br>• No access protection configured |

## Effect of access protection on operability of the display

The operability of the display may be limited depending on the access protection of the CPU. The table below provides an overview of the effects of access protection on the operability of the display:

| | Read-only | Read/write protection | Complete protection |
|---|---|---|---|
| LEDs | always active | always active | always active |
| "Power" button | always active | always active | always active |
| CPU status information | always active | always active | always active |
| Mode selector | active | inactive | inactive |
| "Overview" menu | always active | always active | always active |
| "Diagnostics" menu | active | active | Submenus inactive |
| "Settings" menu | read-only access | Submenus inactive | Submenus inactive |
| "Modules" menu | active | Submenus inactive | Submenus inactive |
| "Display" menu | always active | always active | always active |
| "Settings > Reset" menu | always active | always active | always active |

**NOTE**

**Displaying the value of the time zone with HMI access**

The current local time and time zone under "Settings > Date & Time > General" are only shown on the display with access levels "Full access" and "Read access".

## Changing protection level with the STEP 7 password

The parameterization of the access protection is done in STEP 7. The parameterized protection level can then be changed with the aid of the valid password directly in the display of the CPU.

To change the configured protection level directly in the display, follow these steps:

1. Open the display
2. Select the current protection level in the "Settings > Protection > Protection level" menu.
   The "Protection level" dialog opens.

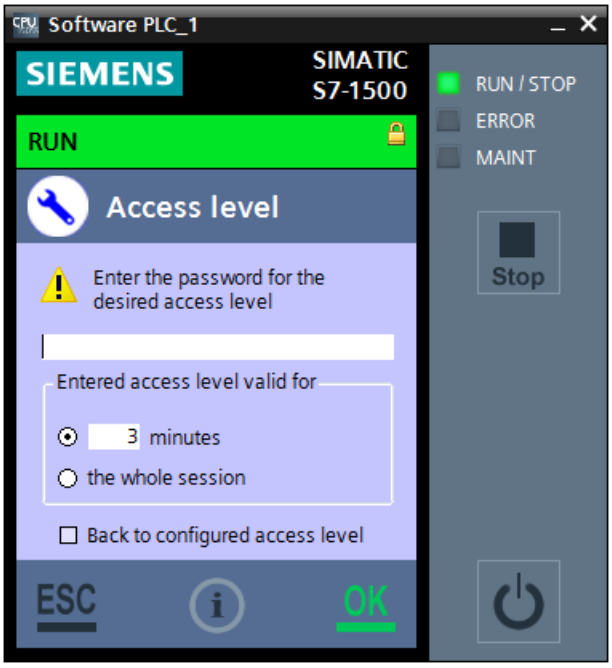



Figure 8-3 Entering a password for a protection level

3. Enter the password configured in STEP 7.
4. Confirm your entry with "OK".
   The password is checked.

## Result

The requested protection level is activated.
The protection level is only valid for the defined time period and for activities with the CPU display. You receive an error message if the password is incorrect. The current protection level has not been changed. After confirmation of the error message, re-enter the password.
If you cancel the "Protection level" dialog with "ESC", the current protection level remains in effect.

**NOTE**

**Using the user program to set additional access protection**

In addition to restricting access to the display, you can also restrict access to a password-protected CPU in the user program using block SFC 110. You can find a description of this block in the STEP 7 online help under the keyword "ENDIS_PW: Limit and enable password legitimation".

If ENDIS_PW is executed immediately with IPCs without a "RUN/STOP" switch, locking required passwords, access to STEP 7 can be blocked. To set up a period for entering passwords before passwords are blocked, delay the execution of ENDIS_PW with a time operation.

## Reference

You can find additional information about access protection and an overview of the protection functions of the CPU in the S7-1500 Automation System System Manual (https://support.automation.siemens.com/WW/view/en/59191792).

## 8.4.4 Locking protection levels with the PLC program

### Introduction

You use the instruction "Limit and enable password legitimization" (ENDIS_PW) to specify whether or not configured passwords are legitimized for the CPU. In this way, you can prevent legitimized connections, even if the correct password is known.

### Inadvertent locking

If passwords are set up (all protection levels) and the output parameters of the password of the block "Limit and enable password legitimation" are set to "Disallow in RUN", you will be completely blocked.

The output parameters of the block are retentive. This means that the parameter assignment is retained after "POWER OFF – POWER ON".

To disable the protection, delete the load memory via the display under Settings with "Format the CPU volume", or by using the PC station display in the information area with "Delete current SIMATIC software configuration".

**NOTE**

**Special features of an F-CPU**

The "Delete the current SIMATIC software configuration" function is only available for a fail-safe CPU if no access protection has been set up or if the current user is a member of the "Failsafe Operators" user group.

The function "Format the CPU Volume" is not available with fail-safe systems.

### IPCs without "RUN/STOP"

If ENDIS_PW is executed immediately on IPCs without a "RUN/STOP" switch and required passwords are thereby locked, access to STEP 7 can be blocked. To set up a period for entering passwords before passwords are blocked, delay the execution of ENDIS_PW with a time operation.

If the period is not long enough, install an input module with a switch and a user program for disabling it.

If you have nevertheless locked yourself out, you will receive access to the CPU again by importing a configuration file without any password protection and "ENDIS_PW" protected blocks. Alternatively, you can format the CPU volume or completely reinstall the Software Controller. This option is available as of firmware V2.5.

For firmware prior to V2.5, you must uninstall the CPU and then reinstall it. A repair installation is not enough to reset the configured access protection using the ENDIS block.

## 8.5 Protecting blocks

You can use know-how protection to protect one or more blocks of the OB, FB, FC type and global data blocks from unauthorized access with a password (Page 153).
This protects the code of the block from unauthorized reading and modification.

**NOTE**

**Transferring protected block or library**

If you transfer a protected block from a hardware controller to a project of a SIMATIC S7-1500 Software Controller or vice versa, the block must be compiled again. To do so, you need the password for the block that is to be compiled.

If you transfer a system library from a hardware controller to a project of a SIMATIC S7-1500 Software Controller, the library must be recompiled.

### Possible actions

The following actions can be performed with a know-how-protected block:

- Copying and deleting
- Calling in a program
- Online/offline comparison
- Downloading

### Readable data

If a block is know-how protected, only the following data is readable without the correct password:

- In/out parameters Input, Output, InOut, Return, Static, Temp
- Block title
- Block comment
- Block properties
- Global tags without information on the point of use

### Reference

For additional information on protected blocks or copying protected blocks and libraries, please refer to the STEP 7 Online Help.

## 8.6 Virus scanners and firewall

### Operation on systems with virus scanner

The CPU and all associated components can be operated on systems with virus scanner. The virus scanner used should give you the option to protect the runtime system.

The CPU has been tested with the following virus scanners:

- Symantec AntiVirus Corporate Edition
- Trend Micro Office Scan Corporate Edition
- McAfee VirusScan Enterprise

### Operation on systems with firewall

The CPU and all associated components can be operated on systems with an activated firewall. For the CPU's default settings, the setup program will configure the firewall rules automatically. You must confirm the changes to the firewall rules during the installation.

For Open User Communication and Web server applications, application-specific IP ports can be used, which are not opened by default by the setup program. Due to the default settings, the firewall can thus prevent the connection. You therefore configure the firewall rules for the following applications yourself:

- Open User Communication via Windows interface
- Web server via Windows interface (default: port 81 or port 343)

### Configuring the firewall for Web server use

If you use a PC with an enabled firewall, you must configure the firewall for the use of the Web server. In order to open the application-specific ports in the Windows firewall, create a new firewall rule for this purpose in the firewall settings.

To configure a new firewall rule, proceed as follows:

1. Select the "Advanced settings" command in the "Control Panel > Windows Firewall" menu.
   The "Windows Firewall with Advanced Security" dialog is opened.
2. Select the "Inbound Rules" entry.
3. Select the "New Rule" command in the "Actions" panel.
   The "New Inbound Rule Wizard" dialog opens.
4. Select the "Port" option.
5. Follow the steps in the dialog.
6. Confirm the configuration by clicking the "Finish" button.

# 8.7 Setting up copy protection

## Application

The CPU has the same copy protection mechanisms as the S7-1500 Advanced Controller. You can link the copy protection to the serial number of the device and the mass storage.

Unlike the S7-1500 Advanced Controllers, the CPU only uses values for the serial number that are derived partly from the serial number of the PC motherboard and the PC mass storage. You can therefore only read the serial numbers at the corresponding locations on the display. Besides the serial number, the function for automatic insertion of the serial number during downloading is available.

## Adding the serial number during download to a device

We recommend that you use the "Serial number is inserted when downloading to a device or a memory card" option for setting up copy protection during configuring.

## Reading serial number from display

You can read the serial number from the display as follows:

- Serial number of the CPU: "Overview > PLC > Serial number"
- Serial number of the mass storage: "Overview > Load memory > Serial number"

## Reference

You can find additional information on setting up the copy protection in the STEP 7 online help.

# Interrupts, diagnostics, error and system message 9

# 9.1 Status and error display of the CPU

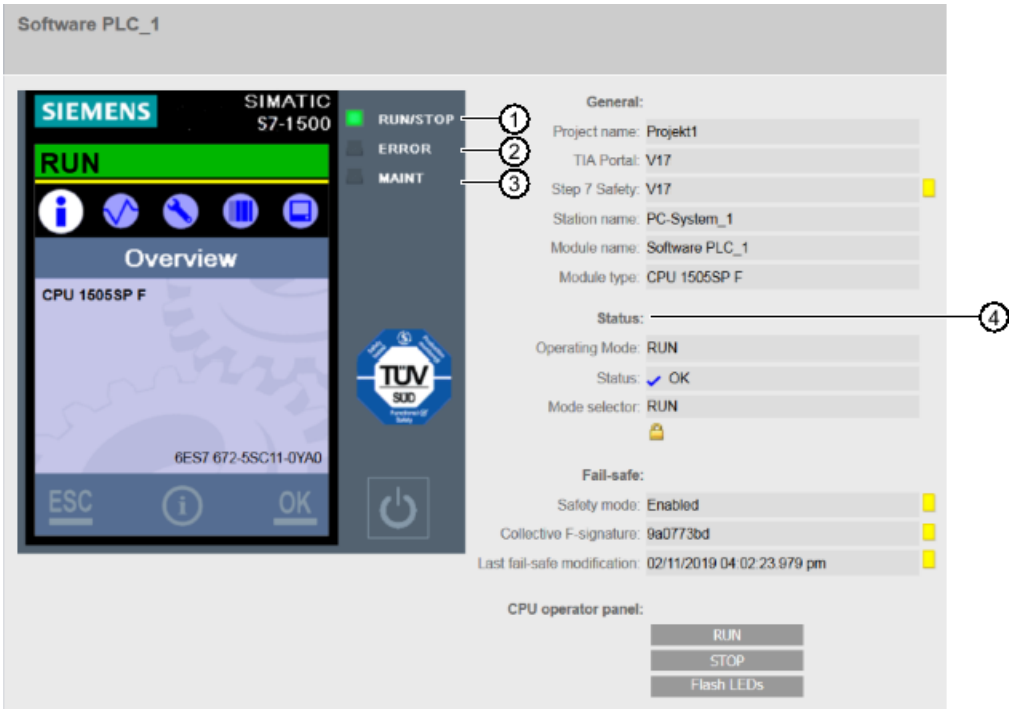
## Introduction

The status and error displays of the CPU are described below.
You will find additional information on "Alarms" in the STEP 7 online help.
You will find additional information on "Diagnostics" and "System messages" in the System diagnostics (https://support.automation.siemens.com/WW/view/en/59192926) function manual.

## Status display

The status of the CPU is displayed at the following places:

- on the LED display
- in STEP 7
- on the start page of the CPU Web server




① RUN/STOP LED (yellow/green LED)
② ERROR LED (red LED)
③ MAINT LED (yellow LED)
④ Status display in words

Figure 9-1 Example status display of a fail-safe Software Controller (CPU 1505SP F)

## Meaning of the LED displays

The CPU has three LEDs to indicate the current operating mode and diagnostic status. The following table below shows the meaning of the various color combinations of the RUN/STOP, ERROR and MAINT LEDs.

Table 9-1 Meaning of the LEDs

| RUN/STOP LED | ERROR LED | MAINT LED | Meaning |
|---|---|---|---|
| LED off | LED off | LED off | POWER OFF, the DIAG LED display is not enabled. |
| LED off | LED flashes red | LED off | An error has occurred. |
| LED green | LED off | LED off | CPU is in RUN mode.<br>There are no events, requirements, errors, etc. |
| LED green | LED flashes red | LED off | A diagnostics event is pending. |
| LED green | LED off | LED yellow | Maintenance demanded for the plant.<br>The affected hardware must be replaced within a short period of time. |
| | | | Active Force job |
| | | | For fail-safe CPU: Safety mode is deactivated. |
| LED green | LED off | LED flashes yellow | Bad configuration |
| LED yellow | LED flashes red | LED off | A diagnostics event is pending. |
| LED yellow | LED off | LED flashes yellow | Firmware update successfully completed. |
| LED yellow | LED off | LED off | CPU is in STOP mode. |
| LED yellow | LED flashes red | LED flashes yellow | The user program causes an error. |
| | | | CPU is in FAULTED status. |
| LED flashes yellow | LED off | LED off | CPU is performing internal activities during STOP, e.g. ramp-up after STOP. |
| | | | Loading the user program. |
| | | | A programmed breakpoint in the user program has been reached. |
| LED flashes yellow/green | LED off | LED off | Startup (transition from STOP → RUN). |
| LED flashes yellow/green | LED flashes red | LED flashes yellow | Startup (CPU booting). |
| | | | Test of LEDs during startup, inserting a module. |
| | | | LED flashing test. |

## 9.2 Export of diagnostic information

Customer Support offers help in critical cases. For a thorough analysis of your situation, Customer Support needs detailed diagnostic information. You can export these service data with the "SIMATIC Diagnostics Tool". The "SIMATIC Diagnostics Tool" gives you the option to collect diagnostic and system information. The "SIMATIC Diagnostics Tool" collects the information from a local computer or by remote access even from several computers connected by a network.

The "SIMATIC Diagnostics Tool" is available as a Download (https://support.automation.siemens.com/WW/view/en/65976201) on the Internet.

### Required service data

The exported service data must include the following information:

- Product-specific data
- Internal error logging as binary code
- Diagnostics buffer entries
- Latest call list
- Memory dump (optional)
- Time stamp of the TIA Portal project

### Additional information and download

For the download and additional information on handling the "SIMATIC Diagnostics Tool", see the corresponding FAQ (https://support.automation.siemens.com/WW/view/en/65976201).

# 9.3 Diagnostics

## 9.3.1 Diagnostic information via the CPU display

### 9.3.1.1 "Overview" and "Diagnostics" menu

The following section provides an overview of the "Overview" menu and the "Diagnostics" menu of the CPU. Both menus display important information about the properties of the CPU and modules.

#### "Overview" menu

The "Overview" menu contains information about the properties of the CPU.

**NOTE**

**Using the DataMatrix code**

Install the SIMATIC SUPPORT APP on your smart phone or tablet to use the QR code. By means of the QR code, you receive access to specific pages with product information, technical specifications or FAQ information in the Customer Support Portal.

To open the "Overview" menu, follow these steps:

1. Open the CPU display.
2. Start the CPU.
3. Select the "Overview" menu with the icon.
4. Select "PLC".

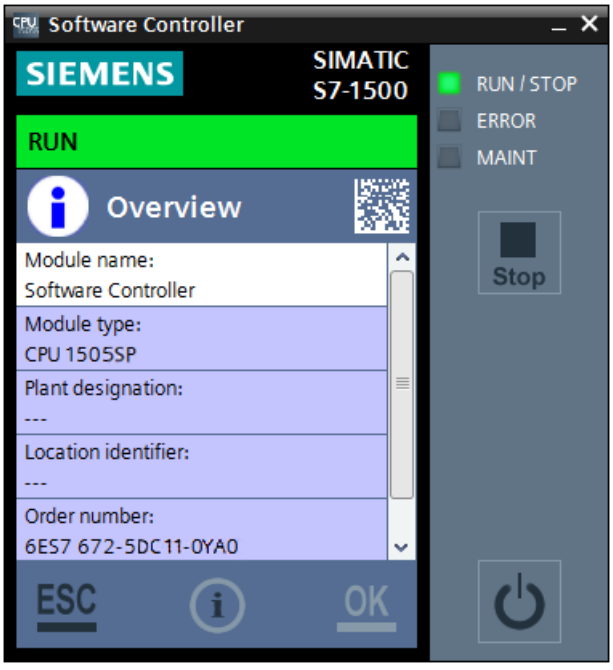



Figure 9-2 "Overview" menu

The "Overview" menu provides an overview of the product-specific data of the CPU:

- Module name: Name from the hardware configuration in STEP 7
- Module type: CPU 1505SP, CPU 1507S or CPU 1508S
- Plant designation (HID): No entry, if no configuration has been downloaded. If a configuration has been downloaded, the configured value is displayed.
- Location identifier (LID): No entry, if no configuration has been downloaded. If a configuration has been downloaded, the configured value is displayed.
- Article number: Article number of the CPU
- Serial number: Serial number of the mass storage and the PC platform
- Software version: Product version of the CPU

The product-specific data of the CPU in the "Overview" menu is dependent on the downloaded configuration. If a new configuration is downloaded, the values change accordingly.

### "Diagnostics" menu

The "Diagnostics" menu contains information about diagnostics alarms, the diagnostics description, and the display of alarms.

To open the "Diagnostics" menu, follow these steps:

1. Open the CPU display.
2. Start the CPU.
3. Select the "Diagnostics" menu with the icon.




Figure 9-3 "Diagnostics" menu

### 9.3.1.2 Display of alarms

#### "Alarms" menu in the CPU display

The "Alarms" menu displays the latest error information. Alarms indicate events and states that occur in the system, in the process, or on the operator unit itself. A state is reported when it occurs.

By means of the system diagnostics, you can create blocks that analyze errors in the system and generate alarms with an error description text and an indication of the error location. These alarms are defined per component with alarm capabilities (for example, channel errors or rack errors) and are limited to 255 alarms per component with alarm capability.

Alarms can be displayed on the CPU display, in STEP 7, and via the Web server.

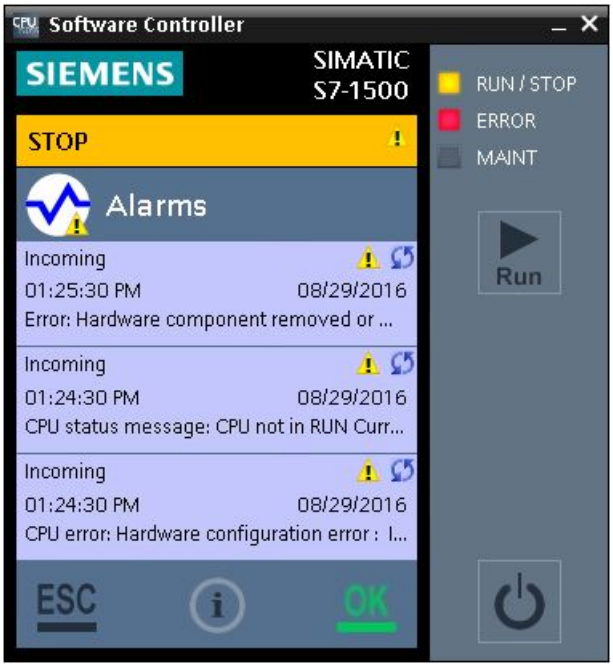



Figure 9-4 "Alarms" menu

## Alarm events

The following alarm events can occur for an alarm:

- Incoming
- Outgoing
- Acknowledge

Alarm events are stored in an internal buffer.

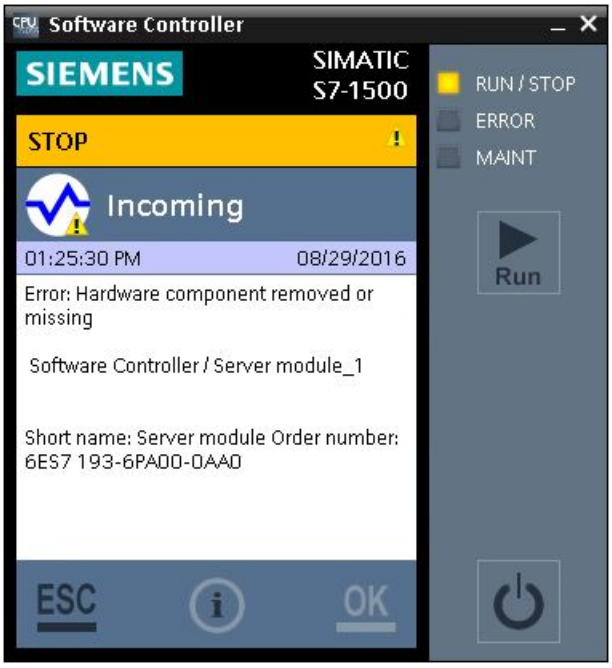



Figure 9-5 Detailed entry

### 9.3.1.3 Display of the diagnostics buffer entries

#### "Diagnostics buffer" menu in the CPU display

The diagnostics buffer is used as a log file for the diagnostics events that have occurred on the controller and the modules assigned to it. These are entered in the order of their occurrence, with the latest event shown at the top.

The diagnostics buffer entries can be displayed on the CPU display, in STEP 7, and via the Web server.

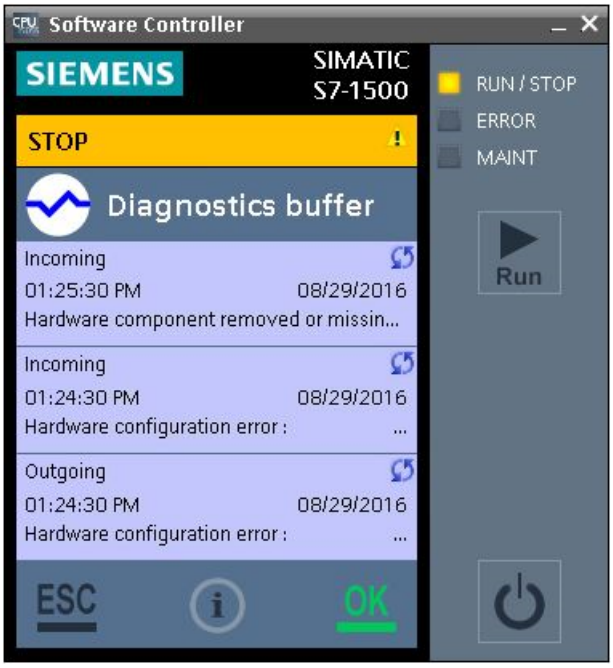



Figure 9-6 "Diagnostics buffer" menu

### Diagnostics events

The entries available in the diagnostics buffer include:

- Internal and external errors on a module
- System errors
- Operating mode transitions (e.g., from RUN to STOP)
- Errors in the user program
- Removal/insertion of modules

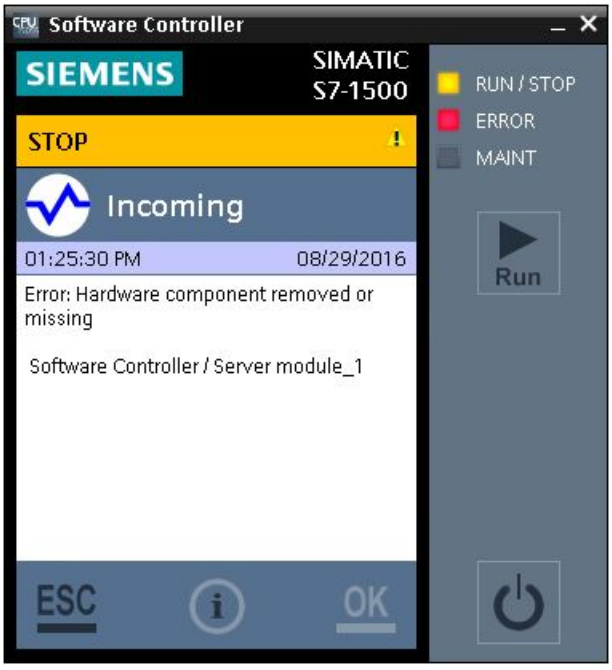



Figure 9-7 Detailed diagnostics buffer entry

The content of the diagnostics buffer is retained in the retentive memory in case of a memory reset of the CPU. Errors or events can be evaluated even after a longer period of time thanks to the diagnostics buffer, in order to determine the cause of a STOP or in order to trace and assign the occurrence of particular diagnostic events.

## 9.3.2 Diagnostic information using STEP 7

### Options for identifying diagnostic information

When the online connection to the CPU is established in STEP 7, the diagnostics status of the CPU and its lower-level components and the operating mode are also determined.

You have various options in STEP 7 for identifying diagnostic information:

- Accessible devices
- Devices and networks
- Online & Diagnostics
- "Diagnostics" tab in the Inspector window
- CPU diagnostics buffer
- "Online tools" task card

### Reference

You can find further information about diagnostics in the Diagnostics Function Manual (https://support.automation.siemens.com/WW/view/en/59192926) and in the STEP 7 online help.

## 9.3.3 Diagnostic information using the Web server

### System diagnostics using the CPU Web server

The CPU has an integrated Web server that enables, among other things, the display of system diagnostics information via PROFINET. Any web client, such as a PC, multi panel, or smartphone, can be used to read-access module data, user program data, and diagnostics data of the CPU by means of an Internet browser. This means access to the CPU is possible without STEP 7 installed.

The Web server offers web pages with reduced complexity which have been optimized for devices with small screens and low computing power.

The following diagnostics options are available with the integrated Web server:

- Start page with general CPU information
- Identification information
- Contents of the diagnostics buffer
- Module information
- Messages (without acknowledgment option)
- Information about communication
- Topology

### Reference

You can find additional information about the "Web server" topic in the Web Server Function Manual (https://support.automation.siemens.com/WW/view/en/59193560).

# Technical Data

# A

## Article number

The CPU 1505SP, 1507S and CPU 1508S are PC-based controllers of the SIMATIC S7-1500 Software Controller family.

## Technical specifications

The following table provides you with an overview of the supported CPUs:

| CPU | Article number | Technical specifications |
|---|---|---|
| CPU 1505SP | 6ES7672-5DC11-0YA0 | CPU 1505SP (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-5DC11-0YA0/td) |
| CPU 1505SP F | 6ES7672-5SC11-0YA0 | CPU 1505SP F (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-5SC11-0YA0/td) |
| CPU 1505SP T | 6ES7672-5VC11-0YA0 | CPU 1505SP T (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-5VC11-0YA0/td?dl=en) |
| CPU 1505SP TF | 6ES7672-5WC11-0YA0 | CPU 1505SP TF (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-5WC11-0YA0/td) |
| CPU 1507S | 6ES7672-7AC01-0YA0 | CPU 1507S (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-7AC01-0YA0/td) |
| CPU 1507S F | 6ES7672-7FC01-0YA0 | CPU 1507S F (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-7FC01-0YA0/td) |
| CPU 1508S | 6ES7672-8AC01-0YA0 | CPU 1508S (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-8AC01-0YA0/td) |
| CPU 1508S F | 6ES7672-8FC01-0YA0 | CPU 1508S F (https://support.industry.siemens.com/cs/ww/en/pv/6ES7672-8FC01-0YA0/td) |

# Reference information for use with SIMATIC IPC

# B

## B.1 Windows Knowledge Base

The BIOS versions named in the reference information for the SIMATIC IPCs requires that the Windows KBs for repairing the Meltdown and Spectre security gaps have been installed.
Ensure that the following KBs are installed:

- Windows 7:
  - KB 4056897
  - KB 4074598
  - KB 4100480 (valid for 64-bit version only)
- Windows 10:
  - KB 4056890

---

**NOTE**

**Special feature for new SIMATIC IPCs**

On the latest SIMATIC IPCS the above-mentioned security updates are already an integral part of the basic system. Before you install the software controller, check to see whether these KBs have already been installed and, if not, install them manually.

---

**Power management settings of IPCs**

With the default SIMATIC power management profile, the Windows power management functionality is deactivated.

---

**NOTE**

Do not change the SIMATIC power management profile on your IPC.

---

Any further power management settings specific to individual IPCs can be found in the following chapters of the IPC concerned.

**BIOS downloads for SIMATIC IPCs**

For a list of BIOS downloads for SIMATIC IPCs, SIMATIC Tablet PCs, SIMATIC Field PGs, SINUMERIK PCU and SIMOTION P320 and their latest BIOS version along with the predecessor versions, see BIOS downloads (https://support.industry.siemens.com/cs/ww/en/view/109763408).

## B.2 SIMATIC IPC227E / IPC277E

If you are using these PCs supported by the CPU, note the following reference information for your device:

| | Property | Notes |
|---|---|---|
| **Hardware version** | FV ≥ AB | The hardware version can be found on the rating plate of your SIMATIC IPC. |
| **BIOS version** | V20.01.17 | To guarantee correct operation, update the BIOS to the specified version or higher. For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305). |
| **Operating systems** | Windows 7:<br>• Windows Embedded Standard 7 E SP1 (32-bit or 64-bit)<br>• Windows Embedded Standard 7 P SP1 (32-bit or 64-bit<br>• Windows 7 Ultimate (32-bit or 64-bit) | • For operation with Windows 7, the Software Controller requires Microsoft .NET Framework Version 4.6.1 or higher. If this version is not installed, make sure to install it before carrying out the Software Controller setup.<br>• During a Windows restart, you may sporadically experience a blue screen, see the section "Restarting Windows".<br>• To avoid boot failures after an uninstallation or upgrade of the Software Controller, install the utility BootSect.exe. For information on how to install this utility, refer to chapter Backing up the image of the PC mass storage (Page 127). |
| | Windows 10:<br>• Windows 10 Enterprise LTSB 2016 (64-bit)<br>• Windows 10 Enterprise LTSC 2019 (64-bit) | • Operation with Windows 10 requires a Windows installation in Legacy mode, see Win 10 Legacy Boot Handling (https://support.industry.siemens.com/cs/ww/en/view/109749498).<br>• During a Windows restart, you may sporadically experience a blue screen, see the section "Restarting Windows". |
| **Boot method** | Legacy boot with MBR partitioning | Legacy boot required; see IPC manual for setting the IPC to legacy boot before installing the CPU |
| **LED use** | IPC227E: Supported, configurable<br>IPC277E: Not supported | |
| **NVRAM use** | Supported, 135 KB can be used for user data | |
| **Mass storage** | | Operating system installation on CFast (internal or external) < 16 GB |
| **Using onboard interfaces for PROFINET or PROFIBUS:** | | |
| PN / IE (LAN) X1 | Not supported | |
| PN / IE (LAN) X2 | Yes | |

The SIMATIC Nanobox PC does not support PROFIBUS CP5623.

**NOTE**

**External monitor via DisplayPort on IPC277E**

To apply a changed monitor configuration on an external monitor, restart the entire PC system.

Configure Windows so that there is no automatic restart in the event of a blue screen. Reboot the entire PC system in case of a blue screen.

## B.3 SIMATIC IPC427D / IPC477D (PRO)

If you are using these PCs supported by the CPU, note the following reference information for your device:

| | Property | Notes |
|---|---|---|
| **Hardware version** | IPC427D: FS ≥ AN<br>IPC477D: FS ≥ AM | The hardware version can be found on the rating plate of your SIMATIC IPC. |
| **BIOS version** | i3: V17.01.17<br>i7: V17.02.17 | To guarantee correct operation, update the BIOS to the specified version or higher. For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305). |
| **Operating systems** | Windows 7:<br>• Windows Embedded Standard 7 E SP1 (32-bit or 64-bit)<br>• Windows Embedded Standard 7 P SP1 (32-bit)<br>• Windows 7 Ultimate (32-bit or 64-bit) | • For operation with Windows 7, the Software Controller requires Microsoft .NET Framework Version 4.6.1 or higher. If this version is not installed, make sure to install it before carrying out the Software Controller setup.<br>• To avoid boot failures after an uninstallation or upgrade of the Software Controller, install the utility BootSect.exe. For information on how to install this utility, refer to chapter Backing up the image of the PC mass storage (Page 127). |
| **Boot method** | Legacy boot with MBR partitioning | Legacy boot required; see IPC manual for setting the IPC to legacy boot before installing the CPU |
| **Graphics driver** | Version: 15.33.35.4176<br>Available on supplied Documentation and Drivers DVD 08/2017. | Only the graphics driver on the Documentation and Drivers DVD ≥ 06/2015 supports the "Windows Reboot" functionality.<br>If you did not receive the Documentation and Drivers DVD with the SIMATIC IPC, contact Customer Support. |
| **LED use** | IPC427D: Supported, configurable<br>IPC477D (PRO): Not supported | |
| **NVRAM use** | Supported, 135 KB can be used for user data | |
| **Mass storage** | | Operating system installation on CFast (internal or external) < 16 GB |

The following hardware configurations of the SIMATIC Microbox PCs are not supported by the CPU: Celeron processor

| | Property | Notes |
|---|---|---|
| **Using onboard interfaces for PROFINET or PROFIBUS:** | | |
| PN / IE (LAN) X1 | Not supported | |
| PN / IE (LAN) X2 | Yes | |
| PROFINET (LAN) X3<br>(CP 1616 onboard) | Not supported | |
| MPI / DP X4<br>(CP 5622 onboard) | Yes, as of FW V1.03.08.046. | For availability of the FW see SIMATIC Product Information (https://support.industry.siemens.com/cs/ww/en/view/92275417) |

The following hardware configurations of the SIMATIC Microbox PCs are not supported by the CPU: Celeron processor

## B.4 SIMATIC IPC427E / IPC477E (PRO)

If you are using these PCs supported by the CPU, note the following reference information for your device:

| | Property | Notes |
|---|---|---|
| **Hardware version** | IPC427E: FS ≥ AA<br>IPC477E: FS ≥ AA | The hardware version can be found on the rating plate of your SIMATIC IPC. |
| **BIOS version** | V21.01.18 | To guarantee correct operation, update the BIOS to the specified version or higher. For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305). |
| | Recommended BIOS settings:<br>• Power→Power and Performance→CPU-Power Management Control→CPU Power Level = Standard<br>• Security→TPM Availability = Hidden (Not Detected, if no TPM available) | |
| | Hiding TPM module<br>Hiding the TPM module will decrease jitter on Windows restart. For this reason, we recommend hiding the TPM module on all IPCs supporting this option to avoid timeouts. | |
| **Operating systems** | Windows 7:<br>• Windows Embedded Standard 7 E SP1 (32-bit or 64-bit)<br>• Windows Embedded Standard 7 P SP1 (64-bit)<br>• Windows 7 Ultimate (32-bit or 64-bit) | • For operation with Windows 7, the Software Controller requires Microsoft .NET Framework Version 4.6.1 or higher. If this version is not installed, make sure to install it before carrying out the Software Controller setup.<br>• To avoid boot failures after an uninstallation or upgrade of the Software Controller, install the utility BootSect.exe. For information on how to install this utility, refer to chapter Backing up the image of the PC mass storage (Page 127). |
| | Windows 10:<br>• Windows 10 Enterprise LTSB 2016 (64-bit)<br>• Windows 10 Enterprise LTSC 2019 (64-bit) | Operation with Windows 10 requires a Windows installation in Legacy mode, see Win 10 legacy boot handling (https://support.industry.siemens.com/cs/ww/en/view/109749498). |

| | Property | Notes |
|---|---|---|
| **Boot method** | Legacy boot with MBR partitioning | Legacy boot required; see IPC manual for setting the IPC to legacy boot before installing the CPU |
| **Graphics driver** | Version for Windows 7:<br>• 32-bit: 15.45.21.4821<br>• 64-bit: 15.45.21.64.4821<br>Version for Windows 10:<br>• 15.46.05.64.4771<br>Available on supplied USB flash drive with version 04/2018. | If you did not receive a USB flash drive with the SIMATIC IPC, contact Customer Support. |
| **LED use** | IPC427E: Supported, configurable<br>IPC477E (PRO): Not supported | |
| **NVRAM use** | Supported, 135 KB can be used for user data | |
| **Mass storage** | | Operating system installation on CFast (internal or external) < 16 GB |
| **Using onboard interfaces for PROFINET or PROFIBUS:** | | |
| PN / IE (LAN) X1 | Not supported | |
| PN / IE (LAN) X2 | Yes | |
| PN / IE (LAN) X3 | Yes | |

## Special features

### Use with Microsoft Windows Embedded Standard 7

When you use the PC Station on the IPC with the "Microsoft Windows Embedded Standard 7" operating system, install the Windows update for universal C RunTime in Windows from the Microsoft Support website (https://www.mircosoft.com/en-US/download/details.aspx?id=49077).

### Windows reboot

- To use the Windows reboot on the SIMATIC IPC427E / IPC477E, assign the Ethernet interfaces X2 or X3 to the PC Station in STEP 7.
- If a manual Windows reboot is not possible on the SIMATIC IPC477E with running CPU, update the IPC to BIOS version V21.01.11 or higher.

### Instruction "SHUT_DOWN: Shut down target system"

To reboot Windows via Remote Desktop on the SIMATIC IPC477E, also use the "-f" parameter with the Shutdown instruction for immediate shutdown.

## B.5 SIMATIC IPC627D / IPC827D / IPC677D

If you are using these PCs supported by the CPU, note the following reference information for your device:

| | Property | Notes |
|---|---|---|
| **Hardware version** | SIMATIC IPC 627D: FS ≥ AG<br>SIMATIC IPC 827D: FS ≥ AF<br>SIMATIC IPC 677D: FS ≥ AJ | The hardware version can be found on the rating plate of your SIMATIC IPC. |
| **BIOS version** | V19.02.12 | To guarantee correct operation, update the BIOS to the specified version or higher. For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305). |
| **Operating systems** | Windows 7:<br>• Windows Embedded Standard 7 P SP1 (32-bit)<br>• Windows 7 Ultimate (32-bit or 64-bit) | • For operation with Windows 7, the Software Controller requires Microsoft .NET Framework Version 4.6.1 or higher. If this version is not installed, make sure to install it before carrying out the Software Controller setup.<br>• If you use remote management, e.g. iAMT, for your IPC, a Windows restart is not supported.<br>• To avoid boot failures after an uninstallation or upgrade of the Software Controller, install the utility BootSect.exe. For information on how to install this utility, refer to chapter Backing up the image of the PC mass storage (Page 127). |
| | Windows 10:<br>• Windows 10 Enterprise LTSB 2016 (64-bit) | • Operation with Windows 10 requires a Windows installation in Legacy mode, see Win 10 Legacy boot handling (https://support.industry.siemens.com/cs/ww/en/view/109749498).<br>• If you use remote management, e.g. iAMT, for your IPC, a Windows restart is not supported. |
| **Boot method** | Legacy boot with MBR partitioning | Legacy boot required; see IPC manual for setting the IPC to legacy boot before installing the CPU |
| **Graphics driver** | Version for Windows 7:<br>• 32-bit: 15.36.18.4156<br>• 64-bit: 15.36.18.64.4156<br>Version for Windows 10:<br>• 15.40.36.64.4703<br>Available on supplied USB flash drive with version 12/2017 | Only this graphics driver supports the "Windows Reboot" functionality.<br>If you did not receive a USB flash drive with the SIMATIC IPC, contact Customer Support. |
| **LED use** | Supported | |
| **NVRAM use** | Supported, 35 KB can be used for user data | |
| **Mass storage** | | Configurations with RAID are not supported. |
| **Using onboard interfaces for PROFINET or PROFIBUS:** | | |
| PN / IE (LAN) X1 | Not supported | |
| PN / IE (LAN) X2 | Yes | |

| | Property | Notes |
|---|---|---|
| PROFINET (LAN) X3<br>(CP 1616 onboard) | Not supported | |
| MPI / DP X4<br>(CP 5622 onboard) | Yes, as of FW V1.03.08.046. | For availability of the FW see SIMATIC Product Information (https://support.industry.siemens.com/cs/ww/en/view/92275417) |
| BIOS setting | Wake up on LAN (X2 P1) | Activate the "Wake up on LAN" option in the BIOS |

**Special features for fail-safe systems**

The CPU 1507S F and CPU 1508S F need NVRAM (buffered SRAM) for operation. To use the CPU on these IPCs, the following ordering options are available under "Processor" during configuration:

- Options with onboard "PROFIBUS DP/MPI (CP 5622 compatible); 2 MB buffered SRAM"
- Options with onboard "PROFINET (IRT, 3 ports, CP 1616 compatible); 2 MB buffered SRAM"

## B.6 SIMATIC IPC647D / IPC847D

If you are using these PCs supported by the CPU, note the following reference information for your device:

| | Property | Notes |
|---|---|---|
| **Hardware version** | SIMATIC IPC 647D: FS ≥ AE<br>SIMATIC IPC 847D: FS ≥ AE | The hardware version can be found on the rating plate of your SIMATIC IPC. |
| **BIOS version** | V19.01.16 | To guarantee correct operation, update the BIOS to the specified version or higher. For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305). |
| **Operating systems** | Windows 7:<br>• Windows 7 Ultimate (32-bit or 64-bit) | • For operation with Windows 7, the Software Controller requires Microsoft .NET Framework Version 4.6.1 or higher. If this version is not installed, make sure to install it before carrying out the Software Controller setup.<br>• If you use remote management, e.g. iAMT, for your IPC, a Windows restart is not supported.<br>• To avoid boot failures after an uninstallation or upgrade of the Software Controller, install the utility BootSect.exe. For information on how to install this utility, refer to chapter Backing up the image of the PC mass storage (Page 127). |
| | Windows 10:<br>• Windows 10 Enterprise LTSB 2016 (64-bit | • Operation with Windows 10 requires a Windows installation in Legacy mode, see Win 10 Legacy boot handling (https://support.industry.siemens.com/cs/ww/en/view/109749498).<br>• If you use remote management, e.g. iAMT, for your IPC, a Windows restart is not supported. |

| | Property | Notes |
|---|---|---|
| **Boot method** | Legacy boot with MBR partitioning | Legacy boot required; see IPC manual for setting the IPC to legacy boot before installing the CPU |
| **Graphics driver** | Version for Windows 7:<br>• 32-bit: 15.36.18.4156<br>• 64-bit: 15.36.18.64.4156<br>Version for Windows 10:<br>• 15.40.36.64.4703<br>Available on supplied Documentation and Drivers DVD 09/2017. | Only the graphics driver on the Documentation and Drivers DVD ≥ 06/2015 supports the "Windows Reboot" functionality.<br>If you did not receive the Documentation and Drivers DVD with the SIMATIC IPC, contact Customer Support. |
| **LED use** | Not supported | |
| **Mass storage** | The following configurations with RAID are supported:<br>RAID1, 1 TB (2x 1 TB HDD SAS, mirror disks) in removable frame, hot-swap, frontside-mounted; PCIe x8 RAID Controller incl. ZMCP module (2 slots occupied) + 1x 240 GB SSD (for OS) in removable frame | The installation of the operating system and the Software Controller must take place on the SSD that is connected over the AHCI controller.<br>Following restriction for operation with RAID:<br>• Windows restart after a blue screen<br>• Windows restart as of firmware version 7.10-0 (33072) and the release version MR2016.2 |
| **Using onboard interfaces for PROFINET or PROFIBUS:** | | |
| PN / IE (LAN) X1 | Not supported | |
| PN / IE (LAN) X2 | Yes | |
| PROFINET (LAN) X3 (CP 1616 onboard) | Not supported | |
| MPI / DP X4 (CP 5622 onboard) | Yes, as of FW V1.03.08.046. | For availability of the FW see SIMATIC Product Information (https://support.industry.siemens.com/cs/ww/en/view/92275417) |
| BIOS setting | Wake up on LAN (X2 P1) | Activate the "Wake up on LAN" option in the BIOS |

## B.7 SIMATIC IPC647E / IPC847E

If you are using these PCs supported by the CPU, note the following reference information for your device:

| | Property | Notes |
|---|---|---|
| **Hardware version** | | The hardware version can be found on the rating plate of your SIMATIC IPC. |
| **BIOS version** | V25.02.12 | To guarantee correct operation, update the BIOS to the specified version or higher. For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305). |

| | Property | Notes |
|---|---|---|
| **BIOS version** | Mandatory BIOS settings:<br>• Advanced→PCH-IO Configuration→SATA and RST Configuration→SATA Mode Selection=AHCI<br>The default value of "SATA Mode Selection" is **Intel RST**. However, the Software Controller requires **AHCI** for installation.<br>**Note:** Do not change the SATA Mode Selection to AHCI directly. To change SATA Mode Selection to AHCI, follow the instructions in section "Changing SATA Mode Selection to AHCI".<br>• Advanced→Power & Performance→CPU - Power Management Control→Intel(R) Speed Shift Technology=**Disabled** | |
| | In addition to the above-stated mandatory settings, these BIOS settings are recommended.<br>• Advanced→Power & Performance→CPU - Power Management Control→Intel(R) SpeedStep(tm)=**Disabled**<br>• Advanced→Power & Performance→CPU - Power Management Control→Power & Performance Scenario=**Max Performance**<br>• Advanced→Power & Performance→CPU - Power Management Control→C States =**Disabled**<br>• Advanced→Power & Performance→CPU - Power Management Control→Turbo Mode =**Disabled** | |
| | Hiding TPM module<br>Hiding the TPM module will decrease jitter on Windows restart. For this reason, we recommend hiding the TPM module on all IPCs supporting this option to avoid timeouts. | |
| **Operating systems** | Microsoft Windows 10 Enterprise LTSC 2019 | If UEFI is used |
| **Boot method** | UEFI boot with GPT partitioning | |
| **Graphics driver** | 25.20.100.6472 | |
| **LED use** | Not supported | |
| **Mass storage** | | Unsupported configurations:<br>• Configurations with RAID<br>• Configurations with NVMe (M.2) |
| **Using onboard interfaces for PROFINET or PROFIBUS:** | | |
| PN / IE (LAN) X1 | Not supported | |
| PN / IE (LAN) X2 | Yes | |
| PN / IE (LAN) X3 | Yes | |

**NOTE**

**Blue screen**

Configure Windows so that there is no automatic restart in the event of a blue screen. Reboot the entire PC system in case of a blue screen.

If Windows is configured to remain in blue screen, disable the TCO Timer: Advanced→PCH-IO Configuration→Enable TCO Timer→**Disabled**

If you do not disable the TCO Timer, then Windows will restart the complete system after a while.

**NOTE**

**System reboot time**

In rare cases, rebooting an IPC with more than one mass storage device connected to it may take longer than expected.

### Changing SATA Mode Selection to AHCI

Before changing to AHCI, complete the other mandatory and recommended BIOS Power Management Control settings.

To change SATA Mode Selection to AHCI, proceed as follows:

Start the installation of the Software Controller. If the SATA Mode Selection is not AHCI, the setup will ask you to change SATA to AHCI and will cause a reboot of the PC.

1. Press ESC during restart to access the BIOS menu.
2. Go to: Setup Utility→Advanced→PCH-IO Configuration→SATA and RST Configuration→SATA Mode Selection
3. Select AHCI.
4. Save and exit.
5. Re-run the installer after restart is completed.

If, in the message prompting you to enable AHCI, you have clicked on "No", proceed as follows:

1. From Windows Start menu, type "cmd" to open the Command Prompt.
2. Right-click and run as administrator.
3. Run the command "config storahci start= boot".
   This command will enable the installation of the AHCI driver on the next reboot.
4. Restart Windows and press ESC to access the BIOS menu.
5. Select SATA Mode Selection as AHCI from the following path:
   Advanced→PCH-IO Configuration→SATA and RST Configuration→SATA Mode Selection
6. Save and exit.
7. Run the installer again.

Installation is completed successfully.

### Supported mass storage driver for a proper execution of Software Controller

For proper execution of the Software Controller for all AHCI mass storage controllers in the system, the standard Microsoft driver must be loaded.

The installer of the Software Controller will try to switch all non-Microsoft AHCI mass storage controller drivers to the standard Microsoft driver.

Switch the mass storage controller drivers to the standard Microsoft driver in case of the following scenarios:

- the installer is repeatedly reporting that the SATA AHCI controller is disabled
- the installer was not able to successfully switch the driver to the standard Microsoft driver and, as a consequence, Windows crashes on the next boot

To manually switch the mass storage controller drivers to the standard Microsoft driver, proceed as follows:

1. Boot the PC in "Windows only" mode.
2. Open the Device Manager.
3. Check the mass storage controllers under "IDE ATA/ATAPI controllers" and under "Storage controllers".
4. If AHCI controllers are found with a non-Microsoft driver loaded, right click on the controller.

5. Select "Update driver".

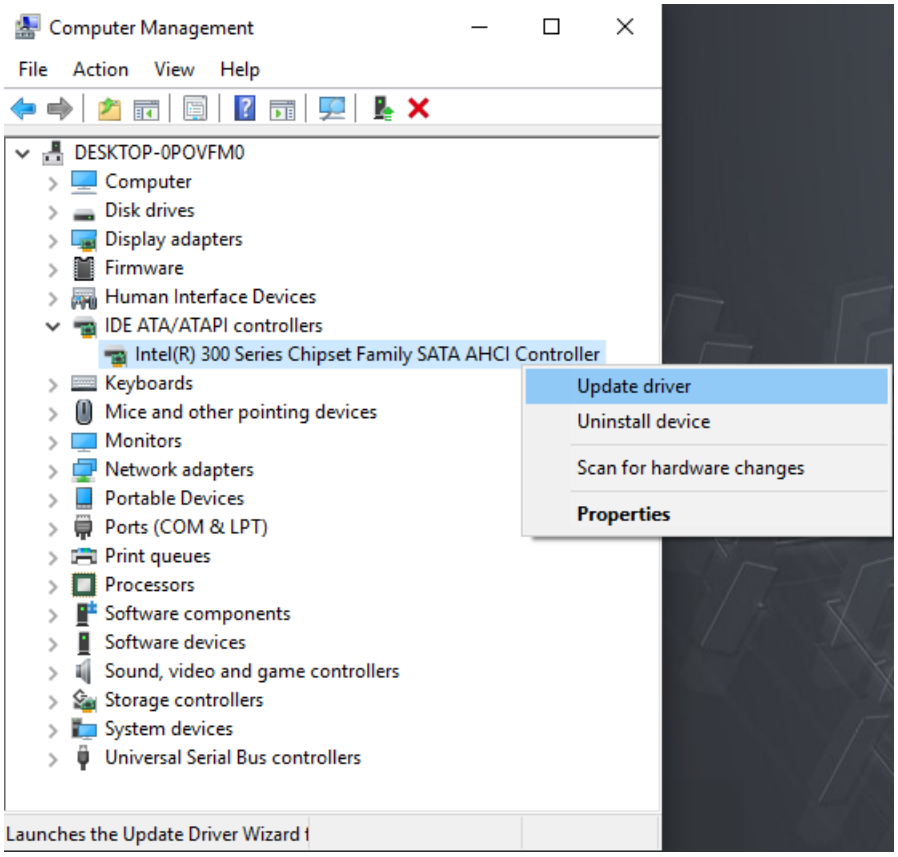



Figure B-1 Updating driver

6. On the next window, select "Browse my computer for driver software".

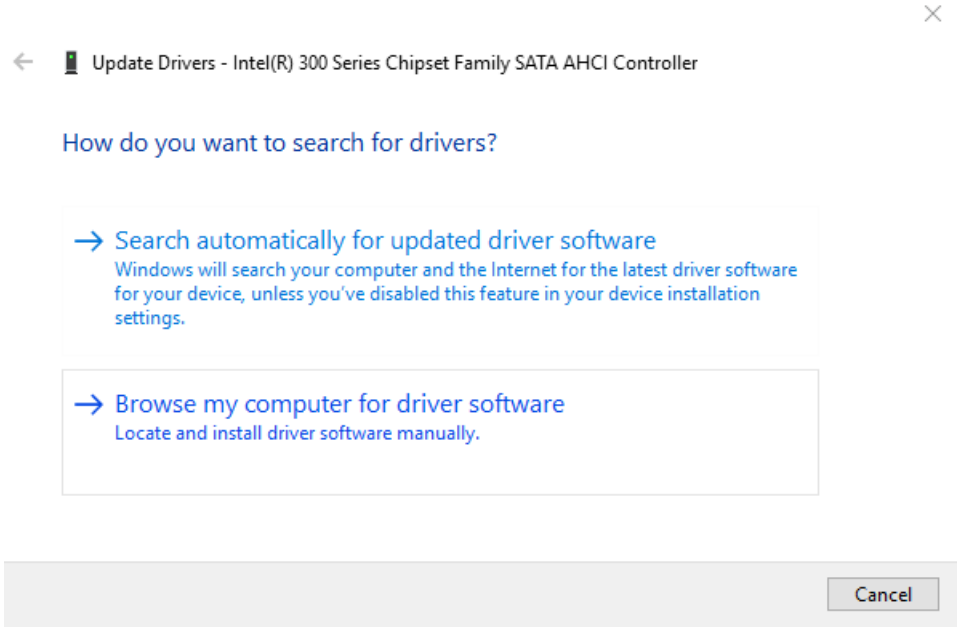



Figure B-2 Browsing for driver software

7. Select "Let me pick from a list of available drivers on my computer".

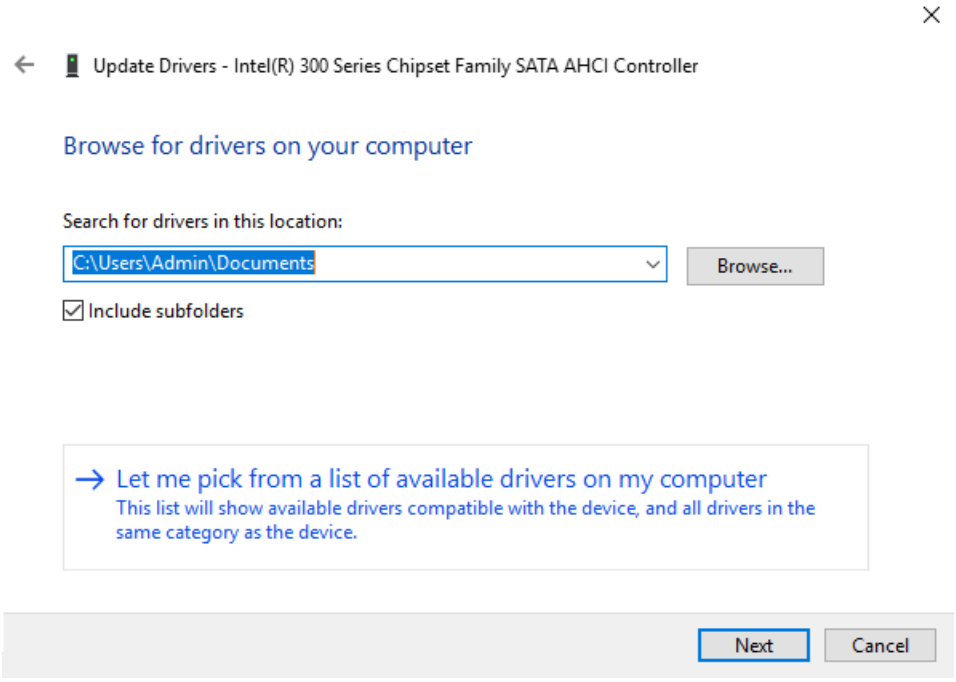



Figure B-3 Opening list of available drivers

8. Select the standard Microsoft driver from the list.

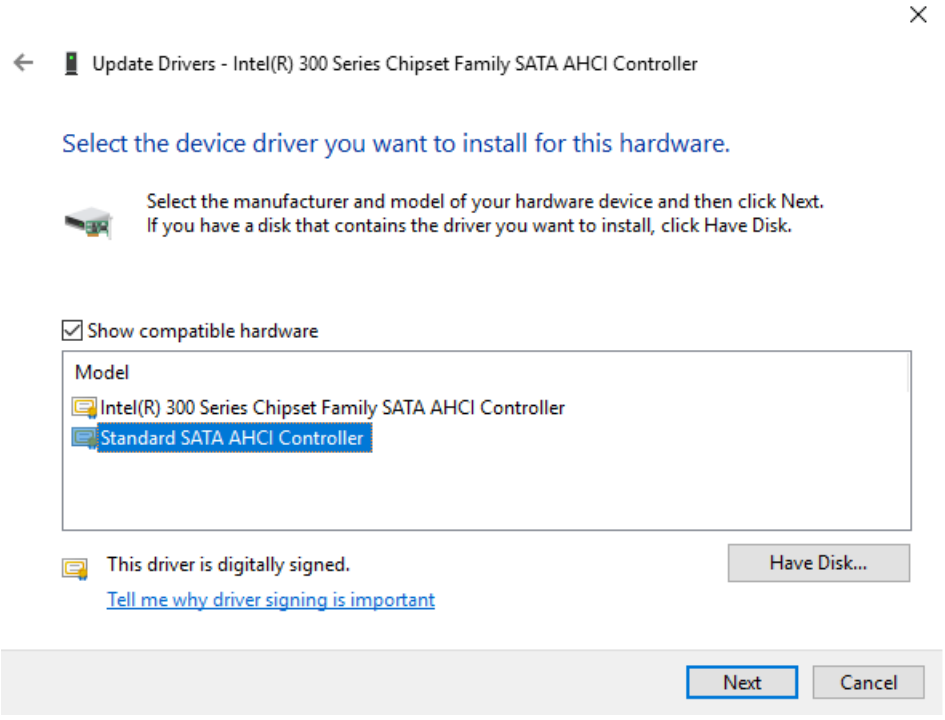



Figure B-4 Selecting standard Microsoft Driver

9. Close the window and restart Windows.

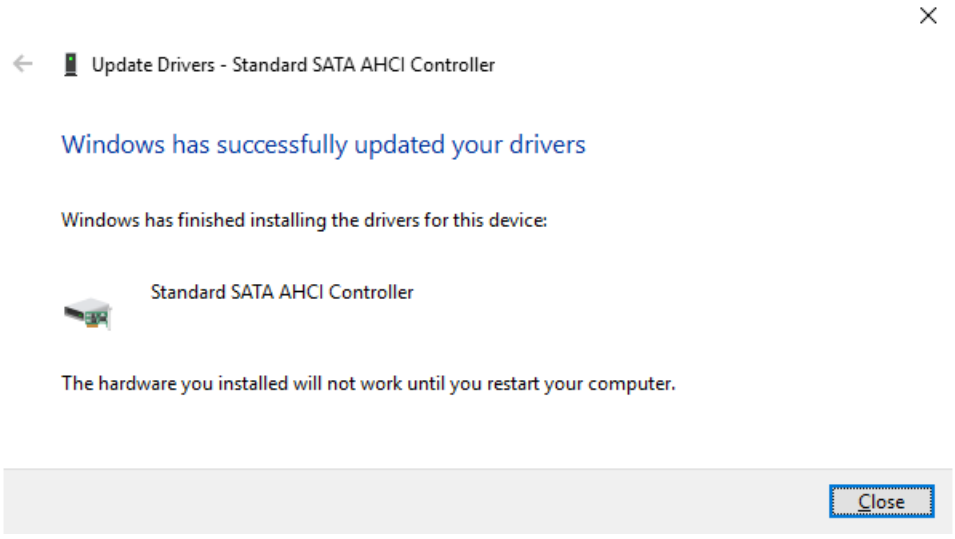



Figure B-5 Driver update successful

Repeat this process for all mass storage controllers (AHCI) for which a non-Microsoft driver is loaded.

## Updating BIOS

**NOTE**

**BIOS settings lost after BIOS update**

The BIOS update will reset the BIOS to its default settings. After having updated the BIOS, configure the correct BIOS settings again.

If, after having reconfigured the BIOS and restarting, a blue screen appears, proceed as follows:

1. Open the BIOS and change the SATA Mode Selection to RAID.
2. Restart the PC in "Windows only" mode to enable the AHCI driver mode.
   To enable the AHCI driver mode, proceed as follows:
   - Run the command line as administrator.
   - Run the command "sc config storahci start= boot".
3. Restart the PC.
4. Open the BIOS again and change the SATA Mode Selection to AHCI.
5. Restart the PC in either "Windows only" or "Windows and CPU 150xS" mode.

After having updated the BIOS, choose the correct BIOS settings and restart Windows. After restarting Windows, the boot menu screen (GRUB) should appear. If the boot menu screen does not appear, proceed as follows.

1. Go to BIOS Setup Boot→EFI.
2. Check, if the boot menu (GRUB) is in the first position of the boot order.
3. If it is not in the first position, move the boot menu (GRUB) to the first position.

If the boot menu cannot be moved to the first position because the entries are greyed out, proceed as follows.

1. Go to Boot→Add Boot Options and check the state.
2. If the state is [Auto], change it to [First].
3. Move the boot menu to the first position in BIOS Setup Boot→EFI.

**NOTE**

**Boot menu window (GRUB)**

You may have to boot Windows once and then return to BIOS Setup before the boot menu will be shown under the boot options.

### Uninstalling DiagBase

We recommend that you uninstall DiagBase to ensure real-time capability also during the Windows boot phase and to prevent SMIs (System Management Interrupts) on Windows start/restart. Note that after uninstalling DiagBase:

- The download preview will report that a configured component is not installed
- DiagBase diagnostics messages will not be shown in the diagnostics buffer of the PC Station

As an alternative to uninstalling DiagBase you can start the Software Controller manually after booting/rebooting Windows by deselecting the option "Automatic start after booting the PC".

### Instruction "SHUT_DOWN: Shutdown target system"; MODE = 5

IPC647E and IPC847E do not support the use of the instruction "SHUT_DOWN: Shutdown target system" in MODE = 5 to restart Windows in case of a crash/blue screen.

## B.8 SIMATIC IPC627E / IPC677E

If you are using these PCs supported by the CPU, note the following reference information for your device:

| | Property | Notes |
|---|---|---|
| **Hardware version** | | The hardware version can be found on the rating plate of your SIMATIC IPC. |
| **BIOS version** | V25.02.12 | To guarantee correct operation, update the BIOS to the specified version or higher. For detailed information on how to update BIOS, see SIMATIC IPC – BIOS update (https://support.industry.siemens.com/cs/ww/en/view/109757305). |

| | Property | Notes |
|---|---|---|
| **BIOS version** | Mandatory BIOS settings:<br>• Advanced→PCH-IO Configuration→SATA and RST Configuration→SATA Mode Selection=AHCI<br>The default value of "SATA Mode Selection" is **Intel RST**. However, the Software Controller requires **AHCI** for installation.<br>**Note:** Do not change the SATA Mode Selection to AHCI directly. To change SATA Mode Selection to AHCI, follow the instructions in section "Changing SATA Mode Selection to AHCI".<br>• Advanced→Power & Performance→CPU - Power Management Control→Intel(R) Speed Shift Technology=**Disabled** | |
| | In addition to the above-stated mandatory settings, these BIOS settings are recommended:<br>• Advanced→Power & Performance→CPU - Power Management Control→Intel(R) SpeedStep(tm)=**Disabled**<br>• Advanced→Power & Performance→CPU - Power Management Control→Power & Performance Scenario=**Max Performance**<br>• Advanced→Power & Performance→CPU - Power Management Control→C States =**Disabled**<br>• Advanced→Power & Performance→CPU - Power Management Control→Turbo Mode =**Disabled** | |
| | Hiding TPM module<br>Hiding the TPM module will decrease jitter on Windows restart. For this reason, we recommend hiding the TPM module on all IPCs supporting this option to avoid timeouts. | |
| **Operating systems** | Microsoft Windows 10 Enterprise LTSC 2019 | If UEFI is used |
| **Boot method** | UEFI boot with GPT partitioning | |
| **Graphics driver** | 25.20.100.6472 | |
| **LED use** | Yes | |
| **NVRAM use** | Supported, 135 KB can be used for user data | |
| **Mass storage** | | Unsupported configurations:<br>• Configurations with RAID<br>• Configurations with NVMe (M.2) |
| **Using onboard interfaces for PROFINET or PROFIBUS:** | | |
| PN / IE (LAN) X1 | Not supported | |
| PN / IE (LAN) X2 | Yes | |
| PN / IE (LAN) X3 | Yes | |

**NOTE**

**Blue screen**

Configure Windows so that there is no automatic restart in the event of a blue screen. Reboot the entire PC system in case of a blue screen.

If Windows is configured to remain in blue screen, disable the TCO Timer: Advanced→PCH-IO Configuration→Enable TCO Timer→**Disabled**

If you do not disable the TCO Timer, then Windows will restart the complete system after a while.

**NOTE**

**System reboot time**

In rare cases, rebooting an IPC with more than one mass storage device connected to it may take longer than expected.

## Changing SATA Mode Selection to AHCI

Before changing to AHCI, complete the other mandatory and recommended BIOS Power Management Control settings.

To change SATA Mode Selection to AHCI, proceed as follows:

Start the installation of the Software Controller. If the SATA Mode Selection is not AHCI, the setup will ask you to change SATA to AHCI and will cause a reboot of the PC.

1. Press ESC during restart to access the BIOS menu.
2. Go to: Setup Utility→Advanced→PCH-IO Configuration→SATA and RST Configuration→SATA Mode Selection
3. Select AHCI.
4. Save and exit.
5. Re-run the installer after restart is completed.

If, in the message prompting you to enable AHCI, you have clicked on "No", proceed as follows:

1. From Windows Start menu, type "cmd" to open the Command Prompt.
2. Right-click and run as administrator.
3. Run the command "config storahci start= boot".
   This command will enable the installation of the AHCI driver on the next reboot.
4. Restart Windows and press ESC to access the BIOS menu.
5. Select SATA Mode Selection as AHCI from the following path:
   Advanced→PCH-IO Configuration→SATA and RST Configuration→SATA Mode Selection
6. Save and exit.
7. Run the installer again.

Installation is completed successfully.

## Supported mass storage driver for a proper execution of Software Controller

For proper execution of the Software Controller for all AHCI mass storage controllers in the system, the standard Microsoft driver must be loaded.

The installer of the Software Controller will try to switch all non-Microsoft AHCI mass storage controller drivers to the standard Microsoft driver.

Switch the mass storage controller drivers to the standard Microsoft driver in case of the following scenarios:

- the installer is repeatedly reporting that the SATA AHCI controller is disabled
- the installer was not able to successfully switch the driver to the standard Microsoft driver and, as a consequence, Windows crashes on the next boot

To manually switch the mass storage controller drivers to the standard Microsoft driver, proceed as follows:

1. Boot the PC in "Windows only" mode.
2. Open the Device Manager.
3. Check the mass storage controllers under "IDE ATA/ATAPI controllers" and under "Storage controllers".
4. If AHCI or NVMe controllers are found with a non-Microsoft driver loaded, right click on the controller.
5. Select "Update driver".

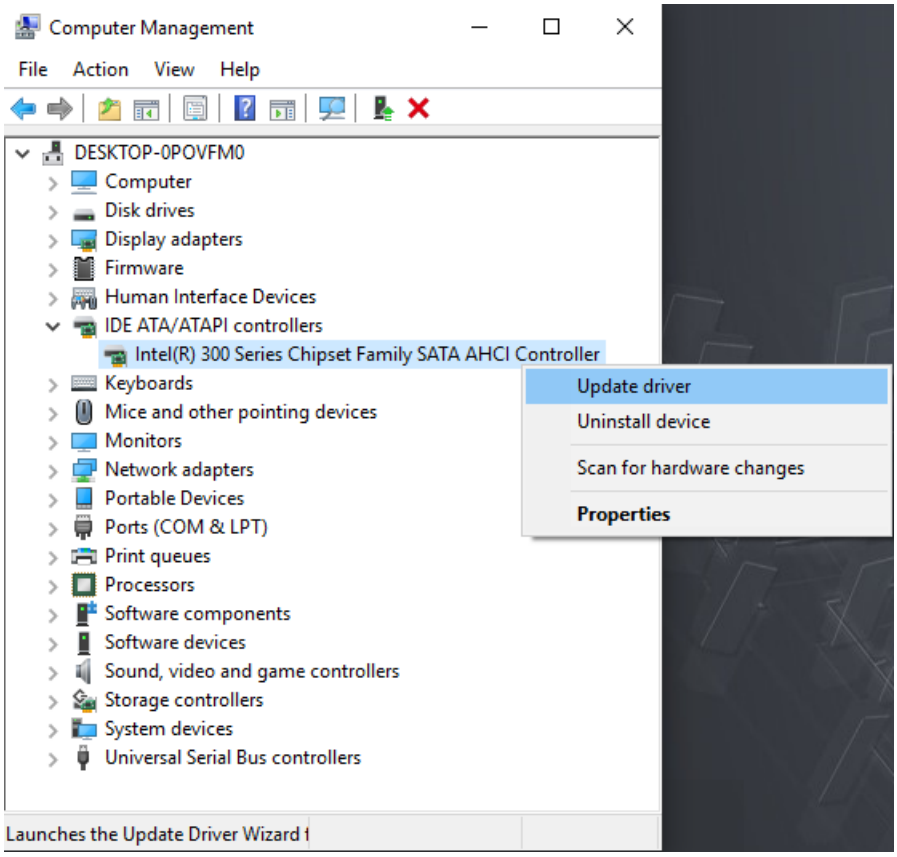



Figure B-6 Updating driver

6. On the next window, select "Browse my computer for driver software".

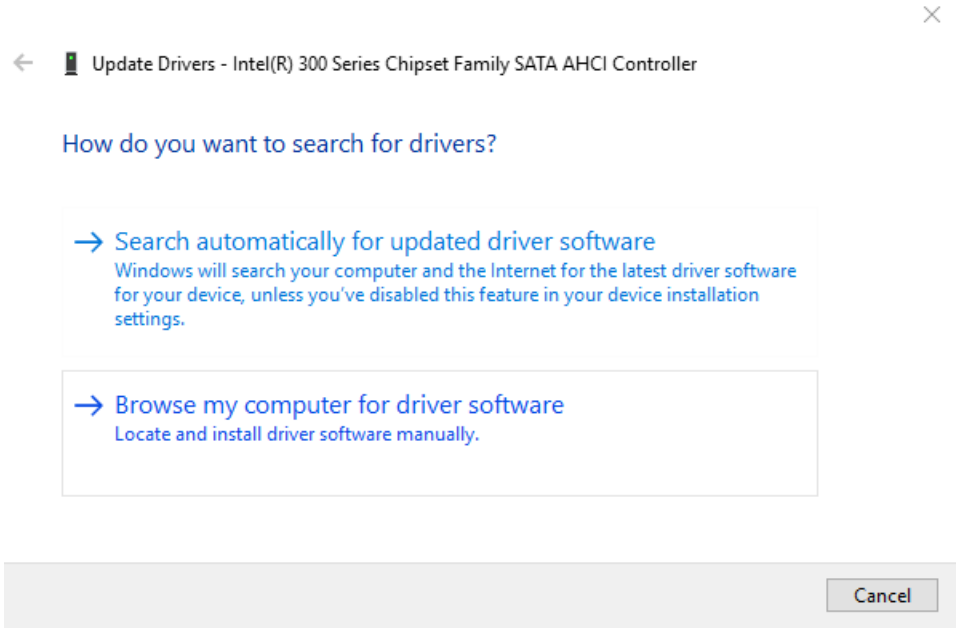



Figure B-7 Browsing for driver software

7. Select "Let me pick from a list of available drivers on my computer".

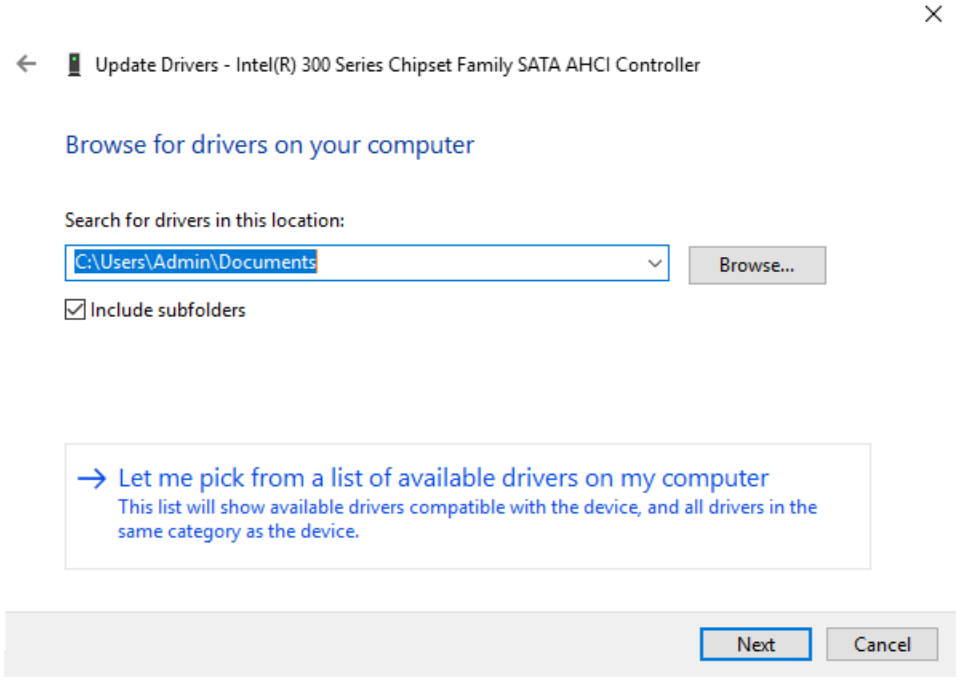



Figure B-8 Opening list of available drivers

8. Select the standard Microsoft driver from the list.

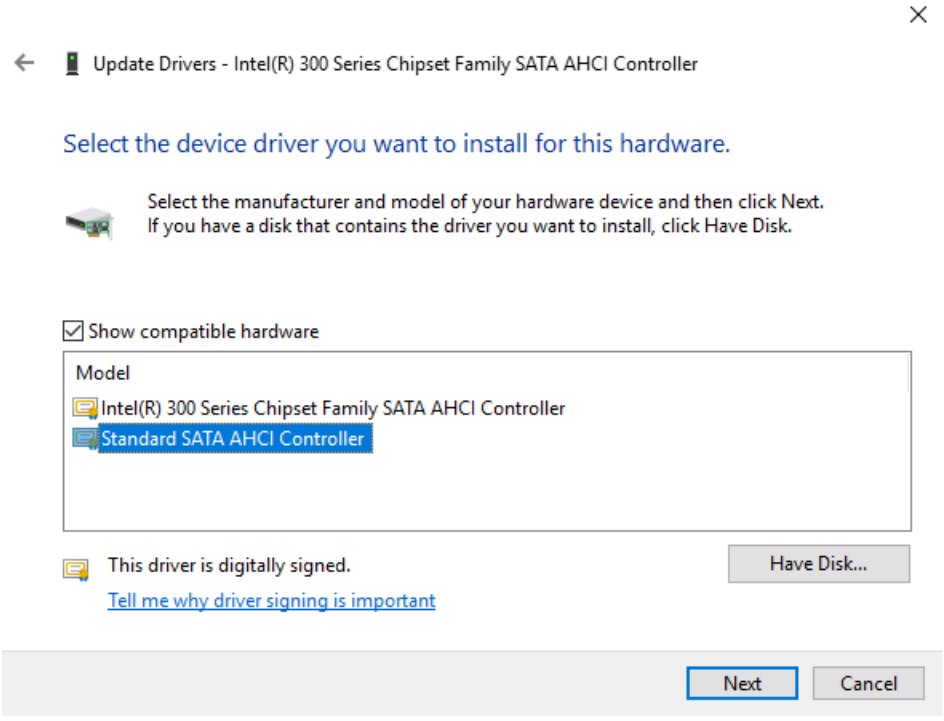



Figure B-9 Selecting standard Microsoft Driver

9. Close the window and restart Windows.

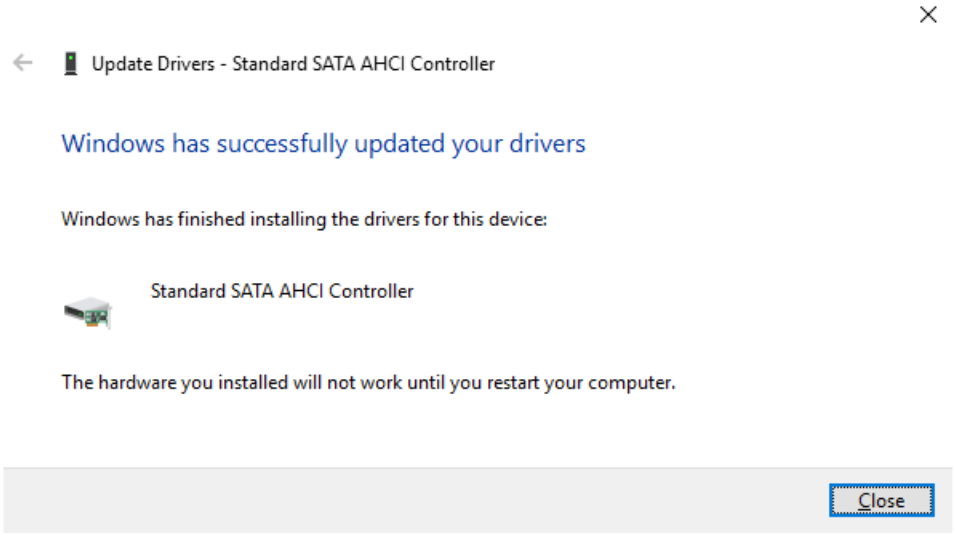



Figure B-10 Driver update successful

Repeat this process for all mass storage controllers (AHCI) for which a non-Microsoft driver is loaded.

## Updating BIOS

**NOTE**

**BIOS settings lost after BIOS update**

The BIOS update will reset the BIOS to its default settings. After having updated the BIOS, configure the correct BIOS settings again.

If, after having reconfigured the BIOS and restarting, a blue screen appears, proceed as follows:

1. Open the BIOS and change the SATA Mode Selection to RAID.
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   To enable the AHCI driver mode, proceed as follows:
   - Run the command line as administrator.
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3. Restart the PC.
4. Open the BIOS again and change the SATA Mode Selection to AHCI.
5. Restart the PC in either "Windows only" or "Windows and CPU 150xS" mode.

After having updated the BIOS, choose the correct BIOS settings and restart Windows. After restarting Windows, the boot menu screen (GRUB) should appear. If the boot menu screen does not appear, proceed as follows.

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1. Go to Boot→Add Boot Options and check the state.
2. If the state is [Auto], change it to [First].
3. Move the boot menu to the first position in BIOS Setup Boot→EFI.

**NOTE**

**Boot menu window (GRUB**

You may have to boot Windows once and then return to BIOS Setup before the boot menu will be shown under the boot options.

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We recommend that you uninstall DiagBase to ensure real-time capability also during the Windows boot phase and to prevent SMIs (System Management Interrupts) on Windows start/restart. Note that after uninstalling DiagBase:

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- DiagBase diagnostics messages will not be shown in the diagnostics buffer of the PC Station.

As an alternative to uninstalling DiagBase you can start the Software Controller manually after booting/rebooting Windows by deselecting the option "Automatic start after booting the PC".

### Instruction "SHUT_DOWN: Shutdown target system"; MODE = 5

IPC627E does not support the use of the instruction "SHUT_DOWN: Shutdown target system" in MODE = 5 to restart Windows in case of a crash/blue screen.

# Glossary

**Blue screen**

Termination of the Windows operating system, resulting in a display on the monitor of the fatal error on a blue background. A blue screen is also known as a Windows Stop Error.

**Cold restart**

The controller executes OB 102 before the start of the free scan cycle (OB 1). Like a warm restart, a cold restart resets the peripheral inputs (PI) and changes the peripheral outputs (PQ) to a pre-defined safe state (default is 0). However, a cold restart does not save the retentive memory (M, T, C, or DB), but sets these areas to their default settings.

**Communication interface**

CP card that is used for communication by the CPU, PROFIBUS interface built into the Siemens PC or Industrial Ethernet interface.

**CP card**

Communications processor

**Cycle time**

The cycle time is the time required to execute the complete scan cycle.

**GPT**

GPT (GUID Partition Table) is an advanced partitioning scheme. GPT allows to add as many Windows partitions as needed without having to configure extended partitions.

**Industrial Ethernet**

Physical communication layer that supports communication with STEP 7, S7 CPUs, PGs, OPs, S7 applications, and PROFINET IO.

**Load memory**

Memory area (RAM) allocated for all of the blocks downloaded from STEP 7 excluding the symbol table and comments.

**NVRAM**

Non-Volatile Random Access Memory: Non-volatile memory area

**PC system**

Representation of a software-based virtual rack in STEP that defines a PC-based automation system.

**PG**

Programming device

**PG/OP communication**

Communication between the CPU and other S7 applications, such as programming devices, operator panels, and S7 controllers. The CPU supports PROFIBUS and Industrial Ethernet for PG/OP communication.

**PLC**

Programmable logic controller - electronic control system. The PLC functions are stored in a program on the control device. The device configuration and wiring are therefore independent of the controller functions. The PLC is configured similar to a computer. It consists of a CPU with memory, input and output devices, and an internal bus system. The I/O and the programming language are oriented to control engineering requirements.

**Priority**

The priority of an application determines the order in which the operating system executes or interrupts an application in relation to the other applications that are running on the computer. An application with a higher priority interrupts the execution of an application with a lower priority. After the application with the higher priority finishes, the application with the lower priority resumes. A higher number indicates a higher priority.

**PROFIBUS**

Physical communications layer that can be used for PROFIBUS DP communication with I/O or S7 communication with STEP 7, S7 CPUs, and S7 applications.

**PROFIBUS DP**

Communications network protocol used to communicate to DP I/O.

**PROFINET IO**

Communications network protocol used to communicate with PROFINET IO devices.

**S7 communication**

Communication between controllers on the network, hardware or software, using the S7 communication functions.

**Scan cycle**

The cycle includes writing to the outputs, reading the inputs, executing OB 1, and satisfying the idle time requirement.

**STEP 7 user program**

Application program created with STEP 7 and downloaded to the CPU for execution. It includes all organization blocks and the other instructions that they call.

**TCP**

Transmission Control Protocol: Enables transmission of data packets ("messages") if both nodes support RFC 1006.

**Time-of-day synchronization**

The ability to broadcast a system standard time from a single source to all devices within the system so that they can set their own clocks to the standard time.

**TPM**

Trusted Platform Module: The hardware can be expanded to include a TPM. The TPM assigns a unique identifier to the device and expands its safety functions.

**UDP**

User Datagram Protocol: Enables transmission of data units.

**UEFI**

UEFI (Unified Extensible Firmware Interface) is the successor of the BIOS. UEFI supports faster boot times, larger hard drives and fail-safe features, such as writing attributes to UEFI flash memory. For fail-safe IPCs supporting UEFI (IPC6x7E/8x7E), NVRAM is not a prerequisite any more.

**UPS**

Uninterruptible power supply: A UPS ensures the power supply in case of brief disturbances in the power network.

**Warm restart**

The controller executes OB 100 before the start of the free scan cycle (OB 1). A warm restart resets the distributed I/O inputs and puts the distributed I/O outputs into a pre-defined safe state. A warm restart saves the current value of the retentive memory areas of bit memories, timers, counters, etc.

**Web server**

The Web server is used to monitor the CPU via the Internet or via your company Intranet. This approach lets you carry out evaluations and diagnostics even at great distances. Messages and status information are visualized on HTML pages.

**Windows Stop Error**

Termination of the Windows operating system, resulting in a display on the monitor of the fatal error on a blue background. A Windows Stop Error is also known as a "blue screen".

**Work memory**

Memory area (RAM) allocated for the blocks used at runtime.

# Index


## A

Access protection, 141

Assigning interfaces, 54

## C

Certificate of license, 47

Command line commands, 76, 110

Communication, 17
- Interfaces, 54
- Open communication, 88

Configuring CPU, 52
- Loading a project, 68

Configuring IPC, 51

Configuring startup, 62

Configuring the Web server, 65

Creating the CPU volume, 35

## D

Delivery state, 120

Diagnostics, 17
- Web server, 17
- Display, 98
- LEDs, 155
- Status display, 155
- Exporting data, 157
- Information via display, 158
- Alarms, 160
- Diagnostics buffer, 162
- Information about STEP 7, 163
- Web server, 164

Display
- Fail-safe, 30
- Introduction, 95
- Advantages, 95
- Layout, 97
- Control, 97
- Display language, 103
- Setting date and time, 106

Downloading
- Project, 68
- PC system, 70
- Project, 131
- Project, 132

## F

Factory settings, 120

Firmware update, 50, 118

Formatting the CPU volume, 124

## I

Installation
- CPU volume, 35
- Via online software delivery, 40
- Installation procedure, 41
- Via DVD, 41
- Licensing, 47
- Uninstallation procedure, 49

Installing drivers, 131

Introduction, 15

## K

Know-how protection, 153

## L

LEDs, 60, 155

Licensing, 47

Load memory, 22, 123

## M

Motion control functions, 18

## N

Notification area, 114, 115

NVRAM, 23, 25, 58

## O

Open User Communication, 88
Operating modes
  Changing the operating mode, 107
  CPU status displays, 107
  Basics, 111
  Operating mode transitions, 112
OUC, 88, 92

## P

Password provider, 19
Power failure, 117
Properties
  Of the CPU, 16
  Of PROFINET IO, 26
Properties of PROFIBUS DP, 27

## R

Real-time concept, 20
Resetting the PC system, 126
Resetting to factory settings, 110
  Via command line, 110
  Via display, 121
  Via STEP 7, 122
  Via mode switch, 123
  CPU volume, 124
Retentive memory, 22

## S

Save image, 127
Security functions, 139
  Notes, 140
  Access protection using STEP 7, 141
  Access protection via display, 146
  Protecting blocks, 151
  Firewall, 152
  Virus scanners, 152
Set date, 106
Set language option, 103
Set time, 106
Setting up copy protection, 153
SIMATIC Diagnostics Tool, 157
SIMATIC IPC Image&Partition Creator, 127
Start CPU, 100
Stop CPU, 100
Storing data
  Memory areas, 21
  Retentive data, 23
  Storage location for retentive data, 58

## T

Technical specifications, 165
Technology functions, 18
TIA Portal Openness, 70
Time-of-day synchronization, 63
Tools
  SIMATIC Diagnostics Tool, 157
Trace, 17
Type of CPU startup, 62

## U

Uninterruptible power supply, 117
UPS, 117

## W

Web server, 28
  Web browser, 28
  Configuring the Web server, 65
  Enabling the Web server, 65
Work memory, 22