

Edition

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EQUIPMENT MANUAL

# SIMATIC

## ET 200SP

CPU 1510SP-1 PN

6ES7510-1DK03-0AB0

# SIEMENS

SIMATIC

ET 200SP

CPU 1510SP-1 PN

(6ES7510-1DK03-0AB0)

Equipment Manual

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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.

 <b>DANGER</b>
indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken.
 <b>WARNING</b>
indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.
 <b>CAUTION</b>
indicates that minor personal injury can result if proper precautions are not taken.
<b>NOTICE</b>
indicates that property damage can result if proper precautions are not taken.


If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

### 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:

 <b>WARNING</b>
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

### Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

### Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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# Introduction

## Purpose of the documentation

This manual supplements the ET 200SP distributed I/O system (<https://support.automation.siemens.com/WW/view/en/58649293>) system manual as well as the function manuals. This manual contains a description of the module-specific information. The system-related functions are described in the system manual. All system-spanning functions are described in the function manuals.

The information provided in this equipment manual and the system manual allows you to commission the CPU.

## Conventions

STEP 7: In this documentation, "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal)".

Please also observe the notes marked as follows:

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### NOTE

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

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## Recycling and disposal

For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

## Industry Mall

The Industry Mall is the catalog and order system of Siemens AG for automation and drive solutions on the basis of Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).

You can find catalogs for all automation and drive products on the Internet (<https://mall.industry.siemens.com>).

## 1.1 ET 200SP Documentation Guide

### 1.1.1 Information classes ET 200SP



The documentation for the SIMATIC ET 200SP distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require. You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742709>).

#### Basic information



The System Manual describes in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200SP distributed I/O system.

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

Examples:

- ET 200SP System Manual
- System Manual ET 200SP HA/ET 200SP modules for devices used in a hazardous area
- 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 Motor Starter
- BaseUnits Equipment Manuals
- Equipment Manual Server Module
- Equipment Manuals Communications Modules
- Equipment Manuals Technology Modules

## General information



The function manuals contain detailed descriptions on general topics relating to the SIMATIC ET 200SP distributed I/O system.

Examples:

- Function Manual ET 200AL/ET 200SP Mixed Configuration
- Function Manual Diagnostics
- Function Manual Communication
- PROFINET Function Manual
- PROFIBUS Function Manual
- Function Manual Designing Interference-free Controllers
- MultiFieldbus 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 ET 200SP distributed I/O system on the Internet. (<https://support.industry.siemens.com/cs/de/en/view/73021864>)

## Manual Collection ET 200SP

The Manual Collection contains the complete documentation on the SIMATIC ET 200SP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet.

(<https://support.industry.siemens.com/cs/cn/en/view/84133942>)

## Manual Collection fail-safe modules

The Manual Collection contains the complete documentation on the fail-safe SIMATIC modules, gathered together in one file.

You can find the Manual Collection on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/109806400>)

### 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 Siemens Industry Online Support:



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 Siemens Industry Online Support and how to use Siemens Industry Online Support 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/TwLSxxRQq5A>)

## mySupport

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

<b>Registration</b>	You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace.
<b>Support requests</b>	Your data is already filled out in support requests, and you can get an overview of your current requests at any time.
<b>Documentation</b>	In the Documentation area you can build your personal library.
<b>Favorites</b>	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.
<b>Recently viewed articles</b>	The most recently viewed pages in mySupport are available under "Recently viewed articles".
<b>CAX data</b>	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: <ul style="list-style-type: none"> <li>• Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files</li> <li>• Manuals, characteristics, operating manuals, certificates</li> <li>• Product master data</li> </ul>

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>)

# Safety instructions

## 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>).

## Product overview

### 3.1 New functions

This section contains an overview of the most important new firmware functions of the CPU compared to the predecessor CPU (V2.9).

#### New functions of the CPU in firmware version V3.0

New functions	Applications	Customer benefits
<b>Communication of the CPU</b>		
Network Management Protocol SNMP	A simple configuration option is available for using the SNMP services. For new configurations, this is disabled by default in terms of "Security-by-Default".	Can be enabled/disabled in the CPU properties. Community strings can be configured.
OPC UA server – Reading the diagnostic status of the own address space	By using the OPC UA instruction for reading ("OPC_UA_ReadList"), the own namespace of the OPC UA Server can be accessed. This allows you to read out the following statuses and react to them in the user program: <ul style="list-style-type: none"> <li>• Status of the own OPC UA server</li> <li>• Status of the connections of OPC UA clients</li> <li>• Status of the session</li> <li>• Status of subscriptions</li> </ul>	This allows connection problems to be quickly detected, for example, and plant availability to be increased.
OPC UA server – Time stamping of the source time of nodes	By using the OPC UA instruction for writing ("OPC_UA_WriteList") it is possible to change the "SourceTimestamp" as well as the status code of an OPC UA variable (node).	Distinction between the "source" and "server" time possible
OPC UA server – Increase of the quantity structures	The following quantity structures have been increased: <ul style="list-style-type: none"> <li>• Possible number of nodes in the server interface</li> <li>• Maximum possible number of subscriptions per session</li> <li>• For subscription, the recommendation for observed values was increased.</li> </ul>	Further applications for CPUs as OPC UA servers
<b>Web server of the CPU</b>		
New Web API methods:	Many new API methods extend your access options to the CPU via the Web API.	Additional applications for the web server
Dynamic management of certificates	The web server certificate for HTTPS communication can now also be managed via the OPC UA GDS mechanism, without separate download of the hardware configuration.	Flexible certificate management

3.2 Hardware properties

New functions	Applications	Customer benefits
Allow data access only via Web API	They limit the functionality of the web server to the web API based functions. This means that only encrypted communication via HTTPS is possible.	Higher security of communication via web server
<b>Technology functions of the CPU</b>		
Axis functions	Save absolute encoder adjustment for device replacement	Saving the adjustment values with the "MC_SaveAbsoluteEncoderData" instruction saves having to perform the absolute encoder adjustment again after a device replacement.
	The "MC_Home" instruction supports the new "Incremental encoder adjustment" homing mode.	Extended scope of functions
	Active homing of absolute encoders is possible.	Extended scope of functions
	The "MC_Power" instruction supports coasting-down.	Extended scope of functions "MC_Power" instruction
	The hardware limit switches are configurable as traversable/non-traversable.	Extended scope of functions
	For axes in a synchronous system, the dynamic filter enables dynamic adaptation of axes with higher dynamic responses to the axis with the lowest dynamic response.	With the dynamic filter, axes with different inertia can be adjusted to each other. Optimization of a synchronous system
	Stop superimposed movements on the axis with the instruction "MC_HaltSuperimposed"	Use the instruction to stop a superimposed motion independently of the basic motion.
Trace functionality of the CPU	The S7-1500 CPU supports up to 64 configured signals per trace.	Number of configurable signals per trace
	Long-term trace: The S7-1500 CPU supports the cycle-granular recording of up to 64 different tags in a .csv file for a long time (hours, days, etc.)	Better diagnostic possibilities when analyzing the course of signals over a long period of time

Reference

You can find an overview of all new functions, improvements and revisions in the respective firmware versions on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109478459>).

3.2 Hardware properties

Article number

6ES7510-1DK03-0AB0

## View of the module

The figure below shows the CPU 1510SP-1PN.

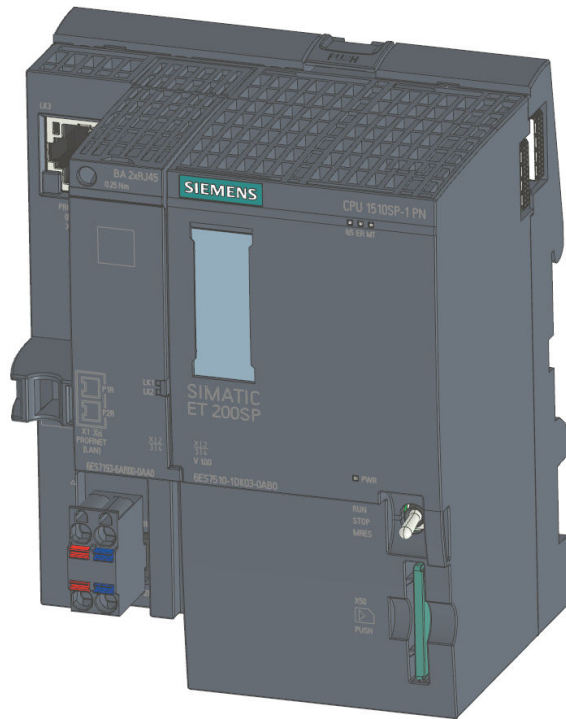


Figure 3-1 CPU 1510SP-1 PN

## Properties

The CPU 1510SP-1 PN has the following technical properties:

Property	Description	Additional information
<b>Supply voltage</b>	The 24 V DC supply voltage is fed via a 4-pin connection plug located at the bottom left on the front panel of the CPU.	<ul style="list-style-type: none"> <li>Section Connecting (Page 21)</li> <li>ET 200SP System Manual (<a href="https://support.industry.siemens.com/cs/ww/en/view/58649-293">https://support.industry.siemens.com/cs/ww/en/view/58649-293</a>)</li> </ul>
<b>Standalone CPU</b>	You can also use the CPU 1510SP-1 PN in the distributed I/O system ET 200SP as a "central system" without a higher-level controller.	
<b>PROFINET IO</b>		

Property	Description	Additional information
PROFINET interface (X1)	<p>The interface has an integrated 3-port switch. Port 1 and port 2 are located on the optionally pluggable BusAdapter. Port 3 is integrated in the housing of the CPU. You can connect the PROFINET IO to the CPU via the BusAdapter. You will find information on the BusAdapters supported by the CPU in the section Connecting (Page 21).</p> <p>In addition to PROFINET basic functionality, the interface also supports PROFINET IO RT (real-time) and IRT (isochronous real-time). PROFINET IO communication or real-time settings can be configured. The basic functionality of PROFINET supports HMI communication, communication with the configuration system, communication with a higher-level network (backbone, router, Internet) and communication with another machine or automation cell. Port 1 and port 2 can also be used as ring ports for the configuration of redundant ring structures in Ethernet.</p>	<ul style="list-style-type: none"> <li>PROFINET Function Manual (<a href="https://support.industry.siemens.com/cs/ww/en/view/49948-856">https://support.industry.siemens.com/cs/ww/en/view/49948-856</a>)</li> <li>ET 200SP System Manual (<a href="https://support.industry.siemens.com/cs/ww/en/view/58649-293">https://support.industry.siemens.com/cs/ww/en/view/58649-293</a>)</li> </ul>
Operation of the CPU as <ul style="list-style-type: none"> <li>IO controller</li> <li>I-device</li> </ul>	<ul style="list-style-type: none"> <li><b>IO controller:</b> As an IO controller, the CPU addresses the connected IO devices</li> <li><b>I-device:</b> As an I-device (intelligent IO device), the CPU is assigned to a higher-level IO controller and is used in the process as an intelligent pre-processing unit of sub-processes</li> </ul>	
<b>PROFIBUS DP</b>		
DP master	To use the ET 200SP CPU as a DP master, you need the CPU and the optional communication module CM DP (PROFIBUS interface X2). When used as a DP master, the ET 200SP CPU exchanges data with the connected DP slaves via PROFIBUS DP.	<ul style="list-style-type: none"> <li>PROFIBUS Function Manual (<a href="https://support.industry.siemens.com/cs/ww/en/view/59193-579">https://support.industry.siemens.com/cs/ww/en/view/59193-579</a>)</li> <li>Communication module CM DP Equipment Manual (<a href="https://support.industry.siemens.com/cs/ww/en/view/90156-526">https://support.industry.siemens.com/cs/ww/en/view/90156-526</a>)</li> </ul>
Intelligent DP slave (I-slave)	To use the ET 200SP CPU as an intelligent DP slave (I-slave), you need the CPU and the optional communication module CM D (PROFIBUS interface X2). As an I-slave, the ET 200SP CPU is connected via PROFIBUS DP to a higher-level DP master and exchanges data with it.	

## Accessories

### NOTE

The CPU is delivered without a BusAdapter. You can find the article numbers of the supported BusAdapters in the "Accessories/spare parts" section of the ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/ww/en/view/58649293>) system manual.

**NOTE**

You must provide covers for unused BusAdapter interfaces. You can find the article no. of the cover in the ET 200SP System Manual (<https://support.industry.siemens.com/cs/ww/en/view/58649293>) in the "Accessories/spare parts" section.

## 3.3 Firmware functions

### Functions

The CPU supports the following functions:

Function	Description	Additional information
<b>Integrated system diagnostics</b>	The system automatically generates the messages for the system diagnostics and outputs these messages via a programming device/PC, HMI device, the web server or the integrated display. System diagnostics information is also available when the CPU is in STOP mode.	Diagnostics function manual ( <a href="https://support.automation.siemens.com/WW/view/en/59192926">https://support.automation.siemens.com/WW/view/en/59192926</a> )
<b>Integrated web server</b>	The web server lets you access the CPU data by means of a network. Evaluations, diagnostics, and modifications are thus possible over long distances. Monitoring and evaluation is possible without STEP 7, only a web browser is required. Note that you must take appropriate measures to protect the CPU from compromise (such as restricting network access, using firewalls).	<ul style="list-style-type: none"> <li>• Web server function manual (<a href="https://support.automation.siemens.com/WW/view/en/59193560">https://support.automation.siemens.com/WW/view/en/59193560</a>)</li> <li>• Security with SIMATIC S7 controllers system manual (<a href="https://support.industry.siemens.com/cs/ww/en/view/90885010">https://support.industry.siemens.com/cs/ww/en/view/90885010</a>)</li> </ul>
<b>Integrated trace functionality</b>	<p>Trace functionality supports you in troubleshooting and/or optimizing the user program. You record device tags and evaluate the recordings with the trace and logic analyzer function. Tags are, for example, drive parameters or system and user tags of a CPU.</p> <p>The device saves the recordings. You can read out and permanently save the recordings with the configuration system (ES), if required. The trace and logic analyzer function is therefore suitable for monitoring highly dynamic processes.</p> <p>The trace record can also be displayed through the web server.</p> <p>With the project trace, you record the variables of multiple devices within a project, for example, a controller and a drive.</p> <p>With the long-term trace, you record up to 64 different tags for each cycle in a .csv file over a long period (e.g. hours, days).</p>	Using the trace and logic analyzer function manual ( <a href="https://support.automation.siemens.com/WW/view/en/64897128">https://support.automation.siemens.com/WW/view/en/64897128</a> )

3.3 Firmware functions

Function	Description	Additional information
<b>OPC UA</b>	With OPC UA, you can exchange data via an open and manufacturer-neutral communication protocol. The CPU can act as OPC UA server. The CPU acting as the OPC UA server can communicate with OPC UA clients. In turn, as an OPC UA client, the CPU can access an OPC UA server, allow the OPC UA server to run methods and read out information from the OPC UA server. Through OPC UA Companion Specification, methods can be specified in a uniform and vendor-neutral way. Using these specified methods, you can easily integrate devices from various manufacturers into your plants and production processes.	Communication function manual ( <a href="https://support.industry.siemens.com/cs/ww/en/view/59192925">https://support.industry.siemens.com/cs/ww/en/view/59192925</a> )
<b>Configuration control</b>	You can use configuration control to operate different real hardware configurations with a configured maximum configuration of the hardware. This means especially in series machine manufacturing you have the option of operating/configuring different configuration variants of a machine with a single project.	ET 200SP System Manual ( <a href="https://support.industry.siemens.com/cs/ww/en/view/58649293">https://support.industry.siemens.com/cs/ww/en/view/58649293</a> )
<b>PROFINET IO</b>		
RT (real time)	RT prioritizes PROFINET IO telegrams over standard telegrams. This ensures the required determinism in the automation technology. In this process the data is transferred via prioritized Ethernet telegrams.	PROFINET function manual ( <a href="https://support.automation.siemens.com/WW/view/en/49948856">https://support.automation.siemens.com/WW/view/en/49948856</a> )
IRT (isochronous real time)	A reserved bandwidth within the send clock is available for IRT data. The reserved bandwidth ensures that the IRT data can be transmitted in time-synchronized intervals, unaffected by other high network loading (e.g. TCP/IP communication or additional real time communication). Update times with maximum determinism can be realized through IRT. Isochronous applications are possible with IRT.	
Isochronous mode	The Isochronous mode system property acquires measured values and process data and processes the signals in a fixed system clock. Isochronous mode thus contributes to high control quality and hence to greater manufacturing precision. Isochronous mode reduces possible fluctuations of the process reaction times to a minimum. Time-assured processing makes higher machine cycles possible.	
MRP (Media Redundancy Protocol)	It is possible to establish redundant networks via the Media Redundancy Protocol. Redundant transmission links (ring topology) ensure that an alternative communication path is made available if a transmission link fails. The PROFINET devices that are part of this redundant network form an MRP domain. RT operation is possible with the use of MRP.	
MRPD (Media Redundancy with Planned Duplication)	The advantage of the MRP extension MRPD is that, in the event of a failure of a device or a line in the ring, all other devices continue to be supplied with IO data without interruption and with short update times. MRPD is based on IRT and MRP. To realize media redundancy with short update times, the PROFINET devices participating in the ring send their data in both directions.	



Function	Description	Additional information
	The devices receive this data at both ring ports so that there is no reconfiguration time.	PROFINET function manual ( <a href="https://support.automation.siemens.com/WW/view/en/49948856">https://support.automation.siemens.com/WW/view/en/49948856</a> )
Shared device	The "Shared device" function allows you to divide the modules or submodules of an IO device up among different IO controllers. Numerous IO controllers are often used in larger or widely distributed systems. Without the "Shared device" function, each I/O module of an IO device is assigned to the same IO controller. If sensors that are physically close to each other must provide data to different IO controllers, several IO devices are required. The "Shared device" function allows the modules or submodules of an IO device to be divided up among different IO controllers, thus allowing flexible automation concepts. You can, for example, combine I/O modules that are physically close to each other in one IO device.	
PROFenergy	PROFenergy is a PROFINET-based data interface for switching off consumers centrally and with full coordination during pause times regardless of the manufacturer or device type. The goal is that the process is only provided with the energy that is absolutely required. The majority of the energy is saved by the process; the PROFINET device itself only contributes a few watts of savings potential.	
<b>Integrated technology</b>		
Motion Control	<p>The CPUs support the S7-1500 Motion Control functions via the technology objects speed axes, positioning axes, synchronized axes, external encoders, cams, cam tracks and measuring probes.</p> <ul style="list-style-type: none"> <li>• Speed-controlled axis for controlling a drive with speed specification</li> <li>• Positioning axis for position-controlled positioning of a drive</li> <li>• Synchronous axis to interconnect with a master value. The axis is synchronized to the master axis position.</li> <li>• External encoder for detecting the actual position of an encoder and its use as a master value for synchronous operation</li> <li>• Cams, cam track for position-dependent generation of switching signals</li> <li>• Measuring input for fast, accurate and event-dependent sensing of actual positions</li> </ul> <p>You program the technology objects with Motion Control instructions according to PLCopen.</p>	Motion Control topic page ( <a href="https://support.industry.siemens.com/cs/ww/en/view/109751049">https://support.industry.siemens.com/cs/ww/en/view/109751049</a> )
Extended Motion Control functions	<b>The technology CPUs</b> of the SIMATIC S7-1500 also support extended Motion Control functions with the additional technology objects cam, leading axis proxy and kinematics:	Motion Control topic page ( <a href="https://support.industry.siemens.com/cs/ww/en/view/109751049">https://support.industry.siemens.com/cs/ww/en/view/109751049</a> )

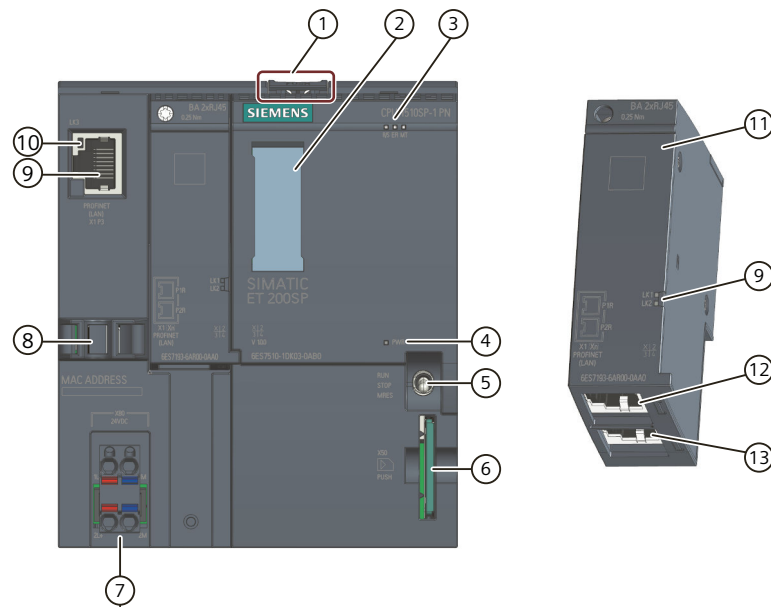
3.3 Firmware functions

Function	Description	Additional information
	<ul style="list-style-type: none"> <li>• Advanced synchronization functions                             <ul style="list-style-type: none"> <li>– Synchronization with specification of the synchronous position</li> <li>– Actual value coupling</li> <li>– Leading value or following value shift in gearing or camming</li> <li>– Camming</li> <li>– Synchronization to specified positions</li> <li>– Cross-PLC synchronous operation</li> <li>– Velocity gearing</li> </ul> </li> <li>• Up to 4 encoders or measuring systems as actual position for position control</li> <li>• Controlling of kinematics, such as                             <ul style="list-style-type: none"> <li>– Cartesian portals</li> <li>– Roller pickers</li> <li>– Delta pickers</li> <li>– SCARA</li> </ul> </li> </ul>	
Integrated closed-loop control functionality	<ul style="list-style-type: none"> <li>• PID Compact (continuous PID controller)</li> <li>• PID 3Step (step controller for integrating actuators)</li> <li>• PID Temp (temperature controller for heating and cooling with two separate actuators)</li> </ul>	PID control function manual ( <a href="https://support.industry.siemens.com/cs/ww/en/view/108210036">https://support.industry.siemens.com/cs/ww/en/view/108210036</a> )
<b>Integrated safety</b>		
Know-how protection	The know-how protection protects user blocks against unauthorized access and modifications.	ET 200SP System Manual ( <a href="https://support.industry.siemens.com/cs/ww/en/view/58649293">https://support.industry.siemens.com/cs/ww/en/view/58649293</a> )
Copy protection	Copy protection links user blocks to the serial number of the SIMATIC memory card or to the serial number of the CPU. User programs cannot run without the corresponding SIMATIC memory card or CPU.	
Access protection	Extended access protection provides high-quality protection against unauthorized configuration changes. You can use authorization levels to assign separate rights to different user groups.	
Integrity protection	The CPUs feature an integrity protection function by default. This helps to detect any manipulation of the engineering data on the SIMATIC Memory Card or during data transfer between the TIA Portal and the CPU, and to check communication from a SIMATIC HMI system to the CPU for possible manipulation of engineering data. The user receives a corresponding message about manipulation of engineering data detected by the integrity protection.	
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: <ul style="list-style-type: none"> <li>• Convenient handling of passwords. STEP 7 reads the password automatically for the blocks. This saves you time.</li> <li>• Optimum block protection because the users do not know the password itself.</li> </ul>	

## 3.4 Operating and display elements

### 3.4.1 Front view of the module with BusAdapter

The figure on the left shows the CPU 1510SP-1 PN including a plugged BA 2xRJ45 BusAdapter. The figure on the right shows a separate view of the BA 2xRJ45 BusAdapter.



- ① Mounting rail release
- ② Labeling strips
- ③ LEDs for status and error displays
- ④ LED for display of the supply voltage
- ⑤ Mode switch
- ⑥ Slot for the SIMATIC memory card
- ⑦ Connection for supply voltage (included in product package)
- ⑧ Cable support and attachment for port P3 of the PROFINET interface
- ⑨ Port P3 of the PROFINET interface: RJ45 socket
- ⑩ LEDs for status displays of the PROFINET interface: LK1 and LK2 on BusAdapter, LK3 on CPU
- ⑪ Separate view of the BusAdapter
- ⑫ Port P1R of the PROFINET interface: RJ45 socket on BusAdapter BA 2xRJ45  
R: Ring port for configuring a ring topology with media redundancy
- ⑬ Port P2R of the PROFINET interface: RJ45 socket on BusAdapter BA 2xRJ45  
R: Ring port for configuring a ring topology with media redundancy

Figure 3-2 Front view of the CPU 1510SP-1 PN with BusAdapter

## 3.5 Mode switch

Use the mode switch to set the CPU operating mode.

### 3.5 Mode switch

The following table shows the position of the switch and the corresponding meaning.

Table 3-1 Mode switch settings

<b>Position</b>	<b>Meaning</b>	<b>Explanation</b>
RUN	RUN mode	The CPU is executing the user program.
STOP	STOP mode	The user program is not being executed.
MRES	Memory reset	Position for CPU memory reset.

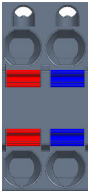
## Wiring

This section provides information on the pin assignment of the individual interfaces and the block diagram of the CPU 1510SP-1 PN.

### 24 V DC supply voltage (X80)

The connector for the supply voltage is plugged in when the CPU ships from the factory. The following table shows the signal names and the descriptions of the pin assignment of the 24 V DC supply voltage.

Table 4-1 Pin assignment 24 V DC supply voltage

View	Signal name <sup>1)</sup>		Description
Connector			
	1	1L+	+ 24 V DC of the supply voltage
	2	1M	Ground of the supply voltage
	3	2M	Ground of the supply voltage for loop-through <sup>2)</sup>
	4	2L+	+ 24 V DC of the supply voltage for loop-through <sup>2)</sup>

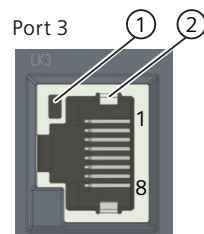
<sup>1)</sup> 1L+ and 2L+ as well as 1M and 2M are bridged internally

<sup>2)</sup> Maximum 10 A permitted

### PROFINET IO interface on the CPU (X1 P3)

The assignment corresponds to the Ethernet standard for an RJ45 connector.

- When autonegotiation is deactivated, the RJ45 socket is allocated as a switch (MDI-X).
- If autonegotiation is activated, then autocrossing is active and the RJ45 socket has either a device assignment (MDI) or switch assignment (MDI-X).



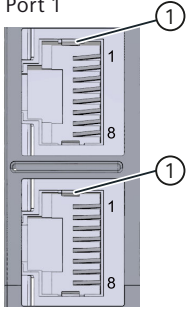
① LINK LED for port P3 (green LED on CPU)

② Shielding

### PROFINET IO interface on the BA 2xRJ45 BusAdapter (X1 P1R and X1 P2R)

The assignment at the BA 2xRJ45 BusAdapter corresponds to the Ethernet standard for an RJ45 connector.

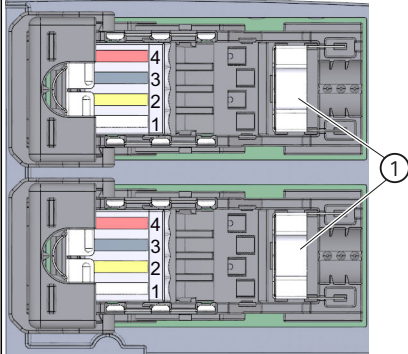
Table 4-2 Pin assignment PROFINET IO interface on the BusAdapter BA 2xRJ45

View	Designation
 <p>Port 1</p> <p>Port 2</p>	<ul style="list-style-type: none"> <li>When autonegotiation is deactivated, the RJ45 socket is allocated as a switch (MDI-X).</li> <li>If autonegotiation is activated, then autocrossing is active and the RJ45 socket has either a device assignment (MDI) or switch assignment (MDI-X).</li> </ul> <p>① Shielding</p>

### PROFINET IO interface on the BA 2xFC BusAdapter (X1 P1R and X1 P2R)

The following table shows the pin assignment for the PROFINET IO interface on the BusAdapter BA 2xFC.

Table 4-3 Pin assignment PROFINET IO interface on the BusAdapter BA 2xFC

View	Signal name		Designation
 <p>Port 1</p> <p>Port 2</p>	4	RD_N	Receive Data -
	3	TD_N	Transmit data -
	2	RD	Receive data +
	1	TD	Transmit Data +
	①		Shielding

### Reference

You can find additional information on the topics of "Connecting the CPU" and "Accessories/spare parts" in the system manual ET 200SP distributed I/O system (<https://support.automation.siemens.com/WW/view/en/58649293>).

## Assignment of the MAC addresses

The MAC address is a globally unique device identifier that is assigned to each PROFINET device in the factory. Its 6 bytes are divided into 3 bytes for the manufacturer ID and 3 bytes for the device ID (serial number). The front of the CPU 1510SP-1 PN is lasered with the MAC address of the PROFINET interface.

The PROFINET interface (X1) of the CPU 1510SP-1 PN has three ports. Port 3 is located on the CPU. Ports 1 and 2 are located on the optional BusAdapter. In addition to the PROFINET interface, each PROFINET port also has a separate MAC address. There is therefore a total of four MAC addresses for the CPU 1510SP-1 PN.

The MAC addresses of the PROFINET ports are needed for the LLDP protocol, for example for the neighborhood discovery function.

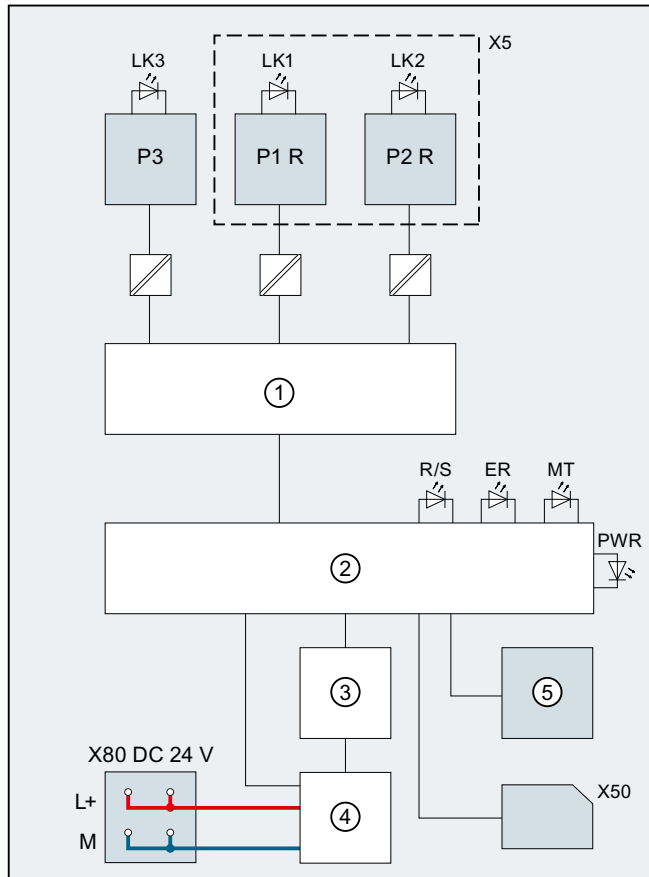
The table below shows how the MAC addresses are assigned.

Table 4-4 Assignment of the MAC addresses

	Assignment
<b>MAC address 1</b>	PROFINET interface X1 <ul style="list-style-type: none"> <li>• visible in STEP 7 in the case of accessible devices</li> <li>• Lasered on the front of the CPU (start of the number range)</li> </ul>
<b>MAC address 2</b>	Port X1 P1R (required for LLDP, for example)
<b>MAC address 3</b>	Port X1 P2R (required for LLDP, for example)
<b>MAC address 4</b>	Port X1 P3 (required for LLDP, for example)

### Block diagram

The following figure shows the block diagram of the CPU 1510SP-1 PN.



①	PROFINET switch	P1R	PROFINET interface X1 Port 1
②	Electronics	P2R	PROFINET interface X1 Port 2
③	Backplane bus interface	P3	PROFINET interface X1 Port 3
④	Internal supply voltage	L+	24 V DC supply voltage
⑤	RUN/STOP/MRES mode selector	M	Ground
X5	BusAdapter	LK1, 2, 3	LED Link TX/RX (green)
X50	SIMATIC memory card	R/S	RUN/STOP LED (green/yellow)
X80 24 V DC	Infeed of supply voltage	ER	ERROR LED (red)
		MT	MAINT LED (yellow)
		PWR	POWER LED (green)

Figure 4-1 Block diagram of the CPU 1510SP-1 PN



# Interrupts, error messages, diagnostics and system alarms

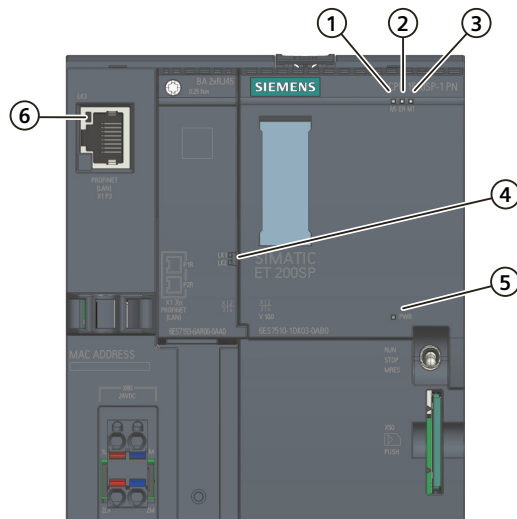
# 5

The status and error displays of the CPU 1510SP-1 PN are described below. You will find additional information on "Interrupts" in the STEP 7 online help. You can find additional information on the topics of "Diagnostics" and "System alarms" in the Diagnostics (<https://support.automation.siemens.com/WW/view/en/59192926>) function manual.

## 5.1 Status and error display of the CPU

### LED displays

The figure below shows the LED displays of the CPU 1510SP-1 PN and the BA 2xRJ45 BusAdapter.



- ① RUN/STOP LED (green/yellow LED)
- ② ERROR LED (red LED)
- ③ MAINT LED (yellow LED)
- ④ LINK LED for ports X1 P1 and X1 P2 (green LEDs on BusAdapter)
- ⑤ POWER LED (green LED)
- ⑥ LINK LED for port X1 P3 (green LED on CPU)

Figure 5-1 LED displays on the CPU and BusAdapter













































### Meaning of the POWER, RUN/STOP, ERROR and MAINT LEDs





CPU 1510SP-1 PN features an LED for monitoring the supply voltage of the electronics (PWR) and three LEDs for displaying the current operating and diagnostics status. The following

5.1 Status and error display of the CPU

table shows the meaning of the various combinations of colors for the POWER, RUN/STOP, ERROR and MAINT LEDs.

Table 5-1 Meaning of the LEDs




POWER LED	RUN/STOP LED	ERROR LED	MAINT LED	Meaning
 LED off	 LED off	 LED off	 LED off	Missing or insufficient power supply on the CPU.
 LED lit green	 LED off	 LED flashes red	 LED off	An error has occurred.
 LED lit green	 LED lit green	 LED off	 LED off	CPU is in RUN mode.
 LED lit green	 LED lit green	 LED off	 LED lit yellow	Maintenance demanded for the plant. The affected hardware must be checked/replaced within a short period of time.
				Active Force job
				OPC UA server of the CPU expects initial trust lists and CRLs via GDS Push function.
 LED lit green	 LED lit green	 LED flashes red	 LED off	Bad configuration
 LED lit green	 LED lit yellow	 LED flashes red	 LED off	A diagnostics event is pending.
 LED lit green	 LED lit yellow	 LED off	 LED flashes yellow	Firmware update using SIMATIC memory card successfully completed.
 LED lit green	 LED lit yellow	 LED off	 LED off	CPU is in STOP mode.
				CPU runs a program with active break-points. The program is at a breakpoint.
 LED lit green	 LED lit yellow	 LED flashes red	 LED flashes yellow	The program on the SIMATIC memory card is causing an error.
				Firmware update using SIMATIC memory card has failed.
				The CPU has detected an error state. Additional information is available via the CPU diagnostic buffer.
 LED lit green	 LED flashes yellow	 LED off	 LED off	CPU is performing internal activities during STOP, e.g. startup after STOP.
				Download of the user program from the SIMATIC memory card
				CPU runs a program with active break-points. The program is presently moving from one breakpoint to another.
				Firmware update is being performed.
 LED lit green	 LED flashes yellow/green	 LED off	 LED off	Startup (transition from STOP → RUN)

POWER LED	RUN/STOP LED	ERROR LED	MAINT LED	Meaning
 LED lit green	 LED flashes yellow/green	 LED flashes red	 LED flashes yellow	Startup (CPU booting) Test of LEDs during startup, inserting a module. LED flashing test

### Meaning of the LINK LED

Each port has a LINK LED (LK1, LK2, LK3). The table below shows the various "LED scenarios" of the ports of the CPU 1510SP-1 PN.

Table 5-2 Meaning of the LEDs

LINK LED	Meaning
 LED off	There is no Ethernet connection between the PROFINET interface of the PROFINET device and the communication partner. No data is currently being sent/received via the PROFINET interface. There is no LINK connection.
 LED flashes green	The "LED flashing test" is being performed.
 LED lit green	There is an Ethernet connection between the PROFINET interface of your PROFINET device and a communication partner.

#### NOTE

##### "LED" instruction

You can read the status (e.g. "On" or "Off") of LEDs of a CPU or a module using the "LED" instruction. Note, however, that it is not possible to read the LED status of the LINK RX/TX LEDs on all S7-1500 CPUs.

You can find additional information on the "LED" instruction in the STEP 7 online help.

## Technical specifications

The following table shows the technical specifications as of 11/2022. You will find a data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/ww/en/pv/6ES7510-1DK03-0AB0/td?dl=en>).

Article number	6ES7510-1DK03-0AB0
<b>General information</b>	
Product type designation	CPU 1510SP-1 PN
HW functional status	FS01
Firmware version	V3.0
<b>Product function</b>	
<ul style="list-style-type: none"> <li>I&amp;M data</li> </ul>	Yes; I&M0 to I&M3
<ul style="list-style-type: none"> <li>Module swapping during operation (hot swapping)</li> </ul>	Yes; Multi-hot swapping
<ul style="list-style-type: none"> <li>Isochronous mode</li> </ul>	Yes; only with PROFINET; with minimum OB 6x cycle of 500 $\mu$ s
<b>Engineering with</b>	
<ul style="list-style-type: none"> <li>STEP 7 TIA Portal configurable/integrated from version</li> </ul>	V18 (FW V3.0); with older TIA Portal versions configurable as 6ES7510-1DJ01-0AB0
<b>Configuration control</b>	
via dataset	Yes
<b>Control elements</b>	
Mode selector switch	1
<b>Supply voltage</b>	
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
<b>Mains buffering</b>	
<ul style="list-style-type: none"> <li>Mains/voltage failure stored energy time</li> </ul>	10 ms
<b>Input current</b>	
Current consumption (rated value)	0.51 A
Current consumption, max.	0.7 A
Inrush current, max.	1.34 A; Rated value
$I^2t$	0.3 A <sup>2</sup> ·s
<b>Power</b>	
Infeed power to the backplane bus	8.05 W
<b>Power loss</b>	
Power loss, typ.	6.5 W
<b>Memory</b>	

<b>Article number</b>	<b>6ES7510-1DK03-0AB0</b>
Number of slots for SIMATIC memory card	1
SIMATIC memory card required	Yes
<b>Work memory</b>	
<ul style="list-style-type: none"> <li>integrated (for program)</li> </ul>	200 kbyte
<ul style="list-style-type: none"> <li>integrated (for data)</li> </ul>	1 Mbyte
<b>Load memory</b>	
<ul style="list-style-type: none"> <li>Plug-in (SIMATIC Memory Card), max.</li> </ul>	32 Gbyte
<b>Backup</b>	
<ul style="list-style-type: none"> <li>maintenance-free</li> </ul>	Yes
<b>CPU processing times</b>	
for bit operations, typ.	25 ns
for word operations, typ.	32 ns
for fixed point arithmetic, typ.	42 ns
for floating point arithmetic, typ.	170 ns
<b>CPU-blocks</b>	
Number of elements (total)	4 000; Blocks (OB, FB, FC, DB) and UDTs
<b>DB</b>	
<ul style="list-style-type: none"> <li>Number range</li> </ul>	1 ... 60 999; subdivided into: number range that can be used by the user: 1 ... 59 999, and number range of DBs created via SFC 86: 60 000 ... 60 999
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	1 Mbyte; For DBs with absolute addressing, the max. size is 64 KB
<b>FB</b>	
<ul style="list-style-type: none"> <li>Number range</li> </ul>	0 ... 65 535
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	200 kbyte
<b>FC</b>	
<ul style="list-style-type: none"> <li>Number range</li> </ul>	0 ... 65 535
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	200 kbyte
<b>OB</b>	
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	200 kbyte
<ul style="list-style-type: none"> <li>Number of free cycle OBs</li> </ul>	100
<ul style="list-style-type: none"> <li>Number of time alarm OBs</li> </ul>	20
<ul style="list-style-type: none"> <li>Number of delay alarm OBs</li> </ul>	20
<ul style="list-style-type: none"> <li>Number of cyclic interrupt OBs</li> </ul>	20; With minimum OB 3x cycle of 250 µs
<ul style="list-style-type: none"> <li>Number of process alarm OBs</li> </ul>	50
<ul style="list-style-type: none"> <li>Number of DPV1 alarm OBs</li> </ul>	3
<ul style="list-style-type: none"> <li>Number of isochronous mode OBs</li> </ul>	1
<ul style="list-style-type: none"> <li>Number of technology synchronous alarm OBs</li> </ul>	2
<ul style="list-style-type: none"> <li>Number of startup OBs</li> </ul>	100

<b>Article number</b>	<b>6ES7510-1DK03-0AB0</b>
<ul style="list-style-type: none"> <li>• Number of asynchronous error OBs</li> <li>• Number of synchronous error OBs</li> <li>• Number of diagnostic alarm OBs</li> </ul>	<p>4</p> <p>2</p> <p>1</p>
<b>Nesting depth</b>	
<ul style="list-style-type: none"> <li>• per priority class</li> </ul>	24
<b>Counters, timers and their retentivity</b>	
<b>S7 counter</b>	
<ul style="list-style-type: none"> <li>• Number</li> </ul>	2 048
<b>Retentivity</b>	
– adjustable	Yes
<b>IEC counter</b>	
<ul style="list-style-type: none"> <li>• Number</li> </ul>	Any (only limited by the main memory)
<b>Retentivity</b>	
– adjustable	Yes
<b>S7 times</b>	
<ul style="list-style-type: none"> <li>• Number</li> </ul>	2 048
<b>Retentivity</b>	
– adjustable	Yes
<b>IEC timer</b>	
<ul style="list-style-type: none"> <li>• Number</li> </ul>	Any (only limited by the main memory)
<b>Retentivity</b>	
– adjustable	Yes
<b>Data areas and their retentivity</b>	
Retentive data area (incl. timers, counters, flags), max.	256 kbyte; in total; available retentive memory for bit memories, timers, counters, DBs, and technology data (axes): 216 KB
<b>Flag</b>	
<ul style="list-style-type: none"> <li>• Size, max.</li> <li>• Number of clock memories</li> </ul>	<p>16 kbyte</p> <p>8; 8 clock memory bit, grouped into one clock memory byte</p>
<b>Data blocks</b>	
<ul style="list-style-type: none"> <li>• Retentivity adjustable</li> <li>• Retentivity preset</li> </ul>	<p>Yes</p> <p>No</p>
<b>Local data</b>	
<ul style="list-style-type: none"> <li>• per priority class, max.</li> </ul>	64 kbyte; max. 16 KB per block
<b>Address area</b>	
Number of IO modules	2 048; max. number of modules / submodules
<b>I/O address area</b>	
<ul style="list-style-type: none"> <li>• Inputs</li> <li>• Outputs</li> </ul>	<p>32 kbyte; All inputs are in the process image</p> <p>32 kbyte; All outputs are in the process image</p>

<b>Article number</b>	<b>6ES7510-1DK03-0AB0</b>
<b>per integrated IO subsystem</b>	
– Inputs (volume)	8 kbyte
– Outputs (volume)	8 kbyte
<b>per CM/CP</b>	
– Inputs (volume)	8 kbyte
– Outputs (volume)	8 kbyte
<b>Subprocess images</b>	
• Number of subprocess images, max.	32
<b>Address space per module</b>	
• Address space per module, max.	288 byte; For input and output data respectively
<b>Address space per station</b>	
• Address space per station, max.	2 560 byte; for central inputs and outputs; depending on configuration; 2 048 bytes for ET 200SP modules + 512 bytes for ET 200AL modules
<b>Hardware configuration</b>	
Number of distributed IO systems	32; A distributed I/O system is characterized not only by the integration of distributed I/O via PROFINET or PROFIBUS communication modules, but also by the connection of I/O via AS-i master modules or links (e.g. IE/PB-Link)
<b>Number of DP masters</b>	
• Via CM	1
<b>Number of IO Controllers</b>	
• integrated	1
• Via CM	0
<b>Rack</b>	
• Modules per rack, max.	82; CPU + 64 modules + server module (mounting width max. 1 m) + 16 ET 200AL modules
• Quantity of operable ET 200SP modules, max.	64
• Quantity of operable ET 200AL modules, max.	16
• Number of lines, max.	1
<b>PtP CM</b>	
• Number of PtP CMs	the number of connectable PtP CMs is only limited by the number of available slots
<b>Time of day</b>	
<b>Clock</b>	
• Type	Hardware clock
• Backup time	6 wk; At 40 °C ambient temperature, typically
• Deviation per day, max.	10 s; Typ.: 2 s
<b>Operating hours counter</b>	

<b>Article number</b>	<b>6ES7510-1DK03-0AB0</b>
<ul style="list-style-type: none"> <li>Number</li> </ul>	16
<b>Clock synchronization</b>	
<ul style="list-style-type: none"> <li>supported</li> <li>to DP, master</li> <li>to DP, slave</li> <li>in AS, master</li> <li>in AS, slave</li> <li>on Ethernet via NTP</li> </ul>	<p>Yes</p> <p>Yes; Via CM DP module</p> <p>Yes; Via CM DP module</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>Interfaces</b>	
Number of PROFINET interfaces	1
Number of PROFIBUS interfaces	1; Via CM DP module
Optical interface	No
<b>1. Interface</b>	
<b>Interface types</b>	
<ul style="list-style-type: none"> <li>RJ 45 (Ethernet)</li> <li>Number of ports</li> <li>integrated switch</li> <li>BusAdapter (PROFINET)</li> </ul>	<p>Yes; X1 P3; opt. X1 P1 and X1 P2 via BusAdapter BA 2x RJ45</p> <p>3; 1. integr. + 2. via BusAdapter</p> <p>Yes</p> <p>Yes; compatible BusAdapters: BA 2x RJ45, BA 2x FC, BA 2x M12</p>
<b>Protocols</b>	
<ul style="list-style-type: none"> <li>IP protocol</li> <li>PROFINET IO Controller</li> <li>PROFINET IO Device</li> <li>SIMATIC communication</li> <li>Open IE communication</li> <li>Web server</li> <li>Media redundancy</li> </ul>	<p>Yes; IPv4</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes; Optionally also encrypted</p> <p>Yes</p> <p>Yes</p>
<b>PROFINET IO Controller</b>	
<b>Services</b>	
<ul style="list-style-type: none"> <li>PG/OP communication</li> <li>Isochronous mode</li> <li>Direct data exchange</li> <li>IRT</li> <li>PROFIenergy</li> <li>Prioritized startup</li> <li>Number of connectable IO Devices, max.</li> <li>Of which IO devices with IRT, max.</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes; Requirement: IRT and isochronous mode (MRPD optional)</p> <p>Yes</p> <p>Yes; per user program</p> <p>Yes; Max. 32 PROFINET devices</p> <p>128; In total, up to 512 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET</p> <p>64</p>



Article number	6ES7510-1DK03-0AB0
<ul style="list-style-type: none"> <li>– Number of connectable IO Devices for RT, max.</li> <li>– of which in line, max.</li> <li>– Number of IO Devices that can be simultaneously activated/deactivated, max.</li> <li>– Number of IO Devices per tool, max.</li> <li>– Updating times</li> </ul>	128  128  8; in total across all interfaces  8  The minimum value of the update time also depends on communication share set for PROFINET IO, on the number of IO devices, and on the quantity of configured user data
<b>Update time for IRT</b> <ul style="list-style-type: none"> <li>– for send cycle of 250 <math>\mu</math>s</li> <li>– for send cycle of 500 <math>\mu</math>s</li> <li>– for send cycle of 1 ms</li> <li>– for send cycle of 2 ms</li> <li>– for send cycle of 4 ms</li> <li>– With IRT and parameterization of "odd" send cycles</li> </ul>	250 $\mu$ s to 4 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 500 $\mu$ s of the isochronous OB is decisive  500 $\mu$ s to 8 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 $\mu$ s of the isochronous OB is decisive  1 ms to 16 ms  2 ms to 32 ms  4 ms to 64 ms  Update time = set "odd" send clock (any multiple of 125 $\mu$ s: 375 $\mu$ s, 625 $\mu$ s ... 3 875 $\mu$ s)
<b>Update time for RT</b> <ul style="list-style-type: none"> <li>– for send cycle of 250 <math>\mu</math>s</li> <li>– for send cycle of 500 <math>\mu</math>s</li> <li>– for send cycle of 1 ms</li> <li>– for send cycle of 2 ms</li> <li>– for send cycle of 4 ms</li> </ul>	250 $\mu$ s to 128 ms  500 $\mu$ s to 256 ms  1 ms to 512 ms  2 ms to 512 ms  4 ms to 512 ms
<b>PROFINET IO Device</b>	
<b>Services</b> <ul style="list-style-type: none"> <li>– PG/OP communication</li> <li>– Isochronous mode</li> <li>– IRT</li> <li>– PROFlenergy</li> <li>– Shared device</li> <li>– Number of IO Controllers with shared device, max.</li> <li>– activation/deactivation of I-devices</li> <li>– Asset management record</li> </ul>	Yes  No  Yes  Yes; per user program  Yes  4  Yes; per user program  Yes; per user program
<b>2. Interface</b>	
<b>Interface types</b>	

<b>Article number</b>	<b>6ES7510-1DK03-0AB0</b>
<ul style="list-style-type: none"> <li>• RS 485</li> <li>• Number of ports</li> </ul>	<p>Yes; Via CM DP module</p> <p>1</p>
<b>Protocols</b>	
<ul style="list-style-type: none"> <li>• PROFIBUS DP master</li> <li>• PROFIBUS DP slave</li> <li>• SIMATIC communication</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>PROFIBUS DP master</b>	
<ul style="list-style-type: none"> <li>• Number of connections, max.</li> <li>• Number of DP slaves, max.</li> </ul>	<p>48; Of which 4 each reserved for ES and HMI</p> <p>125; In total, up to 512 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET</p>
<b>Services</b>	
<ul style="list-style-type: none"> <li>– PG/OP communication</li> <li>– Equidistance</li> <li>– Isochronous mode</li> <li>– Activation/deactivation of DP slaves</li> </ul>	<p>Yes</p> <p>No</p> <p>No</p> <p>Yes</p>
<b>Interface types</b>	
<b>RJ 45 (Ethernet)</b>	
<ul style="list-style-type: none"> <li>• 100 Mbps</li> <li>• Autonegotiation</li> <li>• Autocrossing</li> <li>• Industrial Ethernet status LED</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>RS 485</b>	
<ul style="list-style-type: none"> <li>• Transmission rate, max.</li> </ul>	<p>12 Mbit/s</p>
<b>Protocols</b>	
PROFIsafe	No
<b>Number of connections</b>	
<ul style="list-style-type: none"> <li>• Number of connections, max.</li> <li>• Number of connections reserved for ES/HMI/web</li> <li>• Number of connections via integrated interfaces</li> <li>• Number of connections per CP/CM</li> <li>• Number of S7 routing paths</li> </ul>	<p>128; via integrated interfaces of the CPU and connected CPs / CMs</p> <p>10</p> <p>88</p> <p>32</p> <p>16</p>
<b>Redundancy mode</b>	
<ul style="list-style-type: none"> <li>• H-Sync forwarding</li> </ul>	<p>Yes</p>
<b>Media redundancy</b>	
<ul style="list-style-type: none"> <li>– Media redundancy</li> <li>– MRP</li> </ul>	<p>Yes; only via BusAdapter</p> <p>Yes; MRP Automanager according to IEC 62439-2 Edition 2.0, MRP Manager; MRP Client</p>

Article number	6ES7510-1DK03-0AB0
<ul style="list-style-type: none"> <li>– MRP interconnection, supported</li> <li>– MRPD</li> <li>– Switchover time on line break, typ.</li> <li>– Number of stations in the ring, max.</li> </ul>	Yes; as MRP ring node according to IEC 62439-2 Edition 3.0 Yes; Requirement: IRT 200 ms; For MRP, bumpless for MRPD 50
<b>SIMATIC communication</b> <ul style="list-style-type: none"> <li>• PG/OP communication</li> <li>• S7 routing</li> <li>• Data record routing</li> <li>• S7 communication, as server</li> <li>• S7 communication, as client</li> <li>• User data per job, max.</li> </ul>	Yes; encryption with TLS V1.3 pre-selected Yes Yes Yes Yes See online help (S7 communication, user data size)
<b>Open IE communication</b> <ul style="list-style-type: none"> <li>• TCP/IP                             <ul style="list-style-type: none"> <li>– Data length, max.</li> <li>– several passive connections per port, supported</li> </ul> </li> <li>• ISO-on-TCP (RFC1006)                             <ul style="list-style-type: none"> <li>– Data length, max.</li> </ul> </li> <li>• UDP                             <ul style="list-style-type: none"> <li>– Data length, max.</li> <li>– UDP multicast</li> </ul> </li> <li>• DHCP</li> <li>• DNS</li> <li>• SNMP</li> <li>• DCP</li> <li>• LLDP</li> <li>• Encryption</li> </ul>	Yes 64 kbyte Yes Yes 64 kbyte Yes 2 kbyte; 1 472 bytes for UDP broadcast Yes; max. 78 multicast circuits Yes Yes Yes Yes Yes Yes Yes; Optional
<b>Web server</b> <ul style="list-style-type: none"> <li>• HTTP</li> <li>• HTTPS</li> </ul>	Yes; Standard and user pages Yes; Standard and user pages
<b>OPC UA</b> <ul style="list-style-type: none"> <li>• Runtime license required</li> <li>• OPC UA Client                             <ul style="list-style-type: none"> <li>– Application authentication</li> <li>– Security policies</li> <li>– User authentication</li> </ul> </li> </ul>	Yes; "Small" license required Yes; Data Access (registered Read/Write), Method Call Yes Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256 "anonymous" or by user name & password

Article number	6ES7510-1DK03-0AB0
– Number of connections, max.	4
– Number of nodes of the client interfaces, max.	1 000
– Number of elements for one call of OPC-UA_NodeGetHandleList/OPC-UA_ReadList/OPC-UA_WriteList, max.	300
– Number of elements for one call of OPC-UA_NameSpaceGetIndexList, max.	20
– Number of elements for one call of OPC-UA_MethodGetHandleList, max.	100
– Number of simultaneous calls of the client instructions per connection (except OPC-UA_ReadList, OPC-UA_WriteList, OPC-UA_MethodCall), max.	1
– Number of simultaneous calls of the client instructions OPC-UA_ReadList, OPC-UA_WriteList and OPC-UA_MethodCall, max.	5
– Number of registerable nodes, max.	5 000
– Number of registerable method calls of OPC-UA_MethodCall, max.	100
– Number of inputs/outputs when calling OPC-UA_MethodCall, max.	20
• OPC UA Server	Yes; Data Access (Read, Write, Subscribe), Method Call, Alarms & Condition (A&C), Custom Address Space
– Application authentication	Yes
– Security policies	available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256, Aes128Sha256RsaOaep, Aes256Sha256RsaPss
– User authentication	"anonymous" or by user name & password
– GDS support (certificate management)	Yes
– Number of sessions, max.	32
– Number of accessible variables, max.	50 000
– Number of registerable nodes, max.	10 000
– Number of subscriptions per session, max.	50
– Sampling interval, min.	100 ms
– Publishing interval, min.	200 ms
– Number of server methods, max.	20
– Number of inputs/outputs per server method, max.	20
– Number of monitored items, max.	4 000; for 1 s sampling interval and 1 s send interval

Article number	6ES7510-1DK03-0AB0
<ul style="list-style-type: none"> <li>– Number of server interfaces, max.</li> <li>– Number of nodes for user-defined server interfaces, max.</li> <li>• Alarms and Conditions                             <ul style="list-style-type: none"> <li>– Number of program alarms</li> <li>– Number of alarms for system diagnostics</li> </ul> </li> </ul>	10 of each "Server interfaces" / "Companion specification" type and 20 of the type "Reference namespace" 15 000 Yes 100 50
<b>Further protocols</b> <ul style="list-style-type: none"> <li>• MODBUS</li> </ul>	Yes; MODBUS TCP
<b>S7 message functions</b>	
Number of login stations for message functions, max. Program alarms Number of configurable program messages, max. Number of loadable program messages in RUN, max.	32 Yes 5 000; Program messages are generated by the "Program_Alarm" block, ProDiag or GRAPH 2 500
<b>Test commissioning functions</b>	
Joint commission (Team Engineering) Status block Single step Number of breakpoints	Yes; Parallel online access possible for up to 5 engineering systems Yes; Up to 8 simultaneously (in total across all ES clients) No 8
<b>Status/control</b>	
<ul style="list-style-type: none"> <li>• Status/control variable</li> <li>• Variables                             <ul style="list-style-type: none"> <li>• Number of variables, max.                                     <ul style="list-style-type: none"> <li>– of which status variables, max.</li> <li>– of which control variables, max.</li> </ul> </li> </ul> </li> </ul>	Yes Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters 200; per job 200; per job
<b>Forcing</b>	
<ul style="list-style-type: none"> <li>• Forcing</li> <li>• Forcing, variables</li> <li>• Number of variables, max.</li> </ul>	Yes Peripheral inputs/outputs 200
<b>Diagnostic buffer</b>	
<ul style="list-style-type: none"> <li>• present</li> <li>• Number of entries, max.                             <ul style="list-style-type: none"> <li>– of which powerfail-proof</li> </ul> </li> </ul>	Yes 1 000 500
<b>Traces</b>	
<ul style="list-style-type: none"> <li>• Number of configurable Traces</li> </ul>	4; Up to 512 KB of data per trace are possible

Article number	6ES7510-1DK03-0AB0
<b>Interrupts/diagnostics/status information</b>	
<b>Diagnostics indication LED</b>	
<ul style="list-style-type: none"> <li>• RUN/STOP LED</li> <li>• ERROR LED</li> <li>• MAINT LED</li> <li>• Monitoring of the supply voltage (PWR-LED)</li> <li>• Connection display LINK TX/RX</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
<b>Supported technology objects</b>	
Motion Control	Yes; Note: The number of technology objects affects the cycle time of the PLC program; selection guide via the TIA Selection Tool
<ul style="list-style-type: none"> <li>• Number of available Motion Control resources for technology objects</li> <li>• Required Motion Control resources                             <ul style="list-style-type: none"> <li>– per speed-controlled axis</li> <li>– per positioning axis</li> <li>– per synchronous axis</li> <li>– per external encoder</li> <li>– per output cam</li> <li>– per cam track</li> <li>– per probe</li> </ul> </li> <li>• Positioning axis                             <ul style="list-style-type: none"> <li>– Number of positioning axes at motion control cycle of 4 ms (typical value)</li> <li>– Number of positioning axes at motion control cycle of 8 ms (typical value)</li> </ul> </li> </ul>	<p>1 120</p> <p>40</p> <p>80</p> <p>160</p> <p>80</p> <p>20</p> <p>160</p> <p>40</p> <p>11</p> <p>14</p>
Controller	
<ul style="list-style-type: none"> <li>• PID_Compact</li> <li>• PID_3Step</li> <li>• PID-Temp</li> </ul>	<p>Yes; Universal PID controller with integrated optimization</p> <p>Yes; PID controller with integrated optimization for valves</p> <p>Yes; PID controller with integrated optimization for temperature</p>
Counting and measuring	
<ul style="list-style-type: none"> <li>• High-speed counter</li> </ul>	Yes
<b>Ambient conditions</b>	
<b>Ambient temperature during operation</b>	
<ul style="list-style-type: none"> <li>• horizontal installation, min.</li> <li>• horizontal installation, max.</li> <li>• vertical installation, min.</li> <li>• vertical installation, max.</li> </ul>	<p>-30 °C; No condensation</p> <p>60 °C</p> <p>-30 °C; No condensation</p> <p>50 °C</p>

<b>Article number</b>	<b>6ES7510-1DK03-0AB0</b>
<b>Altitude during operation relating to sea level</b>	
<ul style="list-style-type: none"> <li>Installation altitude above sea level, max.</li> </ul>	5 000 m; Restrictions for installation altitudes > 2 000 m, see manual
<b>configuration / header</b>	
<b>configuration / programming / header</b>	
<b>Programming language</b>	
– LAD	Yes
– FBD	Yes
– STL	Yes
– SCL	Yes
– GRAPH	Yes
<b>Know-how protection</b>	
<ul style="list-style-type: none"> <li>User program protection/password protection</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Copy protection</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Block protection</li> </ul>	Yes
<b>Access protection</b>	
<ul style="list-style-type: none"> <li>protection of confidential configuration data</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Protection level: Write protection</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Protection level: Read/write protection</li> </ul>	Yes
<ul style="list-style-type: none"> <li>Protection level: Complete protection</li> </ul>	Yes
<b>programming / cycle time monitoring / header</b>	
<ul style="list-style-type: none"> <li>lower limit</li> </ul>	adjustable minimum cycle time
<ul style="list-style-type: none"> <li>upper limit</li> </ul>	adjustable maximum cycle time
<b>Dimensions</b>	
Width	100 mm
Height	117 mm
Depth	75 mm
<b>Weights</b>	
Weight, approx.	265 g

### Technical specifications of the BusAdapter BA 2xRJ45

<b>Article number</b>	<b>6ES7193-6AR00-0AA0</b>
<b>General information</b>	
Product type designation	BA 2x RJ45
<b>Interfaces</b>	
Number of PROFINET interfaces	1
<b>Supports protocol for PROFINET IO</b>	

<b>Article number</b>	<b>6ES7193-6AR00-0AA0</b>
<ul style="list-style-type: none"> <li>Number of RJ45 ports</li> <li>Number of SCRJ ports</li> <li>Number of LC ports</li> </ul>	<p>2</p> <p>0</p> <p>0</p>
<b>Cable length</b>	
– Cu conductors	100 m
<b>Ambient conditions</b>	
<b>Ambient temperature during operation</b>	
<ul style="list-style-type: none"> <li>horizontal installation, min.</li> <li>horizontal installation, max.</li> <li>vertical installation, min.</li> <li>vertical installation, max.</li> </ul>	<p>-30 °C</p> <p>60 °C</p> <p>-30 °C</p> <p>50 °C</p>
<b>Altitude during operation relating to sea level</b>	
<ul style="list-style-type: none"> <li>Installation altitude above sea level, max.</li> </ul>	5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200SP system manual
<b>Dimensions</b>	
Width	20 mm
Height	69.5 mm
Depth	59 mm
<b>Weights</b>	
Weight, approx.	46 g

### Technical specifications of the BusAdapter BA 2×FC

<b>Article number</b>	<b>6ES7193-6AF00-0AA0</b>
<b>General information</b>	
Product type designation	BA 2×FC
<b>Interfaces</b>	
Number of PROFINET interfaces	1
<b>Supports protocol for PROFINET IO</b>	
<ul style="list-style-type: none"> <li>Number of FC (FastConnect) connections</li> </ul>	2
<b>Cable length</b>	
– Cu conductors	100 m
<b>Ambient conditions</b>	
<b>Ambient temperature during operation</b>	
<ul style="list-style-type: none"> <li>horizontal installation, min.</li> <li>horizontal installation, max.</li> <li>vertical installation, min.</li> <li>vertical installation, max.</li> </ul>	<p>-30 °C</p> <p>60 °C</p> <p>-30 °C</p> <p>50 °C</p>
<b>Altitude during operation relating to sea level</b>	



<b>Article number</b>	<b>6ES7193-6AF00-0AA0</b>
<ul style="list-style-type: none"> <li>Installation altitude above sea level, max.</li> </ul>	5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200SP system manual
<b>Dimensions</b>	
Width	20 mm
Height	69.5 mm
Depth	59 mm
<b>Weights</b>	
Weight, approx.	53 g

### General technical specifications

You can find information on the general technical specifications, such as standards and approvals, electromagnetic compatibility, protection class, etc., in the system manual ET 200SP distributed I/O system

(<https://support.automation.siemens.com/WW/view/en/58649293>).

# A

## Dimension drawing

This section contains a dimension drawing of the module mounted on a mounting rail. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

### Dimension drawing of the CPU 1510SP-1 PN



Figure A-1 Dimensional drawing CPU 1510SP-1 PN