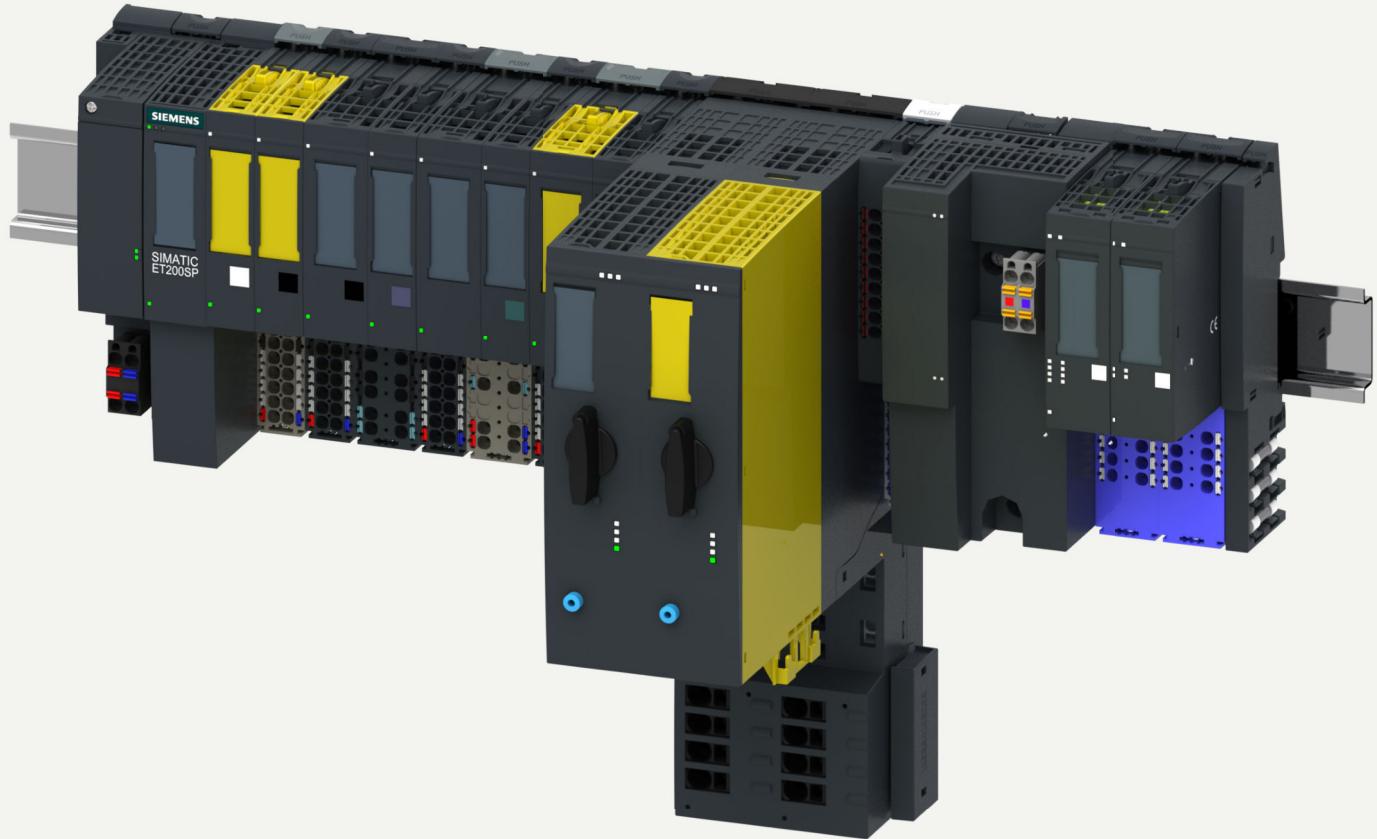


SIEMENS



Edition

11/2023

SYSTEM MANUAL

SIMATIC

ET 200SP

ET 200SP Distributed I/O System

SIMATIC ET 200SP Distributed I/O system

System Manual

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ET 200SP Distributed I/O system

System Manual

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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.

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:

WARNING

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

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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 documentation provides important information on configuring, installing, wiring and commissioning the ET 200SP distributed I/O system.

Basic knowledge required

A basic knowledge of automation technology is required to understand the documentation.

Validity of the documentation

This documentation applies to the distributed I/O system, ET 200SP.

Definition

In this document, "motor starter" always refers to all variants of the ET 200SP motor starters.

Conventions

Please pay particular attention to notes highlighted as follows:

NOTE

Notes contain important information on the product, handling the product or on part of the documentation to which you should pay particular attention.

ID link for the digital nameplate



The ID link is a globally unique identifier according to IEC 61406, which you will find in the future as a QR code on your product and the product packaging.

The figure shows an example of an ID link for the digital input module DI 8x24 VDC HF.

You can recognize the ID link by the frame with a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product.

Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner or reader app. Call the ID link.

In the digital nameplate, you will find product data, manuals, declarations of conformity, certificates and other helpful information about your product.

Standards

You can find a dated reference to the respective standards or the EC Declaration of Conformity on the Internet
(<https://support.industry.siemens.com/cs/ww/en/ps/14031/cert?ct=444&ci=526>)

Special information

 WARNING
Hazardous Voltage Can Cause Death, Serious Injury, or Property Damage.
Proper use of hardware products
This equipment is only allowed to be used for the applications described in the catalog and in the technical description, and only in conjunction with non-Siemens equipment and components recommended by Siemens.
Correct transport, storage, installation and assembly, as well as careful operation and maintenance, are required to ensure that the product operates safely and without faults.
EU note: Start-up/commissioning is absolutely prohibited until it has been ensured that the machine in which the component described here is to be installed fulfills the regulations/specifications of Directive 2006/42/EC.

NOTE

Important note for maintaining operational safety of your plant

Plants with safety-related features are subject to special operational safety requirements on the part of the operator. Even suppliers are required to observe special measures during product monitoring. For this reason, we inform you in the form of personal notifications about product developments and features that are (or could be) relevant to operation of systems from a safety perspective.

By subscribing to the appropriate notifications, you will ensure that you are always up-to-date and able to make changes to your system, when necessary.

Log onto Industry Online Support. Go to the following links and, on the side, right click on "email on update":

- SIMATIC S7-300/S7-300F (<https://support.industry.siemens.com/cs/ww/en/ps/13751>)
 - SIMATIC S7-400/S7-400H/S7-400F/FH
(<https://support.industry.siemens.com/cs/ww/en/ps/13828>)
 - SIMATIC WinAC RTX (F) (<https://support.industry.siemens.com/cs/ww/en/ps/13915>)
 - SIMATIC S7-1500/SIMATIC S7-1500F
(<https://support.industry.siemens.com/cs/ww/en/ps/13716>)
 - SIMATIC S7-1200/SIMATIC S7-1200F
(<https://support.industry.siemens.com/cs/ww/en/ps/13683>)
 - Distributed I/O (<https://support.industry.siemens.com/cs/ww/en/ps/14029>)
 - STEP 7 (TIA Portal) (<https://support.industry.siemens.com/cs/ww/en/ps/14667>)
-

NOTE

When using F-CPU's in safety mode and fail-safe modules, observe the description of the SIMATIC Industrial Software SIMATIC Safety - Configuring and Programming (<https://support.industry.siemens.com/cs/ww/de/view/54110126/en>) fail-safe system.

1.1

Siemens Industry Online Support

You can find current information on the following topics quickly and easily here:

- **Product support**

All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.

- **Application examples**

Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.

- **Services**

Information about Industry Services, Field Services, Technical Support, spare parts and training offers.

- **Forums**

For answers and solutions concerning automation technology.

- **mySupport**

Your personal working area in Industry Online Support for messages, support queries, and configurable documents.

This information is provided by the Siemens Industry Online Support in the Internet (<https://support.industry.siemens.com>).

1.2 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>).

1.3 ET 200SP Documentation Guide

1.3.1 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>)

1.3.2 Basic tools

Tools

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 , the TIA Selection Tool assembles the already known configurators for automation technology 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:

- In the network analysis, you get an overview of the PROFINET topology. Compare a real configuration with a reference installation or make simple parameter changes, e.g. to the names and IP addresses of the devices.
- 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 PROFenergy diagnostics, you can quickly detect the current pause mode or the readiness for operation of devices that support PROFenergy 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>).

1.3.3 MultiFieldbus Configuration Tool (MFCT)

MultiFieldbus Configuration Tool

MultiFieldbus Configuration Tool (MFCT) is a PC-based software and supports the configuration of MultiFieldbus- and DALI-devices. In addition, the MFCT offers convenient options for mass firmware updates of ET 200 devices with MultiFieldbus- support and reading service data for many other Siemens devices.

Functional scope of the MFCT

- MultiFieldbus configuration:
Engineering, configuration and diagnostics of MultiFieldbus-devices, provision of the required project files (project, UDT-, CSV- and EDS-file), transfer/export of the files to device and/or data memory.
- DALI configuration:
Device selection and online configuration of DALI devices.
- TM FAST:
Generation and download of FPGA-UPD- and FPGA-DB-files.
- Maintenance:
Topology scan of a Ethernet network, reading of service data, parameter assignment and firmware update.
- Settings:
Language switching German / English, network scanner speed, setting of the network adapter, installation of GSDML-and EDS-files.

System/installation requirements for MFCT

The MFCT runs under Microsoft Windows and does not require installation or administrator rights.

For MFCT you must also install the following software:

- Microsoft .NET Framework 4.8 (You can find an Offline Installer on the Internet. (<https://support.microsoft.com/en-us/topic/microsoft-net-framework-4-8-offline-installer-for-windows-9d23f658-3b97-68ab-d013-aa3c3e7495e0>))
- NPcap from directory "Misc"
- PG/PC interface from directory "Misc"
- Microsoft C++ Redistributable for x86-systems (you can find the installation data for download on the Internet. (https://aka.ms/vs/15/release/vc_redist.x86.exe))

The download of the tool and further information as well as documentation on the individual functions of the MFCT can be found on the Internet.

(<https://support.industry.siemens.com/cs/de/en/view/109773881>)

1.3.4 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/TwLSxxRQQsA>)

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
 - Industry Online Support International: (<https://support.industry.siemens.com>)
The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
 - ID link:
Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

The documentation of the product is updated in digital form. In particular in the case of function extensions, the new performance features are provided in an updated version.

1. Download the current version as described above via the Industry Online Support or the ID link.
2. Also retain this version of the documentation.

mySupport

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

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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: <ul style="list-style-type: none">• Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files• Manuals, characteristics, operating manuals, certificates• 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>)

5

System overview

5.1 What is the SIMATIC ET 200SP distributed I/O system?

SIMATIC ET 200SP

SIMATIC ET 200SP is a scalable and highly flexible distributed I/O system for connecting process signals to a higher-level controller via a fieldbus.

System overview

5.1 What is the SIMATIC ET 200SP distributed I/O system?

Customer benefits of the system

Easy to use	Compact design	Safety Integrated	Communication standards	Energy efficiency
<ul style="list-style-type: none">Compact modules, fixed wiring with single-cable and multi-cable connectionLess time due to connection technology with push-in terminals and without toolsAdaptation of the configuration for future expansions through integrated configuration control	<ul style="list-style-type: none">Small size and high variability through scalabilityMaximum level of clarity through innovative labeling system in minimum spaceSystem-integrated load current supply	<ul style="list-style-type: none">Easy integration of fail-safe CPUs and modulesAll F-parameters set in software	<ul style="list-style-type: none">PROFINET IOPROFIBUS DPEtherNet/IPModbus TCPET-ConnectionAS-InterfaceIO-LinkPoint-to-point (RS232, RS485)DALIDMX	<ul style="list-style-type: none">PROFIsafe as integrated function
High performance				
CPU	<ul style="list-style-type: none">PROFINET interface with 3 portsIO controllerI-deviceOptional CM DP module for connection to PROFIBUS DP	Motor starter		
Powerful technology		<ul style="list-style-type: none">Easy integration of motor starters with overload and short-circuit protectionCompact design with a maximum connectable motor output of up to 5.5 kW		
	<ul style="list-style-type: none">Modules for Counting, Positioning, Weighing and Measuring functions of electrical parameters	Modules for hazardous area		
		<ul style="list-style-type: none">Modules for the connection of devices in hazardous areas of Zone 0 and Zone 1.		

Figure 5-1 SIMATIC ET 200SP distributed I/O system - Customer benefits

Area of application

Thanks to its multifunctionality, the SIMATIC ET 200SP distributed I/O system is suitable for a wide range of applications. Its scalable design allows you to tailor your configuration to local requirements. Various CPUs/interface modules are available for connection to PROFINET IO, PROFIBUS DP, EtherNet/IP or Modbus TCP.

SIMATIC ET 200SP with CPU allows intelligent pre-processing to relieve the higher-level controller. The CPU can also be used as standalone device.

By using fail-safe CPUs, you can implement applications for safety engineering. Configuration and programming of your safety program takes place the same way as for standard CPUs.

An extensive range of I/O modules extends the area of application of the ET 200SP system.

SIMATIC ET 200SP is designed with degree of protection IP20 and is intended for installation in a control cabinet.

With use of an ET 200SP R1, you increase the availability of the system through redundant interface modules.

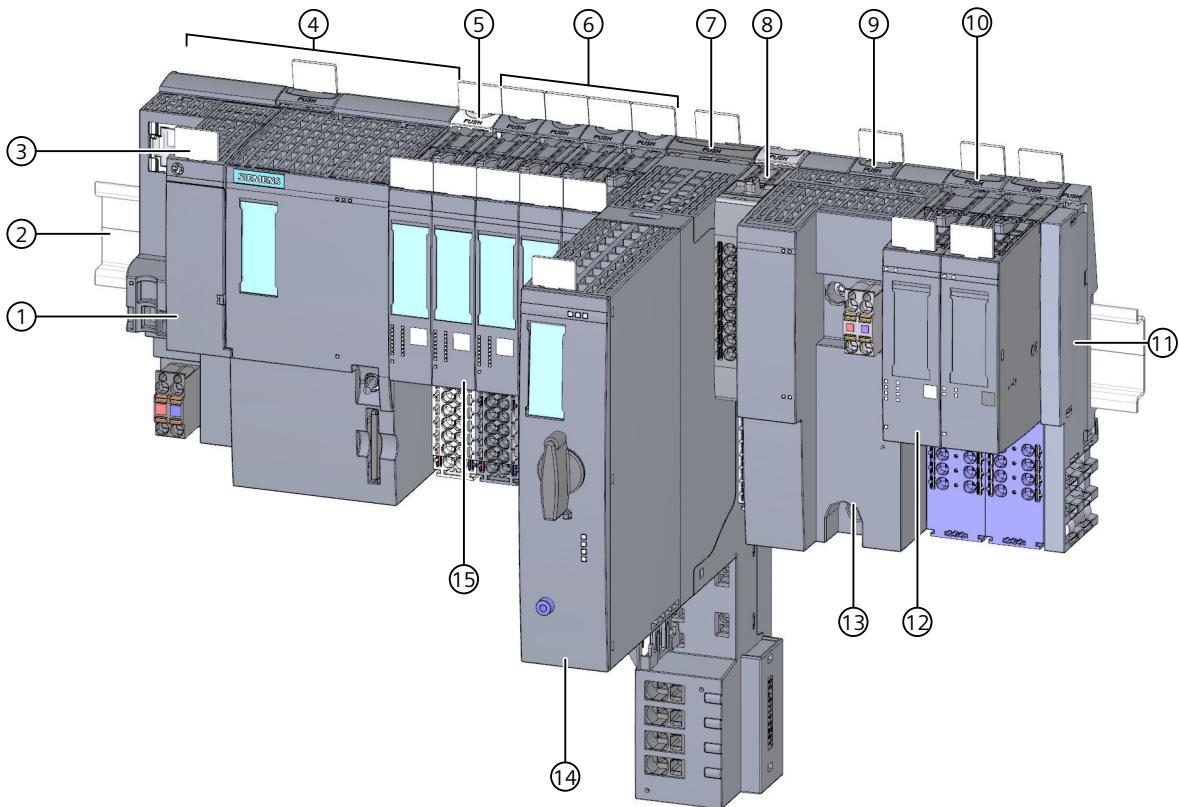
Configuration

The SIMATIC ET 200SP distributed I/O system is installed on a mounting rail. It consists of:

- CPU/interface module
- Up to 64 I/O modules, which can be plugged into BaseUnits in any combination
- Up to 31 motor starters
- A server module that completes the configuration of the ET 200SP.

5.1 What is the SIMATIC ET 200SP distributed I/O system?

Configuration example



- ① BusAdapter
- ② Mounting rail
- ③ Reference identification label
- ④ CPU/interface module
- ⑤ Light-colored BaseUnit BU..D with infeed of supply voltage
- ⑥ Dark-colored BaseUnits BU..B for conducting the potential group further
- ⑦ BaseUnit for motor starters
- ⑧ Potential distributor module
- ⑨ Ex BaseUnit for Ex power module
- ⑩ Ex BaseUnit for Ex I/O module
- ⑪ Server module (included in the scope of supply of the CPU/interface module)
- ⑫ Ex I/O module
- ⑬ Ex power module
- ⑭ ET 200SP motor starter
- ⑮ I/O module

Figure 5-2 Configuration example of the ET 200SP

5.2 What are fail-safe automation systems and fail-safe modules?

Fail-safe automation systems

Fail-safe automation systems (F-systems) are used in systems with higher safety requirements. F-systems control processes and ensure that they are in a safe state immediately after shutdown. In other words, F-systems control processes in which an immediate shutdown does not endanger persons or the environment.

Safety Integrated

Safety Integrated is the integrated safety concept for automation and drive technology from Siemens.

Proven technologies and systems from automation technology are used for safety systems. Safety Integrated includes the complete safety sequence, ranging from sensor, actuator and fail-safe modules right through to the controller, including safety-related communication via standard fieldbuses. Drives and controllers handle safety tasks in addition to their actual functions.

Fail-safe modules

The key difference between fail-safe modules (F-modules) and standard modules is that they have an internal two-channel design. This means the two integrated processors monitor each other, automatically test the input and output circuits, and switch the fail-safe module to a safe state in the event of a fault.

The F-CPU communicates with a fail-safe module via the safety-related PROFIsafe bus profile.

Fail-safe motor starters

Fail-safe motor starters enable safety-related tripping of motor loads. Fail-safe motor starters are not PROFIsafe nodes. Motor starters operate together with the fail-safe modules of the ET 200SP system.

Area of application of ET 200SP with fail-safe I/O modules

By using the ET 200SP distributed I/O system with fail-safe I/O modules, you are replacing conventional safety engineering configurations. This includes the replacement of switching devices for emergency STOP, protective door monitors, two-hand operation, etc.

5.3 How are SIMATIC Safety F-systems structured with ET 200SP?

SIMATIC Safety F-system with ET 200SP

The figure below shows an example of a configuration for a SIMATIC Safety F-system with ET 200SP distributed I/O system and PROFINET IO. You can configure the PROFINET IO lines with copper cable, fiber-optic cable or WLAN.

Fail-safe I/O modules and non-fail-safe I/O modules can be combined in an ET 200SP configuration.

The fail-safe IO controller (F-CPU) exchanges safety-related and non-safety-related data with fail-safe and non-fail-safe ET 200SP modules.

ET 200SP Fe.g. CPU 1512SP F-1 PN and CM DP

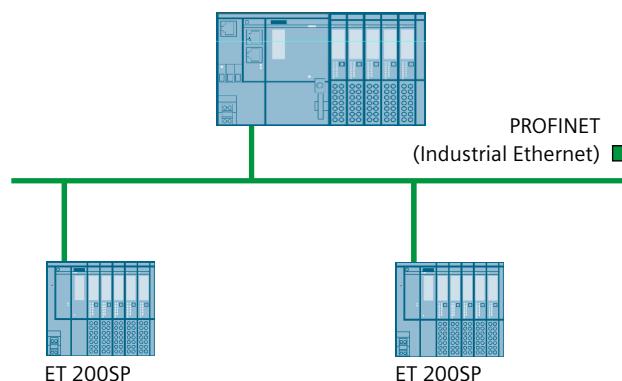


Figure 5-3 Fail-safe SIMATIC Safety automation system (sample configuration)

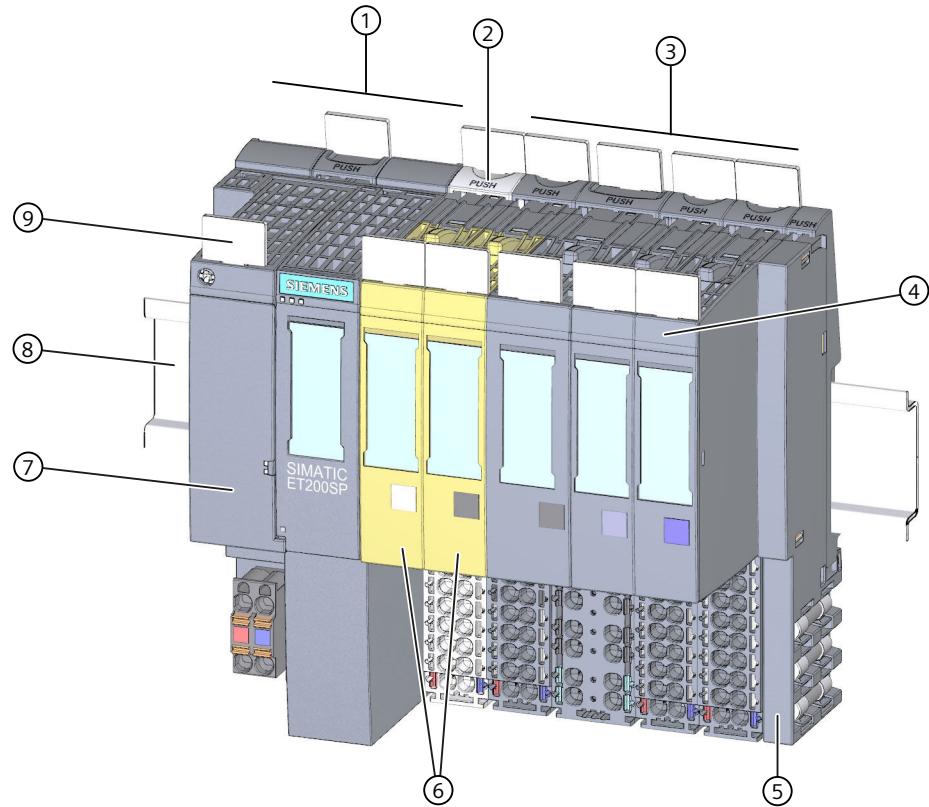
Fail-safe ET 200SP I/O modules

The following fail-safe I/O modules are available for the ET 200SP distributed I/O system:

- Fail-safe power modules are used to supply the potential group load voltage and for the safety-related tripping of the load voltage for non-fail-safe output modules.
- Fail-safe digital input modules detect the signal states of safety-related sensors and send the relevant safety frames to the F-CPU.
- Fail-safe digital output modules are suitable for safety-related shutdown procedures with short circuit and cross-circuit protection up to the actuator.

ET 200SP fail-safe motor starters

Fail-safe motor starters are suitable for safety-related tripping of motor loads.

Example of a configuration with fail-safe I/O modules

- ① Interface module
- ② Light-colored BaseUnit BU..D with infeed of supply voltage
- ③ Dark-colored BaseUnits BU..B for conducting the potential group further
- ④ I/O module
- ⑤ Server module (ships with the interface module)
- ⑥ Fail-safe I/O modules
- ⑦ BusAdapter
- ⑧ Mounting rail
- ⑨ Reference identification label

Figure 5-4 Example of a configuration of the ET 200SP with fail-safe I/O modules

Hardware and software requirements

Fail-safe modules ET 200SP are supported by IM155-6PN ST interface modules as of firmware V1.1.1, IM155-6PN HF as of firmware V2.0, IM155-6PN HS as of firmware V4.0 and IM155-6DP HF as of firmware V1.0.

You require the STEP 7 Safety Advanced option package, V12 or higher including HSP 54, for configuration and programming of the ET 200SP fail-safe modules with the SIMATIC Safety fail-safe system.

You require the F-Configuration Pack V5.5 SP10 or later for configuring and programming the ET 200SP failsafe modules with the Distributed Safety failsafe system.

You require the F-Configuration Pack V5.5 SP12 or later for configuring and programming the ET 200SP failsafe modules with the F/FH Systems failsafe system.

ET 200SP fail-safe motor starters are supported by interface modules IM155-6PN BA, firmware V3.2 or higher, IM155-6PN ST, firmware V3.1 or higher, IM155-6PN HF, firmware V3.1 or higher and IM155-6DP HF firmware V3.0 or higher.

You require SIMATIC Step 7 V14 or higher for configuration and programming of ET 200SP fail-safe motor starters. The F-Configuration Pack is not needed for configuration and programming of the ET 200SP fail-safe motor starter.

NOTE

Configuration of ET 200SP motor starters, SIMATIC Step 7 V13 or higher, is possible with a GSD file (GSDML).

Use in safety mode only

Safety mode is the F-I/O operating mode that allows safety-related communication using safety frames.

Safety mode of motor starters is characterized by the fail-safe digital input (F-DI) and availability of the 24 V power supply.

You can only use the ET 200SP fail-safe I/O modules in safety mode. They cannot be used in non-fail-safe mode.

Achievable safety classes

The fail-safe modules are equipped with integrated safety functions for safety mode.

You can achieve the safety classes of the table below:

- With the appropriate parameter assignment of the safety functions in STEP 7
- With a specific combination of fail-safe and non-fail-safe I/O modules
- With a special arrangement and wiring of the sensors and actuators

Table 5-1 Safety classes that can be achieved with ET 200SP in safety mode

Safety class in safety mode		
According to IEC 61508	According to ISO 13849-1	
SIL2	Category 3	(PL) Performance Level d
SIL3	Category 3	(PL) Performance Level e
SIL3	Category 4	(PL) Performance Level e

More information

You will find the use cases and wiring for the relevant safety class in the manuals of the fail-safe I/Os and the fail-safe motor starters.

5.4 Components

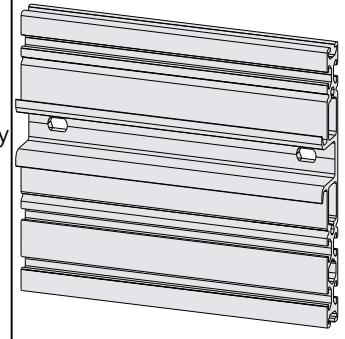
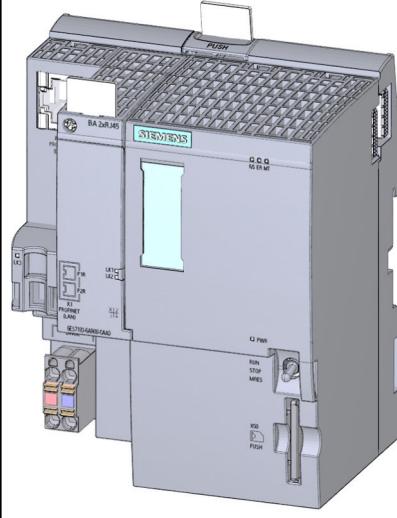
Overview of ET 200SP modules and accessories

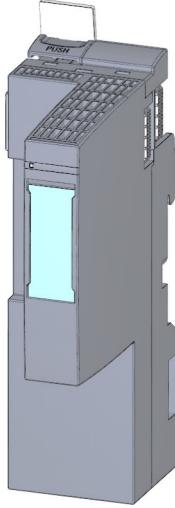
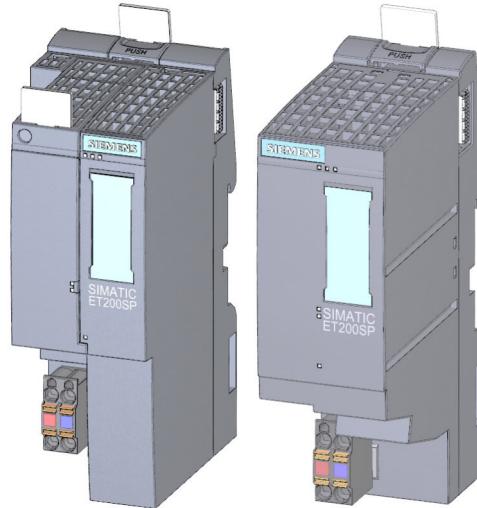
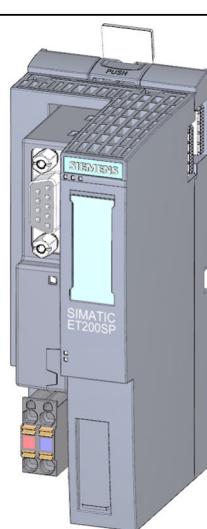
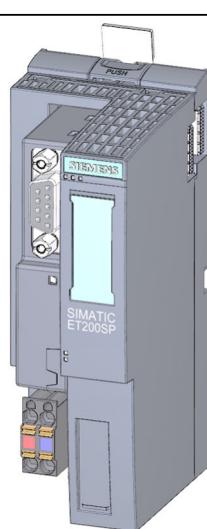
NOTE

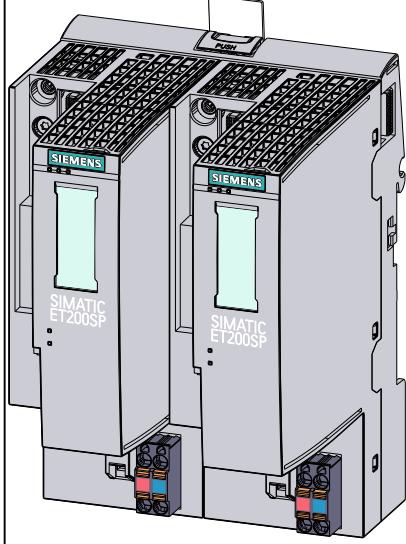
A complete overview of the ET 200SP modules and accessories is available in the Product information on documentation of the ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/de/de/view/73021864/en>).

Basic components of the ET 200SP distributed I/O system

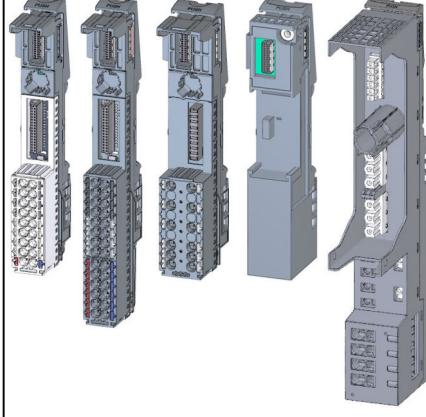
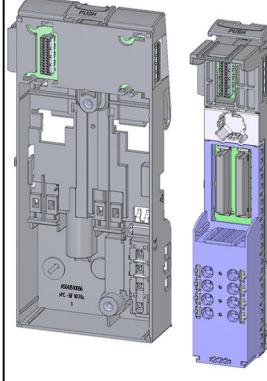
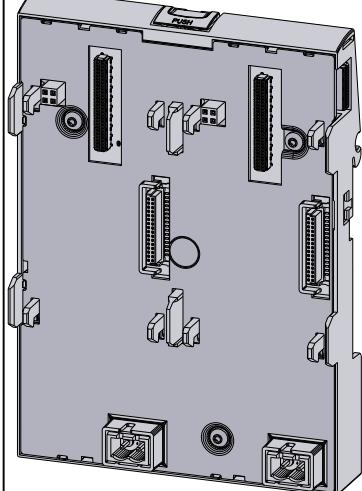
Table 5-2 Basic components of the ET 200SP

Basic component	Function	Figure
Mounting rail in accordance with EN 60715	The mounting rail is the rack of the ET 200SP distributed I/O system. You install the ET 200SP system on the mounting rail. The mounting rail is 35 mm high.	
SIMATIC system rail	The system rail is the mounting rack of the ET 200SP R1 distributed I/O system. The ET 200SP R1 system must be installed on the system rail. You can also mount all other interface modules on the system rail to improve the stability of the system.	
CPU/Fail-safe CPU	<p>The (F) CPU:</p> <ul style="list-style-type: none"> Runs the user program. The F-CPU also runs the safety program. Can be used as an IO controller or I-Device on PROFINET IO or as a standalone CPU Links the ET 200SP to the IO devices or the IO controller Exchanges data with the I/O modules via the backplane bus. <p>Additional CPU functions:</p> <ul style="list-style-type: none"> Communication via PROFIBUS DP (the CPU can be used as a DP master or DP slave in combination with the CM DP communication module) Integrated Web server Integrated technology Integrated trace functionality Integrated system diagnostics Integrated safety Safety mode (when using fail-safe CPUs) 	

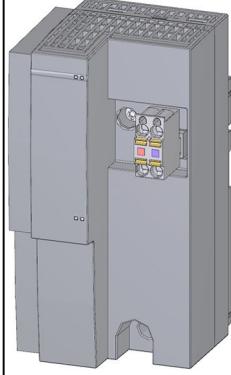
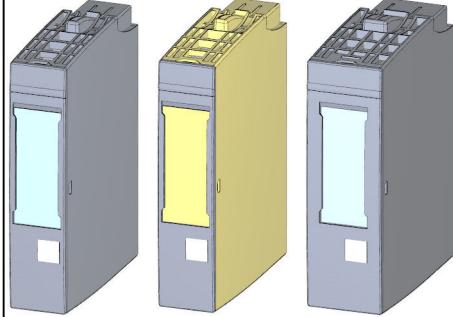
Basic component	Function	Figure
Communication module CM DP	The communication module CM DP <ul style="list-style-type: none"> • Connects the CPU with PROFIBUS DP • The bus connection is an RS485 interface. 	
Interface module for PROFINET IO	The interface module: <ul style="list-style-type: none"> • Can be used as IO device on PROFINET IO • Links the ET 200SP with the IO controller • Exchanges data with the I/O modules via the backplane bus. 	
Interface module for MultiFieldbus	The interface module: <ul style="list-style-type: none"> • Use as IO device on PROFINET IO • Links the ET 200SP with the IO controller • Links the ET 200SP via EtherNet/IP • Links the ET 200SP via Modbus TCP • Exchanges data with the I/O modules via the backplane bus <p>You can find more information about MultiFieldbus in the MultiFieldbus Function Manual (https://support.industry.siemens.com/cs/ww/en/view/109773209) and in the Interface Module IM 155-6 MF HF Equipment Manual (https://support.industry.siemens.com/cs/ww/en/view/109773210).</p>	
Interface module for PROFIBUS DP	The interface module: <ul style="list-style-type: none"> • Can be used as DP slave on PROFIBUS DP • Links the ET 200SP with the DP master • Exchanges data with the I/O modules via the backplane bus. 	

Basic component	Function	Figure
Interface modules and BaseUnit BU type M0 for redundant connection	<p>The ET 200SP R1 system:</p> <ul style="list-style-type: none"> • Use as redundant IO device on PROFINET IO • Connects the ET 200SP to the IO controller • Exchanges data with the I/O modules via the backplane bus. 	

Basic component	Function	Figure
BusAdapter	<p>The BusAdapters allow free selection of the connection technology for PROFINET IO. The following versions are available for PROFINET CPU/interface modules:</p> <ul style="list-style-type: none"> • For standard RJ45 connector (BA 2xRJ45) ① • For direct connection of the bus cable (BA 2xFC) ② • For standard M12 connector (D-coded) with screw-type terminal or plug-in push-pull version (BA 2xM12) ③ • For POF/PCF fiber-optic cable (BA 2xSCRJ) ④ • As media converter for POF/PCF fiber-optic cable ⇔ standard RJ45 plug (BA SCRJ/RJ45) ⑤ • As media converter for POF/PCF fiber-optic cable ⇔ direct connection of the bus cable (BA SCRJ/FC) ⑥ • For glass fiber-optic cable (BA 2xLC) ⑦ • As media converter for glass fiber-optic cable ⇔ standard RJ45 plug (BA LC/RJ45) ⑧ • As media converter for glass fiber-optic cable ⇔ direct connection of the bus cable (BA LC/FC) ⑨ • For single-mode fiber-optic cable with maximum length of 20 km (BA 2xLC-LD, long distance) ⑩ • As media converter for glass fiber-optic cable with an LC plug connector ⇔ standard RJ45 connector (BA LC-LD/RJ45) ⑪ • As media converter for glass fiber-optic cable with an LC plug connector ⇔ standard M12 plug or M12 push-pull connector (BA LC-LD/M12) ⑫ 	
	<p>For mixed ET 200SP/ET 200AL configuration, you require the BusAdapter BA-Send 1xFC ① (plugged into the BaseUnit BU-Send). Connect the bus cable for ET-Connection to the BusAdapter BA-Send 1xFC.</p>	

Basic component	Function	Figure
BaseUnit	<p>The BaseUnits provide the electrical and mechanical connection of the ET 200SP modules. Place the I/O modules or the motor starter onto the BaseUnits.</p> <p>Suitable BaseUnits are available in each case for the different requirements. You can find additional information in section Selecting the BaseUnit for I/O modules (Page 84).</p>	
Ex BaseUnit	<p>You need the following BaseUnits for an Ex module group:</p> <ul style="list-style-type: none"> • Ex BaseUnit for Ex power module • Ex BaseUnit for Ex I/O module 	
BaseUnit ET 200SP R1	<p>Connects the IM 155-6 PN R1 redundant interface modules to the backplane bus.</p> <p>It enables data exchange with the I/O modules.</p> <p>Note: Interface modules cannot be plugged in if the supply voltage connector is plugged in. Only use BusAdapters of the same type.</p>	

Basic component	Function	Figure
PotDis-BaseUnit potential distributor module	<p>You use the potential distributor module to distribute a variety of potentials (P1, P2). This allows you to implement a multi-cable connection without external terminals with 16-channel digital modules.</p> <p>The assembly has two parts:</p> <ul style="list-style-type: none"> • If you need additional potential terminals, plug a PotDis-TerminalBlock in the PotDis-BaseUnit. • Alternatively, plug a BU cover (15 mm) on the PotDis-BaseUnit. <p>With potential distributor modules, you may only connect to the PotDis-TB versions BR-W and n.c.-G potential, which exceed the voltage level of SELV/PELV. Other SELV/PELV potential groups should be separated with light-colored PotDis BUs. Suitable PotDis-BaseUnits are available in each case for the different requirements. You can find additional information in section Selecting a PotDis-BaseUnit (Page 90).</p>	
PotDis-TerminalBlock	<p>If you need additional potential terminals for a PotDis-BaseUnit, plug a PotDis-TerminalBlock in the PotDis-BaseUnit.</p> <p>Voltages greater than SELV/PELV are only permitted for the PO PotDis-TBs BR (bridged) and NC (not connected). The same applies to PE. Voltages at the terminals of the PotDis modules connected to the P1/P2 rails must not be greater than SELV/PELV.</p> <p>Suitable PotDis-TerminalBlocks are available in each case for the different requirements. You can find additional information in section Selecting a PotDis-TerminalBlock (Page 91).</p>	
Fail-safe power module	The fail-safe power module allows the safety-related shutdown of digital output modules / fail-safe digital output modules.	

Basic component	Function	Figure
Ex power module	The Ex power module supplies the downstream Ex I/O modules via the power bus on the Ex BaseUnit of the Ex power module. An Ex BaseUnit is required for installing the Ex power module.	 A 3D rendering of a grey rectangular Ex power module. It has a front panel with several circular connection terminals and a small display or indicator area at the top left.
I/O module / Fail-safe I/O module/ Ex I/O module	<p>The I/O module determines the function at the terminals. The controller detects the current process state via the connected sensors and actuators, and triggers the corresponding reactions. I/O modules are divided into the following module types:</p> <ul style="list-style-type: none"> • Digital input (DI, F-DI, Ex-DI) • Digital output (DQ, F-DQ PM, F-DQ PP, F-RQ, Ex-DQ) • Analog input (AI, F-AI, Ex-AI) • Analog output (AQ, Ex-AQ) • Technology module (TM, F-TM-C) • Communication module (CM) • Power module (F-PM-E) 	 Three 3D renderings of I/O modules. From left to right: a standard grey module, a yellow module, and another standard grey module. Each has a light blue windowed front panel.
Motor starter/fail-safe motor starter	<p>The motor starter is a switching and protection device for 1-phase and 3-phase loads. The motor starter is available as a direct-on-line and reversing starter.</p>	 Two 3D renderings of Siemens motor starters. Both are dark grey with a yellow vertical safety panel on the right side. The left one is labeled "RS 0.3 A HF" and the right one is labeled "F-RS 0.3-1 A HF". They both feature a black handle switch and various connection terminals at the bottom.

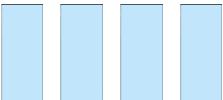
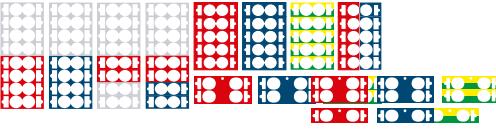
Basic component	Function	Figure
Vale terminal AirLINE SP type 8647 (Bürkert GmbH & Co. KG) ^{1) 2)}	<p>Basic component: Valve terminal AirLINE SP type 8647 (Bürkert). For more information on the AirLINE SP, type 8647 (e.g. data sheet and operating instructions), please contact Bürkert (https://www.burkert.co.uk/en/type/8647) directly.</p> <p>Function: Valve terminals are common in industrial automation and are used as pilot valves for controlling pneumatic actuators, for example in areas of the food, pharmaceutical and water treatment industries. The ET 200SP in combination with the AirLINE SP, type 8647 from Bürkert provides a universal interface between process and plant control that enables the flexible, modular configuration of pilot valves and I/O modules. The valve terminal can also be fitted to the base of the control cabinet with the help of the AirLINE Quick Adapter. This further reduces the space required in the control cabinet and considerably simplifies installation of the pneumatic system.^{1) 2)}</p>	
BU cover	<p>Insert the BU cover on the BaseUnits:</p> <ul style="list-style-type: none"> Whose slots are not equipped with I/O modules/ motor starters//PotDis-TerminalBlocks Whose slots have been reserved for future expansion (as empty slots). <p>You can keep a reference identification label for the planned I/O module inside the BU cover.</p> <p>There are three versions:</p> <ul style="list-style-type: none"> For BaseUnits with a width of 15 mm ① For BaseUnits/Ex BaseUnits with a width of 20 mm ② For BaseUnits of motor starters with a width of 30 mm ③ 	
Server module	<p>The server module completes the configuration of the ET 200SP. The server module includes holders for 3 spare fuses (5 × 20 mm).</p> <p>The server module ships with the CPU/interface module and is available as spare part.</p>	

Basic component	Function	Figure
Coding element	<p>The coding element codes the I/O module with the BaseUnit.</p> <p>There are two versions:</p> <ul style="list-style-type: none"> Mechanical coding element ①: Ensures the coding Electronic coding element ②: This version also has an electronic, rewritable memory for module-specific configuration data (such as the F-destination address for fail-safe modules, parameter data for the IO link master). 	

- 1) Note: The description contains non-binding information on supplementary products that are manufactured and marketed not by Siemens but by third-parties outside the Siemens group ("third-party firms"). These third parties organize the manufacture, sale and delivery of their products independently and their terms and conditions apply.
- 2) Disclaimer/Use of hyperlinks: Siemens has put together this description with great care. However, Siemens is unable to check whether the data provided by third-party firms is complete, accurate and up to date. Certain items of information may therefore potentially be incorrect, incomplete or no longer up to date. Siemens shall not accept any liability should this be the case, nor shall it accept liability for the usability of the data or of the product for the user unless it has a statutory obligation to do so.

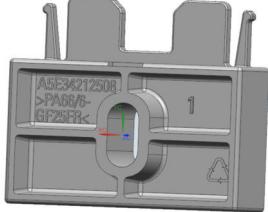
Accessories of the ET 200SP distributed I/O system

Table 5-3 Accessories of the ET 200SP

Accessories	Function	Figure
24 V DC connector	<p>Application of the 24 V DC supply to the connector, and connection, e.g. to the CPU/interface module/Ex power module.</p> <p>The 24 V DC connector is available as a spare part.</p>	
Shield connection	The shield connection allows the low-impedance contacting of cable shields with minimum installation times.	
Labeling strips	<p>Attach the labeling strips to the modules for system-specific labeling of the ET 200SP distributed I/O system. The labeling strips can be printed.</p> <p>The labeling strips can be ordered as accessories (Page 339) on a roll for thermal transfer printers or as DIN A4 format sheets for laser printers.</p>	
Reference identification labels	<p>The labels enable the reference identification labeling of the ET 200SP components.</p> <p>The labels can be ordered on a mat for thermal transfer and inkjet printers as accessories (Page 339).</p>	
Color identification labels	The color identification labels are module-specific and can be ordered for the process terminals, AUX terminals and additional terminals as accessories (Page 339).	

Accessories of the SIMATIC ET 200SP motor starters

Table 5-4 SIMATIC ET 200SP motor starter accessories

Accessories	Function	Figure
3DI/LC module	<p>The optional 3DI/LC module has three digital inputs and one LC input. For reasons of operational safety, input LC is permanently set to manual local mode. By parameterizing the inputs DI1 - DI3 with motor CLOCKWISE or motor COUNTER-CLOCKWISE, you can control the motor in manual local mode.</p> <p>The functions of the 3DI/LC module are not relevant to functional safety.</p> <p>Detailed information on the functions when using a 3DI/LC module can be found in the Manual (https://support.industry.siemens.com/cs/ww/en/view/109479973).</p>	
Mechanical bracket for BaseUnit	Use the mechanical bracket for additional fixing of the motor starter. You can use the mechanical bracket on 7.5 mm and 15 mm mounting rails.	
Infeed bus cover	For finger-safe termination of the infeed bus, use the cover.	
Fan	You can use the motor starter at higher ambient temperatures if a fan is installed.	

6

Application planning

Overview

The BaseUnits (BU) are classified according to different types. Every BaseUnit type is distinguished by characteristics that match certain I/O modules and motor starters (see the following table and graphics).

You recognize the BU type for an I/O module by the last two digits of an I/O module's article number.

The BU type onto which you can plug the respective I/O module is printed on the I/O modules. You can therefore read which BU type you need straight from the I/O module (see Factory labels [\(Page 171\)](#) (page 122)).

Example: On the output module DQ 16x24VDC/0.5A ST with article number

6ES7132-6BH01-0BA0 the information "BU: A0" is printed. This means you can plug this I/O module into a BaseUnit of BU type "A0", which means any BaseUnit whose article number ends in "A0". I/O modules that are suitable for two BU types are labeled accordingly, for example "BU: A0, A1".

NOTE

You will find a complete module overview of the ET 200SP distributed I/O system and an overview of possibilities of combining BaseUnits and I/O modules /motor starters in the Product information for documentation of the ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/de/de/view/73021864/en>).

NOTE

Use of Ex modules

If you are using Ex I/O modules for the connection of intrinsically safe devices from Zone 0 or Zone 1 in the ET 200SP configuration, observe the information for plant planning in the System Manual ET 200SP HA Distributed I/O system / ET 200SP Modules for devices used in an explosion hazardous environment

(<https://support.industry.siemens.com/cs/ww/de/view/109795533/en>).

Table 6-1 Selecting a suitable BaseUnit for interface modules

Select BaseUnit	Interface module (example)	Examples of suitable interface modules for BU types	
		Interface module (example)	BaseUnit
BU type M0	Interface module <ul style="list-style-type: none">• 6ES7...M0• 24 V DC• 100 mm wide	IM 155-6 PN R1 (6ES7155-6AU00-0H M0)	BU (6ES7193-6BR00-0H M0)

Table 6-2 Selecting a suitable BaseUnit for I/O modules

Select BaseUnit	I/O module (example)	Examples of suitable I/O modules for BU types	
		I/O module (example)	BaseUnit
BU type A0 See Digital, fail-safe, communication, technology or analog modules without temperature measurement (Page 84)	Digital, fail-safe, technology or communication module <ul style="list-style-type: none">• 6ES7...A0• 24 V DC• 15 mm wide	DI 16x24VDC ST (6ES7131-6BH00-0BA0)	BU15-P16+A0+2D (6ES7193-6BP00-0DA0)
BU type A1 See Analog modules with temperature measurement (Page 85)	Analog module with temperature measurement* <ul style="list-style-type: none">• 6ES7...A1• 24 V DC• 15 mm wide	AI 4xRTD/TC 2-/3-/4-wire HF (6ES7134-6JD00-0CA1)	BU15-P16+A0+2D/T (6ES7193-6BP00-0DA1)
	Analog module without temperature measurement** <ul style="list-style-type: none">• 6ES7...A1• 24 V DC• 15 mm wide	AI 4xU/I 2-wire ST (6ES7134-6HD00-0BA1)	
BU type B0 (BU..B, dark-colored BaseUnit)	Digital output module with relay <ul style="list-style-type: none">• 6ES7...B0• Up to 230 V AC• 20 mm wide	RQ 4x120VDC-230VAC/5A NO ST (6ES7132-6HD00-0BB0)	BU20-P12+A4+OB (6ES7193-6BP20-0BB0)
BU type B1 (BU..B, dark-colored BaseUnit)	Digital modules <ul style="list-style-type: none">• 6ES7...B1• Up to 230 V AC• 20 mm wide	DI 4x120..230VAC ST (6ES7131-6FD00-0BB1)	BU20-P12+A0+4B (6ES7193-6BP20-0BB1)
BU type C0 (BU..D, light-colored BaseUnit)	Fail-safe power module <ul style="list-style-type: none">• 6ES7...C0• 24 V DC• 20 mm wide CM AS-i Master ST/FCM AS-i Safety ST <ul style="list-style-type: none">• 6ES7...C1• Up to 30 V DC• 20 mm wide	CM AS-i Master ST (3RK7137-6SA00-0BC1)	BU20-P6+A2+4D (6ES7193-6BP20-0DC0)

* For compensation of the reference junction temperature for thermocouples. BU type A1 is required if you measure the reference junction temperature with an internal temperature sensor or if you need the additional 2x5 terminals.

If you use the internal reference junction temperature with BU type A1, ensure an even temperature distribution at the terminals. The specified accuracy of the utilized analog module is then adhered to. If necessary, you can increase the accuracy via user calibration.

** Analog modules **with** and **without** temperature measurement can also be plugged into BU type A0.

Select BaseUnit	I/O module (example)	Examples of suitable I/O modules for BU types	
		I/O module (example)	BaseUnit
BU type C1 (BU..B, dark-colored BaseUnit)	F-CM AS-i Safety ST <ul style="list-style-type: none">• 6ES7...C1• Up to 30 V DC• 20 mm wide	F-CM AS-i Safety ST (3RK7136-6SC00-0BC1)	BU20-P6+A2+4B (6ES7193-6BP20-0BC1)
BU type D0	AI Energy Meter <ul style="list-style-type: none">• 6ES7...D0• Up to 400 V AC/ 480 V AC• 20 mm wide	AI Energy Meter 480VAC ST (6ES7134-6PA20-0BD0)	BU20-P12+A0+0B (6ES7193-6BP00-0BD0)
BU type F0	F-RQ 1×24VDC/24..23-0VAC/5A <ul style="list-style-type: none">• 6ES7...F0• Up to 230 V AC• 20 mm wide	F-RQ 1×24VDC/24..230VA-C/5A (6ES7136-6RA00-0BF0)	BU20-P8+A4+0B (6ES7193-6BP20-0BF0)
BU type U0	DQ 4×24...230VAC/2A HF <ul style="list-style-type: none">• 6ES7...U0• Up to 400 V AC/480 V AC• 20 mm wide	DQ 4×24...230VAC/2A HF (6ES7132-6FD00-0CU0)	BU20-P16+A0+2D (6ES7193-6BP00-0BU0)

* For compensation of the reference junction temperature for thermocouples. BU type A1 is required if you measure the reference junction temperature with an internal temperature sensor or if you need the additional 2×5 terminals.

If you use the internal reference junction temperature with BU type A1, ensure an even temperature distribution at the terminals. The specified accuracy of the utilized analog module is then adhered to. If necessary, you can increase the accuracy via user calibration.

** Analog modules with and without temperature measurement can also be plugged into BU type A0.

Table 6-3 BaseUnit for motor starters

	Selecting the BaseUnit									
	BU-30--MS1	BU-30--MS2	BU-30--MS3	BU-30--MS4	BU-30--MS5	BU-30--MS6	BU-30--MS7	BU-30--MS8	BU-30--MS9	BU-30--MS10
24 V infeed	x		x							
500 V infeed	x	x			x		x	x		
(no routing of the F-DI signal possible) F-DI terminals					x	x				
F-DI infeed							x			x
F-DI routing								x	x	
Motor starters										
DS 0.1 - 0.4 A HF	3RK1308-0A-A00-0CP0	x	x	x	x	x*	x*	x*	x*	x*

* The F-DI terminals or F-DI infeed/routing have no function with this combination.

DS 0.3 - 1A HF	3RK1308-0A-B00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
DS 0.9 - 3A HF	3RK1308-0A-C00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
DS 2.8 - 9A HF	3RK1308-0A-D00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
DS 4.0 - 12A HF	3RK1308-0AE-00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 0.1 - 0.4 A HF	3RK1308-0B-A00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 0.3 - 1A HF	3RK1308-0BB-00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 0.9 - 3A HF	3RK1308-0BC-00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 2.8 - 9A HF	3RK1308-0B-D00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 4.0 - 12A HF	3RK1308-0BE-00-OCPO	x	x	x	x	x*	x*	x*	x*	x*	x*
F-DS 0.1 - 0.4 A HF	3RK1308-0C-A00-OCPO	x	x	x	x	x	x	x	x	x	x
F-DS 0.3 - 1A HF	3RK1308-0CB-00-OCPO	x	x	x	x	x	x	x	x	x	x
F-DS 0.9 - 3A HF	3RK1308-0C-C00-OCPO	x	x	x	x	x	x	x	x	x	x
F-DS 2.8 - 9A HF	3RK1308-0C-D00-OCPO	x	x	x	x	x	x	x	x	x	x
F-DS 4.0 - 12A HF	3RK1308-0CE-00-OCPO	x	x	x	x	x	x	x	x	x	x
F-RS 0.1 - 0.4 A HF	3RK1308-0D-A00-OCPO	x	x	x	x	x	x	x	x	x	x
F-RS 0.3 - 1A HF	3RK1308-0D-B00-OCPO	x	x	x	x	x	x	x	x	x	x
F-RS 0.9 - 3A HF	3RK1308-0D-C00-OCPO	x	x	x	x	x	x	x	x	x	x
F-RS 2.8 - 9A HF	3RK1308-0D-D00-OCPO	x	x	x	x	x	x	x	x	x	x
F-RS 4.0 - 12A HF	3RK1308-0D-E00-OCPO	x	x	x	x	x	x	x	x	x	x

* The F-DI terminals or F-DI infeed/routing have no function with this combination.

Additional information

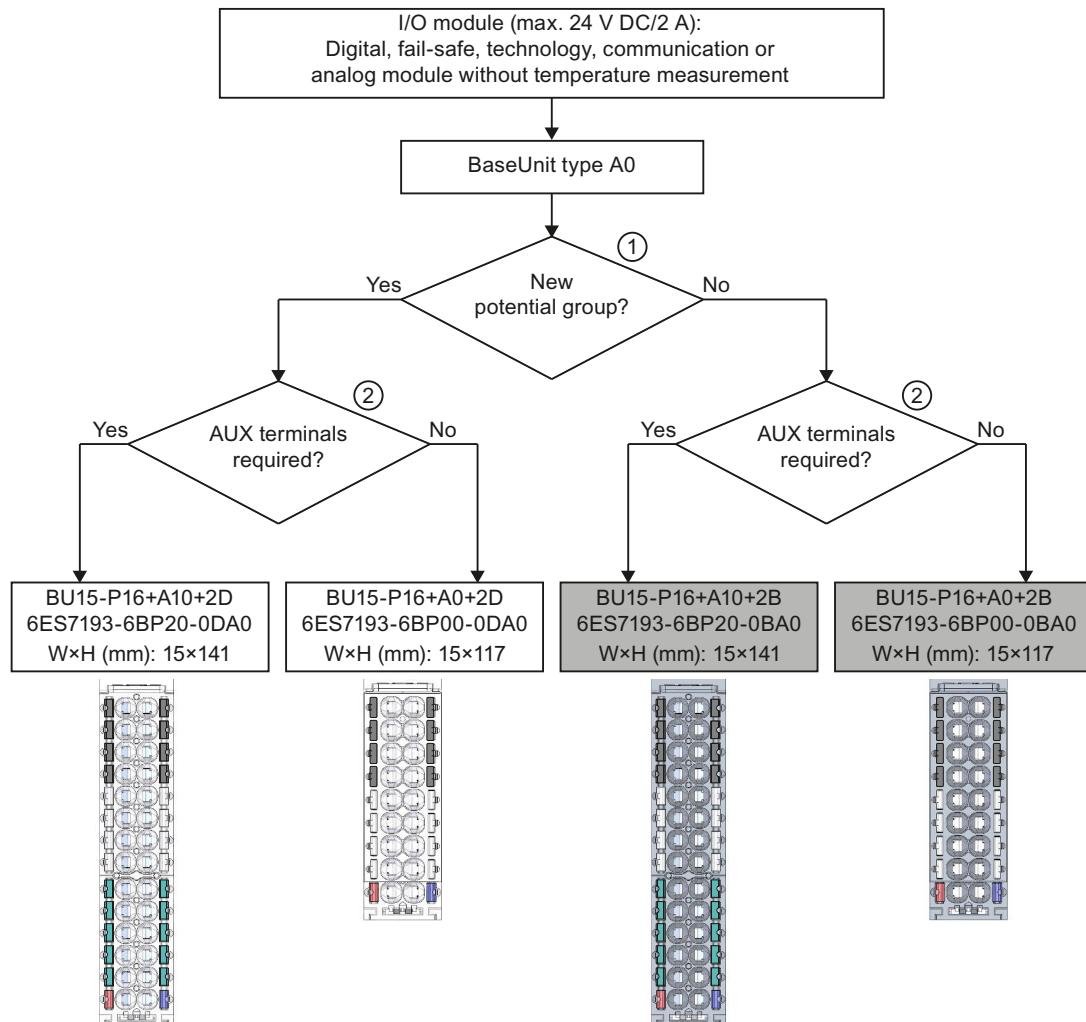
Additional information on the functional assignment of the terminals and on the associated BaseUnits can be found in one of the following manuals:

- Manual for the relevant I/O module (<https://support.industry.siemens.com/cs/ww/en/ps/14039/man>)
- Manual BaseUnits (<https://support.industry.siemens.com/cs/ww/de/view/59753521/en>)
- Motor starter (<https://support.industry.siemens.com/cs/ww/en/view/109479973>) manual

6.1 Selecting the BaseUnit for I/O modules

6.1.1 Digital, fail-safe, communication, technology or analog modules without temperature measurement

Selection of a suitable BaseUnit

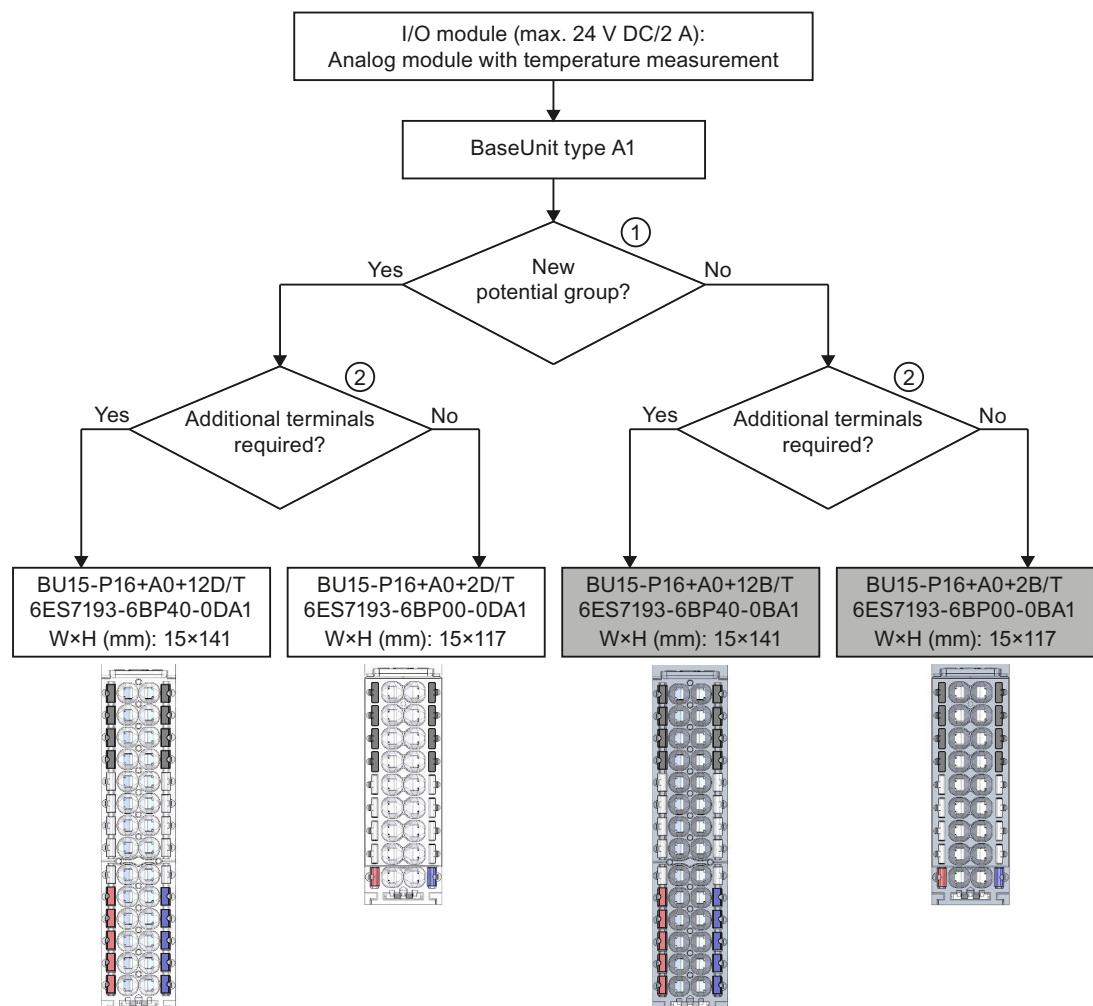


- ① Light-colored BaseUnit: Configuration of a new potential group, electrical isolation from adjacent module on the left. The first BaseUnit of the ET 200SP is usually a light-colored BaseUnit for feeding the supply voltage L+. A potential group opened with a light-colored BU type U0 must not contain any dark-colored BaseUnit of BU type A0 or A1.
Exception: If you insert, as the first I/O module, an AC I/O module, a AI Energy Meter 400VAC or a AI Energy Meter 480VAC, then the first BaseUnit in the ET 200SP configuration can be a dark-colored BaseUnit. The requirement is that you use a CPU or IM 155-6 (as of V3.0).
Dark-colored BaseUnit: Conduction of the internal power and AUX buses from the adjacent module on the left.
- ② AUX terminal: 10 internally bridged terminals for individual use up to 24 V DC/10 A or as protective conductors.
Example: Multiple cable connection for DI 8x24VDC ST

Figure 6-1 Digital, fail-safe, communication, technology or analog modules without temperature measurement

6.1.2 Analog modules with temperature measurement

Selection of a suitable BaseUnit



- ① Light-colored BaseUnit: Configuration of a new potential group, electrical isolation from adjacent module on the left. The first BaseUnit of the ET 200SP is usually a light -colored BaseUnit for feeding the supply voltage L+.
Dark-coloredBaseUnit: Continuation of the internal power and AUX buses from the adjacent module on the left.
- ② Additional terminals: 2×5 internally bridged terminals for individual use up to 24 V DC/2 A
Example: Sensor supply for AI 4×U/I 2-wire ST

Figure 6-2 Analog modules with temperature measurement

6.2 Selecting motor starters with a suitable BaseUnit

6.2.1 Selecting a BaseUnit for motor starters

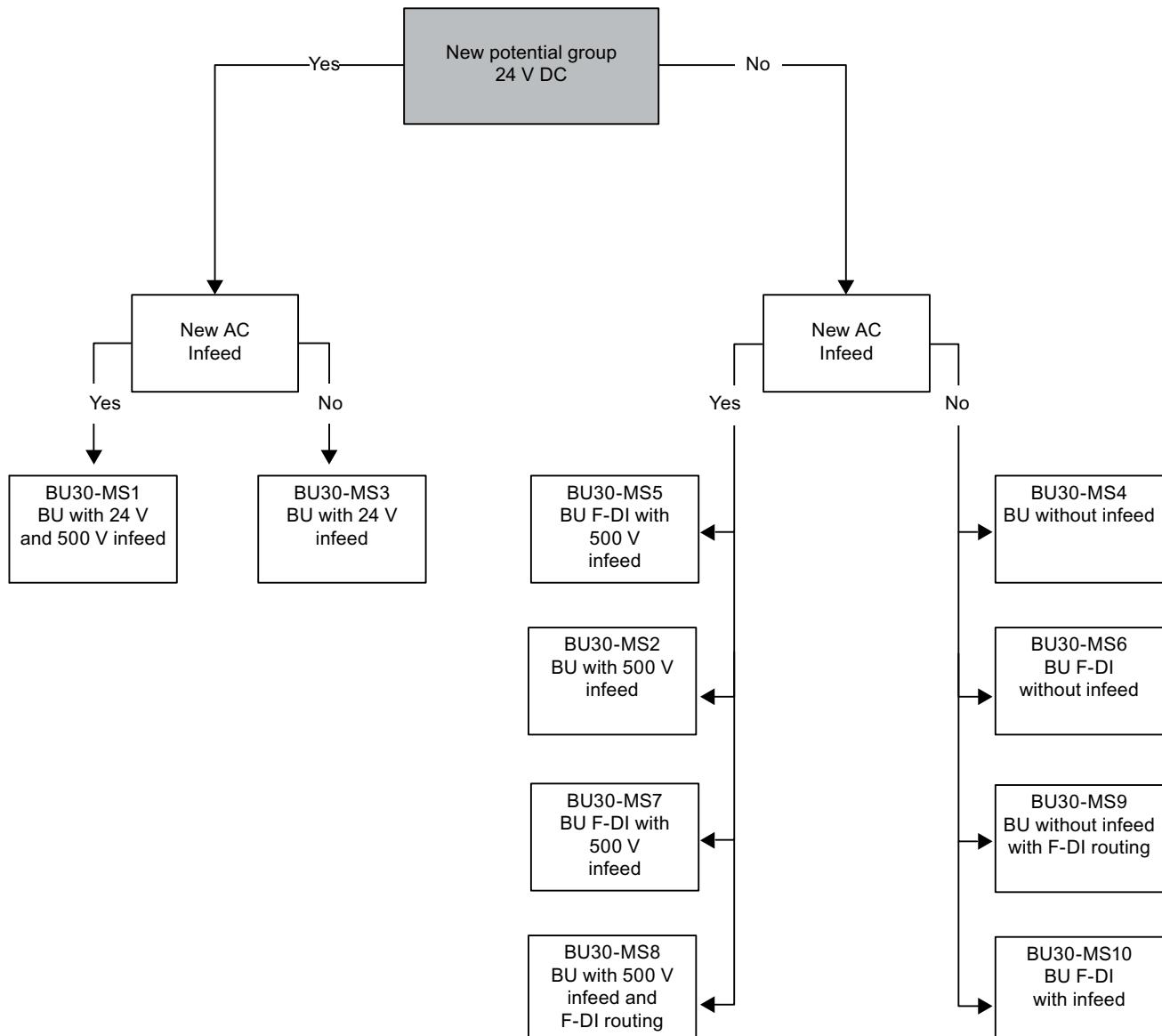
The motor starter BaseUnits "BU30-MS1", "BU30-MS2", "BU30-MS3" and "BU30-MS4" are compatible with all non-fail-safe motor starters. The motor starter BaseUnits "BU30-MS1", "BU30-MS2", "BU30-MS3", "BU30-MS4", "BU30-MS5", "BU30-MS6", "BU30-MS7", "BU30-MS8", "BU30-MS9" and "BU30-MS10" are compatible with all fail-safe motor starters. You will find an overview of available BaseUnits for motor starters here [\(Page 80\)](#). With the different BaseUnits, you can form different potential groups for the 24 V DC electronics supply (L+/M) and for the AC infeed.

Voltage range

The voltage range of the AC infeed is between 48 V AC and 500 V AC.

Selection criteria for the BaseUnit

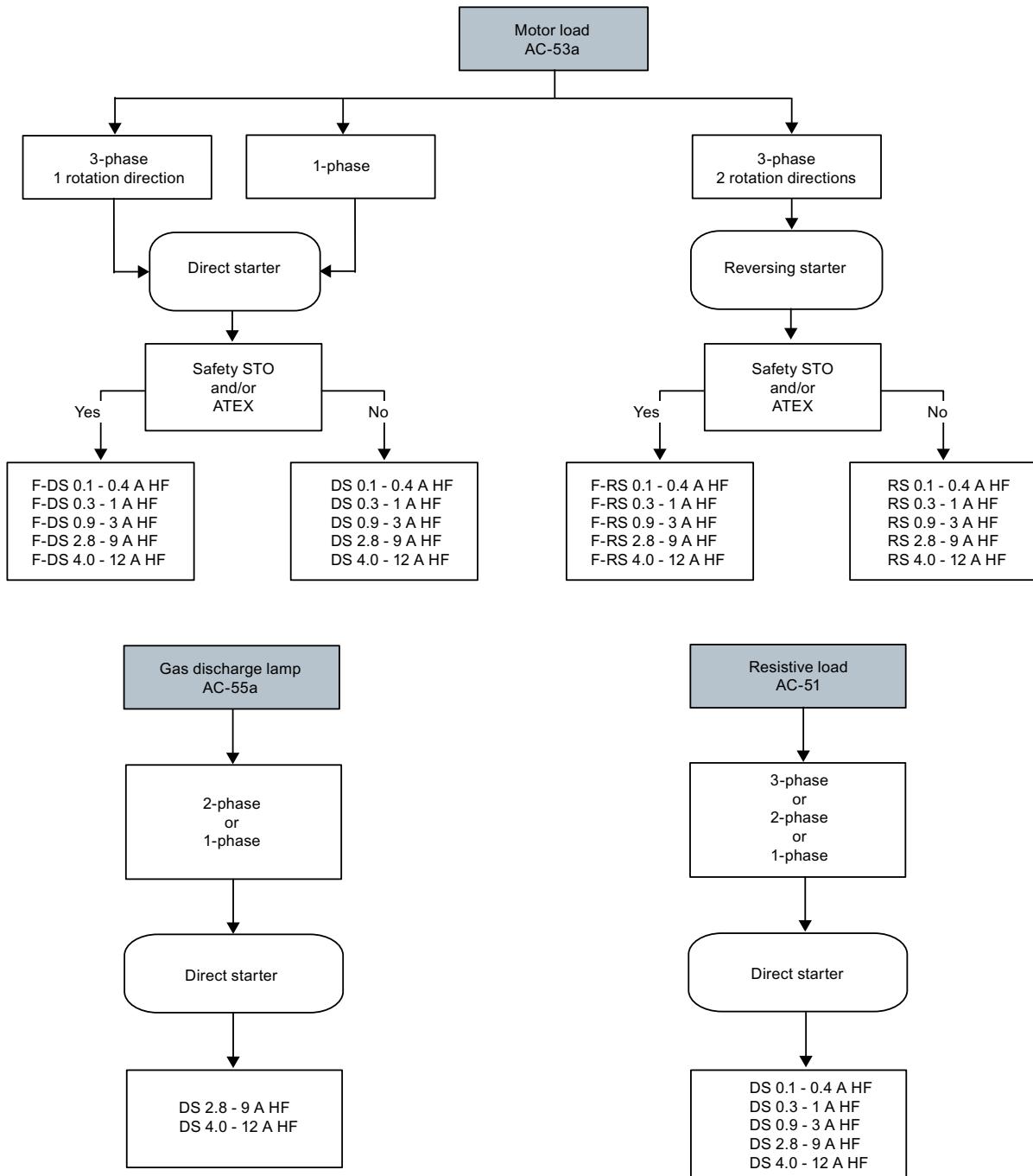
The figure below shows the criteria you use to select the appropriate BaseUnit:



Form separate potential groups on the infeed bus for single-phase (L, N, PE) and three-phase (L1, L2, L3, PE) operation.

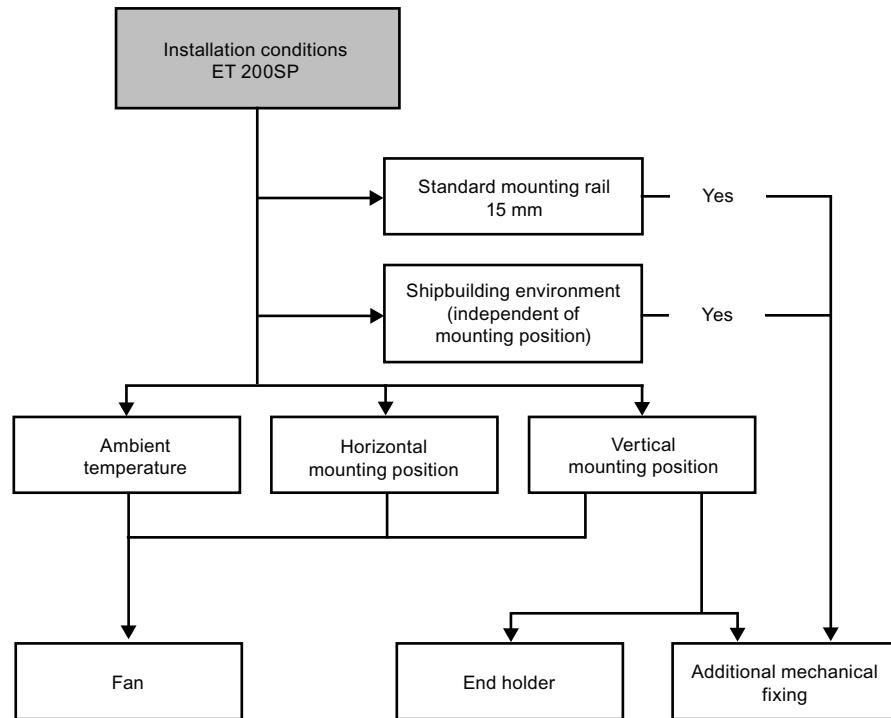
6.2.2 Selecting the motor starter

You select the suitable motor starter using the load type according to the following scheme:



6.2.3 Selecting accessories for motor starters

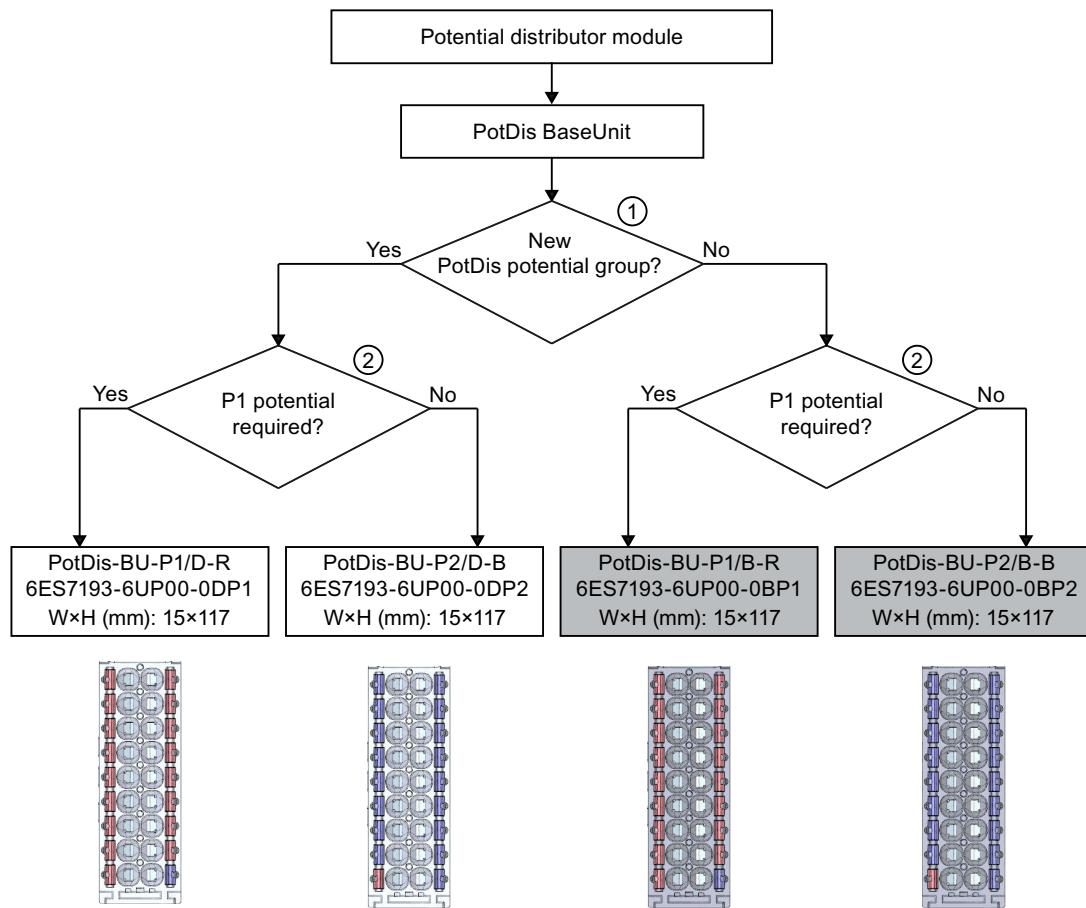
Observe the installation conditions of the station with ET 200SP motor starters. The figure below shows the criteria the station must meet:



6.3 Selecting potential distributor modules

6.3.1 Selecting a PotDis-BaseUnit

Selection of a suitable PotDis-BaseUnit potential distributor module



- ① Light-colored PotDis-BaseUnit: Configuration of a new potential group, electrical isolation from adjacent module on the left. The first BaseUnit of the ET 200SP is usually a light-colored BaseUnit for the incoming supply voltage.
- ② P1 terminal: 16 internally bridged terminals for individual use up to 48 V DC/10 A
Example: Multiple cable connection for DI 16×24VDC ST

Figure 6-3 PotDis-BaseUnits

Please note:

- The potential groups opened with a light-colored PotDis-BU must not contain any I/O modules. You can integrate any dark-colored PotDis-BUs into I/O module potential groups provided they are based on an SELV/PELV supply.
- If you do not need the additional terminals of the PotDis-TB in a potential distributor module, replace the PotDis-TB with a BU cover. You may only connect one potential group within a combination of PotDis-BU and PotDis-TB.

- Only SELV/PELV potentials are permitted on PotDis-BUs. Separate different SELV/PELV potential groups using light-colored PotDis-BUs.
- With potential distributor modules, you may only connect to the PotDis-TB versions BR-W and n.c.-G potential, which exceed the voltage level of SELV/PELV.
- PotDis terminals are not directly configurable as PotDis via GSD/GSDML. When configuring with GSD, always use an dummy module; with GSDML, integrate a free space.

Additional information

Additional information on the potential distributor modules (PotDis-BaseUnits and PotDis-TerminalBlocks) is available in the BaseUnits (<https://support.industry.siemens.com/cs/ww/de/view/59753521/en>) manual.

6.3.2 Selecting a PotDis-TerminalBlock

Selection of a suitable PotDis-TerminalBlock

With a PotDis-TerminalBlock you are expanding a PotDis-BaseUnit potential distributor module by an additional 18 potential terminals.

You can freely combine PotDis-TerminalBlocks and PotDis-BaseUnits.

The following PotDis-TerminalBlocks are available:

Table 6-4 Selection of TerminalBlock PotDis-TB

PotDis-TerminalBlocks		
TerminalBlock	Explanation	Application
PotDis-TB-P1-R	Terminal block with 18 terminals with red spring releases with connection to the supply voltage P1 of the PotDis-BaseUnit with SELV/PELV.	Provision of 18 x P1 potential, e.g. for P1 sensor supply with 3-wire connection for 16-channel digital input modules
PotDis-TB-P2-B	Terminal block with 18 terminals with blue spring releases with connection to ground (P2) of the PotDis-BaseUnit	Provision of 18 x P2 potential, e.g. for ground of the sensor supply with 2-wire connection for 16-channel digital output modules
PotDis-TB-n.c.-G	Terminal block with 18 terminals with gray spring releases without connection to each other or to a voltage bus of the PotDis-BaseUnit	Provision of 18 x n.c. (not connected), for reserving ("parking") unused signals/lines, e.g. for antivalent sensors in the same potential group
PotDis-TB-BR-W	Terminal block with 18 terminals connected to each other with white spring releases without connection to a voltage bus of the PotDis-BaseUnit	Provision of 17 terminals with shared potential (the 18th terminal is used for infeed) for supply of external consumers

Additional information

Additional information on the potential distributor modules (PotDis-BaseUnits and PotDis-TerminalBlocks) is available in the BaseUnits (<https://support.industry.siemens.com/cs/ww/de/view/59753521/en>) manual.

6.4 Hardware configuration

Maximum mechanical configuration

As soon as **one** of the following rules applies, the maximum configuration of the ET 200SP has been reached:

Table 6-5 Maximum mechanical configuration

Properties	Rule
Number of modules	Maximum of 12/30/32/64 I/O modules (depending on the CPU used/the interface module used; see CPU (https://support.automation.siemens.com/WW/view/en/90466439/133300) and interface module (https://support.automation.siemens.com/WW/view/en/55683316/133300) manuals)
	For every 6 F-modules F-RQ 1x24VDC/24..230VAC/5A (6ES7136-6RA00-0BF0), the maximum configuration is reduced by 1 module.
Number of motor starters	Maximum of 31 motor starters
Backplane bus length of the ET 200SP	maximum 1 m mounting width (without CPU/interface module, including server module)

Electrical maximum configuration for I/O modules

The number of operable I/O modules of a potential group is limited by the following factors:

- Power consumption of the I/O modules
- Power consumption of the components supplied via these I/O modules

The maximum current carrying capacity of the terminals on the BaseUnit L+/M is 10 A.

Current carrying capacity refers to the current load via the power bus and the infeed bus of the ET 200SP station. Consider the current carrying capacity when using a motor starter.

Maximum electrical configuration for motor starter power bus (24 V DC)

To determine the current requirement of an individual motor starter via the power bus, take account of the following parameters:

- Current consumption via DC infeed in the ON state
- Current consumption via DC infeed when switching on (40 ms peak load)
- Increased power consumption through fan operation
- Current requirement via encoder supply of the connected DI module

The maximum current carrying capacity of the 24 V potential group is 7 A across the entire permissible temperature range.

Maximum electrical configuration for motor starter infeed bus (500 V AC)

To determine the current requirement of an individual motor starter via the infeed bus, proceed as follows:

Calculate the current requirement via the main current paths of the individual motor starter. In doing so, take into account the parameter I_e (set rated operational current of the motor starter). The permissible overload characteristics of the motor feeder for motors are determined with the thermal motor model. You calculate the current value ($I_{\text{infeed bus}}$) for the infeed bus of the ET 200SP system according to the following formula:

$$I_{\text{infeed bus}} = \sum_n (I_e * 1.125)$$

n = number of motor starters of a potential group on the infeed bus

Refer to the Manual (<https://support.industry.siemens.com/cs/ww/en/view/109479973>) for details of how to assign the basic rated operational current I_e parameter.

The following values apply for the potential group of the AC infeed:

- The maximum current carrying capacity is 32 A at an ambient temperature of up to 50 °C.
- The maximum current carrying capacity is 27 A at an ambient temperature of up to 60 °C.
- The maximum current carrying capacity for applications according to UL requirements is 24 A at an ambient temperature of up to 60 °C.

Address space

The address space depends on the CPU/interface module (see CPU

(<https://support.automation.siemens.com/WW/view/en/90466439/133300>) Manual) and the interface module used (see Interface module

(<https://support.automation.siemens.com/WW/view/en/55683316/133300>) Manual):

- For PROFINET IO: Dependent on the IO controller/IO device used
- For PROFIBUS DP: Dependent on the DP master used

6.5 Forming potential groups

6.5.1 Basics

Introduction

Potential groups for the ET 200SP distributed I/O system are formed by systematically arranging the BaseUnits.

Requirements

For formation of potential groups, the ET 200SP distinguishes between the following BaseUnits:

- BaseUnits BU...D (recognizable by the light-colored terminal box and the light-colored mounting rail release button):
 - Opening of a new potential group (power busbar and AUX bus are interrupted to the left)
 - Feeding in the supply voltages (DC or AC) up to an infeed current of 10 A, depending on the BaseUnit used.
- BaseUnits BU...B (recognizable by the dark-colored terminal box and the dark-colored mounting rail release button):
 - Conduction of the potential group (power busbar and AUX bus continued)
 - Tapping the supply voltages (DC or AC) for external components or looping through with a maximum total current of 10 A, depending on the BaseUnit used.
- BaseUnits BU30-MSx (BaseUnit for the motor starter only)
Depending on the version, the BaseUnits in the "BU30-MSx" model series possess the following properties:
 - Opening a new potential group or continuing an existing one
 - Feeding in the supply voltage L+ up to an infeed current of 7 A DC
 - Opening a new load group or continuing an existing one by means of 500 V AC infeed bus
 - Feeding in the line voltage up to an infeed current of 32 A AC
 - Feeding in and routing the F-DI signal

NOTE

The BaseUnits BU...B of type B1 and D0 loop through the voltage buses P1/P2 and the AUX bus. The buses are not tapped by the module.

Placement and grouping of I/O modules

Each BaseUnit BU...D that you install in the ET 200SP configuration opens a new potential group and supplies all subsequent I/O modules (on BaseUnits BU...B) with the necessary supply voltage. The first 24 V DC I/O module to the right of the CPU/interface module must be installed on a light-colored BaseUnit BU...D. Exception: If you insert an AC I/O module or an AI Energy Meter as the first I/O module, the first BaseUnit in the ET 200SP configuration can be a dark-colored BaseUnit. The requirement is that you use a CPU or IM 155-6 (as of V3.0). If you want to place another BaseUnit BU...B after a BaseUnit BU...D, disconnect the power and AUX buses and open a new potential group at the same time. This allows individual grouping of the supply voltages.

NOTE

All BaseUnits placed in a load group must match the infeed potential of the corresponding light-colored BaseUnits.

Do not connect any BaseUnit of the "BU...B" type on the right of a motor starter's BaseUnit (BU30-MSxx).

Placing and connecting potential distributor modules

Potential distributor modules provide potential distributors integrated into the system that you can use to configure a rapid, space-saving customized replacement for standard potential distribution systems.

You can place potential distributor modules at any location within the ET 200SP distributed I/O system. To do so, you must observe the same design rules as for placing and connecting I/O modules. Potential distributor modules are only suitable for SELV/PELV.

A potential distributor module consists of a potential distributor BaseUnit (PotDis-BU) and (if necessary) a potential distributor TerminalBlock (PotDis-TB) plugged onto it. If you do not need the additional terminals of the PotDis-TB, install a BU cover (15 mm) on the PotDis-BaseUnit.

You must not place a BaseUnit for I/O modules in a PotDis potential group formed with a light-colored PotDis-BaseUnit.

NOTE

Identical voltages with potential distributor modules

You can only connect identical (supplied) SELV/PELV voltages to the terminals of a potential distributor module or PotDis potential group. Example: You only connect 24 V DC.

Placement and grouping of I/O modules and motor starters

For the potential group (L+/M), the following slot rules apply within the motor starter modules and other I/O modules of the ET 200SP:

- An unassembled BaseUnit (BaseUnit with BU cover) must be inserted between the CPU, an interface module or an I/O module and the motor starter. This is not necessary between the motor starters.
- The empty slot can take on the potential (24 V DC) of the potential group on the left of it (L+, M), i.e. I/O modules and motor starters can be operated in the same potential group.
- If you would like to insert an I/O module on the right of a motor starter, then use only one BaseUnit of the BU...D Typ A0 type (light terminal box).
- The BaseUnits BU30-MS2, BU30-MS4, BU30-MS5, BU30-MS6, BU30-MS7, BU30-MS8, BU30-MS9 and BU30-MS10 can continue the potential group of other BaseUnit types. However, note the following exceptions:
 - Only a BaseUnit of type BU30-MS1 or BU30-MS3 may follow an AS-i module (AS-i potential group).
 - Only BaseUnits with fail-safe motor starters can be connected together in the same potential group of an F-PM-E.



WARNING

Hazardous Voltage

Can Cause Death, Serious Injury, or Property Damage.

Hazardous electrical voltage can cause electric shock, burns and property damage.

Disconnect your system and devices from the power supply before starting any assembly tasks.

AUX bus (AUX(iliary) bus)

BaseUnits with additional AUX terminals (e.g. BU15-P16+A10+2D) enable the additional connection of a potential (up to the maximum supply voltage of the module), which is applied via the AUX bus.

In the case of light-colored BaseUnits, the AUX bus is interrupted to the left. In the case of BaseUnits BU30-MS1 to BU30-MS7 and BU30-MS10, the AUX bus is interrupted to the left. The AUX bus of BU30-MS8 and BU30-MS9 is used for F-DI routing.

The AUX bus can be used individually:

- As a PE bar, in which case you may plug a maximum of 8 BaseUnits in the corresponding potential group
- For additionally required voltage

NOTICE

AUX bus as PE bar

If you use an AUX bus as a protective conductor bar, attach the yellow-green color identification labels to the AUX terminals, and establish a functional connection to the central protective conductor connection.

If you stop using the AUX bus as a protective conductor bar, make sure you remove the yellow-green color identification labels and remove the connection to the central protective conductor connection again.

If you use the AUX bus as a protective conductor bar, the corresponding protective conductor tests must be conducted by the installer of the system before commissioning. In addition, both ends of the ET 200SP system assembly must be mechanically fixed to the mounting rail in this case (e.g. using 8WA1010-1PH01 ground terminals); this connection can only be detached by using a tool.

The AUX bus is designed as follows:

- Maximum current carrying capacity (at 60 °C ambient air temperature): 10 A
- Permissible voltage: Depending on the BaseUnit type (see BaseUnit manual (<https://support.automation.siemens.com/WW/view/en/59753521>))

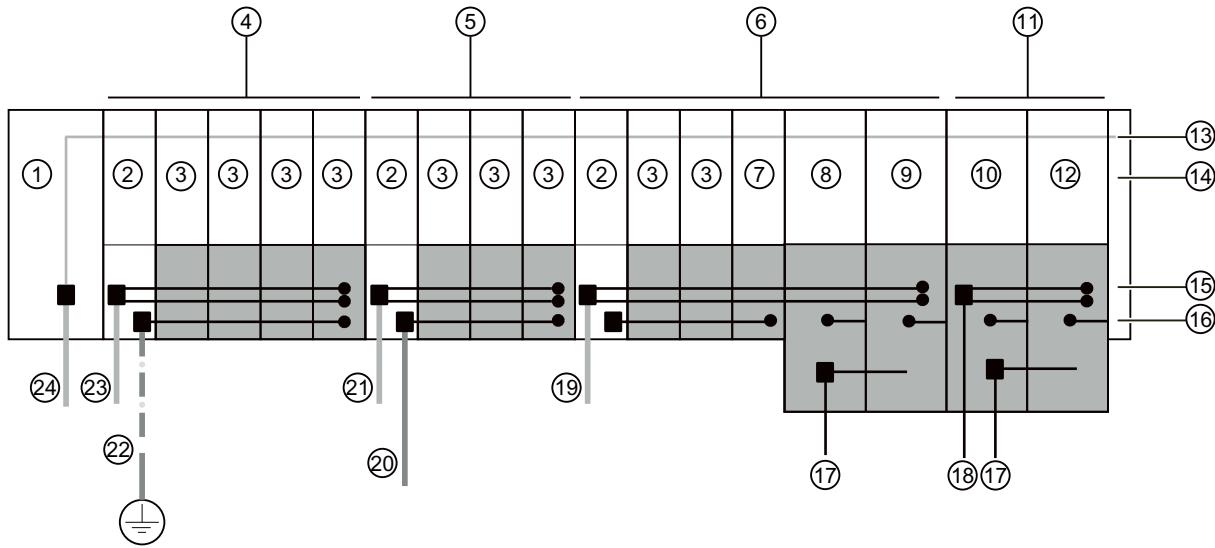
NOTE

The AUX potential must always be identical to the potential group of the supply voltage if it is not being used as PE.

Self-assembling voltage buses

You must feed in the supply voltage L+ via the BaseUnit BU...D, BU30-MS1 or BU30-MS3.

Each BaseUnit BU...B allows access to the supply voltage L+ via terminals (red/blue). The motor starter BaseUnits "BU30-MS1", "BU30-MS2", "BU30-MS3", "BU30-MS4", "BU30-MS5", "BU30-MS6", "BU30-MS7", "BU30-MS8", "BU30-MS9" and "BU30-MS10" do not have this access.

Operating principle

1	CPU/interface module	14	Server module
2	BaseUnit BU...D	15	Self-assembling voltage buses P1/P2
3	BaseUnit BU...B	16	AUX bus
4	Potential group 1	17	Infeed bus 500 V AC (L1, L2(N), L3, PE)
5	Potential group 2	18	Supply voltage L+
6	Potential group 3	19	Supply voltage L+ (3)
7	BaseUnit BU...B with dummy module	20	Additionally required voltage
8	BaseUnit BU30-MS2	21	Supply voltage L+ (2)
9	BaseUnit BU30-MS4	22	Protective conductor (green/yellow)
10	BaseUnit BU30-MS1	23	Supply voltage L+ (1)
11	Potential group 4	24	Supply voltage 1L+
12	BaseUnit BU30-MS4		
13	Backplane bus		

Figure 6-4 Placing the BaseUnits

Connecting different potentials to the power or AUX bus**NOTE**

If you apply different potentials to the power or AUX bus within an ET 200SP station, you need to separate the potential groups with a BaseUnit BU...D.

6.5.2 Forming potential groups with BaseUnit type B1

Introduction

The AC I/O modules of the ET 200SP are required to connect sensors/actuators with alternating voltage 24 to 230 V AC.

Requirements

BaseUnits BU20-P12+A0+4B (BU type B1) and

- DI 4x120..230VAC ST digital input module
- DQ 4x24..230VAC/2A ST digital output module

Operating principle

Connect the needed module-dependent alternating voltage for the AC I/O modules directly to the BaseUnits BU20-P12+A0+4B (terminals 1L, 2L/1N, 2N). Insert the AC I/O modules on the BaseUnits.

NOTE

Placing the BaseUnits for AC I/O modules

If you insert an AC I/O module as the first I/O module, then a BaseUnit BU20-P12+A0+4B can also be the first BaseUnit to the right of the CPU/interface module in the ET 200SP configuration.

The requirement is that you use a CPU as of V3.0 or IM 155-6 (as of V3.0).

- The BaseUnits BU20-P12+A0+4B do not monitor the connected alternating voltage. Please note the information on limiting the overvoltage and power rating in the AC I/O module manuals.
 - Pay attention to the type of the BaseUnits during configuration.
-

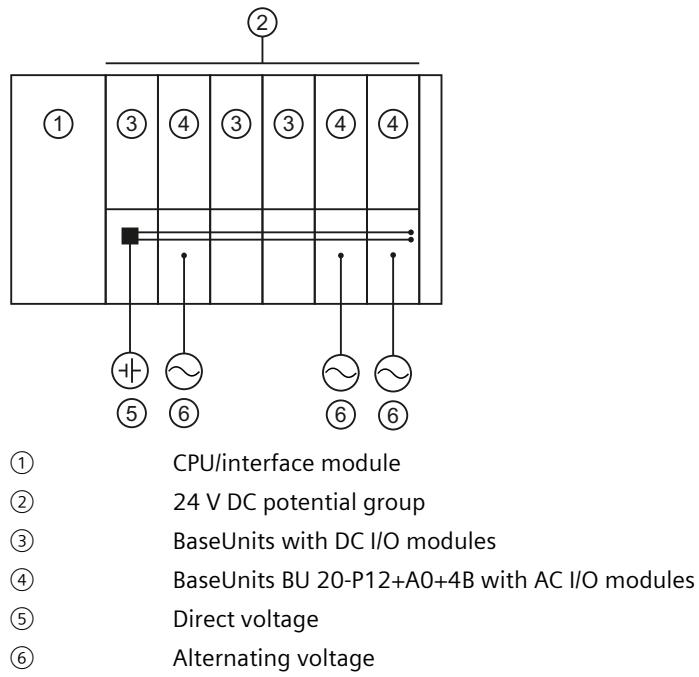


Figure 6-5 Placing the BaseUnits for the AC I/O modules

6.5.3 Forming potential groups with fail-safe modules

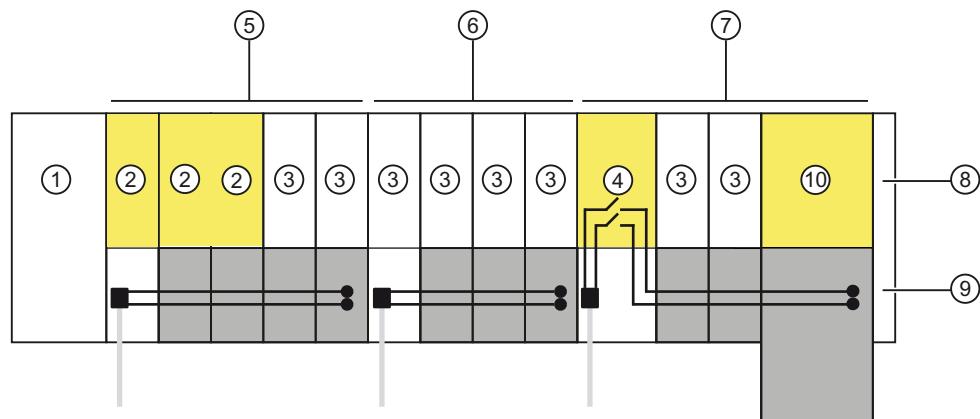
Introduction

ET 200SP distributed I/O systems can be configured using fail-safe and non-fail-safe modules. This chapter provides an example of a mixed configuration comprising fail-safe and non-fail-safe modules.

Example of an ET 200SP configuration with fail-safe and non-fail-safe modules

In principle, it is not necessary to operate fail-safe and non-fail-safe modules in separate potential groups. You can divide the modules into fail-safe and non-fail-safe potential groups and install them.

The figure below shows an example of a configuration with fail-safe and non-fail-safe modules within a single ET 200SP distributed I/O system.



- ① IM 155-6 PN HF interface module
- ② F-module
- ③ Non-fail-safe module
- ④ Power module F-PM-E 24VDC/8A PPM ST
- ⑤ Mixed fail-safe and non-fail-safe potential group with BaseUnits BU15..D and BU15..B.
You achieve SIL3/Cat. 4/PLd for the fail-safe modules. No safety category can be achieved with the non-fail-safe motor starter.
- ⑥ Non-fail-safe potential group with BaseUnits BU15..D and BU15..B
- ⑦ Fail-safe potential group with BaseUnits BU20..D, BU15..B and BU30-MSx.
Up to SIL2/Cat. 3/PLd is possible if you disconnect the self-assembling voltage bus and thus the non-failsafe modules.
- ⑧ Server module
- ⑨ Self-assembling voltage buses P1/P2
- ⑩ Fail-safe motor starter F-DS HF

Figure 6-6 ET 200SP - example of a configuration with fail-safe modules

6.5.4 Forming potential groups with Ex modules

Ex module group

When you form an Ex module group with Ex BaseUnits and Ex power module/Ex I/O modules, observe the information in the System Manual ET 200SP HA Distributed I/O system / ET 200SP Modules for devices used in an explosion hazardous environment (<https://support.industry.siemens.com/cs/ww/de/view/109795533/en>).

NOTE

Thermal decoupling required

For thermal decoupling of ET 200SP modules and Ex module groups, you must install the following in front of the first Ex power module:

- An empty slot with BU cover or
- Recommendation: Potential distributor (PotDis-TerminalBlock PotDis-TB-P1-R on a PotDis-BaseUnit PotDis-BU-P2/B-B). This allows for a distribution of the supply voltage for the downstream Ex power modules.

6.5.5 Forming potential groups with motor starters

Overview of the functions of the BaseUnits

	24 V infeed	24 V continuation from left module	24 V transmission	500 V infeed	500 V continuation from left module	500 V transmission	F-DI infeed	F-DI continuation from left module	F-DI routing
3RK1908-0AP00-OAPO	✓	--	✓	✓	--	✓	--	--	--
3RK1908-0AP00-OCPO	--	✓	✓	✓	--	✓	--	--	--
3RK1908-0AP00-OBPO	✓	--	✓	--	✓	✓	--	--	--
3RK1908-0AP00-ODPO	--	✓	✓	--	✓	✓	--	--	--
3RK1908-0AP00-OEPO	--	✓	✓	✓	--	✓	✓	--	--
3RK1908-0AP00-OFPO	--	✓	✓	--	✓	✓	✓	--	--
3RK1908-0AP00-OGPO	--	✓	✓	✓	--	✓	✓	--	✓
3RK1908-0AP00-OHPO	--	✓	✓	✓	--	✓	--	✓	✓
3RK1908-0AP00-OJPO	--	✓	✓	--	✓	✓	--	✓	✓
3RK1908-0AP00-OKPO	--	✓	✓	--	✓	✓	✓	--	✓

✓ Function available

-- Function not available

Properties of the 500 V AC infeed bus

The infeed bus has the following properties:

- The infeed bus is assembled by lining up the motor starter BaseUnits "BU30-MSx".
- The infeed bus distributes the energy to the SIMATIC ET 200SP motor starter within one load group.
- You can open load groups by plugging in a 500 V infeed BaseUnit (BU30-MS1, BU30-MS2, BU30-MS5, BU30-MS7 or BU30-MS8). With BaseUnits BU30-MS3, BU30-MS4, BU30-MS6, BU30-MS9 or BU30-MS10, you can continue the infeed bus from the left BaseUnit.
- Via the infeed bus, you have the option of supplying three-phase load groups via L1, L2 and L3 or with single-phase load groups via L and N.
- The permissible voltage range is between 48 and 500 V AC.
- The maximum current carrying capacity is up 32 A (3-phase) at 50 °C and 500 V. Pay attention to the derating values depending on the configuration.

Properties of the self-assembling voltage bus (L+)

Self-assembling voltage buses have the following properties:

- Maximum current: 7 A
- Rated voltage: 24 V

Pay attention to the derating values depending on the configuration.

The AUX1 bus is not supported in the BaseUnits of the SIMATIC ET 200SP motor starters. The AUX1 bus is used in ET 200SP motor starters for routing the F-DI signal in BU30-MS7 to BU30-MS10.

WARNING

Electric shock when operating the infeed bus without touch protection cover

There is a risk of electric shock when touching the infeed bus if you have not fitted a touch protection cover on the infeed bus on the right.

Always fit a touch protection cover on the infeed bus on the right (article number: 3RK1908-1DA00-2BPO).

WARNING

Electric shock when operating a BaseUnit without an inserted motor starter

If you fit a BaseUnit for motor starters without cover (e.g. option handling), there is a risk of an electric shock when touching the BaseUnit.

Always fit a cover on the BaseUnit (article number: 3RK1908-1CA00-0BPO).

Requirements

Use the following devices to form potential groups with motor starters:

- BaseUnits BU30-MSx
- 3RK1308-0xx00-0CP0 motor starters

Operating principle

Feed in the supply voltage L+ via the BaseUnit BU30-MS1 and BU30-MS3 at the 24V DC and M terminals.

You can operate the motor starter on a single-phase (L1, N, PE) or a three-phase (L1, L2, L3, PE) AC voltage system. You connect the required AC voltage directly to the BaseUnits BU30-MSx (terminals L1, L2(N), L3, PE). You plug the motor starter onto the BaseUnits.

NOTE

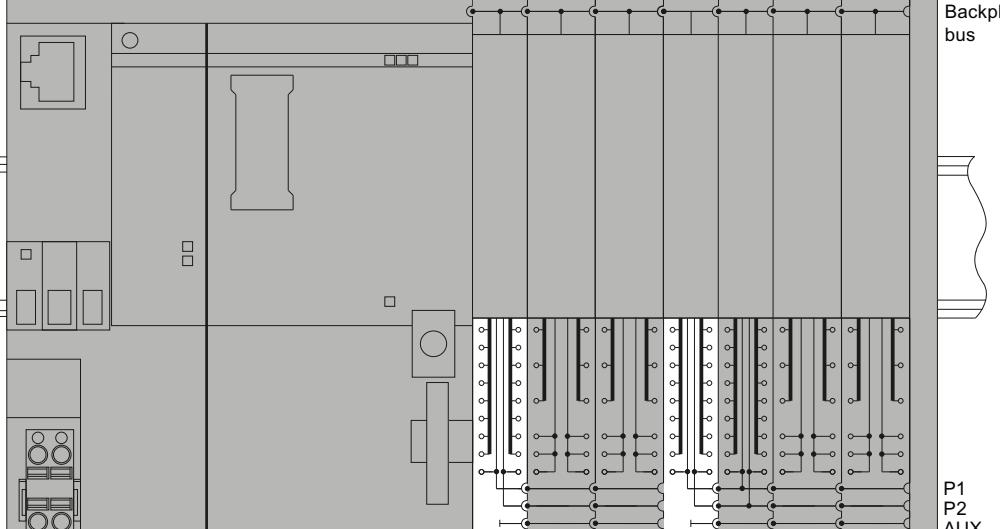
The motor starters' AC power supply is not connected to the AC power supply for the AC I/O modules (see Chapter "Forming potential groups with BaseUnit type B1 [\(Page 99\)](#)").

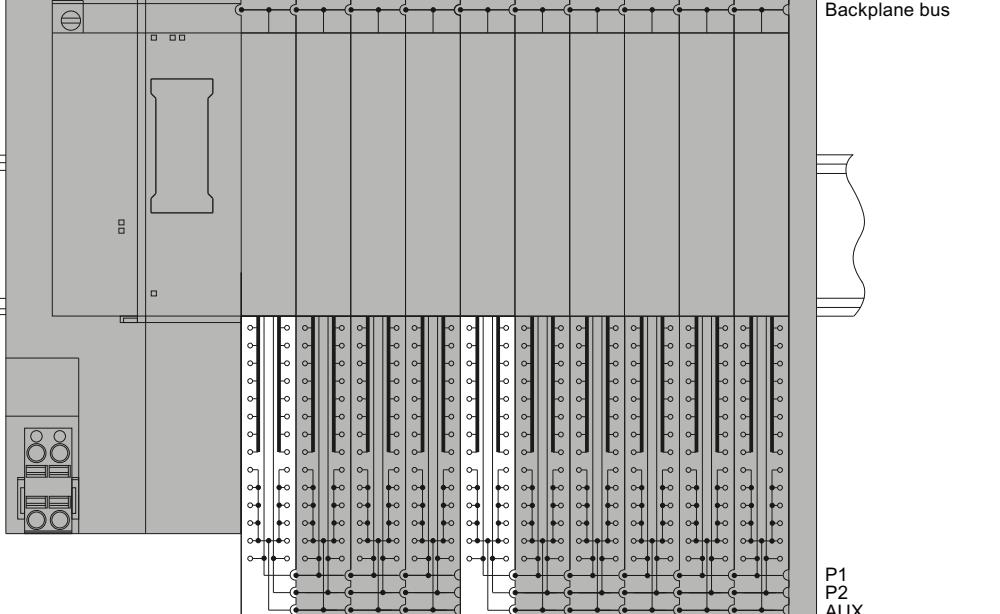
6.6 Configuration examples for potential groups

6.6.1 Configuration examples with BaseUnits

Table 6-6 Configuration examples with BaseUnits

BaseUnits	Configuration
BU15-P16+A0+- 2D BU15-P16+A0+- 2B	<p>Potential group 1 Potential group 2</p> <p>Backplane bus</p> <p>P1 P2 AUX</p>

BaseUnits	Configuration	
	Potential group 1	Potential group 2
BU15-P16+A0+- 2D BU15-P16+A0+- 2B BU20-P12+A0+- OB		Backplane bus P1 P2 AUX

BaseUnits	Configuration	
	Potential group 1	Potential group 2
BU15-P16+A10- +2D BU15-P16+A10- +2B		Backplane bus P1 P2 AUX

6.6.2 Configuration examples with potential distributor modules

3-wire connection

The potential distributor modules allow for a space-saving design. For a 3-wire connection, you can, for example, replace two digital input modules with 8 channels on a 141 mm long BaseUnit with a digital input module with 16 channels and a potential distributor module, each of which is only 117 mm long.

NOTE

You must not place a BaseUnit for I/O modules in a PotDis potential group formed with a light-colored PotDis-BaseUnit.

The figure below shows a configuration example with a DI 16×24VDC ST digital input module on a BU15-P16+A0+2B BaseUnit and a PotDis-TerminalBlock PotDis-TB-P1-R on a PotDis-BaseUnit PotDis-BU-P2/B-B.

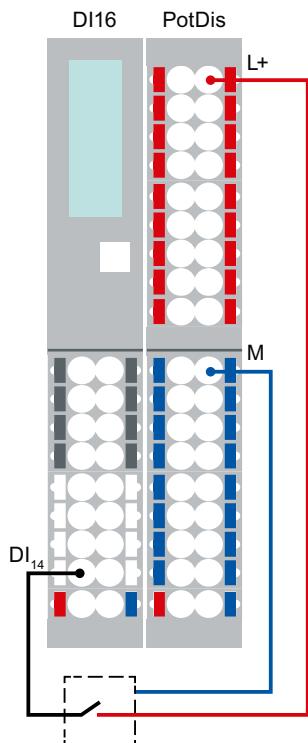


Figure 6-7 Example: 3-wire connection

Supply of external components

Another application of the potential distributor modules is the supply of potentials for external components. Potential distributor modules enable simple, compact, integrated and clear design.

Observe the current carrying capacity of each terminal: max. 10 A.

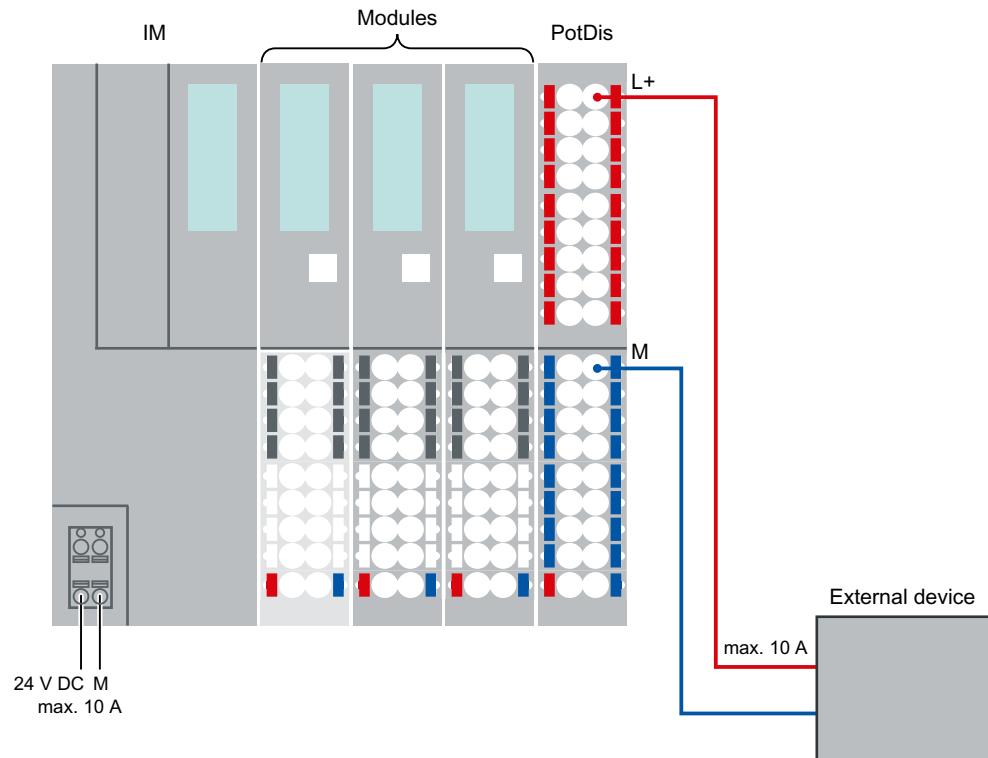


Figure 6-8 Example: Supply of external components

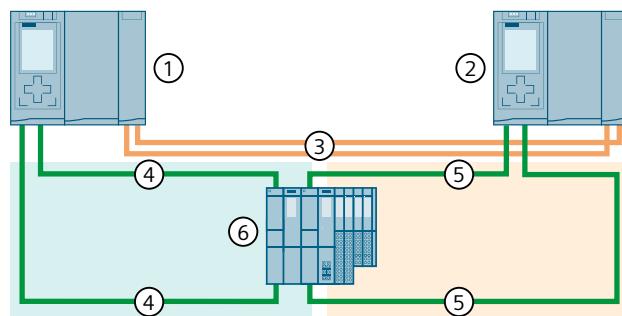
6.7 System redundancy R1

6.7.1 General notes on operating an ET 200SP R1 system

6.7.1.1 Example configuration of a system with ET 200SP R1

You need at least the following components for configuration of an ET 200SP R1 station:

- SIMATIC system rail (1 unit)
- BaseUnit BU type M0 (1 unit)
- Interface module IM 155-6 PN R1 (2 units)
- SIMATIC BusAdapter (2 units, e.g. BA 2×M12)
- BaseUnits and electronic modules (see section Configuration examples for potential groups [\(Page 104\)](#))
- Server module (1 unit)
- To operate a station with R1 system redundancy, you also need a set of R1-compatible S7-1500 CPUs (e.g. CPU 1517H-3 PN or CPU 1518HF-4 PN, 2 units).



- | | |
|---|---|
| ① | CPU 1 |
| ② | CPU 2 |
| ③ | Two fiber-optic cables (redundancy connections) |
| ④ | PROFINET cable (PROFINET ring 1) |
| ⑤ | PROFINET cable (PROFINET ring 2) |
| ⑥ | ET 200SP I/O device (with system redundancy R1) |

Figure 6-9 Configuration of S7-1500H with R1 devices in the PROFINET ring

You can find additional configuration examples in the SIMATIC S7-1500 S7-1500R/H Redundant System (<https://support.industry.siemens.com/cs/ww/de/view/109754833>) System Manual.

6.7.1.2 Commissioning an R1 station

After you configure an ET 200SP R1 station, you perform a commissioning maintenance cycle before the deployment in productive operation. This ensures that both redundant interface modules have been correctly contacted and can operate the electronic modules. The following is checked at the same time:

- Test for hardware integrity. Especially for hardware units that are not used while the device is passive and has no access to the SP bus. To ensure that the hardware is fully intact, perform at least a temporary takeover of the SP bus.
- After the maintenance cycle, the redundancy group must return to its pre-maintenance state.

To perform a commissioning maintenance cycle, proceed as follows:

The initial state is: The S7-1500H redundant system is in the RUN-Redundant system state. The ACT LED of one of the two interface modules (IM 1: regardless whether slot 0 or slot 1) is continuously lit.

1. Test step: Disconnect the interface module with the continuously lit ACT LED (IM 1) from the operating voltage by removing the connector from the 24 V connection. The station must assume the following state:
 - The LEDs of interface module 1 all go out.
 - The ACT LED of interface module 2 starts to flash.
 - In the CPU user program, an OB 70 (loss of redundancy) is reported on the station.
 - In the CPU user program, no OB 86 (station failure) is reported on the station.
2. Test step: Check the inputs and outputs via interface module 2. Use the engineering or configuration tool (e.g. user program or tag table).
3. Test step: Restore the operating voltage of interface module 1. The station must assume the following state after restart of interface module 1:
 - The ACT LED of interface module 2 lights up continuously.
 - In the CPU user program, an OB 70 (redundancy return) is reported.
 - The S7-1500H redundant system is again in the RUN-Redundant system state.
4. Test step: Disconnect the interface module with the permanently lit LED ACT (IM 2) from the operating voltage by pulling the plug out of the 24 V connection. The station must assume the following state:
 - The LEDs of interface module 2 all go out.
 - The ACT LED of the interface module 1 starts to flash.
 - In the CPU user program, an OB 70 (loss of redundancy) is reported on the station.
 - In the CPU user program, no OB 86 (station failure) is reported on the station.
5. Test step: Check the inputs and outputs via interface module 1. Use the engineering or configuration tool (e.g. user program or tag table).
6. Test step: Restore the operating voltage of interface module 2. The station must assume the following state after restart from interface module 2:
 - The ACT of interface module 1 is lit continuously.
 - In the CPU user program, an OB 70 (redundancy return) is reported.
 - The S7-1500H redundant system is again in the RUN-Redundant system state.
 - The system is again in the same state as before test step 1. The commissioning maintenance cycle has been successfully completed.

6.7.1.3 Increased availability

Compared to other ET 200SP interface modules, the system availability has been increased through use of PROFINET R1 redundancy. Even if one interface module fails, the function of the station is maintained.

The module automatically restarts to quickly return to the redundant state if one of the two redundant interface modules of a station fails (e.g. due to a critical error). This eliminates repair time.

Critical failures are stored in the device for later evaluation. You make this information available to Customer Support by reading the service data. You can find information on reading out the service data in the Interface Module IM 155-6 PN R1 Equipment Manual.

6.7.2 Improving the switchover time of the ET 200SP R1 system

Definition

The switchover time of the ET 200SP R1 station is the time that elapses after failure of the primary connection until the back-up IM has established the primary connection and takes control of the process. The response time is extended once during a redundancy switchover.

Composition of the cycle time and response time

You can find information and notes on the configuration of the CPU, the general composition of the cycle time and response time and how you can improve these times in the Cycle and Response Times (<https://support.industry.siemens.com/cs/ww/en/view/59193558>) Function Manual.

Improving the switchover time through configuration of the ET 200SP R1 station

To improve response times for an R1 system, we recommend that you follow the instructions below when configuring the ET 200SP R1 station:

- The shorter the PROFINET update time of an IO device, the shorter the response time of the R1 system tends to be.
- The fewer the number of I/O modules plugged into an R1 station, the shorter the response time of the R1 system tends to be.
- The smaller the input and output data range of the I/O modules, the shorter the response time of the R1 system tends to be.
- Certain module types increase the switchover time. Therefore, configure the stations in such a way that these module types are configured in a separate ET 200SP R1 station. This ensures that the switchover time of the ET 200SP R1 station that does not contain these module types is shorter.

The following table provides you an overview of the modules that belong to these module types.

Name	MLFB
SIMATIC ET 200SP, Analog Input Module, AI Energy Meter 480VAC/CT HF for 1 A or 5 A current transformer, with network analysis functions	6ES7134-6PA00-0CU0 (no longer available)
SIMATIC ET 200SP, Analog Input Module, AI Energy Meter CT ST, for 1 A or 5 A current transformer	6ES7134-6PA01-0BU0
SIMATIC ET 200SP, Analog Input Module, AI Energy Meter CT HF, for 1 A or 5 A current transformer, with network analysis functions	6ES7134-6PA01-0CU0
SIMATIC ET 200SP, Analog Input Module, AI Energy Meter 480V AC ST	6ES7134-6PA20-0BD0
SIMATIC ET 200SP, Analog Input Module, AI Energy Meter 480V AC/RC HF for Rogowski coils, current/voltage transformer 333 mV, with network analysis functions	6ES7134-6PA20-0CU0 (no longer available)
SIMATIC ET 200SP, Analog Input Module, AI Energy Meter RC HF, for Rogowski coils or current/voltage transformer 333 mV, with network analysis functions	6ES7134-6PA21-0CU0
SIMATIC ET 200SP, Analog Input Module, AI Energy Meter RC ST, for Rogowski coils or current/voltage transformer 333 mV	6ES7134-6PA21-0BU0
SIMATIC ET 200SP, CM 4xIO-Link ST Communication module IO-Link Master V1.1	6ES7137-6BD00-0BA0
Technology Module SITRANS FST070 Ultrasonic Flow Transmitter	7ME3448-6AA00-0BB1
Technology Module SITRANS FCT070 Coriolis Flow Transmitter	7ME4138-6AA00-0BB1

NOTE

You can find additional information on switchover times from SIEMENS Customer Support.

Installation

7.1 Basics

Introduction

All modules of the ET 200SP distributed I/O system are open equipment. This means you may only install the ET 200SP distributed I/O system in housings, cabinets or electrical operating rooms and in a dry indoor environment (degree of protection IP20). The housings, cabinets and electrical operating rooms must guarantee protection against electric shock and spread of fire. The requirements regarding mechanical strength must also be met. The housings, cabinets, and electrical operating rooms must not be accessible without a key or tool. Personnel with access must have been trained or authorized.

Installation location

Install the ET 200SP distributed I/O system in a suitable enclosure/control cabinet with sufficient mechanical strength and fire protection. Take into account the environmental conditions for operating the devices.

Mounting position

You can mount the ET 200SP distributed I/O system in any position. The preferred mounting position is horizontal mounting on a vertical wall.

The ambient temperature may be restricted in certain installation positions. You will find more information in section Mechanical and climatic environmental conditions ([Page 330](#)). Pay attention to chapter "Installation conditions for motor starters ([Page 116](#))" when using motor starters.

Mounting rail

Install the ET 200SP distributed I/O system on a mounting rail in accordance with ISO 60715 (35 × 7.5 mm or 35 × 15 mm) or on a SIMATIC system rail.

The ET 200SP R1 system must be mounted on the SIMATIC system rail only.

You need to ground the mounting rail separately in the control cabinet. Exception: If you install the rail on grounded, zinc-plated mounting plates, there is no need to ground the rail separately.

NOTE

If the ET 200SP distributed I/O system is exposed to vibration and shock loads, both ends of the ET 200SP system assembly must be mechanically fixed to the mounting rail (e.g. using 8WA1010-1PH01 ground terminals). This measure prevents the ET 200SP distributed I/O system from shifting to the side.

NOTE

If the ET 200SP, distributed IO system is exposed to increased vibrations and shock, fasten the mounting rail to the mounting surface at intervals of approx. 200 mm.

For increased vibration and shock loads, you can mount the ET 200SP system on the SIMATIC system rail.

The following are suitable surfaces for the mounting rails:

- Steel strip in accordance with Appendix A of EN 60715 or
 - Tinned steel strip. We recommend these in conjunction with the mounting rails in the section Accessories/spare parts ([\(Page 339\)](#)).
-

NOTE

If you use mounting rails from other manufacturers, make sure that they have the required properties for your ambient climatic conditions.

Minimum clearances

The figure below shows the minimum clearances you must observe when installing or dismantling the ET 200SP distributed I/O system.

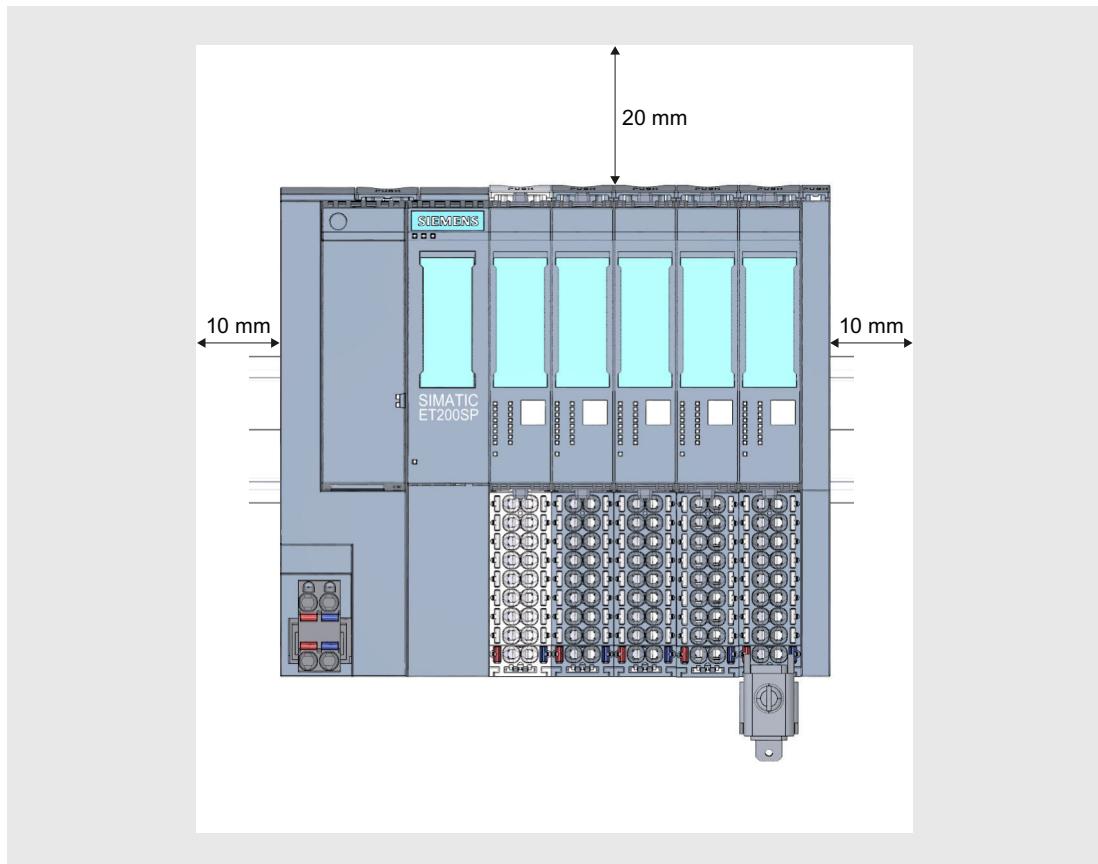


Figure 7-1 Minimum clearances

NOTE**Ex module group**

When you are using an Ex module group in your configuration, you must observe other minimum clearances.

Additional information on minimum clearances and installing/removing Ex modules is available in the System Manual ET 200SP HA Distributed I/O system / ET 200SP Modules for devices used in an explosion hazardous environment (<https://support.industry.siemens.com/cs/ww/de/view/109795533/en>).

General rules for installation

WARNING

Hazardous Voltage Can Cause Death, Serious Injury, or Property Damage.

Hazardous electrical voltage can cause electric shock, burns and property damage.

Disconnect your system and devices from the power supply before starting any assembly tasks.

Observe the following rules:

- Installation starts on the left-hand side with the CPU/interface module.
- A light-colored BaseUnit BU..D0, BU30-MS1 or BU30-MS3 with infeed of supply voltage L+ follows the CPU/interface module or is placed at the start of each potential group. If you use a CPU or IM 155-6 (V3.0 or higher), the first BaseUnit in the installation of the ET 200SP may also be a dark-colored BaseUnit of type B1 or D0.
- This is followed by BaseUnits BU..B, BU30-MS2 or BU30-MS4 (with a dark-colored terminal box).
- The matching I/O modules / motor starters can be plugged onto the BaseUnits. You will find matching combinations of BaseUnits and I/O modules / motor starters in Application planning [\(Page 80\)](#).
- The server module completes the configuration of the ET 200SP distributed I/O system.

NOTE

Mount the ET 200SP distributed I/O system only with disconnected supply voltage.

WARNING

Protection from conductive contamination

Taking into account the environmental conditions, the devices must be protected from conductive contamination.

This can be achieved, for example, by installing the devices in a control cabinet with the appropriate degree of protection.

Mounting rules for reducing the thermal load

The following rules reduce the thermal load of the ET 200SP distributed I/O system in the control cabinet:

- Separate 2 modules with high power dissipation with a module of low power dissipation or by an empty space.
- Mix modules with higher power dissipation and modules with less power dissipation. For example, modules with 16 outputs have a higher power dissipation than modules with 8 outputs.
- You should give preference to the horizontal mounting position.
- For vertical mounting position, plug modules with high power dissipation at the top, the interface module/CPU at the bottom.

7.2 Installation conditions for motor starters

- Mount an ET 200SP station with modules with high power dissipation in the lower area of the control cabinet.
- For a multi-tier configuration, plug modules with high power dissipation on the sides so that the waste heat can rise to the top unhindered.
- Avoid air movements at the terminals when using TC measurement with internal compensation.

7.2 Installation conditions for motor starters

Observe the following installation conditions when using an ET 200SP motor starter:

- Mounting position

You can fit the motor starter vertically or horizontally. The mounting position refers to the alignment of the mounting rail. The maximum permissible ambient temperature range depends on the mounting position:

- Up to 60° C: Horizontal mounting position
- Up to 50° C: Vertical installation position

You also need to consider the current carrying capacity of the ET 200SP components.

In the case of a vertical mounting position, use end retainers "8WA1808" at both ends of the ET 200SP station:

- Mounting rail

Use one of the following mounting rails:

- 35x15 mm DIN rail in accordance with DIN EN 60715
- 35x7.5 mm DIN rail in accordance with DIN EN 60715
- SIMATIC S7 mounting rail

- Current carrying capacity of the ET 200SP station

Current carrying capacity refers to the current load via the power bus and the infeed bus of the ET 200SP station.

Depending on the ambient conditions and mounting position, you have to take account of the fan unit or additional mechanical fixings.

Mechanical brackets

Use the mechanical brackets in the following situations:

- When using a 15 mm mounting rail with a single motor starter installation, i.e. no motor starter mounted directly next to it in the system
- With a vertical mounting position
- For applications according to shipbuilding standards in all mounting positions with 7.5 mm and 15 mm mounting rails

Designing interference-free motor starters

For interference-free operation of the ET 200SP station in accordance with standard IEC 60947-4-2, use a dummy module before the first motor starter. No dummy module is required to the right of the motor starter.

Note the following mounting rules:

Use the following dummy module on the standard mounting rail between the previous module and the SIMATIC ET 200SP motor starter:

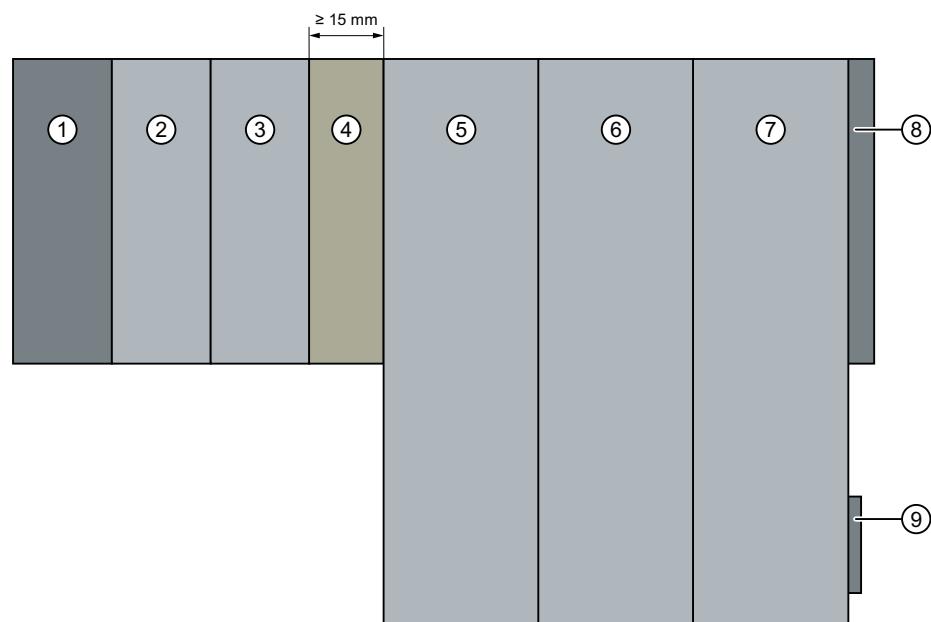
BU cover 15 mm: 6ES7133-6CV15-1AM0 with BaseUnit 6ES7193-6BP00-0BA0

For operation of the ET 200SP station with an unused BaseUnit, a cover must be provided for the open BaseUnit plug contacts (power connector, power bus connector, and backplane bus connector).

The cover protects the plug contacts against dirt. The BU cover can be ordered as an accessory.

Mount the dummy module

The figure below provides a schematic representation of how to implement measures for improving interference immunity.



- | | | | |
|---|-----------------------|---|------------------|
| ① | Interface module | ⑥ | Motor starter |
| ② | Digital input module | ⑦ | Motor starter |
| ③ | Digital output module | ⑧ | Server module |
| ④ | Dummy module | ⑨ | Infeed bus cover |
| ⑤ | Motor starter | | |

NOTICE

Ensure interference immunity

You must not plug any other module into the BaseUnit of the dummy module, otherwise interference immunity is no longer ensured.

7.3 Mounting the CPU/interface module

Introduction

The CPU/the interface module connects the ET 200SP distributed I/O system to the fieldbus and exchanges the data between the higher-level control system and the I/O modules / motor starters.

Requirement

The mounting rail is fitted.

Required tools

3 to 3.5 mm screwdriver (only for mounting and removing the BusAdapter)

Mounting the CPU/interface module

Watch the video sequence (<https://support.automation.siemens.com/WW/view/en/95886218>)

To install a CPU/interface module, follow these steps:

1. Install the CPU/interface module on the mounting rail.
2. Swivel the CPU/interface module towards the back until you hear the mounting rail release button click into place.

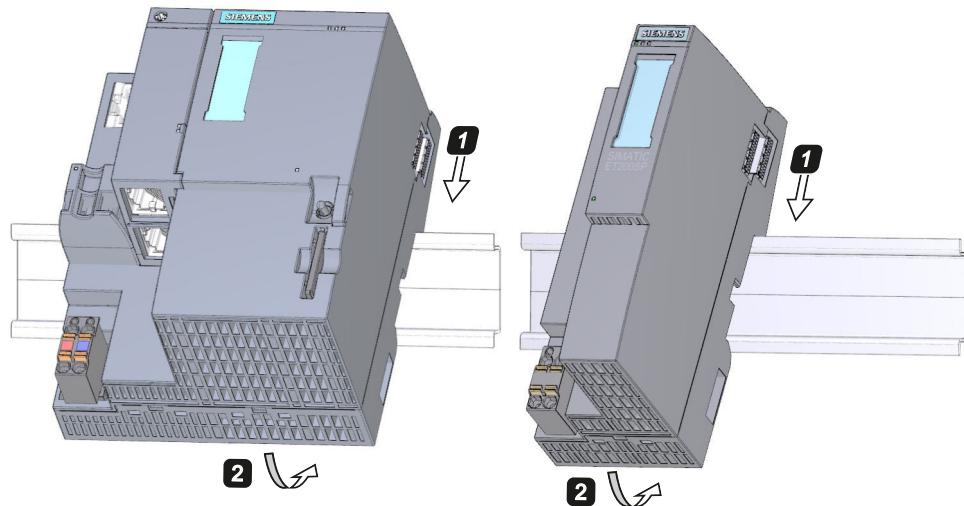


Figure 7-2 Mounting the CPU/interface module

Dismantling the CPU/interface module

The CPU/interface module is wired and BaseUnits are located to its right.

To remove the CPU/interface module, follow these steps:

1. Switch off the supply voltage for the CPU/interface module. Remove the 24 V DC connector from the CPU/interface module.
2. Press the mounting rail release button on the first BaseUnit. At the same time, shift the CPU/interface module parallel to the left until it detaches from the rest of the module group.
Note: The mounting rail release button is located above the CPU/interface module or BaseUnit.
3. While pressing the mounting rail release button on the CPU/interface module, swivel the CPU/interface module off of the mounting rail.

NOTE

It is not necessary to remove the BusAdapter from the CPU/interface module.

7.4 **Installing ET 200SP R1**

Introduction

The ET 200SP R1 system connects the ET 200SP distributed I/O system to the fieldbus and exchanges the data between the higher-level controller and the I/O modules / motor starters.

Requirement

The SIMATIC system rail is installed.

Tools required

3 to 3.5 mm screwdriver (only for mounting and removing the BusAdapter)

Mounting the ET 200SP R1 system

To mount the ET 200SP R1 system, proceed as follows:

1. Hang the BaseUnit BU type M0 onto the SIMATIC system rail.
2. Swivel the BaseUnit BU type M0 backwards until the system rail release audibly engages.
3. Plug the IM 155-6 PN R1 interface modules onto the BaseUnit BU type M0 until the lock audibly engages.
4. Plug the 24 V DC connectors into both interface modules.
5. Connect a BusAdapter to each interface module. Screw the BusAdapter to the interface module.

Removing the ET 200SP R1 system

To remove the ET 200SP R1 system, proceed as follows:

1. Switch off the supply voltage for the ET 200SP R1 system. Unplug the 24 V DC connectors from both interface modules.
2. Press the interface module release on the BaseUnit BU type M0. Detach the interface modules from the BaseUnit BU type M0.
3. Press the system rail release on the BaseUnit. Move the BaseUnit BU type M0 parallel to the left until it detaches from the rest of the module group.
Note: The system rail release is located above the BaseUnit BU type M0.
4. With the system rail release pressed on the BaseUnit, swivel the BaseUnit BU type M0 off of the system rail.

NOTE

It is not necessary to remove the BusAdapter from the IM 155-6 PN R1 interface modules.

7.5 Installing the CM DP communication module

Introduction

You need the CM DP communication module to use the CPU with a DP master or DP slave.

Requirements

- The mounting rail is fitted.
- The CPU is installed.

Installing CM DP

To install the CM DP communication module, follow these steps:

1. Install the CM DP to the right of the CPU.
2. Swivel the CM DP towards the back until you hear the mounting rail release button click into place.
3. Slide the CM DP to the left until you hear it click into the CPU.

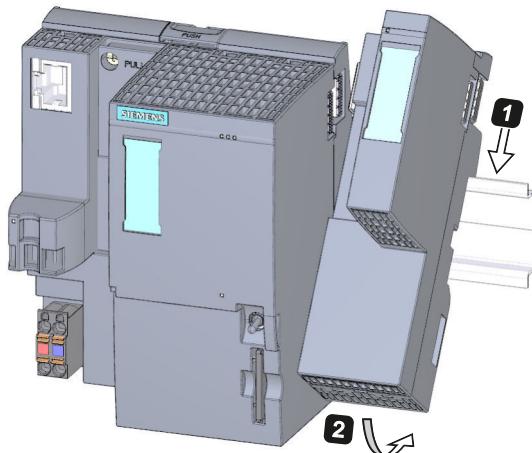


Figure 7-3 Installing CM DP

Removing a CM DP

The CPU and the CM DP are wired and BaseUnits are located to its right.

To remove the CM DP communication module, follow these steps:

1. Switch off the supply voltage on the CPU.
2. Press the mounting rail release button on the first BaseUnit and, at the same time, move the CPU and the CM DP parallel to the left until they detach from the rest of the module group (clearance about 16 mm).
3. Press the mounting rail release button on the CM DP and move it to the right until it detaches from the CPU (clearance about 8 mm).
4. While pressing the mounting rail release button on the CM DP, swivel the CM DP off of the mounting rail.

NOTE

It is not necessary to remove the bus connector from the CM DP unless you have to replace the CM DP.

7.6 Mounting BaseUnits for I/O modules

Introduction

The BaseUnits are used for electromechanical connection between the individual ET 200SP components. They also provide terminals for connecting external sensors, actuators and other devices.

Requirements

The mounting rail is fitted.

Required tools

3 to 3.5 mm screwdriver (only for dismantling the terminal box and the encoding element)

Installing a BaseUnit

Watch "Install configuration" video sequence
(<https://support.automation.siemens.com/WW/view/en/95886218>)

To install a BaseUnit, follow these steps:

1. Hook the BaseUnit onto the mounting rail.
2. Swivel the BaseUnit backwards until you hear it click into place on the mounting rail.
3. Slide the BaseUnit parallel to the left until you hear it latch onto the preceding CPU/interface module or BaseUnit.

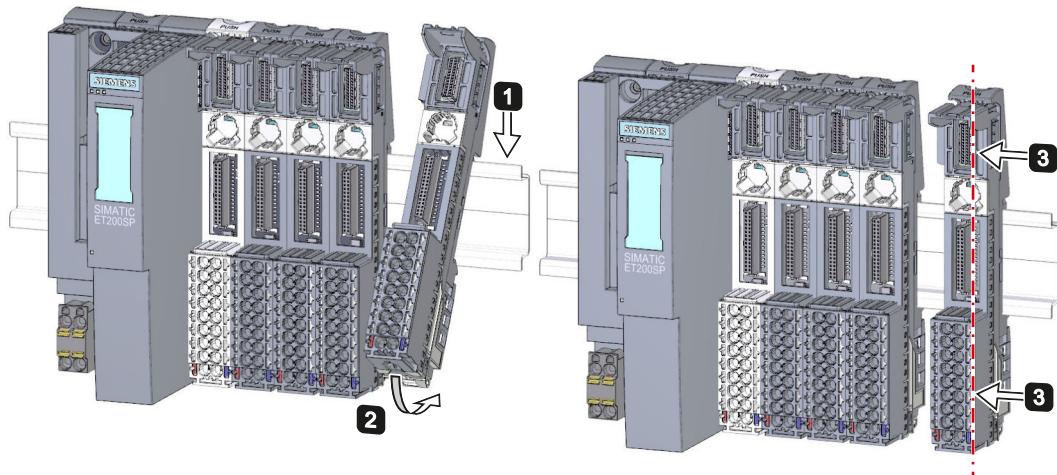


Figure 7-4 Installing a BaseUnit

Removing a BaseUnit

WARNING

Hazardous Voltage

Hazardous electrical voltage can cause electric shock, burns and property damage.

Disconnect your system and devices from the power supply before starting any assembly tasks.

To remove a BaseUnit, follow these steps:

The BaseUnit is wired and there are other BaseUnits to its right and left.

To remove a specific BaseUnit, move the adjacent modules. As soon as you have created a clearance of about 8 mm from the adjacent BaseUnits, you can remove the BaseUnit.

NOTE

You can replace the terminal box without removing the BaseUnit. Refer to section Replacing the terminal box on the BaseUnit [\(Page 290\)](#).

To remove a BaseUnit, follow these steps:

1. Switch off all supply voltages on the ET 200SP distributed I/O system.
2. Loosen the wiring on the BaseUnit (with a 3 to 3.5 mm screwdriver).

3. Removing (from the right):

Press the mounting rail release on the relevant BaseUnit. Move the BaseUnit parallel to the right and swivel the BaseUnit off of the mounting rail while pressing the mounting rail release.

Removing (from the left):

Press the mounting rail release on the relevant BaseUnit and the BaseUnit located to its right. Move the BaseUnit parallel to the left and swivel the BaseUnit off of the mounting rail while pressing the mounting rail release.

Note: The mounting rail release is located above the BaseUnit

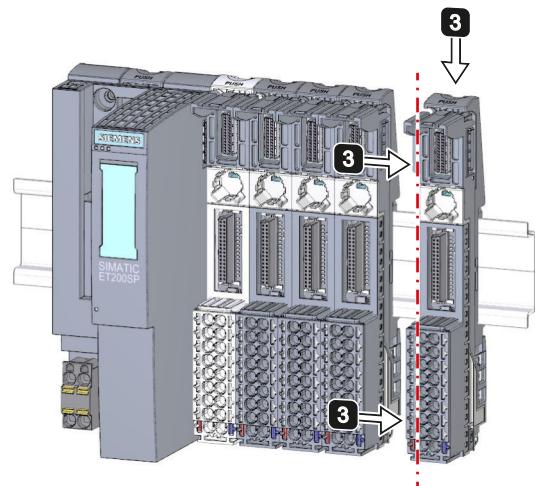


Figure 7-5 Removing the BaseUnit (removing from the right)

7.7 Mounting and dismantling BaseUnits for motor starters

Requirements

- The mounting rail is fitted.
- When using a 15 mm mounting rail, you must install the additional mechanical mounting (3RK1908-1EA00-1BPO).

NOTE**Mechanical bracket for BaseUnit**

You will find out how to mount the mechanical bracket for the BaseUnit in chapter "Mounting the mechanical bracket for the BaseUnit [\(Page 129\)](#)".

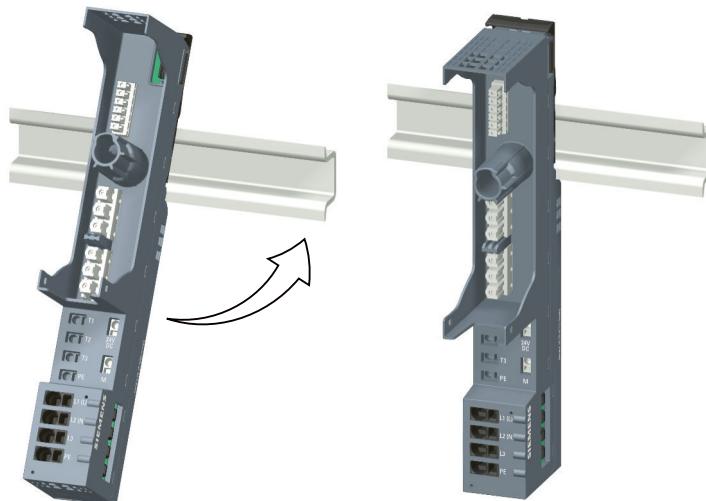
CAUTION**Protection against electrostatic charge**

When handling and installing the SIMATIC ET 200SP motor starter, ensure protection against electrostatic charging of the components. Changes to the system configuration and wiring are only permissible after disconnection from the power supply.

Mounting a BaseUnit

Proceed as follows to mount a BaseUnit for motor starters:

1. Hook the BaseUnit into the DIN rail from above.
2. Swing the BaseUnit to the rear until the BaseUnit audibly engages.



3. Slide the individual BaseUnits to the left to the previous BaseUnit until they audibly engage.

Assemble the BaseUnits only on the DIN rail.

NOTE

The BaseUnits for motor starters can be plugged together with the BaseUnits for I/O modules.

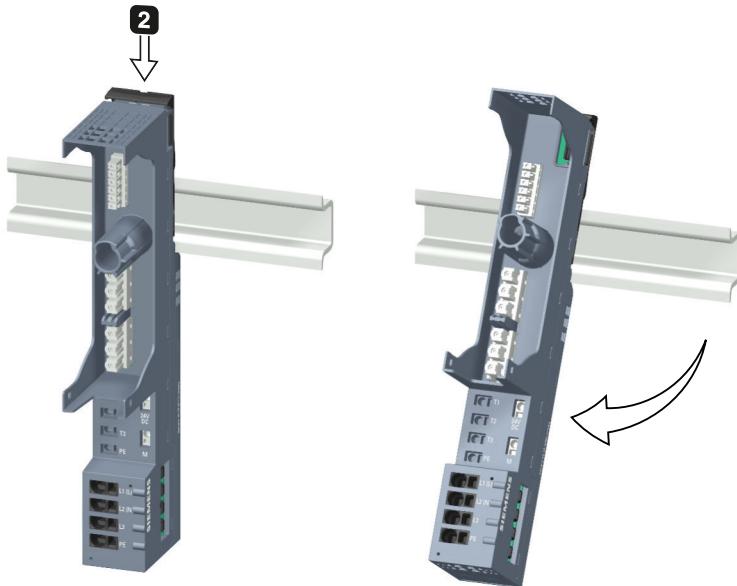
Disassembling the BaseUnit

⚠️ WARNING
Hazardous Voltage
Hazardous electrical voltage can cause electric shock, burns and property damage. Disconnect your system and devices from the power supply before starting any assembly tasks.

To disassemble the BaseUnit, proceed as follows:

1. Disconnect the main power supply and the control current supply of the SIMATIC ET 200SP motor starter.
2. Actuate the DIN rail release on the BaseUnit of the motor starter.
3. Move the BaseUnit to the left. As soon as there is a clearance of approximately 8 mm to the neighboring BaseUnits, you can disassemble the BaseUnit of the motor starter.

4. Swing the BaseUnit away from the DIN rail while pressing the DIN rail release.



7.8 Installing potential distributor modules

Introduction

You use the potential distributor module to distribute a variety of potentials (P1, P2).

Requirements

The mounting rail is installed.

Installing and uninstalling PotDis-BaseUnit

You install/uninstall PotDis-BaseUnits as you would the BaseUnits for I/O modules. You can find additional information in section [Mounting BaseUnits for I/O modules \(Page 122\)](#).

Installing and uninstalling PotDis-TerminalBlock

Installing

Plug the PotDis-TerminalBlock in die PotDis-BaseUnit. Proceed exactly as described in Section [Inserting I/O modules / motor starters and BU covers \(Page 163\)](#).

Uninstalling

To remove a PotDis-TerminalBlock, follow these steps:

1. Switch off all supply voltages on the ET 200SP distributed I/O system.
2. Simultaneously press the top and bottom release buttons of the PotDis-TerminalBlock.
3. Remove the PotDis-TerminalBlock from the front of the PotDis-BaseUnit.

7.9 Installing the server module

Introduction

The server module on the far right of the assembly/line completes the ET 200SP distributed I/O system.

Requirement

The last BaseUnit is mounted.

Installing the server module

Watch "Install configuration" video sequence
(<https://support.automation.siemens.com/WW/view/en/95886218>)

Proceed as follows to install a server module:

1. Hook the server module onto the mounting rail to the right of the last BaseUnit.
2. Swivel the server module backwards on the mounting rail.
3. Move the server module parallel to the left until you hear it latch onto the last BaseUnit that precedes it.

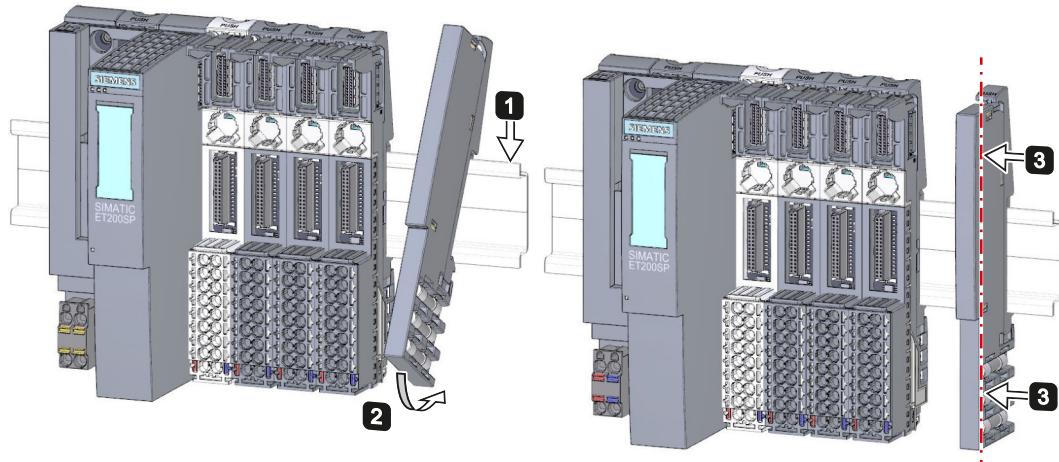


Figure 7-6 Installing the server module

Removing the server module

Proceed as follows to remove a server module:

1. Press the mounting rail release button on the server module.
2. Move the server module parallel to the right.
3. While pressing the mounting rail release button, swivel the server module off the mounting rail.

7.10 Mounting further accessories for motor starters

7.10.1 Mounting the cover for the 500 V AC infeed bus

Introduction

The 500 V infeed bus connects all SIMATIC ET 200SP motor starters. For finger-safe termination of the infeed bus, you must use the cover.



DANGER

Hazardous Voltage

Can Cause Death, Serious Injury, or Property Damage.

Hazardous electrical voltage causes electric shock, burns and property damage.

Disconnect your system and devices from the power supply before starting any assembly tasks.



DANGER

Infeed bus - electric shock

You must provide the infeed bus with a touch protection cover on the right (Article No.: 3RK1308-1DA00-2BPO).

Failure to do so will result in the danger of electric shock.



WARNING

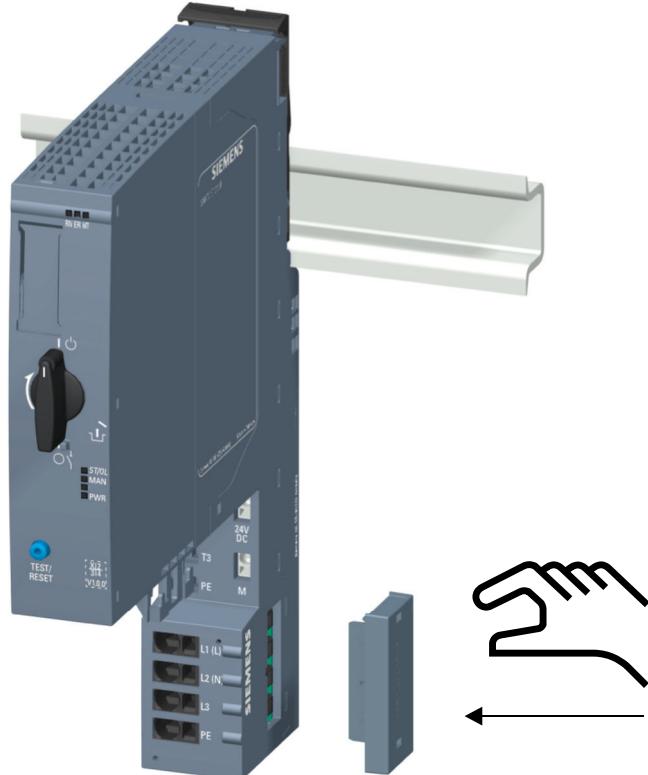
Personal injury may occur

On the last plugged-in BaseUnit of a motor starter, place a cover on the opening of the contacts of the infeed bus.

Procedure

Proceed as follows to mount the infeed bus cover on a SIMATIC ET 200SP motor starter:

1. Press the cover onto the opening of the BaseUnit on the right until it audibly engages.

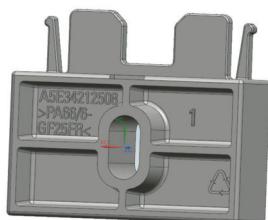


The cover can be removed again using 2 fingers and without tools.

7.10.2 Mounting the mechanical bracket for the BaseUnit

Introduction

To achieve higher stability, you can use a mechanical bracket on 7.5 mm and 15 mm mounting rails.



You must use the mechanical bracket in the following situations:

- When using a 15 mm mounting rail
- With a vertical mounting position
- For applications according to shipbuilding standards in all mounting positions with 7.5 mm and 15 mm mounting rails

7.10 Mounting further accessories for motor starters

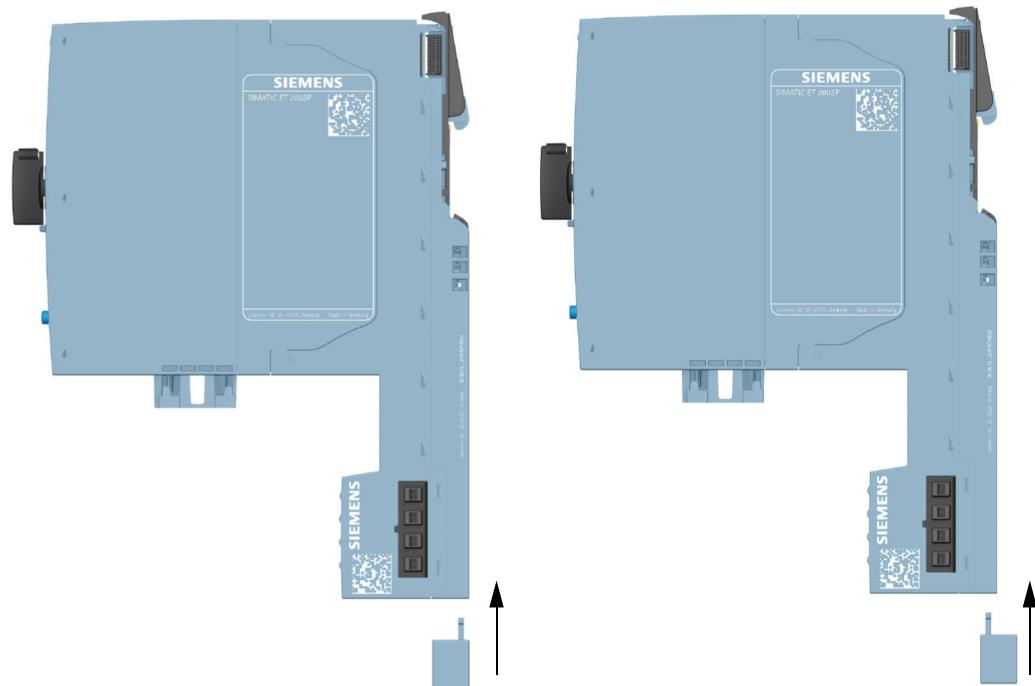
You can find further information on the mechanical bracket in chapter "Installation conditions for motor starters [\(Page 116\)](#)".

Procedure

To mount the mechanical bracket, proceed as follows:

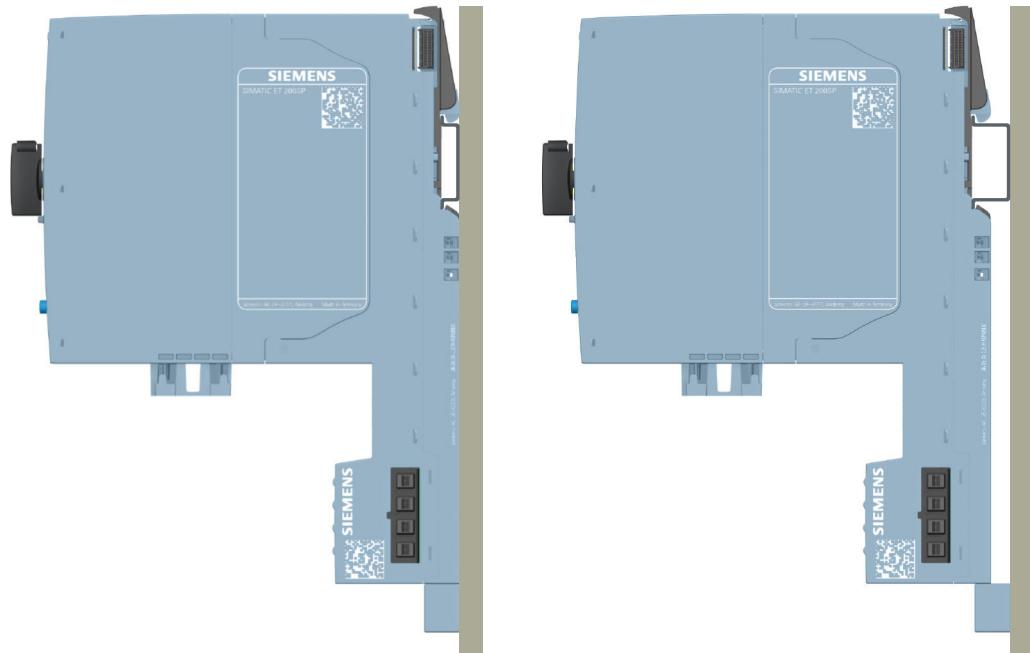
1. Insert the mechanical bracket into the opening at the bottom of the BaseUnit.

You use the same mechanical bracket for both mounting rails, rotated through 180° respectively.



2. Hook the BaseUnit into the mounting rail.
3. Insert the mechanical bracket into the BaseUnit.
4. Screw the mechanical bracket securely onto the mounting panel. Use an M4 screw and a suitable washer.

The figures below show the mechanical bracket after installation on a 7.5 mm or 15 mm mounting rail.



7.10.3 Mounting the BU cover

Introduction

BU covers are plugged onto BaseUnits whose slots have been reserved for future expansion (as empty slots). The BU covers for motor starters serve as touch protection covers for unoccupied slots.

DANGER

**Hazardous Voltage
Can Cause Death, Serious Injury, or Property Damage.**

Hazardous electrical voltage causes electric shock, burns and property damage.

Disconnect your system and devices from the power supply before starting any assembly tasks.

DANGER

BaseUnit without motor starter - electric shock

If you install a BaseUnit without motor starter in the ET 200SP system (e.g. options handling), you must provide the BaseUnit with a BU cover (Article No: 3RK1908-1CA00-OBPO).

Failure to do so will result in the danger of electric shock.

7.10 Mounting further accessories for motor starters

Procedure

To mount the BU cover onto a SIMATIC ET 200SP motor starter, insert the BU cover in the BaseUnit in parallel until both interlocks audibly engage.

Wiring

8.1 Rules and regulations for operation

Introduction

When installing the ET 200SP distributed I/O system as part of a plant or system, special rules and regulations need to be adhered to depending on the area of application.

This section provides an overview of the most important rules that must be observed for the integration of the ET 200SP distributed I/O system in a plant or system.

Specific application

Adhere to the safety and accident prevention regulations applying to specific applications, for example machine protection guidelines.

EMERGENCY STOP devices

EMERGENCY STOP devices in accordance with IEC 60204 (corresponds to DIN VDE 0113) must remain effective in all operating modes of the plant or system.

External fuses/switches

Install the external fuses/switches in the proximity of the ET 200SP distributed I/O system.

Excluding hazardous plant states

Hazardous operating states must not occur when

- the plant restarts after a voltage dip or power failure.
- Bus communication is reestablished following a fault.

If necessary, EMERGENCY STOP must be forced!

An uncontrolled or undefined startup must not occur after the EMERGENCY STOP is unlocked.

Line voltage

Below, everything you need to consider in terms of line voltage is described (refer to section Insulation, protection class, degree of protection and rated voltage ([Page 333](#))):

- For fixed plants or systems without an all-pole mains disconnection switch, a mains disconnection device (all-pole) must be available in the building installation.
- For load power supplies, the configured rated voltage range must correspond to the local line voltage.
- For all power circuits of the ET 200SP distributed I/O system, the fluctuation/deviation of the line voltage from the rated value must be within the permitted tolerance.

24 V DC supply

Below you will find a description of what you need to pay attention to with 24 V DC supply:

- In the event of danger through overload, you must provide lightning protection measures:
 - For external lightning protection
 - For internal lightning protection: Only if greater values (phase - ground) or (phase - phase) are required for the power surge than those specified in the section Electromagnetic compatibility ([Page 333](#)).
- For 24 V DC supply: Ensure protection by electrical separation and separate cable routing or increased insulation of circuits with dangerous potentials from extra low voltage (SELV/PELV) in accordance with IEC 61131-2 / IEC 61010-2-201.

Requirements for power supplies in the event of voltage interruption

NOTE

To ensure adherence to IEC 61131-2, only use power packs/power supply units (e.g. 230/400 V AC → 24 V DC) with a mains buffering time of at least 10 ms. Observe the relevant requirements in your application (e.g. product standard for "burners" 30 ms according to EN 298 or 20 ms according to NAMUR recommendation NE 21) with respect to possible voltage interruptions. The latest up-to-date information on PS components is available on the Internet (<https://mall.industry.siemens.com>).

Of course, these requirements also apply to power packs/power supply units not constructed using ET 200SP or S7-1500/S7-300-/S7-400 design.

Protection against outside electrical influences

Below is a description of what you must pay attention to in terms of protection against electrical impacts and/or faults:

- Make sure that the system for discharging electromagnetic interference is connected to a functional earth or to protective conductor with a sufficient cross-section for all plants with an ET 200SP distributed I/O system.
- For supply, signal and bus lines, you must ensure that the laying of the lines and the installation is correct.
- For signal and bus lines, you must ensure that a wire/cable break or a cross-circuit does not lead to undefined states of the plant or system.

Reference

You can find more information in the Designing interference-free controllers (<https://support.automation.siemens.com/WW/view/en/59193566>) function manual.

8.2 Additional rules and regulations for the operation of the ET 200SP with fail-safe modules

8.2.1 Safety extra-low voltage (SELV, PELV) for failsafe modules and failsafe motor starters

WARNING

The failsafe modules must be operated with safety extra-low voltage (SELV, PELV). You can find more information on safety extra-low voltage (SELV, PELV) in the data sheets of the applicable power supplies, for example.

The fail-safe modules operate with the 24 V DC rated voltage. The tolerance range is 19.2 V DC to 28.8 V DC.

The fail-safe motor starters operate with the 24 V DC rated voltage. The tolerance range is 20.4 V DC to 28.8 V DC.

Within the overvoltage range from 32 V DC to 36 V DC, the F-modules react in a fail-safe manner and the inputs and outputs are passivated. For overvoltages greater than 36 V DC, the F-modules are permanently de-energized.

Use a power supply unit that does not exceed $U_m = 36$ V DC even in the event of a fault. For more on this, refer to the information in the data sheet on overvoltage protection in the case of an internal error. Or implement appropriate measures to limit the voltage, e.g. use of an overvoltage protector.

All system components that can supply electrical energy in any form whatsoever must fulfill this condition.

Each additional circuit (24 V DC) used in the system must have a safety extra-low voltage (SELV, PELV). Refer to the relevant data sheets or contact the manufacturer.

Sensors and actuators with an external power supply can also be connected to F-modules. Make sure that power is supplied to these components from safety extra-low voltage (SELV, PELV) as well. The process signal of a 24 V DC digital module may not exceed a fault voltage U_m in the event of a fault.

WARNING

Even when a fault occurs, the permissible potential difference between the supply of the interface module (bus voltage) and the load voltage must not be exceeded.

An external direct electrical connection is one way to meet this requirement. This also prevents potential differences from causing voltage additions at the individual voltage sources, which would cause the fault voltage U_m to be exceeded.

8.2.2 Requirements for sensors and actuators for fail-safe modules and fail-safe motor starters

General requirements for sensors and actuators

Note the following important warning regarding safety-related use of sensors and actuators:

WARNING

Note that instrumentation with sensors and actuators bears a considerable **safety responsibility**. Also bear in mind that sensors and actuators generally do not have proof-test intervals of 20 years as defined in IEC 61508:2010 without considerable loss of safety.

The probability of hazardous faults and the rate of hazardous faults of safety functions must comply with an SIL-defined high limit. A listing of values achieved by F-modules in the technical specifications of the F-modules is available under "Fail-safe performance characteristics".

To achieve the required safety class, suitably qualified sensors and actuators are necessary.

Additional sensor requirements

General rule: To achieve SIL3/Cat. 3/PLe, a single-channel sensor is adequate. However, to achieve SIL3/Cat. 3/PLe with a single-channel sensor, the sensor itself must be SIL3/Cat. 3/PLe-capable; otherwise the sensor must be connected by two channels to achieve this safety level.

To achieve SIL3/Cat. 4/PLe, sensors must be connected by two channels.

WARNING

In the case of fail-safe input modules, the value "0" is output to the F-CPU after detection of faults. You therefore need to make sure that the sensors are implemented in such a way as to ensure the reliable reaction of the safety program when the sensor is in the "0" state.

Example: In its safety program, an EMERGENCY-STOP sensor must achieve the shutdown of the relevant actuator when it is in the "0" state (EMERGENCY-STOP button pressed).

Additional requirements for sensors for fail-safe motor starters

Only single-channel sensors that fulfill the required safety category themselves may be connected to the fail-safe motor starter's F-DI. Fail-safe laying must be observed in accordance with the required safety category.

⚠ WARNING

Safety-related shutdown using the F-DI

Depending on the I/O used, the shutdown takes place via one or two output channels (terminals):

- PM-switching: The shutdown takes place via two output channels.
- PP-switching: The shutdown takes place via one output channel.

Shutdown via only one output channel (PP-switching) achieves SIL 3 according to ISO 62061 and PLe/Cat.4 according to EN ISO 13849-1, if it is ensured that the cabling is installed in a cross-circuit-proof/P-short-circuit-proof manner.

Duration requirements for sensor signals

⚠ WARNING

Observe the following requirements for sensor signals:

- To ensure the correct detection of the sensor signals via fail-safe modules with inputs, you need to make sure that the sensor signals are output for a minimum duration.
- For pulses to be detected with certainty, the time between two signal changes (pulse duration) must be greater than the PROFIsafe monitoring time.

Reliable detection by F-modules with inputs

The minimum duration of sensor signals for F-modules with inputs depends on the configured input delay, the parameters of the short circuit test of the sensor supplies, and the configured discrepancy behavior for 1oo2 evaluation. The signal must be greater than the maximum response time of the configured application. Information on calculating the maximum response time can be found in the section "Response times" of the relevant F-module.

The maximum permitted switching frequency of the sensor signals results from the minimum duration.

Additional requirements for actuators

The fail-safe output modules test the outputs at regular intervals. The F-module briefly switches off the activated outputs and, if necessary, switches on the deactivated outputs. You can assign the maximum duration of the test pulses (dark and light period) with parameters. Fast reacting actuators may briefly drop out or be activated during the test. If your process does not tolerate this, set the pulse duration of the light or dark test correspondingly or use actuators that have sufficient lag.

WARNING

If the actuators switch voltages greater than 24 V DC (e.g. 230 V AC), the outputs of a fail-safe output module and the parts carrying a higher voltage must be electrically isolated (in accordance with IEC 60664-1).

This is generally the case for relays and contactors. Particular attention must be paid to this with semiconductor switching devices.

Technical specifications of sensors and actuators

Refer to the manuals of the fail-safe modules for technical specifications to assist you in selecting sensors and actuators.

8.2.3 Crosstalk of digital input/output signals

When fail-safe digital output and input signals are in a single cable, F-DQ modules and F-PM-E modules may experience readback errors.

Cause: capacitive crosstalk

During the bit pattern test of the outputs or the sensor supply of the inputs, the steep switching edge of the output drivers caused by the coupling capacitance of the line may result in crosstalk to other non-activated output or input channels. This may then lead to a response of the readback circuit in these channels. A cross circuit/short-circuit is detected, which leads to safety-related tripping.

Remedy:

- Separate cables for F-DI modules, F-DQ modules, and F-PM-E modules or non-fail-safe DQ modules
- Separate cables for F-DQ channel and F-DI channels for the F-PM-E module
- Coupling relay or diodes in the outputs
- Disable the sensor supply test if safety class requirements allow it.

Cause: magnetic crosstalk

Note that an inductive load connected to the F-DQ channels can induce coupling of a strong magnetic field.

Remedy:

- Separate the inductive loads spatially or shield against the magnetic field.
- Configure the readback time to 50 ms or higher.

8.3 Additional rules and regulations for operation of an Ex module group

Ex module group

You can find the rules and regulations for operation of an Ex module group in the System Manual ET 200SP HA Distributed I/O system / ET 200SP Modules for devices used in an explosion hazardous environment
(<https://support.industry.siemens.com/cs/ww/de/view/109795533/en>)

8.4 Additional rules and instructions for operation with motor starters

8.4.1 Protection against short circuit

The motor starter complies with type of coordination 1. Secure the feeder cable for the infeed bus according to current, country-specific rules for conductor protection.



WARNING

**Hazardous Voltage at the Motor
Can Cause Death, Serious Injury, or Property Damage.**

Following a short-circuit, the SIMATIC ET 200SP motor starter is defective. Replace the motor starter following a short-circuit.

8.5 Operating the ET 200SP on grounded incoming supply

Introduction

Below you will find information on the overall configuration of an ET 200SP distributed I/O system on a grounded incoming supply (e.g. TN-S network). The specific subjects discussed are:

- Disconnecting devices and short-circuit and overload protection according to IEC 60364 (corresponds to DIN VDE 0100) and IEC 60204 (corresponds to DIN VDE 0113)
- Load power supplies and load circuits.

Grounded incoming supply

In the case of grounded incoming supplies (TN-S system) the neutral conductor (N) and the protective conductor (PE) are each grounded. Both conductors form a part of the overvoltage concept. When a plant is in operation, the current flows across the neutral conductor. When a fault occurs, for example, a single ground fault between a live conductor and ground, the current flows through the protective conductor.

Safe electrical separation (SELV in accordance with IEC 61131-2 or IEC 61010-2-201)

Load power supplies/power supply modules with 24 V DC output voltage require safe electrical separation and voltage limiting (extra low voltage). Load power supplies/power supply modules with 24 V DC output voltage are not connected to the protective conductor. According to IEC 61131-2 and IEC 61010-2-201, this protection is referred to as SELV (Safety Extra Low Voltage).

The wiring of SELV circuits must be safely separated from the wiring of other circuits that are not SELV, or the insulation of all conductors must be dimensioned for the higher voltage.

Grounded extra-low voltage (PELV in accordance with IEC 61131-2 or IEC 61010-2-201)

Load power supplies/power supply modules with grounded 24 V DC output voltage require safe connection to the protective conductor and voltage limiting (extra low voltage).

According to IEC 61131-2 and IEC 61010-2-201, this protection is referred to as PELV (Protective Extra Low Voltage).

The wiring of PELV circuits must be safely separated from the wiring of other circuits that are not PELV, or the insulation of all conductors must be dimensioned for the higher voltage.

Configuration of ET 200SP with ungrounded reference potential

To conduct interference currents, the reference potential of the CPU/interface module and the BaseUnits BU15...D is connected internally via an RC combination (IM/CPU:

$R = 10 \text{ M}\Omega / C = 100 \text{ nF}$, BU15...D: $R = 10 \text{ M}\Omega / C = 4 \text{ nF}$) with the mounting rail (functional grounding).

- This configuration conducts high-frequency interference currents and prevents static charges.
- It is always possible to configure an ungrounded setup of the ET 200SP distributed I/O system as the ET 200SP distributed I/O system has no fixed ground connection. The power pack/power supply module for 24 V DC must also be ungrounded and electrically isolated.

If you want to configure the ET 200SP distributed I/O system with grounded reference potential, connect the 1M connection of the CPU/interface module electrically with the protective conductor.

Short-circuit / overload protection

Various measures as protection against short-circuits and overloads are required for setting up a full installation. The type of components and the binding protective measures depend on which IEC (DIN VDE) regulation applies to your system configuration. The table refers to the figure below and compares the IEC (DIN VDE) regulations.

Table 8-1 Components and protective measures

	Refer to figure	IEC 60364 (DIN VDE 0100)	IEC 60204 (DIN VDE 0113)
Disconnecting device for controller, sensors, and actuators	①	Main switch	Disconnecter
Short-circuit / overload protection: In groups for sensors and actuators	② ③	Single-pole protection of circuits	With grounded secondary circuit: single-pole protection otherwise: all-pole protection
Load current supply for AC load circuits with more than five items of electromagnetic equipment	②	Galvanic isolation by transformer recommended	Galvanic isolation by transformer recommended

Cable temperature measurement threshold

NOTE

Cable temperature measurement threshold

When choosing a cable, remember that the cable temperature in operation can be up to 30 °C higher than the ambient temperature of the ET200SP system (example: at an ambient temperature of 60 °C, a connection conductor must be dimensioned for a temperature range of at least 90 °C).

You should specify other connection types and material requirements based on the electrical characteristics of the circuits you use and the installation environment.

ET 200SP in the overall configuration

The figure below shows the overall configuration of the ET 200SP distributed I/O system (load current supply and grounding concept) with supply from a TN-S network.

Own distribution/Zone B

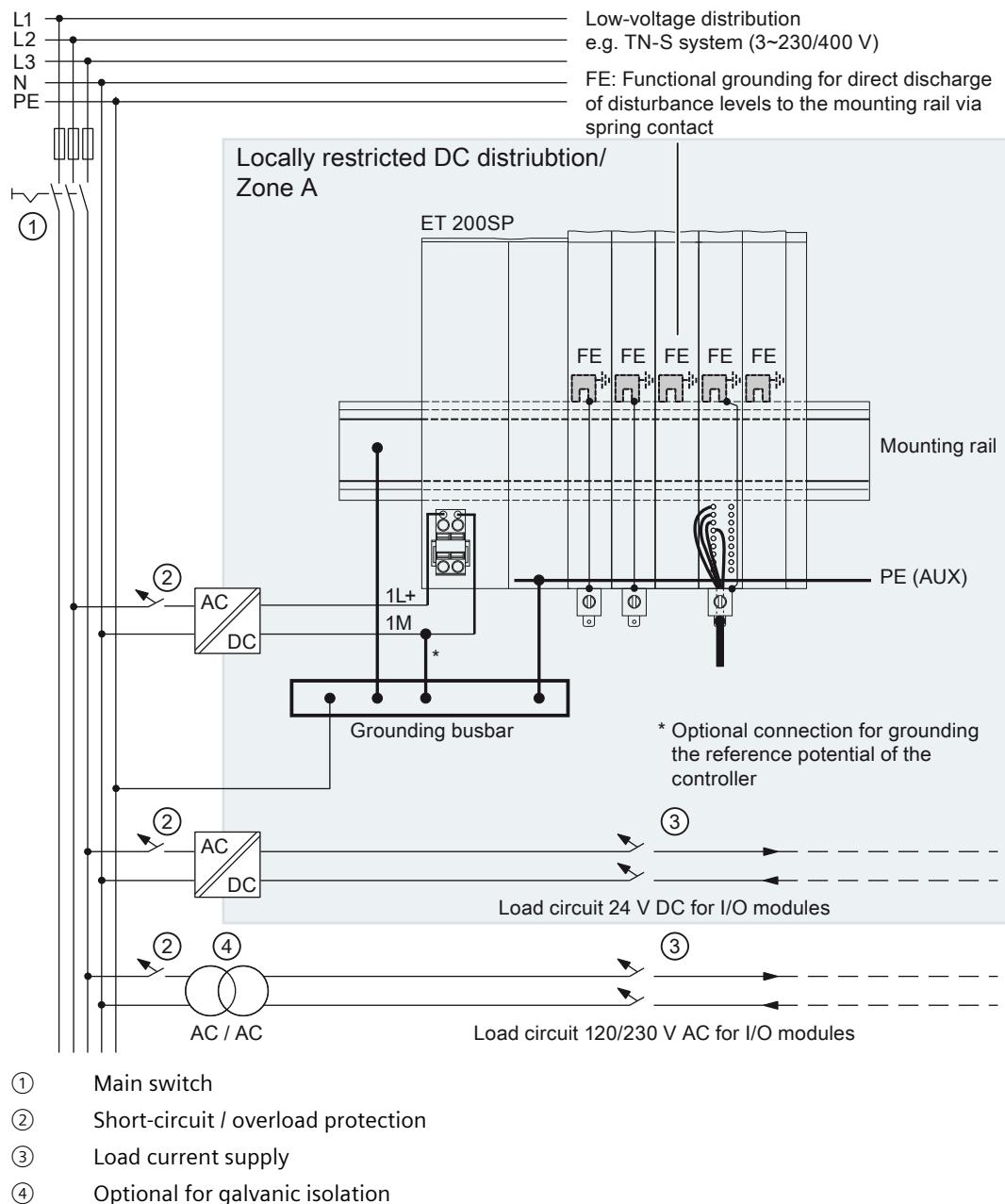


Figure 8-1 ET 200SP in the total configuration

NOTE

In general, you need to connect the DC I/O modules of the ET 200SP distributed I/O system to your own distribution (or batteries) via an upstream, local power supply unit.

If you connect the DC I/O modules directly to your own distribution, you need to provide additional protective measures against overvoltages.

8.6 Electrical configuration of the ET 200SP

Electrical isolation

Electrical relationships

With the ET 200SP distributed I/O system, there is electrical isolation between:

- The load circuits/process and all other circuit components of the ET 200SP distributed I/O system.
- The communication interfaces of the CPU (PROFINET) or of the interface module (PROFINET/PBIFBUS) and all other circuit components.

The figures below show the electrical relationships of the ET 200SP distributed I/O system with the CPU and the interface module. Only the most important components are represented in the figures.

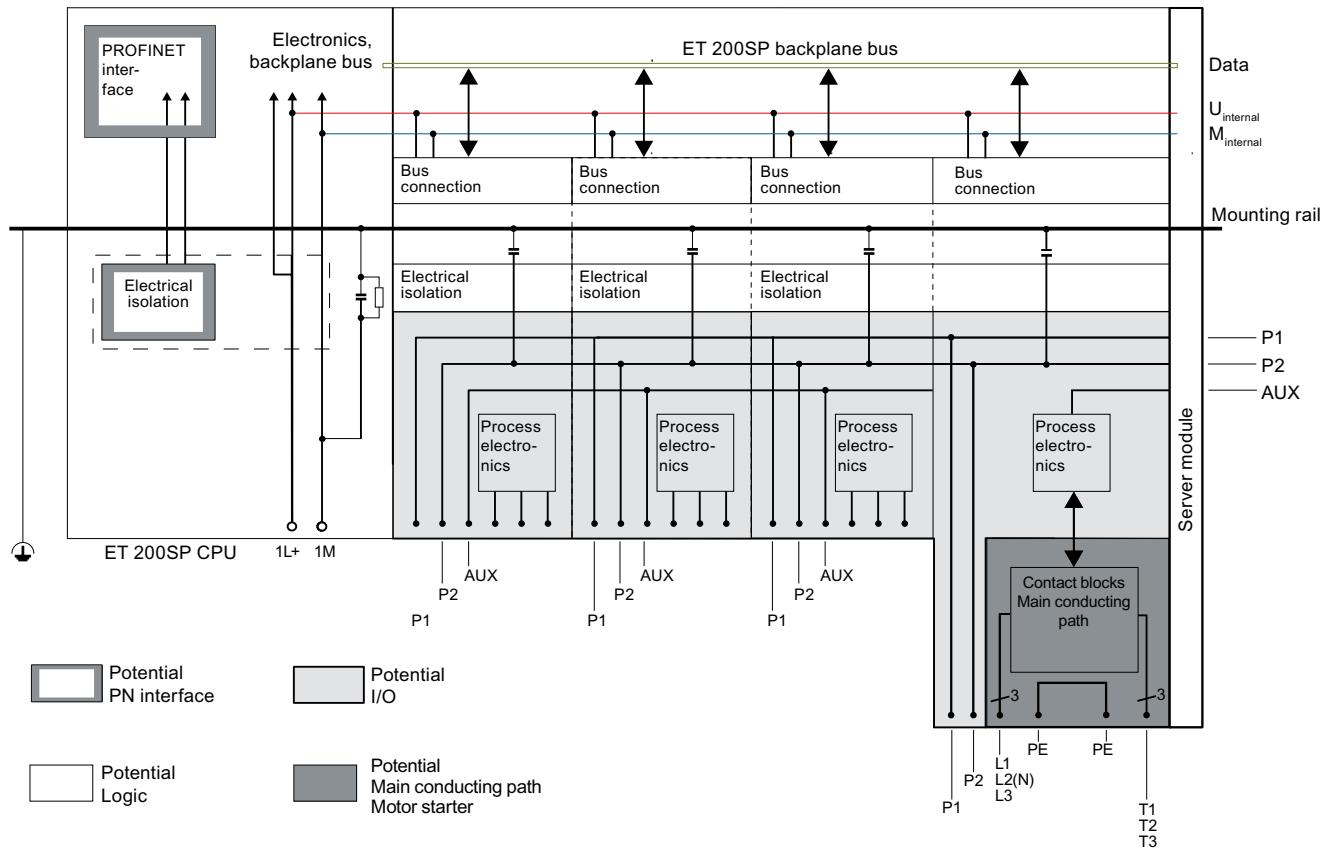


Figure 8-2 Electrical relationships for ET 200SP with CPU

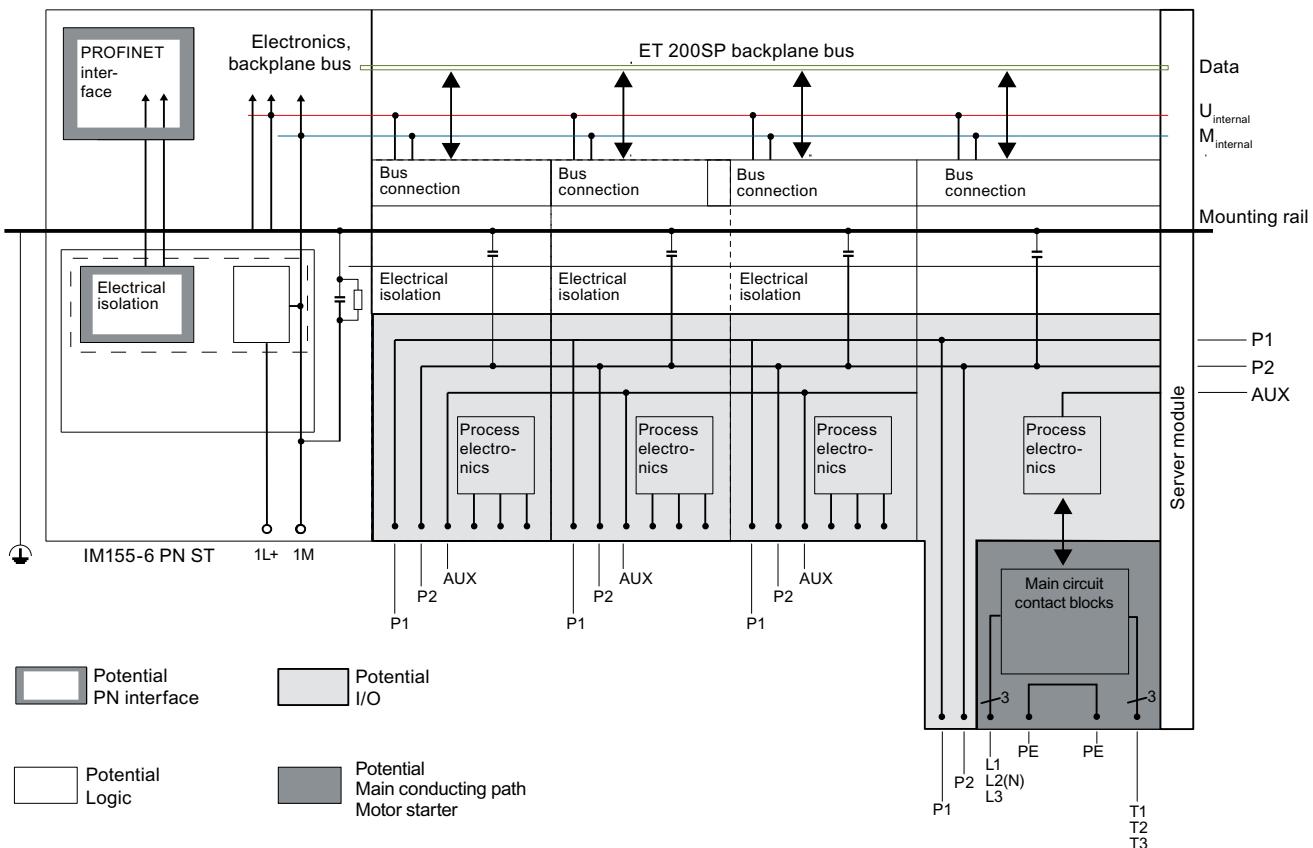


Figure 8-3 Electrical relationships for ET 200SP with interface module (using IM 155-6 PN ST as an example)

8.7 Wiring rules

Introduction

Use suitable cables to connect the ET 200SP distributed I/O system. Also select the cable insulation corresponding to the applied voltage. The tables below set out the wiring rules for CPU/interface module, BaseUnits and motor starter.

Wiring rules for the CPU/interface module and BaseUnits for I/O modules

Wiring rules for ...	CPU/interface module (supply voltage)	BaseUnits (push-in terminal)
Permitted cable cross-sections of solid cables (Cu)	0.2 to 2.5 mm ² AWG*: 24 to 13	
Permitted cable cross-sections of flexible cables (Cu)	Without end sleeve 0.2 to 2.5 mm ²	

* AWG: American Wire Gauge

** End sleeves without plastic sleeve: 0.25 to 2.5 mm²/AWG: 24 to 13

*** See note on end sleeves

Wiring rules for ...		CPU/interface module (supply voltage)	BaseUnits (push-in terminal)
sections of flexible cables (Cu)	Without end sleeve	AWG*: 24 to 13	AWG*: 24 to 14
	With end sleeve (with plastic sleeve)***	0.25 mm to 1.5 mm ² **	0.14 mm to 1.5 mm ²
		AWG*: 24 to 16	AWG*: 26 to 16
	With TWIN end sleeve***	0.5 mm to 1 mm ²	0.5 to 0.75 mm ² (see below)
		AWG*: 20 to 17	AWG*: 20 to 18
Stripping length of the wires		8 to 10 mm	
End sleeves in accordance with DIN 46228 with plastic sleeve***		8 and 10 mm long	
TWIN end sleeves		12 mm long	

* AWG: American Wire Gauge

** End sleeves without plastic sleeve: 0.25 to 2.5 mm²/AWG: 24 to 13

*** See note on end sleeves

Note the following for BaseUnits with function version < FS10:

NOTE

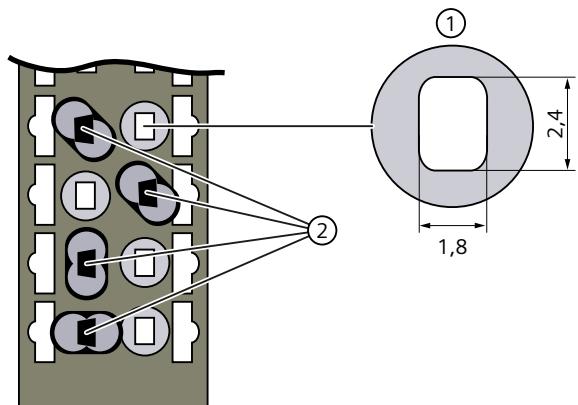
End sleeves

Optimum results with respect to a high-quality and permanent electrical connection with maximum conductor pull forces at the same time can be achieved by using crimping dies, preferably with smooth surfaces, which are provided, for example, with rectangular and trapezoidal crimp cross-sections.

Crimping dies with a pronounced wave profile are unsuitable.

TWIN end sleeves for the cables of the I/O modules' push-in terminals

Due to the space required by TWIN end sleeves with 0.75 mm^2 cross-section, you must ensure a correct angle for the cable arrangement when crimping the TWIN end sleeve so that the cables are optimally arranged.



- ① Cross-section of the terminal compartment
- ② Crimping TWIN end sleeves at the correct angle

Figure 8-4 TWIN end sleeves

Wiring rules for motor starters

Wiring rules for ...		L1(L), L2(N), L3, PE	T1, T2, T3, PE, 24 V DC, F-DI, M	DI1 ... DI3, LC, M, 24 V OUT	
Permitted cable cross-sections of solid cables (Cu)		1 to 6 mm^2	0.5 to 2.5 mm^2	0.2 to 1.5 mm^2	
		AWG: 18 to 10	AWG: 20 to 12	AWG: 24 to 16	
Permitted cable cross-sections of flexible cables (Cu)	Without end sleeve	1 to 6 mm^2	0.5 to 2.5 mm^2	0.2 to 1.5 mm^2	
		AWG: 18 to 10	AWG: 20 to 12	AWG: 24 to 16	
	With end sleeve	1 to 6 mm^2	0.5 to 2.5 mm^2	0.25 to 1.5 mm^2	
		AWG: 18 to 10	AWG: 20 to 12	AWG: 24 to 16	
	With end sleeve (with plastic sleeve)	1 to 4 mm^2	0.5 to 1.5 mm^2	0.25 to 0.75 mm^2	
		AWG: 18 to 11	AWG: 20 to 16	AWG: 24 to 18	
Stripping length of the wires		15 mm	10 mm	8 mm	
End sleeves according to DIN 46228 with plastic sleeve		15 mm long	10 mm long	8 mm long	

Safety standards for fail-safe motor starters

Fail-safe motor starters fulfill the following standards under certain conditions:

- PLe/Cat.4 according to EN ISO 13849-1
- Safety Integrity Level SIL 3 according to IEC 62061

To fulfill both standards, lay cross-circuit proof and P-cross-circuit proof control cables from the safe output of a sensor or F-DQ to the safe input of the motor starter, e.g. as a separately sheathed cable or in a separate cable duct.

Line protection

The line protection of the SIMATIC ET 200SP motor starter is provided for the motor outgoing feeder cable when the following condition is met:

The cross-section of the motor outgoing feeder cable must be dimensioned for the load ratios of the motor and for the cable-laying method.

Comply with national regulations. The user is responsible for the correct selection and dimensioning of the motor connection cable to DIN VDE 0100 and DIN VDE 0298-4 and/or UL 508.

The conductor protection for the incoming feeders must be ensured by the owner of the installation depending on the cross-section.

Cable temperature measurement threshold

NOTE

Cable temperature measurement threshold

When choosing a cable, remember that the cable temperature in operation can be up to 30 °C higher than the ambient temperature of the ET200SP system (example: at an ambient temperature of 60 °C, a connection conductor must be dimensioned for a temperature range of at least 90 °C).

You should specify other connection types and material requirements based on the electrical characteristics of the circuits you use and the installation environment.

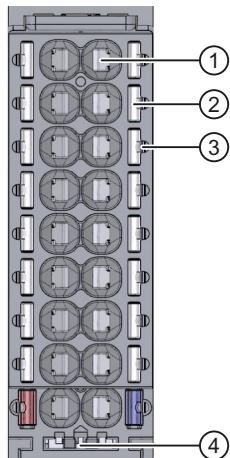
8.8 Wiring BaseUnits for I/O modules

Introduction

The BaseUnits connect the ET 200SP distributed I/O system to the process. The following versions of the BaseUnits can be used:

- BaseUnits (with light-colored terminal box) for opening a potential group: BU..D
- BaseUnits (with dark-colored terminal box) for extending the potential group: BU..B
- BaseUnits with additional AUX terminals or additional terminals: BU..+10..
- BaseUnits with integrated thermal resistor for compensation of the reference junction temperature when connecting thermocouples: BU..T
- PotDis-BaseUnits (with light-colored terminal box) for opening a PotDis potential group: PotDis-BU..D

- PotDis-BaseUnits (with dark-colored terminal box) for extending the potential group:
PotDis-BU..B



- ① Push-in terminal
- ② Spring release
- ③ Measuring probe (suitable probes: 1 mm diameter, length \geq 10 mm while observing the permitted voltage category)
- ④ Holder for shield connection

Figure 8-5 View of the BaseUnit

NOTE

The pin assignment of the BaseUnit depends on the connected I/O module. Information on the BaseUnits and I/O modules can be found in the associated manuals.

Replacement of the terminal box on the BaseUnit is described in the section [Replacing the terminal box on the BaseUnit \(Page 290\)](#).

NOTE

Special terminal designations in the wiring and block diagrams of the I/O modules/BaseUnits

- **RES:** Reserve, these terminals must remain unconnected so that they can be used for future expansions
- **n.c.:** Not connected, these terminals have no function. However, they can be connected to potentials specifically defined for a module, for example, for the laying unused wires.

Requirements

- The supply voltages are turned off.
- Follow the wiring rules.
- Color identification labels ([Page 175](#)) (optional) have been applied.

Required tools

3 to 3.5 mm screwdriver

Tool-free connection of cables: single-wire without wire end ferrule, multi-wire (stranded) with wire end ferrule or ultrasonically sealed

Watch the video sequence (<https://support.automation.siemens.com/WW/view/en/95886218>)

To connect a wire without tools, follow these steps:

1. Strip 8 to 10 mm of the wires.
2. Only in the case of stranded conductors (except for 2.5 mm² cross-section):
Seal or crimp the wire with wire end ferrules.
3. Insert the wire into the push-in terminal as far as it will go.

Connection of cables: multi-wire (stranded), without wire end ferrule, unprocessed

To connect a wire without a wire end ferrule, follow these steps:

1. Strip 8 to 10 mm of the wires.
2. Push with the screwdriver into the spring release.
3. Insert the wire into the push-in terminal as far as it will go.
4. Pull the screwdriver out of the spring release.

Removing wires

Using the screwdriver, press the spring release of the terminal as far as it will go and pull out the wire.

NOTE

When you press the spring release, you should not pull on the wire/cable at the same time. This prevents you from damaging the terminal.

8.9 Connecting cable shields for I/O modules

Introduction

- You need the shield connector to contact cable shields (e.g. for analog modules). The shield connector conducts interference currents on cable shields to ground via the mounting rail. It is not necessary to contact the shield at where the cable enters the cabinet.
- Attach the shield connector to the BaseUnit.
- The shield connection consists of a shield support, a shield terminal and a supporting element.
- The shield connector is automatically connected to the functional ground (FG) of the mounting rail after installation.

Requirements

- BaseUnit must be one of the following types:
 - A0, A1
 - B0
 - C0, C1
 - F0
 - U0
- The shield terminal is suitable for cables with max. Ø 7 mm each.

Required tools

- Stripping tool
- Slotted screwdriver with a 3.5 mm blade or Torx T10

Procedure

Watch the "Wiring BaseUnits" video sequence
(<https://support.automation.siemens.com/WW/view/en/95886218>)

To connect the cable shield, follow these steps:

1. If necessary, connect the supply voltage L+ and ground to the BaseUnit.
2. Push the supporting element with the shield support into the guideway till the supporting element clicks into place.
If you use a 7.5 mm mounting rail, you must first shorten the supporting element. To do so, unscrew the spacer of the support element.
3. Remove the cable insulation material around the shield terminal.
Connect the cable to the BaseUnit and place the cable in the shield contact.
4. Insert the shield terminal into the corresponding clamping position of the shield support.
 - Clamping space height 1: 1.9 mm to 15.5 mm
 - Clamping space height 2: 10.9 mm to 23.5 mm

5. Tighten the shield terminal with approximately 0.5 Nm.

When doing this, ensure that the terminal is completely in contact with the exposed protective braided shield.

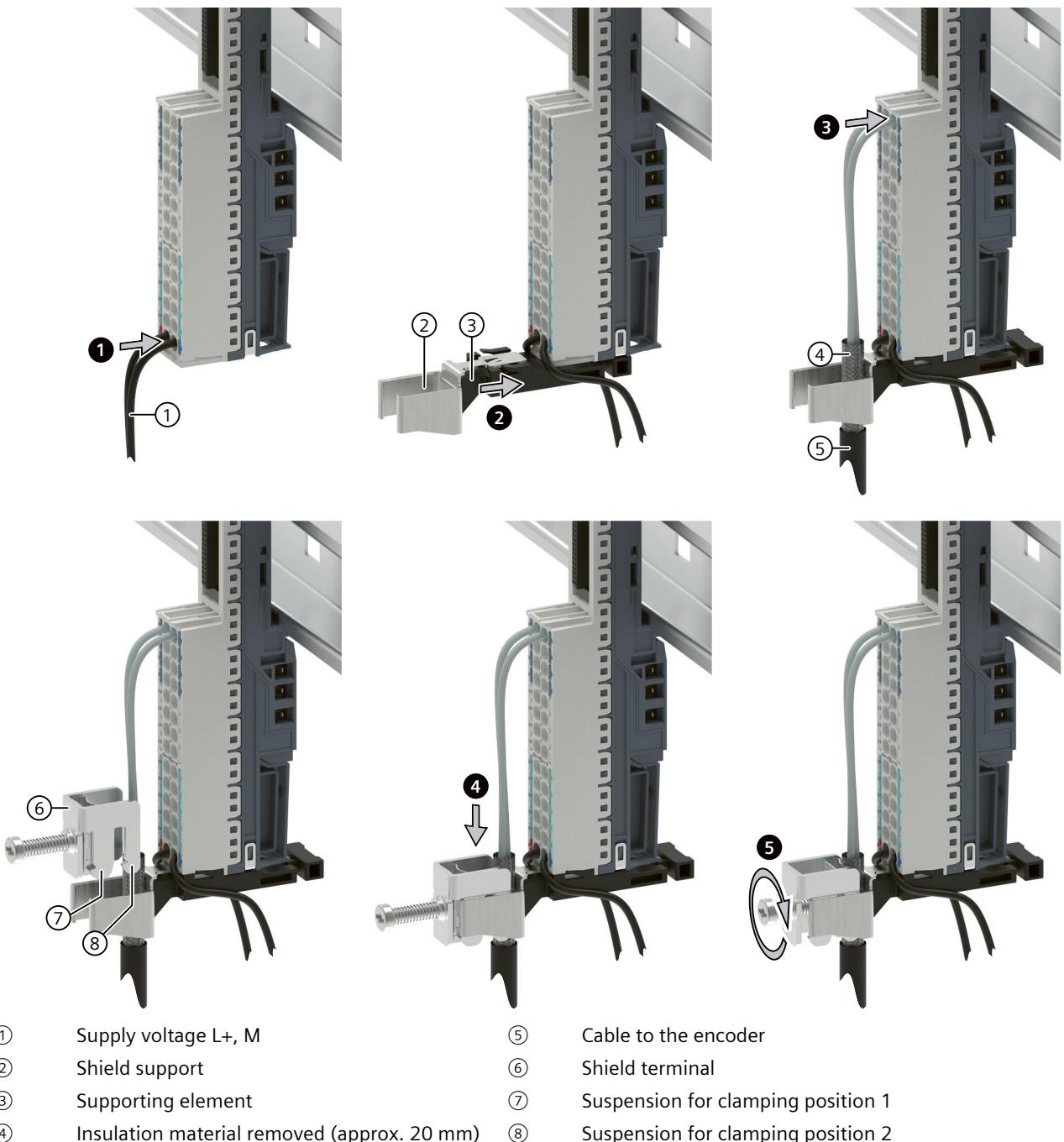


Figure 8-6 Mounting the shield contact

NOTE

Shield terminal does not have a null terminal.

Fix the shield terminal only when there is at least one inserted cable.

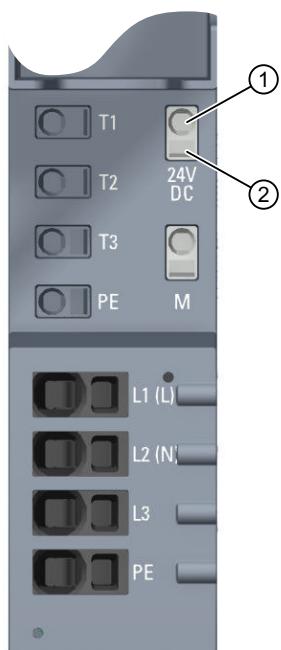
8.10 **Wiring BaseUnits for motor starters**

Introduction

The following versions of BaseUnits can be used:

- BU30-MS1 (with 24 V DC and 500 V AC infeed)
- BU30-MS2 (with 500 V AC infeed)
- BU30-MS3 (with 24 V DC infeed)
- BU30-MS4 (without infeed)
- BU30-MS5 (with 500 V AC infeed and single F-DI)
- BU30-MS6 (without infeed and with single F-DI)
- BU30-MS7 (with F-DI and 500 V AC infeed)
- BU30-MS8 (with 500 V AC infeed and F-DI routing)
- BU30-MS9 (with F-DI routing)
- BU30-MS10 (with F-DI infeed)

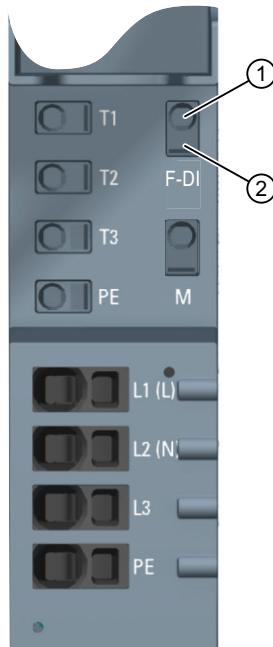
The following figure shows an example of a BaseUnit BU30-MS1 (with the maximum number of terminals):



- ① Push-in terminal
② Spring release

Figure 8-7 Terminals on a BaseUnit BU30-MS1

The following figure shows an example of a BaseUnit BU30-MS5 (with the maximum number of terminals):



- ① Push-in terminal
- ② Spring release

Figure 8-8 Terminals on a BaseUnit BU30-MS5

DANGER
Hazardous Voltage Can Cause Death, Serious Injury, or Property Damage.
Hazardous electrical voltage can cause electric shock, burns and property damage. Turn off and lock out all power supplying this device before working on this device.

For wiring finely-stranded or stranded conductors without end sleeves on push-in connections, a screwdriver is required.

Requirements

- The supply voltages are switched off
- Observe the wiring rules

NOTICE

Interconnection of the F-DI input of BaseUnits BU-30-MS5, BU-30-MS6, BU-30-MS7 and BU-30-MS10 with surge filters

If your system requires overvoltage protection, you must interconnect the F-DI input of the BaseUnits BU-30-MS5, BU-30-MS6, BU-30-MS7 and BU-30-MS10 with surge filters.

Please see "Electromagnetic Compatibility" in the technical specifications.

Required tools

Use the screwdriver "SZF 1-0.6x3.5" (for finely-stranded cables only).

Connecting conductors: Solid without end sleeve, stranded (stranded wire) with end sleeve

To connect a cable, proceed as follows:

1. Insulate the cables in accordance with the table in chapter "Electromagnetic compatibility of fail-safe modules (Page 326)".
2. Only in the case of stranded conductors:
Crimp the cable with end sleeves.
3. Insert the cable into the push-in terminal as far as it will go.
4. Pull on the cable to ensure it is tight.

Connecting conductors: multi-wire (stranded), without end sleeve, unfinished

To connect a cable, proceed as follows:

1. Insulate the cables in accordance with the table in chapter "Wiring rules (Page 146)".
2. Press the screwdriver into the spring release.
3. Insert the conductor into the push-in terminal until it engages.
4. Pull the screwdriver out of the spring release.
5. Check whether or not the conductor is firmly connected by pulling on the cable.

Video sequence

At the following Internet link, you can see a video about connecting conductors: Wire BaseUnits (<http://support.automation.siemens.com/WW/view/en/95886218>)

Releasing conductors

To release a conductor, proceed as follows:

1. Press the screwdriver into the spring release of the terminal until it engages.
2. Pull the conductor out.

NOTE

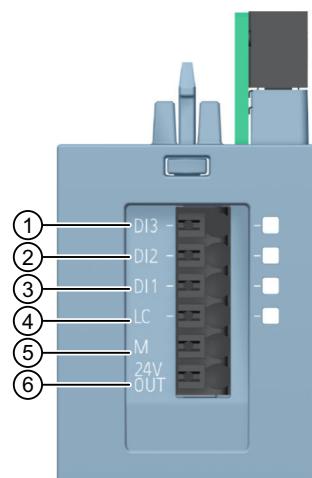
When pressing the spring release, you must not pull on the wire/cable at the same time. In this way, you avoid damaging the terminal.

8.11 Connecting the 3DI/LC module for the motor starter

You will find further information on the 3DI/LC module in the ET 200SP motor starter (<https://support.industry.siemens.com/cs/ww/en/view/109479973>) manual.

Procedure

The figure below shows the connections of the 3DI/LC module.



- ① Digital input 3
- ② Digital input 2
- ③ Digital input 1
- ④ Local control (manual local)
- ⑤ Ground
- ⑥ 24 V DC/ 100 mA output

NOTE

The digital inputs (1 to 4) are not isolated. The reference potential is M (5). Control the digital inputs only via a unit supplied from the 24 V DC output (6).

Connect only cables of a width not exceeding 30 m to the 3DI/LC module.

The supply (5 and 6) is protected against short-circuits.

Terminal sketch of the 3DI/LC module

The following diagram shows a terminal sketch of the 3DI/LC module:

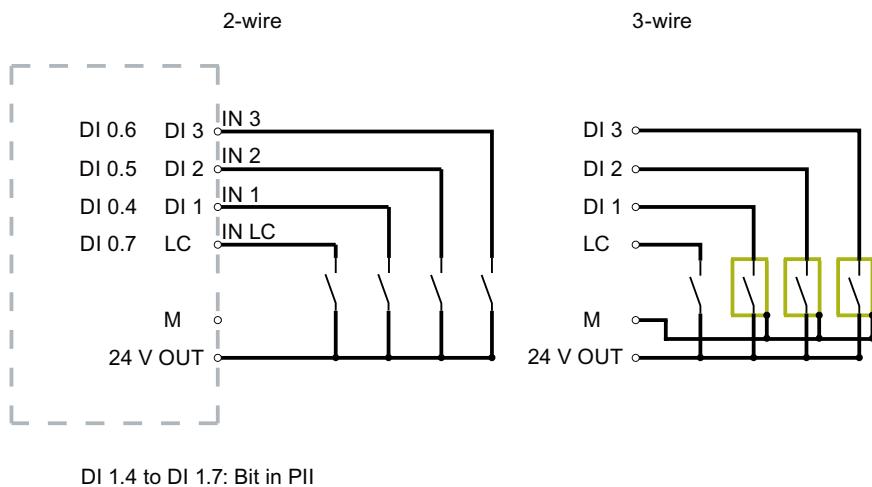


Figure 8-9 Connection example of inputs

8.12 Connecting the supply voltage to the CPU/interface module

Introduction

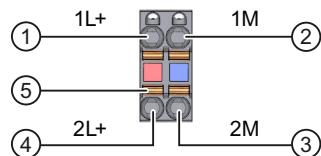
The supply voltage of the CPU/interface module is supplied by means of a 4-pin connector plug located on the front of the CPU/interface module.

Power supply unit

Only use power supply units of type SELV/PELV with safe electrically isolated functional extra low voltage (≤ 28.8 V DC).

Connection for supply voltage (X80)

The connections of the 4-pole connector have the following meaning:



- ① +24 V DC of the supply voltage (current limited to 10 A)
- ② Ground of the supply voltage (current limited to 10 A)
- ③ Ground of the supply voltage for loop-through
- ④ +24 V DC of the supply voltage for loop-through
- ⑤ Spring opener (one spring opener per terminal)
1L+ and 2L+ and 1M and 2M are internally jumpered

Figure 8-10 Supply voltage connection

A strain relief is not present. The cable connector offers you the option of looping the supply voltage uninterrupted, even when it is unplugged.

For the maximum wire cross-sections, observe the information in the tables of the wiring rules [\(Page 146\)](#).

Requirements

- Only wire up the connector plug when the supply voltage is turned off.
- Follow the wiring rules [\(Page 146\)](#).

Required tools

3 to 3.5 mm screwdriver

Tool-free connection of cables: single-wire without end sleeve, multi-wire (stranded) with end sleeve or ultrasonically sealed

Watch video sequence: "Connect BusAdapter to the interface module"
<https://support.automation.siemens.com/WW/view/en/95886218>

To connect a wire without tools, follow these steps:

1. Strip 8 to 10 mm of the wires.
2. Only in the case of stranded conductors:
Seal or crimp the wire with end sleeves.
3. Insert the cable into the push-in terminal as far as it will go.
4. Push the wired connector plug into the plug socket of the interface module.

Connection of cables: multi-wire (stranded), without end sleeve, unfinished

To connect a wire without an end sleeve, follow these steps:

1. Strip 8 to 10 mm of the wires.
2. Using a screwdriver, press the spring release and insert the wire into the push-in terminal as far as it will go.
3. Pull the screwdriver out of the spring release.
4. Push the wired connector plug into the socket in the interface module.

Removing a wire

Using the screwdriver, press the spring release as far as it will go and pull out the wire.

8.13 Connecting interfaces for communication

Connect the communication interfaces of the ET 200SP distributed I/O system using the standardized connector or directly. If you want to prepare communication cables yourself, the interface assignment is specified in the manuals of the corresponding modules. Observe the mounting instructions for the connectors.

Detailed information on the available BusAdapters and the procedure for connecting PROFINET IO to the CPU/interface module is available in the BusAdapter (<https://support.industry.siemens.com/cs/ww/en/view/109751716>) manual.

8.13.1 Connecting PROFINET IO (port P3) to the CPU

Introduction

You use the RJ-45 bus connector to connect PROFINET IO (port P3) directly to the CPU.

Required accessories

- Cable ties with standard width of 2.5 mm or 3.6 mm for strain relief
- Please observe the specifications in the PROFINET Installation Guide (<https://www.profibus.com>).

Mounting the bus connector

Mount the PROFINET connector in accordance with the instructions in the PROFINET Installation Guide (<https://www.profibus.com>).

Procedure

Insert the RJ45 bus connector into the PROFINET port (port P3) on the CPU.

NOTE

Cable support and strain relief

If you are using a FastConnect RJ45 bus connector with 90° cable outlet (6GK1901-1BB20-2AA0), we recommend you provide strain relief for the PROFINET connecting cable. For this you need a cable tie with a standard width of 2.5 mm or 3.6 mm. Use it to fasten the PROFINET connecting cable directly after it exits the bus connector to the provided cable support on the CPU (on the front directly below the PROFINET interface X1P3).

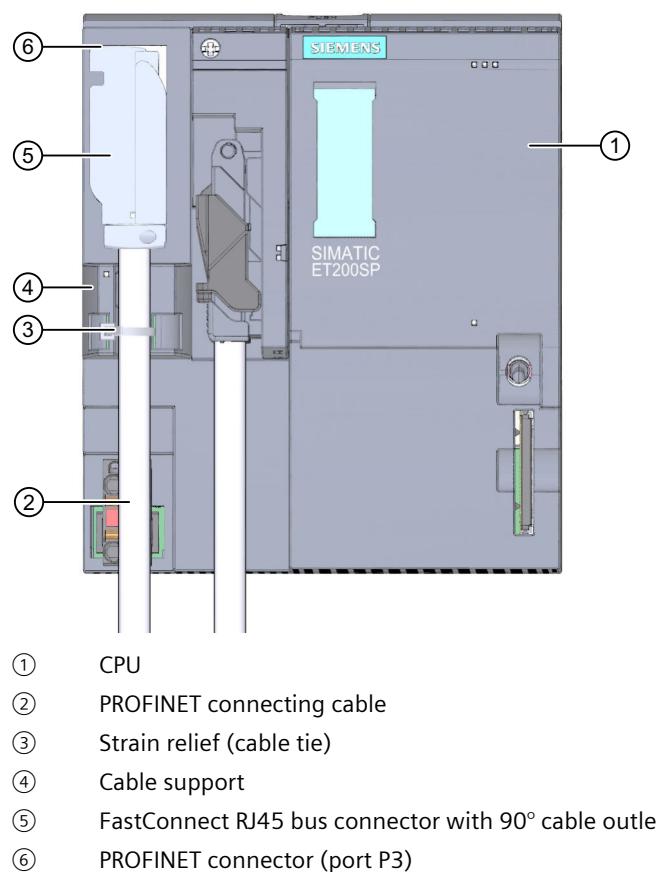


Figure 8-11 Connecting PROFINET IO (port P3) to the CPU

8.13.2 Connecting the PROFIBUS DP interface to the interface module/communications module CM DP

Introduction

Using the bus connector (RS485), connect the PROFIBUS DP to the interface module/communications module CM DP.

Required tools

3 to 3.5 mm screwdriver

Procedure

To connect the PROFIBUS DP interface to the interface module / DP communication module CM DP, follow these steps:

1. Connect the PROFIBUS cable to the bus connector.
2. Plug the bus connector into the PROFIBUS DP connector.
3. Securely tighten the fixing screws of the bus connector (0.3 Nm).

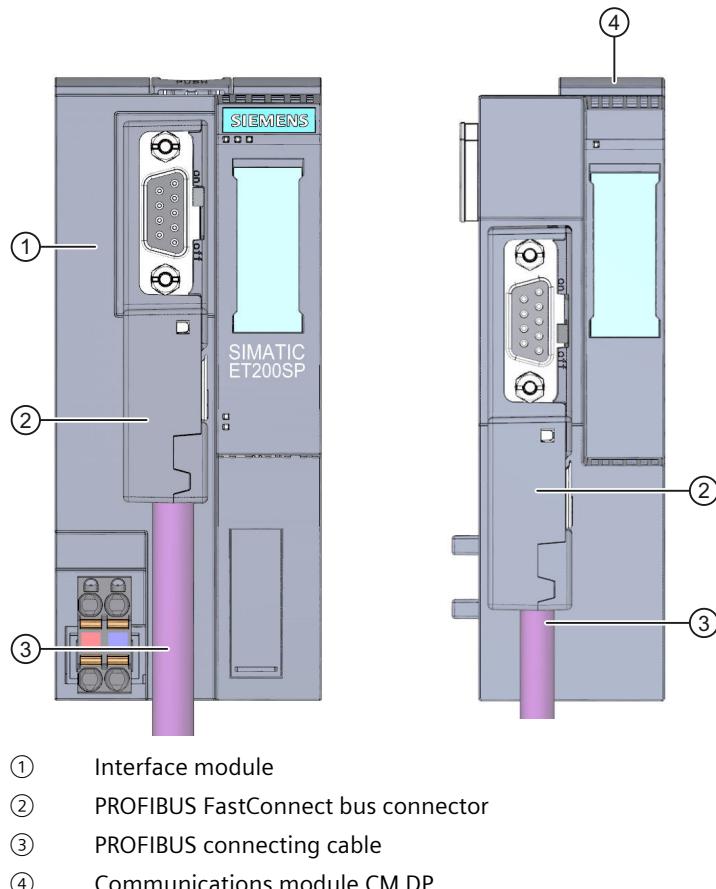


Figure 8-12 Connect PROFIBUS DP to the interface module/communications module CM DP

Reference

You can find additional information on the PROFIBUS FastConnect bus connector in the corresponding product information on the Internet (<https://support.industry.siemens.com/cs/ww/de/view/109793857/en>).

8.14 Inserting I/O modules / motor starters and BU covers

Introduction

- You insert the I/O modules on the BaseUnits. The I/O modules are self-coding and type-coded.
- You insert the PotDis-TerminalBlocks on the PotDis-BaseUnits.
- You insert the BU covers on BaseUnits whose slots are not equipped with I/O modules/PotDis-TerminalBlocks.
- You insert the BU covers on BaseUnits whose slots have been reserved for future expansion (as empty slots).
- The BU covers for motor starters serve as touch protection covers for unoccupied slots. The BU covers have a holder for the reference identification label on the inside. For future expansion of the ET 200SP, remove the reference identification label from the holder and insert it into the final I/O module.
It is not possible to attach a reference identification label to the BU cover itself.
There are three versions:
 - BU cover with a width of 15 mm
 - BU cover with a width of 20 mm
 - BU cover with a width of 30 mm (for motor starters)

Requirement

Refer to chapter "Application planning [\(Page 80\)](#)".

Plugging in I/O modules and BU covers

Watch video sequence: "Insert I/O modules"

(<https://support.automation.siemens.com/WW/view/en/95886218>)

Insert the I/O module or BU cover parallel into the BaseUnit until you hear both latches click into place.

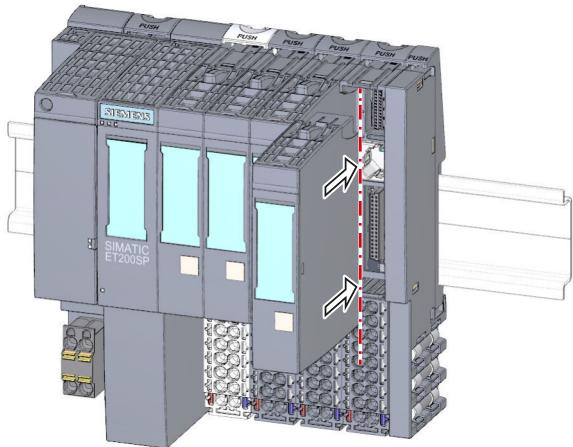


Figure 8-13 Plugging in I/O modules or BU covers (using an I/O module as example)

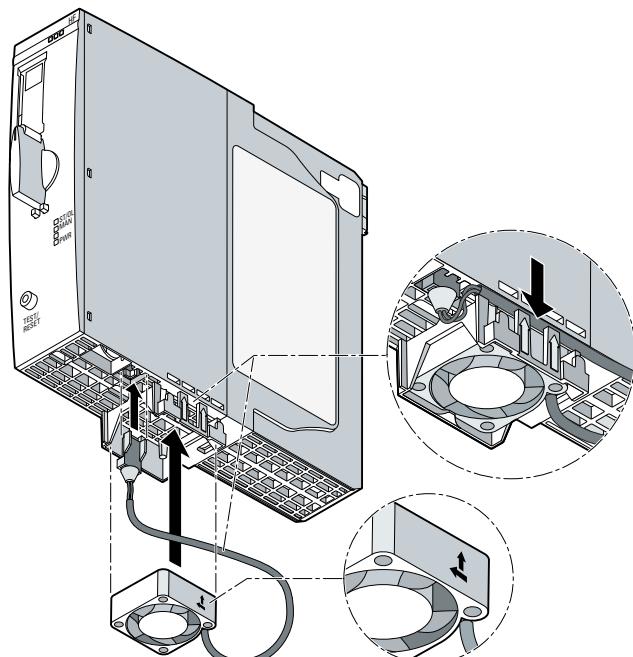
8.15 Mounting/disassembly of motor starters

8.15.1 Mounting the fan

Procedure

Proceed as follows to mount a fan on a SIMATIC ET 200SP motor starter:

1. Slide the fan onto the motor starter until you can hear the fan engage.
Observe the blowing direction of the fan when mounting. The air stream must be directed to the inside of the motor starter. The correct blowing direction is indicated by arrows on the bottom of the fan.
2. Insert the connection plug into the opening above the fan.



3. Secure the fan cable to the fixing eyes on the right-hand side of the fan cover.

NOTE

Specified ambient temperatures are not reached if the fan is incorrectly installed

If you do not observe the blowing direction of the fan when mounting, the specified ambient temperatures will not be reached. The device shuts down prematurely due to excessively high temperature.

8.15.2 Mounting/disassembly of motor starters

Procedure

⚠ CAUTION

Protection against electrostatic charge

When handling and installing the SIMATIC ET 200SP motor starter, ensure protection against electrostatic charging of the components. Changes to the system configuration and wiring are only permissible after disconnection from the power supply.

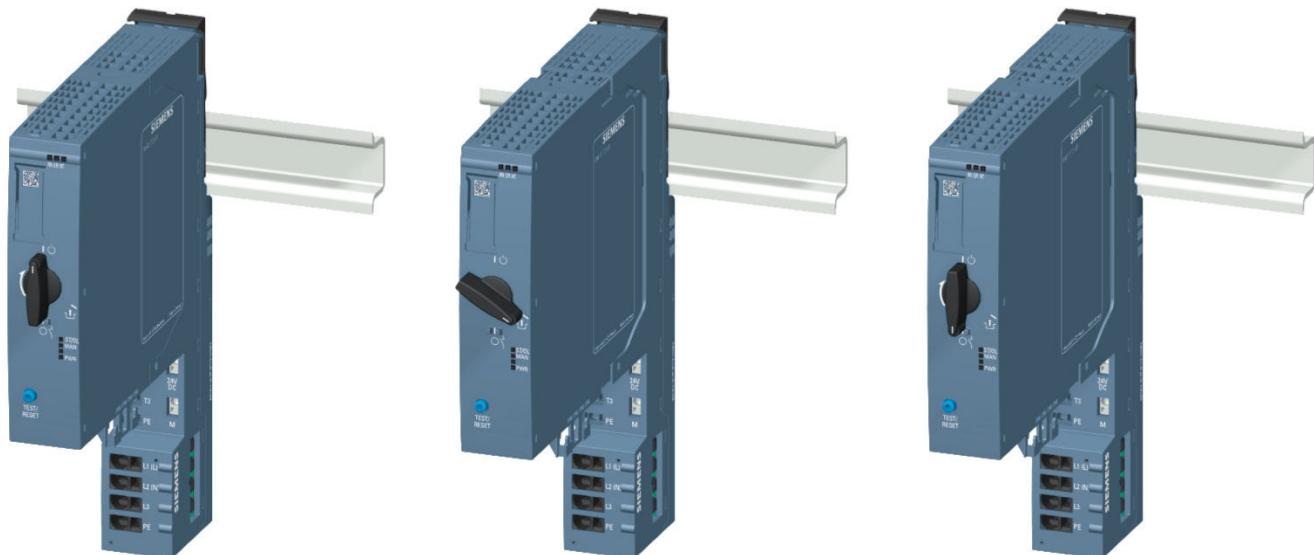
To assemble a SIMATIC ET 200SP motor starter, proceed as follows:

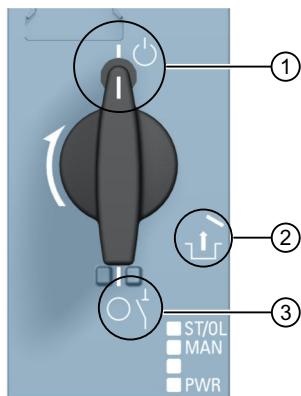
- Position the mechanical interlock of the SIMATIC ET 200SP motor starter in the assembly/disassembly position ②
- Place the SIMATIC ET 200SP motor starter onto the BaseUnit.
- Turn the mechanical interlock clockwise to the parking position ③
- Turn the mechanical interlock counterclockwise to the operating position (= end position) ①

①

②

③





- ① Operating position/READY
The motor starter is firmly locked in the BaseUnit, and all electrical contacts are connected.
- ② Assembly/disassembly position
All electrical contacts are open, and you can use the SIMATIC ET 200SP motor starter in the BaseUnit, or you can remove it from the BaseUnit.
- ③ Parking position/OFF
In this position, you cannot remove the SIMATIC ET 200SP motor starter from the BaseUnit, but all electrical contacts are open. In addition, you can open the locking lever on the mechanical rotary interlock in this position, and fix the position with a padlock (shackle diameter 3 mm). This ensures the isolating function in accordance with IEC 60947-1.
In the parking position, the motor starter counts as a disconnected element for the head module. During operation, the parking position is therefore a hot swapping state. See also Removing and inserting I/O modules/motor starters (hot swapping) (Page 283)



NOTE

Parking position/OFF

This position is only permissible for maintenance purposes and not for continuous operation. In this position, dust protection and mechanical durability are not ensured.

If you do not use the motor starter for an extended period, remove it and attach the BU cover (3RK1908-1CA00-OBPO).

Mount the touch protection cover for the infeed bus on the last BaseUnit.

NOTE

Touch protection cover for the infeed bus

You will find out how to mount the touch protection cover of the infeed bus on a SIMATIC ET 200SP motor starter in chapter "Mounting the cover for the 500 V AC infeed bus (Page 128)".

To connect the assembly, mount the server module after the last BaseUnit.

NOTE

Server module

You can find out how to assemble/disassemble the server module in chapter "Installing the server module [\(Page 127\)](#)".

NOTE

Removing the motor starter

You will find out how to remove the motor starter in chapter "Replacing a motor starter [\(Page 289\)](#)".

8.15.3 3DI/LC module

Introduction

The optional 3DI/LC module with three inputs and one further LC input can be connected to the motor starter. The status of the inputs of the 3DI/LC module can be seen via the process image input (PII) of the motor starter.

NOTE

The 3DI/LC module can be used for the motor starter and the fail-safe motor starter.

The input actions can be parameterized. For reasons of operational safety, the LC input is permanently set to manual local mode. For example, by parameterizing the inputs DI1 - DI3 with motor CLOCKWISE or motor COUNTER-CLOCKWISE, you can control the motor in manual local mode.

The figure below shows the 3DI/LC module.



Assembly

⚠ WARNING

Risk of injury from automatic restart

When you mount the the 3DI/LC module, the motor starter can switch on autonomously if an ON command (DI1 to DI3) is active. This can result in property damage or serious injury caused by connected devices that are automatically started up.

Revoke the ON commands at DI1 to DI3 before mounting the 3DI/LC module.

Proceed as follows to mount a 3DI/LC module onto a motor starter:

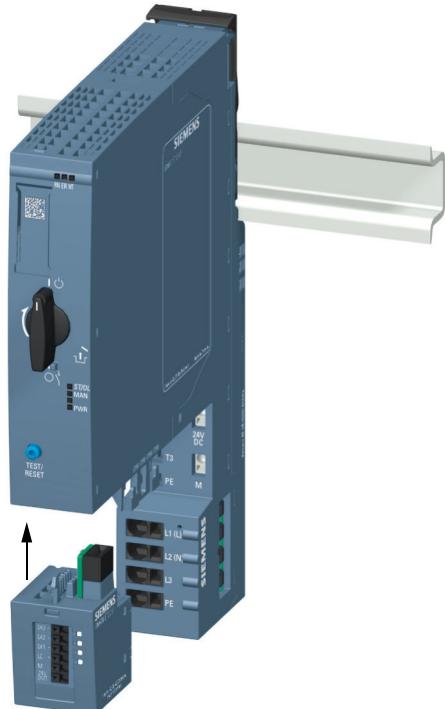
1. Wire the 3DI/LC module according to the connection diagram.

NOTE

Connecting the 3DI/LC module

You will find out how to connect the 3DI/LC module in chapter "Connecting the 3DI/LC module for the motor starter [\(Page 157\)](#)".

2. Slide the 3DI/LC module into the motor starter until the 3DI/LC module engages.



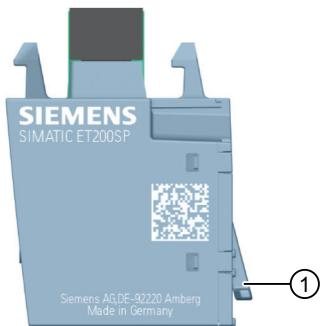
The figure below shows a motor starter with a mounted 3DI/LC module.



Disassembly

Proceed as follows to remove a 3DI/LC module from a motor starter:

1. Push the release lever on the rear of the 3DI/LC module.



2. Remove the 3DI/LC module from the motor starter while pressing the release lever.

8.16 Labeling ET 200SP

8.16.1 Factory markings

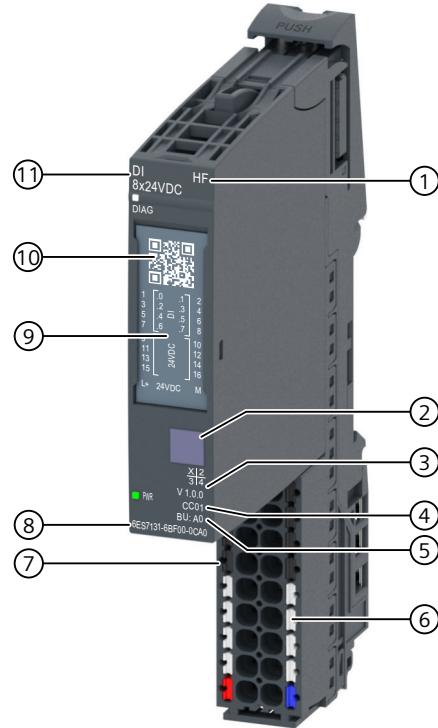
Introduction

For better orientation, the ET 200SP is equipped with various markings ex factory, which help in the configuration and connection of the modules.

Factory markings

- Module labeling
- Color coding of module type
 - Digital input modules: white
 - Digital output modules: black
 - Analog input modules: light blue
 - Analog output modules: dark blue
 - Technology module: turquoise
 - Communication module: light gray
 - Special module: mint green
- Module information
 - Functional version of the module, e.g. "X/2/3/4" (= functional version 1)
 - Firmware version of the module at delivery, e.g. "V1.0.0"
 - Color code for usable color identification label, e.g. "CC0"
 - Usable BaseUnit type, e.g. "BU: A0"
- Color coding of the potential group
 - Opening the potential group: Light-colored terminal box and light-colored mounting rail release button
 - Further conduction of the potential group: Dark-colored terminal box and dark-colored mounting rail release button
- Color coding of the spring releases
 - Process terminals: gray, white
 - AUX terminals: turquoise
 - Additional terminals: red, blue

- Terminals for self-assembling voltage buses P1, P2: red, blue



- ① Function class
- ② Color coding of module type
- ③ Function and firmware version
- ④ Color code for selection of the color coding labels
- ⑤ BU type
- ⑥ Color coding of the spring releases (by group)
- ⑦ Color coding of the potential group
- ⑧ Article number
- ⑨ Wiring diagram
- ⑩ 2D matrix code
- ⑪ Module type and designation

Figure 8-14 Factory markings

8.16.2 Optional markings

Introduction

In addition to the factory markings, there are also other options for labeling and/or marking terminals, BaseUnits and I/O modules for the ET 200SP distributed I/O system.

Optional markings

Color identification labels

The color identification labels are module-specific labels for color coding the potentials of the I/O modules. A color code (e.g. 01) is printed on each color identification label and I/O module. The color code allows you to read which color identification label is required for the terminals of the associated BaseUnit directly from the I/O module.

The following versions of color coded labels are available:

- Module-specific color combinations for the process terminals (see the device manuals I/O modules (<https://support.automation.siemens.com/WW/view/en/55679691/133300>)).
The different colors have the following meaning: Gray = input or output signal, red = potential +, blue = ground.
- For the AUX terminals in the colors yellow-green, blue or red
- For the add-on terminals in the colors blue-red
- For the potential distributor modules (see manual BaseUnits (<https://support.automation.siemens.com/WW/view/en/59753521>)):
 - For PotDis-BaseUnit PotDis-BU-P1/x-R: red
For PotDis-BaseUnit PotDis-BU-P2/x-B: blue
 - For PotDis-TB-P1-R: red or gray
For PotDis-TB-P2-B: blue or gray
For PotDis-TB-BR-W: depending on application, yellow/green, blue, red or gray
For PotDis-TB-n.c.-G: gray

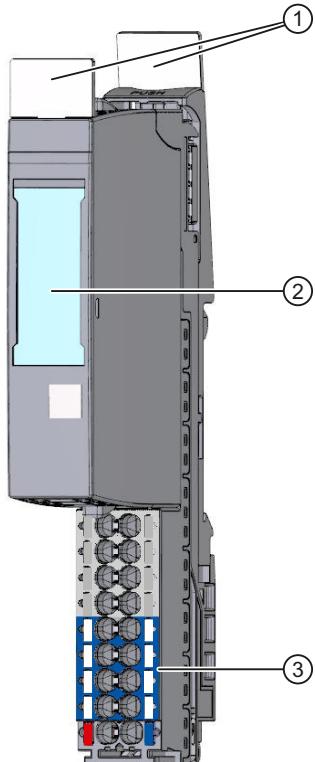
Reference identification labels

The reference identification labels (in accordance with EN 81346) can be inserted onto each CPU/interface module, BusAdapter, BaseUnit, I/O module and PotDis-TerminalBlock. This makes it possible to create a fixed assignment between the reference identification label of the BaseUnit and the I/O module/PotDis-TerminalBlock.

With the standard plotter setting, the reference identification label is suitable for automatic labeling with E-CAD systems.

Labeling strips

The labeling strips can be inserted in the CPU/interface module, I/O module and BU cover and allow identification of the ET 200SP distributed I/O system. The labeling strips can be ordered on a roll for thermal transfer printers or as DIN A4 format sheets for laser printers.



- ① Reference identification labels
- ② Labeling strips
- ③ Color identification labels

Figure 8-15 Optional markings

8.16.3 Applying color identification labels

Requirements

The BaseUnits must not be wired when you apply the color identification labels.

Required tools

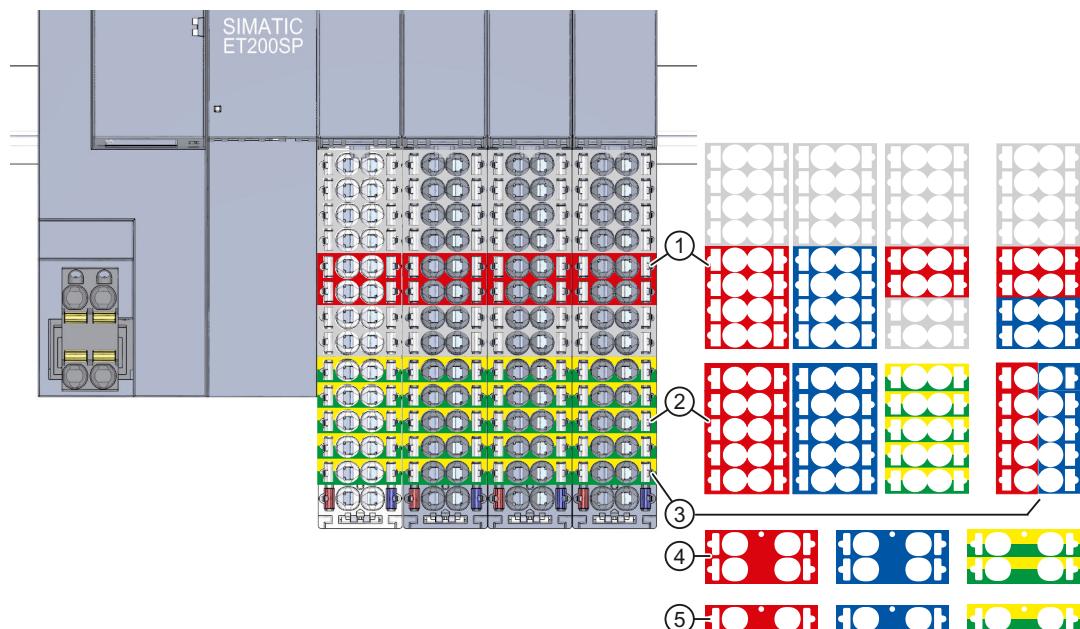
3 mm screwdriver (only for removing the color identification labels)

Applying color identification labels

Press color identification labels into the terminal box of the BaseUnit.

NOTE

To remove the color identification labels, you must first disconnect the wiring on the BaseUnit and then carefully lever the color identification labels out of the holder using a screwdriver.



- ① Module-specific color identification labels (15 mm) for the process terminals. You can find additional information in the I/O Module (<https://support.automation.siemens.com/WW/view/en/55679691/133300>) manual.
- ② Color identification labels (15 mm) for the 10 AUX terminals
- ③ Color identification label (15 mm) for the 10 add-on terminals
- ④ Color identification labels (20 mm) for the 4 AUX terminals
- ⑤ Color identification labels (20 mm) for the 2 AUX terminals

Figure 8-16 Applying color identification labels (example)

NOTICE**AUX bus as PE bar**

If you use an AUX bus as a protective conductor (PE), attach the yellow-green color identification labels to the AUX terminals.

If you stop using the AUX terminals as a protective conductor bar, remove the yellow-green color identification labels and make sure that the system is still protected.

NOTICE**Supply of incorrect potential possible**

Check that the color-coded labels/wiring is correct before commissioning the plant.

8.16.4 Applying labeling strips

Procedure

Watch video sequence: "Labeling"
(<https://support.automation.siemens.com/WW/view/en/95886218>)

Proceed as follows to install a labeling strip:

1. Label the strips.
2. Insert the labeling strip into the interface module or I/O module.

8.16.5 Applying reference identification labels

Procedure

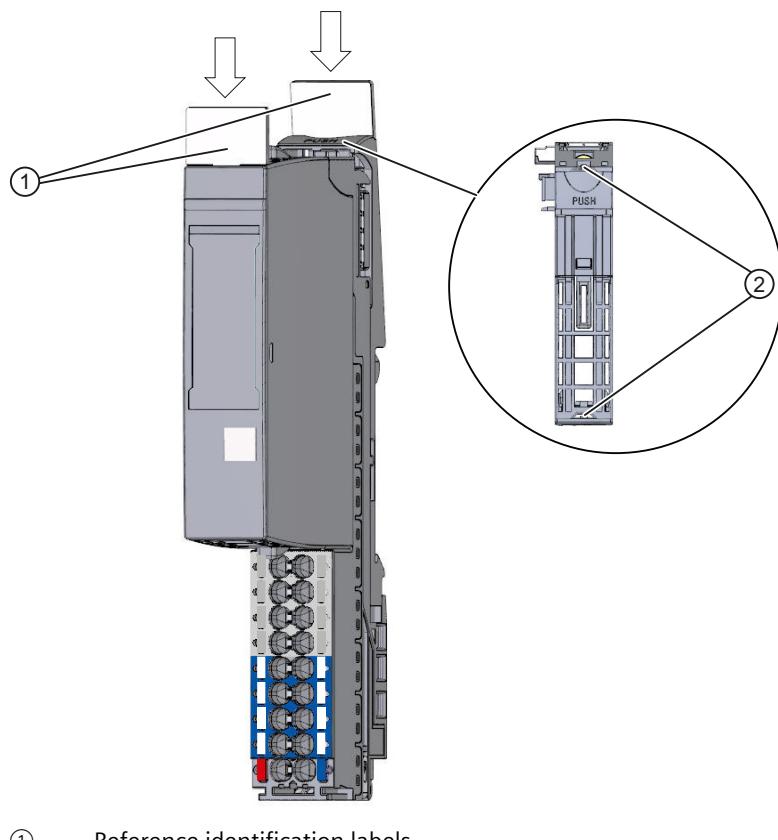
Watch video sequence: "Labeling"
(<https://support.automation.siemens.com/WW/view/en/95886218>)

Proceed as follows to install a reference identification label:

1. Break off the reference identification labels from the sheet.
2. Insert the reference identification labels into the opening on the CPU/interface module, BusAdapter, BaseUnit, I/O module and PotDis-TerminalBlock. The insertion opening is located on top of the BaseUnit or the I/O module/PotDis-TerminalBlock.

NOTE**Reference identification label**

The printable side of the reference identification label must be facing forward.



① Reference identification labels

② Opening for label

Figure 8-17 Applying reference identification labels

13

Commissioning

13.1 Overview

Introduction

This section includes information on the following topics:

- Commissioning the ET 200SP distributed I/O system on the PROFINET IO
- Commissioning the ET 200SP distributed I/O system on the PROFIBUS DP
- Startup of the ET 200SP distributed I/O system with empty slots
- Removing/inserting the SIMATIC memory card
- Operating modes of the CPU
- CPU memory reset
- Reassigning parameters during operation
- Identification and maintenance data

Commissioning requirements

NOTE

Performing tests

You must ensure the safety of your plant. You therefore need to run a complete functional test and make the necessary safety checks before the final commissioning of a plant.

Also allow for any possible foreseeable errors in the tests. This avoids endangering persons or equipment during operation.

NOTE

Check coding element in the I/O module

Make sure that the coding element is present in the I/O module before you plug in the I/O module for the first time. This reduces the risk of plugging the wrong type of module onto a wired BaseUnit when replacing a module.

PRONETA

With SIEMENS PRONETA (PROFINET network analysis), you analyze the system network during commissioning. PRONETA features two core functions:

- The topology overview independently scans PROFINET and all connected components.
- The IO check is a fast test of the wiring and the module configuration of a system.

You can find SIEMENS PRONETA on the Internet

(<https://support.automation.siemens.com/WW/view/en/67460624>).

MultiFieldbus Configuration Tool (MFCT)

MultiFieldbus Configuration Tool (MFCT) is a PC-based software and supports the configuration of MultiFieldbus- and DALI-devices. In addition, the MFCT offers convenient options for bulk firmware update of ET 200 devices with MultiFieldbus-support and reading of service data for many other Siemens devices.

You can find MFCT on the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/109773881>).

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities simultaneously on various SIMATIC S7 stations as a bulk operation independent of the TIA Portal.

General function overview:

- Network browsing and creation of a table showing the accessible devices in the network.
- Flashing of device LEDs or HMI display to locate a device
- Loading addresses (IP, subnet, gateway) into a device
- Loading the PROFINET name (station name) into a device name
- Placing a CPU in RUN or STOP mode
- Setting the time in a CPU to the current time of your programming device/PC
- Downloading a new program to a CPU or an HMI device
- Downloading from CPU, downloading to CPU or deleting recipe data from a CPU
- Downloading from CPU or deleting data log data from a CPU
- Backup/restore of data from/to a backup file for CPUs and HMI devices
- Downloading service data from a CPU
- Reading the diagnostics buffer of a CPU
- General reset of a CPU's memory
- Resetting devices to factory settings
- Downloading a firmware update to a device

You can find the SIMATIC Automation Tool on the Internet

(<https://support.industry.siemens.com/cs/ww/de/view/98161300>).

13.2 Commissioning the ET 200SP for PROFINET IO

Requirements

- The CPU/interface module is in the "Factory settings" status or has been reset to factory settings (see section Interface module (<https://support.automation.siemens.com/WW/view/en/55683316/133300>)).
- For CPU: The SIMATIC memory card is as delivered or has been formatted.

13.2.1 ET 200SP CPU as an IO controller

Configuration example

To use the ET 200SP distributed I/O system as an IO controller, you require the CPU 151xSP-1 PN.

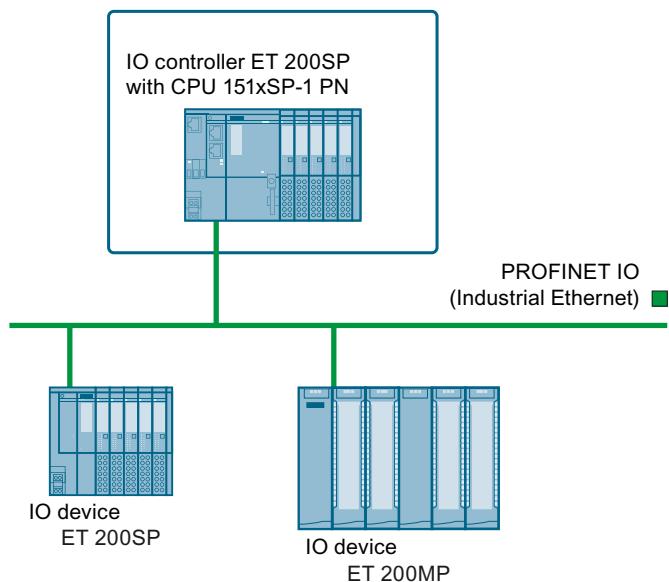


Figure 13-1 ET 200SP CPU as an IO controller

Commissioning procedure

To commission the ET 200SP distributed I/O system CPU as an IO controller for PROFINET IO, we recommend the following procedure:

Table 13-1 Procedure for commissioning the ET 200SP CPU as an IO controller for PROFINET IO

Step	Procedure	See ...
1	Installing ET 200SP	Section Installation (Page 112)
2	Connecting ET 200SP <ul style="list-style-type: none"> • Supply voltages • PROFINET IO • Sensors and actuators 	Section Wiring (Page 133)
3	Inserting a SIMATIC memory card in the IO controller	Section Removing/inserting a SIMATIC memory card on the CPU (Page 258)
4	Configuring the IO controller ¹	Section Configuring (Page 178)
5	Checking the protective measures	-
6	Switching on supply voltages for the IO controller	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
7	Switching on supply voltages for IO devices	Documentation of the IO device
8	Downloading the configuration to the IO controller	STEP 7 online help
9	Switching IO controller to RUN mode	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
10	Checking LEDs	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
11	Testing inputs and outputs	The following functions are helpful: Monitoring and modifying tags, testing with program status, forcing, controlling the outputs. See section Test and service functions (Page 307)

¹ The IO devices are configured with the IO controller.

13.2.2 ET 200SP CPU as an I-device

Configuration example

You need the CPU 151xSP-1 PN to use the ET 200SP distributed I/O system as an I-device.

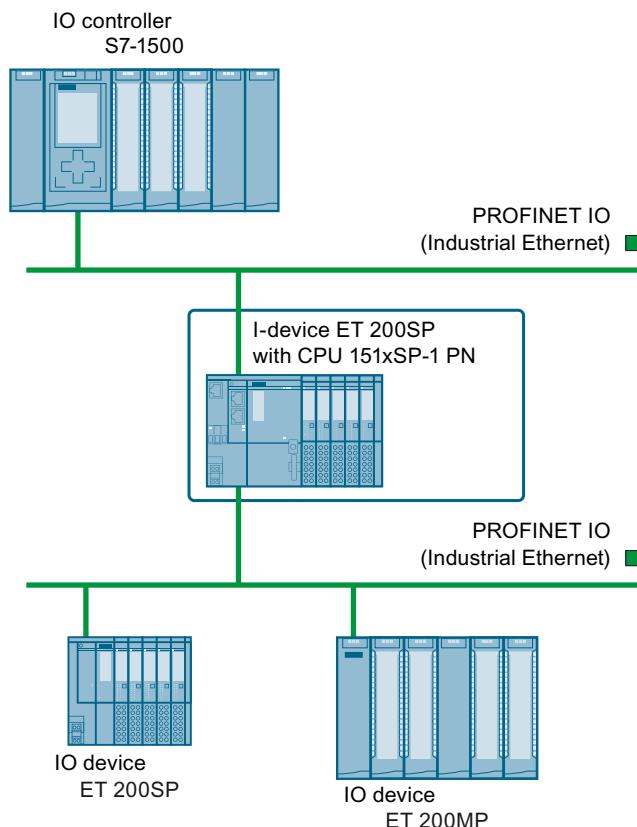


Figure 13-2 ET 200SP CPU as an I-device

Commissioning procedure

For commissioning of the ET 200SP distributed I/O system as an I-device on the PROFINET IO, we recommend the following procedure:

Table 13-2 Procedure for commissioning the ET 200SP as an I-device on the PROFINET IO

Step	Procedure	See ...
1	Installing ET 200SP	Section Installation (Page 112)
2	Connecting ET 200SP <ul style="list-style-type: none"> • Supply voltages • PROFINET IO • Sensors and actuators 	Section Wiring (Page 133)
3	Inserting a SIMATIC memory card in the I-device	Section Removing/inserting a SIMATIC memory card on the CPU (Page 258)
4	Configuring the I-device	Section Configuring (Page 178)

Step	Procedure	See ...
5	Checking the protective measures	-
6	Switching on supply voltages for the IO controller	Documentation of the IO controller
7	Switching on supply voltages for I-device and IO devices	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual and documentation of the IO devices
8	Download configuration to the I-device	STEP 7 online help
9	Switching IO controller and I-device to RUN mode	Documentation of the IO controller and CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
10	Checking LEDs	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
11	Testing inputs and outputs	The following functions are helpful: Monitoring and modifying tags, testing with program status, forcing, controlling the outputs. See section Test and service functions (Page 307)

13.2.3 ET 200SP as an IO device

Configuration example

To use the ET 200SP distributed I/O system as an IO device, you need the IM 155-6 PNxx interface module.

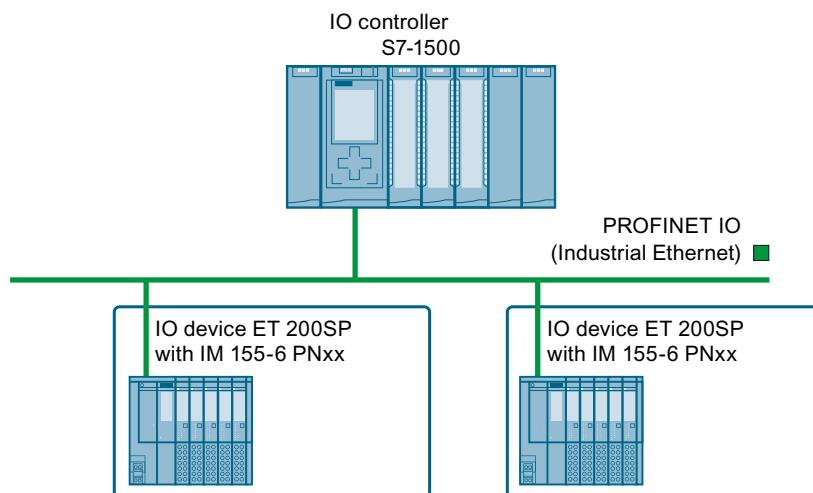


Figure 13-3 ET 200SP as an IO device

You can find information on further configuration variants of the ET 200SP distributed I/O system in redundancy mode in section "Configuration variants" of the Redundant System S7-1500R/H (<https://support.industry.siemens.com/cs/ww/en/view/109754833>) System Manual.

Commissioning procedure

For commissioning of the ET 200SP distributed I/O system as an IO device on the PROFINET IO, we recommend the following procedure:

Table 13-3 Procedure for commissioning the ET 200SP as an IO device for PROFINET IO

Step	Procedure	See ...
1	Installing ET 200SP	Section Installation (Page 112)
2	Connecting ET 200SP <ul style="list-style-type: none">• Supply voltages• PROFINET IO• Sensors and actuators	Section Wiring (Page 133)
4	Configuring IO controller	Documentation of the IO controller
5	Checking the protective measures	-
6	Switching on supply voltages for the IO controller	Documentation of the IO controller
7	Switching on supply voltages for IO devices	Interface module (https://support.automation.siemens.com/WW/view/en/55683316/133300) Manual
8	Downloading the configuration to the IO controller	STEP 7 online help
9	Switching IO controller to RUN mode	Documentation of the IO controller
10	Checking LEDs	Interface module (https://support.automation.siemens.com/WW/view/en/55683316/133300) Manual
11	Testing inputs and outputs	The following functions are helpful: Monitoring and modifying tags, testing with program status, forcing, controlling the outputs. Refer to section Test and service functions (Page 307)

13.3 Commissioning the ET 200SP on PROFIBUS DP

Requirements

- The CPU/interface module is in the "Factory settings" status or has been reset to factory settings (see section Interface module (<https://support.automation.siemens.com/WW/view/en/55683316/133300>)).
- For CPU: The SIMATIC memory card is as delivered or has been formatted.

13.3.1 ET 200SP as a DP master

Configuration example

To use the ET 200SP distributed I/O system as a DP master, you need the CPU 151xSP-1 PN and the CM DP communication module.

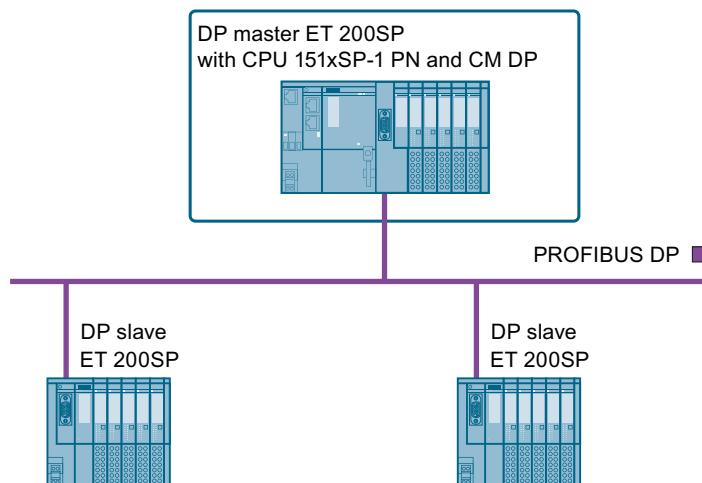


Figure 13-4 ET 200SP as a DP master

Commissioning procedure

To commission the ET 200SP distributed I/O system as a DP master on PROFIBUS DP, we recommend the following procedure:

Table 13-4 Procedure for commissioning the ET 200SP as a DP master on the PROFIBUS DP

Step	Procedure	See ...
1	Installing ET 200SP (with CPU and CM DP)	Section Installation (Page 112)
2	Connecting ET 200SP <ul style="list-style-type: none"> • Supply voltages • PROFIBUS DP • Sensors and actuators 	Section Wiring (Page 133)
3	Inserting a SIMATIC memory card in the DP master (CPU)	Section Removing/inserting a SIMATIC memory card on the CPU (Page 258)
4	Configuring DP master (including PROFIBUS address)	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) and CM DP manual
5	Switching on supply voltages for DP master	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
6	Switching on supply voltages for DP slaves	Documentation of the DP slave

Step	Procedure	See ...
7	Download configuration to the DP master	STEP 7 online help
8	Switching DP master to RUN	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
9	Checking LEDs	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
10	Testing inputs and outputs	The following functions are helpful: Monitoring and modifying tags, testing with program status, forcing, controlling the outputs. See section Test and service functions (Page 307)

13.3.2 ET 200SP as I-slave

Configuration example

To use the ET 200SP distributed I/O system as I-slave, you need the CPU 151xSP-1 PN and the CM DP communication module.

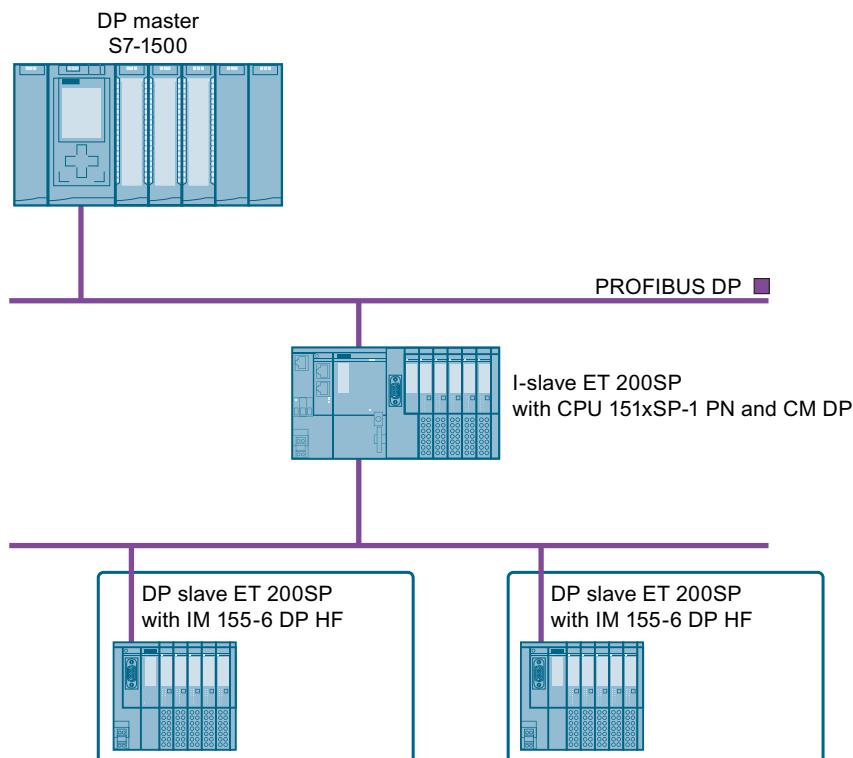


Figure 13-5 ET 200SP as I-slave

Commissioning procedure

For commissioning of the ET 200SP distributed I/O system as an I-slave on the PROFIBUS DP, we recommend the following procedure:

Table 13-5 Procedure for commissioning the ET 200SP as an I-slave for PROFIBUS DP

Step	Procedure	See ...
1	Installing ET 200SP (with CPU and CM DP)	Section Installation (Page 112)
2	Connecting ET 200SP <ul style="list-style-type: none"> • Supply voltages • PROFIBUS DP • Sensors and actuators 	Section Wiring (Page 133)
3	Configuring DP master (including PROFIBUS address)	Documentation of the DP master
4	Inserting a SIMATIC memory card in the I-slave (CPU)	Section Removing/inserting a SIMATIC memory card on the CPU (Page 258)
5	Configuring I-slave (including PROFIBUS address)	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) and CM DP manual
6	Switching on supply voltages for DP master	Documentation of the DP master
7	Switching on supply voltages for I-slaves	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
8	Loading configuration in the DP master and I-slaves	STEP 7 online help
9	Switching DP master and I-slaves to RUN	Documentation of the DP master and CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
10	Checking LEDs	CPU 15xxSP-1 PN (https://support.automation.siemens.com/WW/view/en/90466439/133300) manual
11	Testing inputs and outputs	The following functions are helpful: Monitoring and modifying tags, testing with program status, forcing, controlling the outputs. See the Test functions and fault resolution (https://support.automation.siemens.com/WW/view/en/90466439/133300) section

13.3.3 ET 200SP as a DP slave

Configuration example

To use the ET 200SP distributed I/O system as a DP slave, you need the IM 155-6 DP HF.

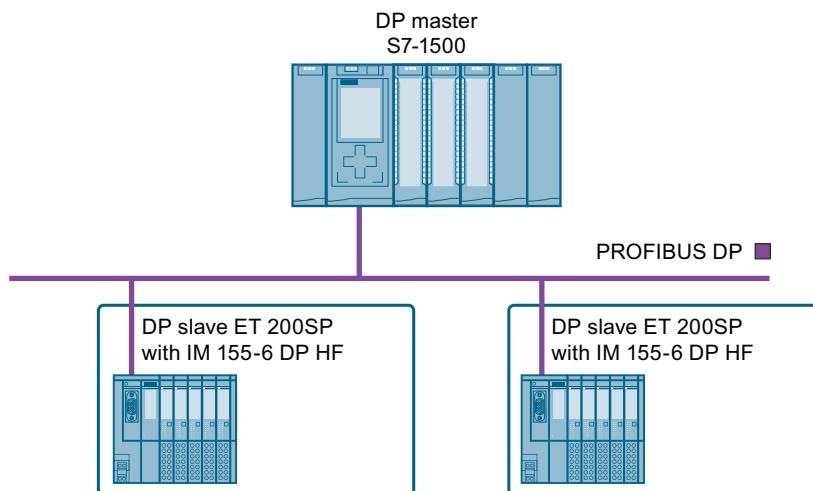


Figure 13-6 ET 200SP as a DP slave

Commissioning procedure

To commission the ET 200SP distributed I/O system as a DP slave on PROFIBUS DP, we recommend the following procedure:

Table 13-6 Procedure for commissioning the ET 200SP as a DP master for PROFIBUS DP

Step	Procedure	See ...
1	Installing ET 200SP (with IM 155-6 DP HF)	Section Installation (Page 112)
2	Setting the PROFIBUS address on the interface module	Section Interface module (http://support.automation.siemens.com/WW/view/en/55683316/133300)
3	Connecting ET 200SP <ul style="list-style-type: none"> • Supply voltages • PROFIBUS DP • Sensors and actuators 	Section Wiring (Page 133)
4	Configuring DP master (including PROFIBUS address)	Documentation of the DP master
5	Switching on supply voltages for DP master	Documentation of the DP master
6	Switching on supply voltages for DP slaves	Interface module (http://support.automation.siemens.com/WW/view/en/55683316/133300) Manual
7	Download configuration to the DP master	STEP 7 online help

Step	Procedure	See ...
8	Switching DP master to RUN	Documentation of the DP master
9	Checking LEDs	Interface module (http://support.automation.siemens.com/WW/view/en/55683316/133300) Manual
10	Testing inputs and outputs	The following functions are helpful: Monitoring and modifying tags, testing with program status, forcing, controlling the outputs. Refer to section Test and service functions (Page 307)

13.4 Startup of the ET 200SP with empty slots

Procedure

You can configure the ET 200SP distributed I/O system with any number of empty slots. To build the ET 200SP distributed I/O system with any number of empty slots, follow these steps:

1. Cover all empty slots with BU covers.
2. Finish the configuration with a server module.

Special consideration: A "Module missing in slot x" diagnostic message is generated by the CPU/interface module for empty slots in which I/O modules are configured.

13.5 Removing/inserting a SIMATIC memory card on the CPU

Requirement

The CPU only supports pre-formatted SIMATIC memory cards. If necessary, delete all previously stored data before using the SIMATIC memory card. You can find more information on deleting the content of the SIMATIC memory card in the function manual Structure and use of the CPU memory.

In order to work with the SIMATIC memory card, first ensure that the SIMATIC memory card is not write-protected. If it is, move the slider out of the lock position.

Inserting the SIMATIC memory card

To insert a SIMATIC memory card, follow these steps:

1. Ensure that the CPU is either switched off or in STOP mode.
2. Insert the SIMATIC memory card, as depicted on the CPU, into the slot for the SIMATIC memory card.

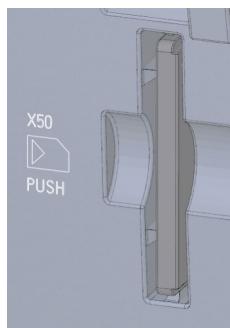


Figure 13-7 Slot for the SIMATIC memory card

3. Insert the SIMATIC memory card with light pressure into the CPU, until the SIMATIC memory card latches.

Removal of the SIMATIC memory card

To remove a SIMATIC memory card, follow these steps:

1. Switch the CPU to STOP mode.
2. Press the SIMATIC memory card into the CPU with light pressure. After audible unlatching of the SIMATIC memory card, remove it.

Only remove the SIMATIC memory card in POWER OFF or STOP mode of the CPU. Ensure that no writing functions (online functions with the programming device, e.g. loading/deleting a block, test functions) are active in STOP mode or were active before POWER OFF.

Reactions after removing/inserting the SIMATIC memory card

Inserting and removing the SIMATIC memory card in STOP, STARTUP or RUN mode triggers a re-evaluation of the SIMATIC memory card. The CPU hereby compares the content of the configuration on the SIMATIC memory card with the backed-up retentive data. If the backed-up retentive data matches the data of the configuration on the SIMATIC memory card, the retentive data is retained. If the data differs, the CPU automatically performs a memory reset (which means the retentive data is deleted) and then goes to STOP.

The CPU evaluates the SIMATIC memory card, and this is indicated by the RUN/STOP LED flashing.

Reference

You can find more information on the SIMATIC memory card in the function manual Structure and use of the CPU memory (<https://support.industry.siemens.com/cs/ww/en/view/59193101>).

13.6 Operating modes of the CPU

Introduction

Operating modes describe the status of the CPU. The following operating modes are possible using the mode selector:

- STARTUP
- RUN
- STOP

In these operating modes, the CPU can communicate, for example, via the PROFINET interface.

The status LEDs on the front of the CPU indicate the current operating mode.

13.6.1 STARTUP mode

Behavior

Before the CPU starts to execute the cyclic user program, a startup program is executed. By suitably programming startup OBs, you can specify initialization tags for your cyclic program in the startup program. You have the option of programming no, one or several startup OBs.

Special features during startup

Note the following points regarding STARTUP mode:

- The CPU resets the process image input.
- All outputs are disabled or respond as configured for the given module: They provide a substitute value as set in the parameters or retain the last value output and bring the controlled process to a safe operational status.
- Before processing the start-up routine, the CPU transfers the I/O inputs to the process image input.
- After processing the start-up routine, the CPU releases the peripheral outputs.

NOTE

To read the current state of inputs during STARTUP, you can access inputs via the process image or via direct I/O access.

To initialize outputs during STARTUP, you can write values via the process image or via direct I/O access. The values are output to the outputs during the transition to RUN mode.

- The CPU always starts up in warm restart mode.
 - The non-retentive bit memory, timers and counters are initialized.
 - The non-retentive tags in data blocks are initialized.
- During startup, cycle-time monitoring is not yet running
- The CPU processes the startup OBs in the order of the startup OB numbers. The CPU processes all programmed startup OBs regardless of the selected startup mode. (Figure "Setting the startup behavior").
- If a corresponding event occurs, the CPU can start the following OBs during startup:
 - OB 82: Diagnostics interrupt
 - OB 83: Pull/plug interrupt for modules
 - OB 86: Rack error
 - OB 121: Programming error (only for global error handling)
 - OB 122: I/O access error (only for global error handling)You can find a description of how to use global and local error handling in the STEP 7 online help.

The CPU does not start all the other OBs until the transition to RUN mode.

Response when expected and actual configurations do not match

The configuration downloaded to the CPU represents the expected configuration. The actual configuration is the actual configuration of the ET 200SP distributed I/O system. If the expected configuration and actual configuration do not match, the setting of the "Comparison preset to actual configuration" parameter determines the behavior of the CPU. You can find additional information on hardware compatibility in the section Operating mode transitions (Page 263).

Cancellation of startup

If errors occur during startup, the CPU cancels startup and returns to STOP mode. The CPU does not perform the startup or interrupts the startup under the following conditions:

- You have not inserted a SIMATIC memory card or have inserted an invalid one.
- You have not downloaded a hardware configuration to the CPU.

Configuring the startup behavior

You configure the behavior of the CPU in the Startup group in the CPU properties.

Setting the startup behavior

To set the startup behavior, follow these steps:

1. Select the CPU in the device view of the STEP 7 hardware network editor.
2. In the properties under "General" select the "Startup" area.

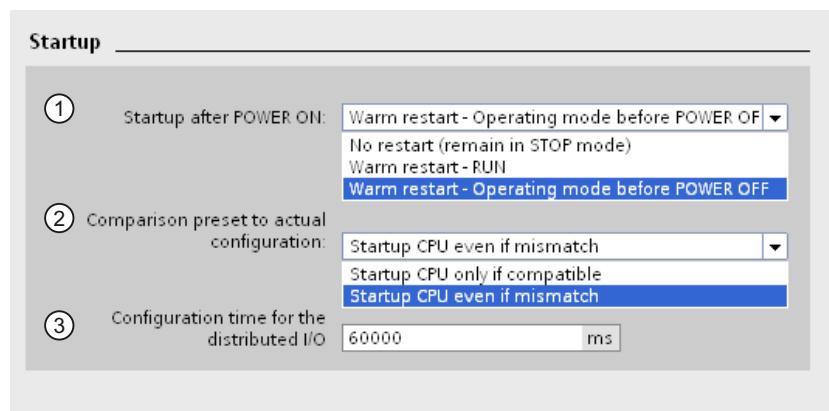


Figure 13-8 Setting the startup behavior

- ① Sets the startup type after POWER ON

- ② Defines the startup behavior when a module in a slot does not correspond to the configured module. You can set this parameter centrally, on the CPU or for each module. When you change the setting for a module, the setting made centrally for this module no longer applies.
- Startup CPU only if compatible: In this setting a module on a configured slot has to be compatible with the configured module. Compatible means that the module matches in terms of the number of inputs and outputs and with respect to its electrical and functional properties.
 - Startup CPU even if mismatch: With this setting the CPU starts up regardless of the type of module plugged in.
- ③ Specifies a maximum period (default: 60000 ms) in which the I/O must be ready for operation. The CPU changes to RUN.
If the central and distributed I/O is not ready for operation within the configuration time, the startup characteristics of the CPU depends on the setting of the "Comparison preset to actual configuration" parameter.

Example for the "Comparison preset to actual configuration" parameter

"Startup CPU only if compatible":

The DI 16x24VDC ST input module with 16 digital inputs is a compatible replacement for a DI 8x24VDC ST input module with 8 digital inputs. The pin assignment and all electrical and functional properties are identical.

"Startup CPU even if mismatch":

Instead of a configured digital input module, you insert an analog output module or no module is present in this slot and thus in all subsequent slots. Although the configured inputs cannot be accessed, the CPU starts up.

Note that the user program cannot function correctly in this case and take the appropriate measures.

13.6.2 STOP mode

Behavior

The CPU does not execute the user program in STOP mode.

All outputs are disabled or react according to the parameter settings for the particular I/O module: They provide a substitute value as set in the parameters or retain the last value output keeping the controlled process in a safe operating status.

In STOP mode, the motor starter responds according to how it was parameterized for the CPU STOP state. The CPU STOP state can be circumvented with the manual local control (Local Control) function. If the CPU is switched off, a motor can be switched on in the motor starter's commissioning mode.

You will find additional information in the Motor starter

(<https://support.industry.siemens.com/cs/ww/en/view/109479973>) manual.

13.6.3 RUN mode

Behavior

In "RUN" mode the cyclic, time-driven, and interrupt-driven program is executed. Addresses that are in the "Automatic Update" process image are automatically updated in each program cycle. See also the section Process images and process image partitions (Page 185).

Execution of the user program

Once the CPU has read the inputs, the cyclic program is executed from the first instruction to the last instruction.

If you have configured a minimum cycle time, the CPU will not end the cycle until this minimum cycle time is finished even if the user program is completed sooner.

A cycle monitoring time is set to ensure that the cyclic program is completed within a specified time. You can change the cycle monitoring time to suit your requirements. If the cyclic program has not finished running within this time, the system responds with a time error.

Further events such as hardware interrupts and diagnostics interrupts can interrupt the cyclic program flow and prolong the cycle time.

Reference

Further information about cycle and response times is available in the Function Manual Cycle and response times (<https://support.automation.siemens.com/WW/view/en/59193558>).

13.6.4 Operating mode transitions

Operating modes and operating mode transitions

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

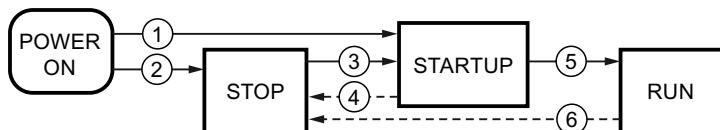


Figure 13-9 Operating modes and operating mode transitions

The table below shows the effects of the operating mode transitions:

Table 13-7 Operating mode transitions

No.	Operating mode transitions	Effects
(1)	POWER ON → STARTUP	After switching on, the CPU switches to "STARTUP" mode if: The CPU clears the non-retentive memory, and resets the content of non-retentive DBs to the start values of the load memory. Retentive memory and retentive DB contents are retained. The 500 newest entries in the diagnostics buffer are retained.

No.	Operating mode transitions	Effects
	<ul style="list-style-type: none"> The hardware configuration and program blocks are consistent. The preceding "POWER OFF" was triggered by an interruption in the power supply. Startup type "Warm restart - RUN" is set. Or Startup type "Warm restart - mode before POWER OFF" is set and the CPU was in RUN mode before POWER OFF. 	
②	POWER ON → STOP	<p>After switching on, the CPU goes to "STOP" mode if:</p> <ul style="list-style-type: none"> The hardware configuration and program blocks are inconsistent. Or The "No restart" startup type is set. Or Startup type "Warm restart - mode before POWER OFF" is set and the CPU was in STOP mode before POWER OFF.
③	STOP → STARTUP	<p>The CPU switches to "STARTUP" mode if:</p> <ul style="list-style-type: none"> The hardware configuration and program blocks are consistent. You set the CPU to "RUN" mode via the programming device and the mode switch is RUN position. Or You set the mode switch from STOP to RUN.
④	STARTUP → STOP	<p>In the following cases, the CPU goes from "STARTUP" to "STOP" mode when:</p> <ul style="list-style-type: none"> The CPU detects an error during startup. You set the CPU to "STOP" via the programming device or mode switch. The CPU executes a STOP command in the Startup OB.
⑤	STARTUP → RUN	<p>In the following cases, the CPU goes from "STARTUP" to "RUN" mode when:</p> <ul style="list-style-type: none"> The CPU has initialized the PLC tags. The CPU has executed the startup blocks successfully.
⑥	RUN → STOP	<p>In the following cases, the CPU goes from "RUN" back to "STOP" mode when:</p> <ul style="list-style-type: none"> The CPU detects an error which prevents further work. The CPU executes a STOP command in the user program. You set the CPU to "STOP" via the programming device or mode switch.

13.7 CPU memory reset

Basics of a memory reset

The CPU must be in STOP mode for a memory reset.

A memory reset returns the CPU to its "initial state".

Memory reset means:

- An existing online connection between your programming device/PC and the CPU is terminated.
- The content of the work memory and the retentive and non-retentive data (applies only to manual memory reset by the user) are deleted.
- The diagnostics buffer, time of day, IP address and the device name are retained.
- Subsequently the CPU is initialized with the loaded project data (hardware configuration, code and data blocks, force jobs). The CPU copies this data from the load memory to the work memory.

Result:

- If you set an IP address in the hardware configuration ("Set IP address in the project" option) and a SIMATIC memory card with the project is in the CPU, this IP address is valid after the memory reset.
- Data blocks no longer have current values but rather their configured start values.
- Force jobs remain active.

Detecting a CPU memory reset

The RUN/STOP LED flashes yellow at 2 Hz. After completion, the CPU switches to STOP. The RUN/STOP LED is on (constant yellow light).

Result after memory reset

The following table provides an overview of the contents of the memory objects after memory reset.

Table 13-8 Memory objects after memory reset

Memory object	Content
Actual values of the data blocks, instance data blocks	Initialized
Bit memory, timers and counters	Initialized
Retentive tags from technology objects (for example, adjustment values of absolute encoders)*	Retained
Diagnostics buffer entries	Retained
IP address	Retained
Device name	Retained
Counter readings of the runtime meters	Retained
Time of day	Retained

* The retentive tags from technology objects are retained but the content of certain tags is re-initialized in some cases.

NOTE

Password for protection of confidential configuration data

The password for protection of confidential configuration data is retained after a memory reset of the CPU. The password is only deleted when the "Delete password for protection of confidential PLC configuration data" option is set.

You can find additional information on the password for protection of confidential configuration data in the Communication

(<https://support.industry.siemens.com/cs/ww/en/view/59192925>) function manual.

13.7.1 Automatic memory reset

Possible causes of automatic memory reset

The CPU executes an automatic memory reset if an error occurs that prevents normal further processing.

Causes of such errors are:

- User program is too large, and cannot be completely loaded into work memory.
- The project data on the SIMATIC memory card is corrupt, for example, because a file was deleted.
- If you remove or insert the SIMATIC memory card and the backed-up retentive data differs in structure from that of the configuration on the SIMATIC memory card.

13.7.2 Manual memory reset

Reason for a manual memory reset

CPU memory reset is required to reset the CPU to its "original state".

CPU memory reset

Two options are available for performing a CPU memory reset:

- Using the mode selector
- Using STEP 7

Procedure using the mode selector

NOTE

Memory reset ↔ Reset to factory settings

The procedure described below also corresponds to the procedure for resetting to factory settings:

- Selector operation with inserted SIMATIC memory card: CPU executes a memory reset
 - Selector operation without inserted SIMATIC memory card: CPU executes reset to factory settings
-

To reset the CPU memory using the mode selector, proceed as follows:

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 selector in this position until the RUN/STOP LED lights up for the 2nd time and remains continuously lit (this takes 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 memory reset.

For information on resetting the CPU to factory settings, refer to the section [Resetting the CPU to factory settings \(Page 298\)](#).

Procedure using STEP 7

For a memory reset of the CPU using STEP 7 proceed as follows:

1. Open the "Online Tools" task card of the CPU.
2. Click the "MRES" button in the "CPU control panel" pane.
3. Click "OK" in response to the confirmation prompt.

Result: The CPU switches to STOP mode and performs a memory reset.

13.8 Reassigning parameters during operation

Introduction

You have the option of reassigning the parameters for the ET 200SP I/O modules during operation.

Changing parameters during operation

You make the parameter settings of the I/O modules using data records. Each I/O module has a separate data record. The instruction "WRREC" applies the changed parameters to the I/O module. The parameters that you have set with STEP 7 are not changed. After a POWER OFF/POWER ON of the ET 200SP, the parameters set with STEP 7 are valid again.

If you are using the CPU as an I-device, you reassign the parameters of the I/O modules via the I-device.

NOTE

If you write data records from the user program to the modules of the distributed I/O, make sure that these modules actually exist and are available. You can evaluate OB83 for this purpose. After inserting a module, the CPU does not call OB83 until the module has started up and its parameters are assigned. This ensures the execution of the data record operations without errors.

NOTE

You need to transfer the new parameters with the "WRREC" instruction after a POWER OFF/POWER ON of the ET 200SP.

Instruction for parameter assignment

The following instruction is provided for assigning parameters to the I/O module in the user program:

Instruction	Application
"WRREC"	Transfer the modifiable parameters to the addressed ET 200SP module.

Error message

In the event of an error, the following return values are reported:

Table 13-9 Error message

Error code	Meaning
80E0 _H	Error in header information
80E1 _H	Parameter error

Reference

You will find the setup of the parameter data record in the manuals of the I/O modules (<https://support.automation.siemens.com/WW/view/es/55679691/133300>).

13.9 Backing up and restoring the CPU configuration

13.9.1 Overview

Backup from online device

You make changes where necessary in the system operation. You add new devices, replace existing devices or adapt the user program. If these changes result in undesirable behavior, you can restore the plant to an earlier state. Before you load a changed configuration to the CPU, first use the option "Backup from online device" to create a complete backup of the current device status. If you have assigned a password to protect confidential PLC configuration data, then this password is not secured. For more information on the password, refer to the section Protection of confidential configuration data (Page 204).

Upload from device (software)

With the option "Upload from device (software)", you load the software project data from the CPU to an existing CPU in the project.

Upload device as new station

If you are operating a new PG/PC on a system, the STEP 7 project that was used to create the system configuration might not be available. In this case, you upload the data to a project in your PG/PC with the "Upload device as new station" option.

Snapshot of the monitor values

To allow you to restore the actual values after changes, back up the actual values of the data blocks with the "Snapshot of the monitor values" option.

Overview of backup types

The table below shows the backup of CPU data depending on the selected type of backup and its specific characteristics:

	Backup from online device	Upload from device (software)	Upload device as new station	Snapshot of the monitor values
Current values of all DBs (global and instance data blocks) ¹⁾	✓	✓	✓	✓
Blocks of the type OB, FC, FB and DB	✓	✓	✓	--
PLC tags (tag names and constant names)	✓	✓	✓	--
Technology objects	✓	✓	✓	✓ ³⁾
Hardware configuration	✓	--	✓	--
Actual values (bit memories, timers, counters)*	✓	--	--	--

¹⁾ Only the values of the tags that are set as retentive are saved.

²⁾ Only possible in the STOP operating state and for individual fail-safe blocks.

³⁾ Nur die High_Speed_Counter und SSI_Absolute_Encoder modules

	Backup from online device	Upload from device (software)	Upload device as new station	Snapshot of the monitor values
Contents of the SIMATIC memory card	✓	--	--	--
Archives, recipes	✓	--	--	--
Entries in the diagnostics buffer	--	--	--	--
Current time	--	--	--	--
Properties of the type of backup				
Backup possible for fail-safe CPUs	✓	✓ ²⁾	--	✓
Backup can be edited	--	✓	✓	✓
Backup possible in operating mode	STOP	RUN, STOP	RUN, STOP	RUN, STOP

1) Only the values of the tags that are set as retentive are saved.

2) Only possible in the STOP operating state and for individual fail-safe blocks.

3) Nur die High_Speed_Counter und SSI_Absolute_Encoder modules

Reference

You can find more information on the different backup types in the STEP 7 online help.

Emergency address (emergency IP)

The emergency address (emergency IP address) of a CPU was conceived for diagnostic and downloading functions, e.g. if the CPU can no longer be reached via the IP protocol due to loading of an incorrect project. You can find information on the emergency address in the Communication (<https://support.industry.siemens.com/cs/ww/de/view/59192925/en>) function manual.

Archiving multilingual project texts

When you configure a CPU, different categories of texts come into being, e.g.

- Object names (names of blocks, modules, tags, etc.)
- Comments (for blocks, networks, watch tables, etc.)
- Messages and diagnostic texts

Texts are provided by the system (e.g. diagnostic buffer texts) or are created during configuration (e.g. messages).

In a project, texts exist in one single language or in several languages after a translation process. You can maintain project texts in all languages, which are at your disposal in the project navigator (Languages & Resources > Project Texts). The texts arising during configuration can be loaded into the CPU.

The following texts containing the project data are loaded into the CPU in the chosen languages and are also used by the Web server:

- Diagnostic buffer texts (not editable)
- Module status texts (not editable)
- Message texts with associated text lists
- Tag comments and step comments for S7 GRAPH and PLC Code Viewer
- Comments in watch tables

The following texts containing the project languages are also loaded into the CPU in the chosen languages, but are not used by the Web server:

- Comments in tag tables (for tags and constants)
- Comments in global data blocks
- Comments of elements in block interfaces of FBs, FCs, DBs and UDTs
- Network titles in data blocks that are written in ladder logic (LAD), function block diagram (FBD) or statement list (STL)
- Block comments
- Network comments
- Comments of LAD and FBD elements

The CPUs support archiving of multilingual project texts in up to three different project languages. If the project texts for a particular project language nevertheless exceed the memory space reserved for them, the project cannot be downloaded to the CPU. The download is aborted with a notice that not enough memory space is available. In such a case, take measures to reduce the required storage space, for example by shortening comments.

NOTE**Size of the SIMATIC memory card**

If, when loading projects, the required memory space is more extensive/larger than the memory space on the

SIMATIC memory card used, the download to the CPU is canceled. You receive an error message.

Therefore, make sure that there is enough available storage space on your SIMATIC memory card for loading projects.

You will find information on reading out the storage space capacity utilization of the CPU and the SIMATIC memory card in the Structure and use of the CPU memory (<https://support.industry.siemens.com/cs/de/de/view/59193101/en>) function manual.

You will find information on parameterization of multilingual project texts in STEP 7 in the STEP 7 online help.

13.10 Time synchronization

Introduction

All CPUs are equipped with an internal clock. The clock shows:

- The time of day with a resolution of 1 millisecond
- The date and the day of the week

The CPU takes into account the time change caused by daylight saving time.

You can synchronize the time of the CPUs with an NTP server in NTP mode (NTP: Network Time Protocol).

Operating principle

In NTP mode, the device sends time queries at regular intervals (in client mode) to the NTP server in the subnet (LAN). Based on the replies of the servers, the most reliable and most accurate time is calculated and the time of day of the CPU is synchronized. The advantage of this mode is that it allows the time to be synchronized across subnets. You can synchronize the time of day of up to a maximum of four NTP servers. You address a communications processor or an HMI device, for example, as sources for time synchronization via the IP addresses.

The update interval defines the interval between the time queries (in seconds). The value range of the interval is between 10 seconds and one day. In NTP mode, it is generally UTC (Universal Time Coordinated) that is transferred. UTC corresponds to GMT (Greenwich Mean Time).

NTP server for the ET 200SP CPU

You can assign an ET 200SP CPU to up to 4 NTP servers.

You have the following options to reset the IP addresses of the NTP servers:

- Configure IP addresses of the NTP servers in STEP 7.
- Set IP addresses of the NTP servers with the "T_CONFIG" instruction.
- Obtain IP addresses of the NTP servers via DHCP.

As of firmware version V2.9, the CPU can also obtain the NTP servers via DHCP. You can find more information on the procedure and the DHCP communication protocol in the Communication (<https://support.industry.siemens.com/cs/ww/de/view/59192925/en>) function manual.

Configuring IP addresses of the NTP servers in STEP 7

To configure the IP addresses of the NTP servers in STEP 7, follow these steps:

1. Select the ET 200SP CPU in STEP 7.
2. In the properties of the CPU, navigate to "Time of day" > "Time synchronization" > "NTP mode".
3. For "Time synchronization:", select "Set NTP server in the project" from the drop-down list.
4. Enter the IP addresses of up to four NTP servers for "Server 1" to "Server 4".
5. Set the time interval of time queries for "Update interval". Set the update interval to between 10 s and 86400 s.

Setting the IP addresses of the NTP servers with the "T_CONFIG" instruction

Requirements:

- You selected the option "Set NTP server directly on the device (e.g. PLC program, display)" in the "Time synchronization" drop-down list in STEP 7.

Proceed as follows to set the IP addresses of the NTP servers with the T_CONFIG instruction:

1. Enter the IP addresses of up to four NTP servers in a tag of the data type IF_CONF_NTP.
2. Interconnect the tag of data type IF_CONF_NTP at the block parameter CONF_DATA of the T_CONFIG instruction.
3. Call the T_CONFIG instruction in the user program.

Result: The addresses of the NTP servers from the T_CONFIG instruction are transferred to the CPU.

If necessary, you can change the addresses of the NTP servers several times with T_CONFIG.

Reference

For additional information on time synchronization in the automation environment, refer to the following FAQ on the Internet (<https://support.industry.siemens.com/cs/de/en/view/86535497>).

13.10.1 Example: Configuring and changing NTP server

Automation task

You are using your own NTP server in your network with the IP address 192.168.1.15. Your own server provides you with the following advantages:

- Protection against unauthorized accesses from outside
- Every device that you synchronize with your own NTP server uses the same time.

You want to synchronize the ET 200SP CPU with this NTP server.

The following sections describe how to configure the IP address of the NTP server in STEP 7 or set it in the user program.

Configuring the IP address of the NTP server in STEP 7

Procedure

1. Select the ET 200SP CPU in STEP 7.
2. In the properties of the CPU, navigate to "Time of day" > "Time synchronization" > "NTP mode".
3. For "Time synchronization:", select "Set NTP server in the project" from the drop-down list.
4. For "Server 1:", enter the IP address of the NTP server: 192.168.1.15.
5. Download the hardware configuration to the CPU.

Result

The CPU synchronizes the time with the NTP server 192.168.1.15.

Set IP addresses of the NTP server with the "T_CONFIG" instruction

Requirements:

- You selected the option "Set NTP server directly on the device (e.g. PLC program, display)" in the "Time synchronization" drop-down list in STEP 7.

To set the IP address for the NTP server, use the following block parameters of the "T_CONFIG" instruction:

- Req: A positive edge at the block parameter "Req" starts a job of the "T_CONFIG" instruction.
- Interface: Enter the HW ID of the PROFINET interface 1 of the CPU at the block parameter "Interface". In this example, the HW ID is "64".
- Conf_Data: Area in which you save the IP addresses of the NTP server. Use the data type "IF_CONF_NTP" for this purpose.

Procedure

Proceed as follows to set the IP address of the NTP server in the user program to "192.168.1.15":

1. Create a global data block in the project tree under "Program blocks > Add new block". Name the global data block "NTP".
2. Create a tag of the data type "IF_CONF_NTP" in the global data block "NTP".

NTP				
	Name	Data type	Start value	Comment
1	Static			
2	NTP_Server	IF_CONF_NTP		
3	Id	UInt	17	
4	Length	UInt	22	
5	Mode	UInt	0	
6	NTP_IP	Array[1..4] of IP_V4		
7	NTP_IP[1]	IP_V4		
8	ADDR	Array[1..4] of Byte		
9	ADDR[1]	Byte	192	IPv4 address
10	ADDR[2]	Byte	168	IPv4 address
11	ADDR[3]	Byte	1	IPv4 address
12	ADDR[4]	Byte	10	IPv4 address
13	NTP_IP[2]	IP_V4		
14	NTP_IP[3]	IP_V4		
15	NTP_IP[4]	IP_V4		
16	change_NTP-Server	Bool	false	
17	done	Bool	false	
18	busy	Bool	false	
19	error	Bool	false	
20	status	DWord	16#0	
21	err_loc	DWord	16#0	

Figure 13-10 Example: Data block with IF_CONF_NTP

3. Create a "T_CONFIG" instruction in the user program.

4. Connect the "T_CONFIG" instruction as follows.

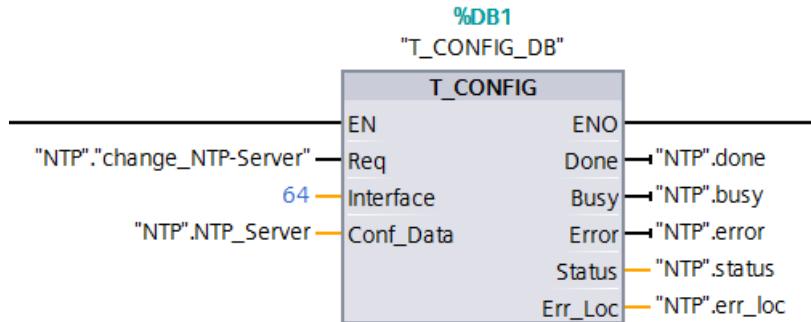


Figure 13-11 Example T_CONFIG: Changing the NTP server

5. In the user program, assign the IP address 192.168.1.15 to the data type "IF_CONF_NTP":

```
"NTP".NTP_Server.NTP_IP[1].ADDR[1] := 192;
"NTP".NTP_Server.NTP_IP[1].ADDR[2] := 168;
"NTP".NTP_Server.NTP_IP[1].ADDR[3] := 1;
"NTP".NTP_Server.NTP_IP[1].ADDR[4] := 15;
```
6. Generate a positive edge for the tag "change_NTP-Server" in the user program:

```
"NTP".change_NTP-Server := true;
```

Result

The CPU synchronizes the time with the NTP server 192.168.1.15.

13.11 Identification and maintenance data

13.11.1 Reading out and entering I&M data

I&M data

Identification and maintenance data (I&M data) is information saved on the module. The data is:

- Read-only (I-data) or
- Readable/writable (M-data)

Identification data (I&M0): Manufacturer information about the module that can only be read. Some identification data is also printed on the housing of the module, for example article number and serial number.

Maintenance data (I&M1, 2, 3): Plant-dependent information, e.g. installation location. Maintenance data is created during configuration and downloaded to the module. All modules of the ET 200SP distributed I/O system support identification data (I&M0 to I&M3).

The I&M identification data supports you in the following activities:

- Checking the plant configuration
- Locating hardware changes in a plant
- Correcting errors in a plant

Modules can be clearly identified online using the I&M identification data.

Maintenance data (I&M4): Storage of a CRC checksum for interface modules IM 155-6 PN ST for ensuring data integrity of data used by the interface module.

NOTE

The BusAdapter and the interface module IM 155-6 PN HF support the identification data I&M0 to I&M4 (signature).

Options for reading out I&M data

- Via the user program
- Via STEP 7 or HMI devices
- Via the CPU web server

Reading I&M data via the user program

You have the following options to read the modules' I&M data in the user program:

- Using the RDREC instruction
The record structure for distributed modules that are accessible via PROFINET IO/PROFIBUS DP, is described in the chapter Record structure for I&M data [\(Page 277\)](#).
- Using the Get_IM_Data instruction

Reference

The description of the instructions can be found in the STEP 7 online help.

Reading I&M data via STEP 7

Requirements: There must be an online connection to the CPU/interface module.

To read I&M data using STEP 7, follow these steps:

1. In the project tree, under "Distributed I/O" select the IO device IM 155-6 PN ST (for example)
2. Select > **IO device > Online & diagnostics > Identification & Maintenance.**

Entering maintenance data via STEP 7

STEP 7 assigns a default module name. You can enter the following information:

- Plant designation (I&M1)
- Location identifier (I&M1)
- Installation date (I&M2)
- Additional information (I&M3)

To enter maintenance data via STEP 7, follow these steps:

1. In the device view of the STEP 7 hardware network editor, select the interface module, for example.
2. In the properties under "General", select the "Identification & Maintenance" area and enter the data.

During the loading of the hardware configuration, the I&M data is also loaded.

Procedure for reading I&M data via the Web server

The procedure is described in detail in the Web server

(<https://support.automation.siemens.com/WW/view/en/59193560>) Function Manual.

13.11.2 Data record structure for I&M data

Reading I&M records via the user program (distributed via PROFINET IO)

You directly access specific identification data using **Read data record** ("RDREC" instruction). You obtain the corresponding part of the identification data under the relevant data record index.

The data records are structured as follows:

Table 13-10 Basic structure of data records with I&M identification data

Content	Length (bytes)	Coding (hex)
Header information		
BlockType	2	I&M0: 0020 _H I&M1: 0021 _H I&M2: 0022 _H I&M3: 0023 _H I&M4: 0024 _H
BlockLength	2	I&M0: 0038 _H I&M1: 0038 _H I&M2: 0012 _H I&M3: 0038 _H I&M4: 0038 _H
BlockVersionHigh	1	01

Content	Length (bytes)	Coding (hex)
BlockVersionLow	1	00
Identification data		
Identification data (see table below)	I&M0/index AFF0 _H : 54 I&M1/index AFF1 _H : 54 I&M2/index AFF2 _H : 16 I&M3/index AFF3 _H : 54 I&M4/Index AFF4 _H : 54	

Table 13-11 Data record structure for I&M identification data

Identification data	Access	Default	Explanation
Identification data 0: (data record index AFF0 hex)			
VendorIDHigh	Read (1 byte)	00 _H	This is where the name of the manufacturer is stored (42 _D = SIEMENS AG).
VendorIDLow	Read (1 byte)	2 A _H	
Order_ID	Read (20 bytes)	6ES7155-6AU02-0BNO	Article number of the module (e.g. of the IM 155-6 PN ST interface module)
IM_SERIAL_NUMBER	Read (16 bytes)	-	Serial number (device-specific)
IM_HARDWARE_REVISION	Read (2 bytes)	1	Corresponding HW version
IM_SOFTWARE_REVISION	Read	Firmware version	Provides information about the firmware version of the module
• SWRevisionPrefix	(1 byte)	V	
• IM_SWRevision_Functional_E nhancement	(1 byte)	00 - FF _H	
• IM_SWRevision_Bug_Fix	(1 byte)	00 - FF _H	
• IM_SWRevision_Internal_ Change	(1 byte)	00 - FF _H	
IM_REVISION_COUNTER	Read (2 bytes)	0000 _H	Provides information about parameter changes on the module (not used)
IM_PROFILE_ID	Read (2 bytes)	0000 _H	Generic Device
IM_PROFILE_SPECIFIC_TYPE	Read (2 bytes)	0005 _H 0003 _H 0001 _H	Interface modules/BusAdapters I/O modules and motor starters CPU
IM_VERSION	Read	0101 _H	Provides information on the version of the identification data (0101 _H = Version 1.1)
• IM_Version_Major	(1 byte)		
• IM_Version_Minor	(1 byte)		
IM_SUPPORTED	Read (2 bytes)	000E _H	Provides information about the available identification data (I&M1 to I&M3)
Maintenance data 1: (data record index AFF1 hex)			
IM_TAG_FUNCTION	Read/write (32 bytes)	-	Enter a module identifier here that is unique plant-wide.

* A value of 0 indicates that the IM firmware does not yet support the CRC calculation of the assigned modules. If the value is ≠ 0, the IM supports this function, regardless of whether the assigned modules support I&M4 data.

Identification data	Access	Default	Explanation
IM_TAG_LOCATION	Read/write (22 bytes)	-	Enter the installation location of the module here.
Maintenance data 2: (data record index AFF2 hex)			
IM_DATE	Read/write (16 bytes)	YYYY-MM-DD HH:MM	Enter the installation date of the module here.
Maintenance data 3: (data record index AFF3 hex)			
IM_DESCRIPTOR	Read/write (54 bytes)	-	Enter a comment describing the module.
Maintenance data 4: (data record index AFF4 hex)			
USI	Read (4 bytes)	0x63726331	UserstructureIdentifier: Internal, fixed value
CHK_OVERALL	Read (4 bytes)	-	Overall CRC of all individual CRCs
CHK_OVERALL_SUBS	Read (4 bytes)	0 or value*	Overall CRC of all assigned modules of the IM
CHK_STATIC_LOCAL	Read (4 bytes)	-	CRC of static data of the IM
CHK_STATIC_SUBS	Read (4 bytes)	0 or value*	CRC of all static data of the modules of the IM
CHK_OVERALL_SETUP	Read (4 bytes)	-	Overall CRC of all setup data of the IM and modules of the IM
CHK_REMANENT_LOCAL	Read (4 bytes)	-	CRC of retentive data of the IM
CHK_REMANENT_SUBS	Read (4 bytes)	0 or value*	CRC of all retentive data of the modules of the IM
CHK_WORKING_LOCAL	Read (4 bytes)	-	CRC of the parameters in STEP 7 for the IM
CHK_WORKING_SUBS	Read (4 bytes)	0 or value*	CRC of all parameters in STEP 7 for the modules of the IM
NOT USED	Read (14 bytes)	0	14 reserved bytes

* A value of 0 indicates that the IM firmware does not yet support the CRC calculation of the assigned modules. If the value is ≠ 0, the IM supports this function, regardless of whether the assigned modules support I&M4 data.

Reading I&M data records with data record 255 (distributed via PROFIBUS DP)

The modules support standardized access to identification data via DS 255 (index 65000 to 65003). For more information on the DS 255 data structure, refer to the specifications of the Profile Guidelines Part 1: Identification & Maintenance Functions, Order No.: 3.502, Version 2.1, May 2016

13.11.3 Example: Read out firmware version of the CPU with Get_IM_Data

Automation task

You want to check whether the modules in your automation system have the current firmware. You can find the firmware version of the modules in the I&M0 data. The I&M0 data is the basic information for a device. The I&M0 data contains information such as:

- Manufacturer ID
- Order number, serial number
- Hardware and firmware version

To read out the I&M0 data, use the "Get_IM_Data" instruction. You read the I&M0 data of all the modules in the user program of the CPU using "Get_IM_Data" instructions and store it in a data block.

Conditions and parameters

To read out the I&M data of the CPU, use the following block parameters of the "Get_IM_Data" instruction:

- LADDR: Enter the HW ID of the module at the block parameter "LADDR".
- IM_TYPE: Enter the I&M data number (e.g. "0" for I&M0 data) at the "IM_TYPE" block parameter.
- DATA: Area for storing the read I&M data (e.g. in a global data block). Store I&M0 data in an area of data type "IM0_Data".

This example shows you how to read out the I&M0 data of an ET 200SP CPU. To read out the I&M0 data of a different module, simply use the HW ID of the module at the LADDR parameter.

Solution

Proceed as follows to read out the I&M0 data of the CPU:

1. Create a global data block to store the I&M0 data.
2. Create a structure of the data type "IM0_Data" in the global data block. You can assign any name to the structure ("imData") in this case.

SLI_gDB_Get_IM_Data			
	Name	Data type	Start value
1	Static		
2	imData	IM0_Data	
3	done	Bool	false
4	busy	Bool	false
5	error	Bool	false
6	status	Word	16#0

Figure 13-12 Example: Data block for I&M data

3. Create the "Get_IM_Data" instruction in the user program, e.g. in OB 1.

4. Connect the "Get_IM_Data" instruction as follows:

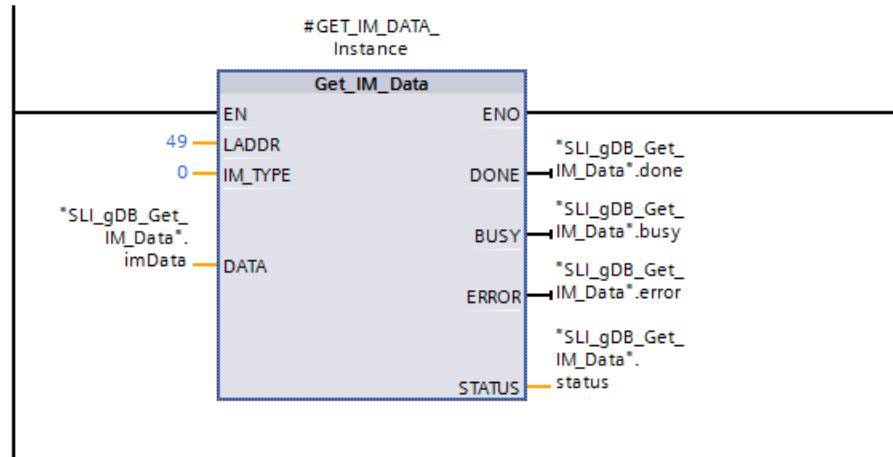


Figure 13-13 Example: Calling the "Get_IM_Data" instruction

5. Call the "Get_IM_Data" instruction in the user program.

Result

The "Get_IM_Data" instruction has stored the I&M0 data in the data block.

You can view the I&M0 data online in STEP 7, for example, in the data block with the "Monitor all" button. The CPU in the example is a 1512SP-1 PN (6ES7512-1DK01-0AK0) with the firmware version V2.5.

SLI_gDB_Get_IM_Data				
	Name	Data type	Start value	Monitor value
1	Static			
2	imData	I&M0_Data		
3	Manufacturer_ID	UInt	0	42
4	Order_ID	String[20]	"	'6ES7 512-1DK01-0...
5	Serial_Number	String[16]	"	'S C-DOS710132013'
6	Hardware_Revision	UInt	0	3
7	Software_Revision	I&M0_Version		
8	Type	Char	"	'V'
9	Functional	USInt	0	2
10	Bugfix	USInt	0	5
11	Internal	USInt	0	0
12	Revision_Counter	UInt	0	0
13	Profile_ID	UInt	0	0
14	Profile_Specific_Ty...	UInt	0	0
15	IM_Version	Word	16#0	16#0101
16	IM_Supported	Word	16#0	16#001E
17	done	Bool	false	TRUE
18	busy	Bool	false	FALSE
19	error	Bool	false	FALSE
20	status	Word	16#0	16#0000

Figure 13-14 Example: I&M0 data of an ET 200SP CPU

13.12 Shared commissioning of projects

Team Engineering

In Team Engineering several users from various engineering systems work on a project at the same time and access one ET 200SP CPU.

The users can edit separate parts of a master project independently of one another at the same time. The changes of the other editors are displayed in a synchronization dialog during the loading of the configuration in the CPU and synchronized automatically, if possible.

Certain online functions can also be executed at the same time from several engineering systems on a shared CPU, such as:

- Monitoring blocks on the CPU
- Modifying blocks on the CPU
- Trace functions

You can find detailed information on the topic of Team Engineering in the STEP 7 online help.

Maintenance

Maintenance of Ex modules

When you use an Ex module group, observe the information in the System Manual ET 200SP HA Distributed I/O system / ET 200SP Modules for devices used in an explosion hazardous environment (<https://support.industry.siemens.com/cs/ww/de/view/109795533/en>).

14.1 Removing and inserting I/O modules/motor starters (hot swapping)

Introduction

The ET 200SP distributed I/O system supports removal and insertion of I/O modules and motor starters (hot swapping) during operation (RUN mode):

- CPU/interface module HF, HS, R1: You can remove and insert any number of I/O modules/motor starters.
- ST, BA interface module: You can only remove and insert one I/O module/motor starter.

This section provides more information on removing and inserting I/O modules/motor starters.

I/O modules/motor starters must not be removed or inserted during operation (RUN operating state) in hazardous areas.

Requirements

The following table describes which modules you may insert and remove under which conditions:

Table 14-1 Removal and insertion of modules

Modules	Removal and insertion	Conditions
CPU	No	---
BusAdapter	No	---
CM DP module	No	---
Interface module	No	---
Interface module R1	Yes	The second interface module must be operational.

1) The motor starter also counts as removed in the parking position

14.1 Removing and inserting I/O modules/motor starters (hot swapping)

Modules	Removal and insertion	Conditions
I/O modules	Yes	<ul style="list-style-type: none"> Digital output modules: Only when load is switched off Digital modules: For load voltage above the safe extra-low voltage: Only with switched off load voltage supply Technology modules: Only with switched off supply voltage L+ AI Energy Meter: <ul style="list-style-type: none"> Only when measuring voltage on primary side is switched off, or Without the special current transformer terminal, measuring voltage and load current must be through the converters, which means the machine or the load must be switched off in the process. With the special terminal, the process can continue because the current transformer is isolated safely. However, the measuring voltage on the module, at connections UL1-UL3, still needs to be isolated.
PotDis-TerminalBlock	Yes	Only in de-energized state.
Motor starter	Yes ¹⁾	Only when the load is disconnected; when switched on, the motor starter switches off automatically when the rotary interlock is operated.
Server module	No	---

1) The motor starter also counts as removed in the parking position

NOTICE**Risk of hazardous system states**

If you remove and insert digital output modules with the load switched on or technology modules with the supply voltage switched on, this can result in hazardous system states. The ET 200SP distributed I/O system or the connected sensors may be damaged as a result. Therefore, a digital output module may only be inserted and removed when the load is switched off and a technology module may only be inserted and removed when the supply voltage is switched off.

NOTICE**Risk of hazardous system states**

If you remove and insert the AI Energy Meter ST with the primary-side voltage switched on at the current transformer, this can result in hazardous system states.

The ET 200SP distributed I/O system may be damaged as a result.

For this reason, remove and insert the AI Energy Meter ST only in the following cases:

- When measuring voltage is switched off on the primary side, or
- When a special current transformer terminal is used that short-circuits the secondary side of the transformer when the module is removed

Do not remove or insert the AI Energy Meter ST until you have removed this current transformer terminal. With the special terminal, the process can continue because the current transformer is isolated safely. However, the measuring voltage on the module at the connections UL1-UL3 still needs to be isolated.

⚠ WARNING**Risk of injury from automatic restart**

Inserting a motor starter can result in dangerous system states. The motor starter can restart again autonomously if an ON command is active.

This can result in serious injury caused by connected devices that are automatically started up.

Withdraw and insert a motor starter only after disconnecting the load.

Removing and inserting an I/O module or a motor starter in case of CPU/interface module HF, HS, R1

You can remove and insert any number of I/O modules/motor starters during operation. The CPU/interface module and the inserted I/O modules/motor starters remain in operation.

NOTICE**Reaction of the CPU to removal and insertion of the ET 200SP server module**

Please note that the backplane bus is deactivated when you remove the server module, regardless of the CPU operating state. Also note that the outputs do not adopt their configured substitute value behavior when you remove the server module.

This means you should not remove the server module when the CPU is in STARTUP, RUN and STOP modes. If you have nevertheless removed the server module, perform a POWER OFF/POWER ON after you have inserted the server module again.

Removing and inserting BusAdapter or CM DP module

Do not remove or insert the BusAdapter or CM DP module when the supply voltage is switched on. If you remove the BusAdapter or CM DP module after CPU startup, the supply voltage of the BusAdapter or CM DP module is switched off automatically. To switch on the supply voltage again, you need to perform a POWER OFF/POWER ON after inserting the BusAdapter/CM DP module.

Removing and inserting I/O module or motor starter with interface module ST, BA

1. You can remove **one** I/O module/**one** motor starter during operation. If you remove another I/O module/motor starter, this results in a station stop of the ET 200SP distributed I/O system:
 - All I/O modules/motor starters of the ET 200SP distributed I/O system fail → Substitute value behavior.
 - The interface module continues to exchange data with the IO controller and report diagnostics.

NOTE

If you want to replace several I/O modules/motor starters during operation, you must replace them one after the other.

2. If you insert all but one of the I/O modules/motor starters withdrawn during operation, all I/O modules will start up again.

NOTE

I/O modules/motor starters inserted in empty slots and then removed are also regarded as withdrawn during operation.

3. After a POWER OFF/POWER ON of the supply voltage 1L+ of the interface module, all available I/O modules/motor starters start up again in line with the configuration.
Evaluation of the I/O modules/motor starters removed during operation starts again (see 1).

Removing I/O modules

To remove an I/O module, follow these steps:

1. Simultaneously press the top and bottom release buttons of the I/O module.
2. Pull the I/O module out of the BaseUnit, parallel in a forward direction.

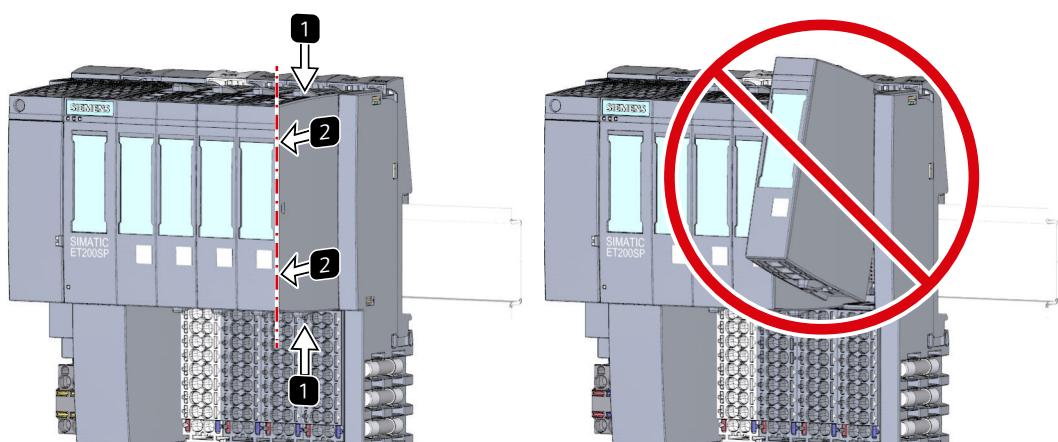


Figure 14-1 Removing I/O modules

14.2 Changing the type of an I/O module

Introduction

The coding element is a two-part element. When shipped from the factory, both parts are in the I/O module. When an I/O module is installed for the first time, a part of the coding element clicks into the BaseUnit. This mechanically prevents the insertion of a different module type.

There are two versions of the ET 200SP distributed I/O system:

- Mechanical coding element: Ensures the mechanical coding described above.
- Electronic coding element: In addition to the above-mentioned mechanical coding, this version also has an electronic, rewritable memory for module-specific configuration data (such as the F-destination address for fail-safe modules, parameter data for IO link master).

Requirement

Refer to section Application planning ([Page 80](#)).

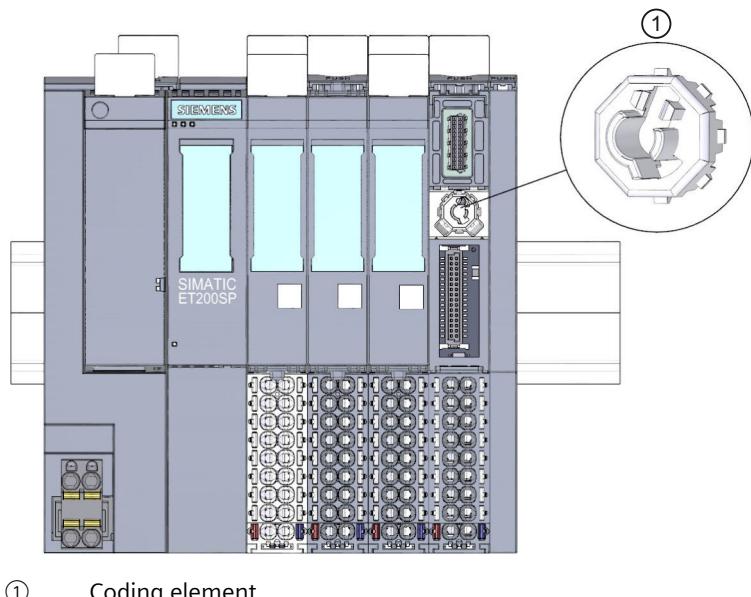
NOTICE
Do not manipulate the coding element
Making changes to the coding element may cause dangerous conditions in your plant and/or result in damage to the outputs of the ET 200SP distributed I/O system.
To avoid physical damage, do not manipulate the coding.

Changing the type of an I/O module

You have already removed the I/O module.

To make a type change for an I/O module, follow these steps:

1. Push the coding element out of the BaseUnit using a screwdriver.
2. Put the coding element back onto the removed I/O module.
3. Insert the new I/O module (other module type) into the BaseUnit until you hear it click into place.
4. Label the new I/O module.



① Coding element

Figure 14-2 Changing the type of an I/O module

14.3 Replacing an I/O module

Introduction

When an I/O module is installed for the first time, a part of the coding element clicks into the BaseUnit. When you replace an I/O module with the same type of module, the correct coding element is already present in the BaseUnit.

Requirement

Refer to section Application planning ([Page 80](#)).

Replacing an I/O module

You have already removed the I/O module.

To replace an I/O module, follow these steps:

1. Remove the coding element (part) from the underside of the new I/O module.
2. Insert the new I/O module (same module type) into the BaseUnit until you hear it click into place.
3. Mark the new I/O module (labeling strip, equipment labeling plate).

14.4 Replacing a motor starter

The SIMATIC ET 200SP motor starter is wired.

To replace a SIMATIC ET 200SP motor starter, proceed as follows:

1. Turn the mechanical rotary interlock counter-clockwise to the assembly/disassembly position.

NOTE

Operating position/READY

Turn the mechanical rotary interlock out of the READY position only in the current-free state (motor off).

2. Remove the SIMATIC ET 200SP motor starter from the BaseUnit.

3. Assemble the new motor starter as described.

NOTE

Mounting the motor starter

You will find out how to mount the motor starter in chapter "Mounting/disassembly of motor starters [\(Page 165\)](#)".

⚠ WARNING

Risk of injury from automatic restart

When you replace the motor starter, the motor starter can restart again autonomously if an ON command is active. This can result in property damage or serious injury caused by connected devices that are automatically started up.

Revoke the ON commands on the motor starter before replacing the motor starter.

⚠ CAUTION

Protection against electrostatic charge

When handling and installing the SIMATIC ET 200SP motor starter, ensure protection against electrostatic charging of the components. Changes to the system configuration and wiring are only permissible after disconnection from the power supply.

14.5 Replacing the terminal box on the BaseUnit

Introduction

The terminal box is part of the BaseUnit. You can replace the terminal box if necessary. You do not need to dismantle the BaseUnit to do this.

The power and AUX buses of the potential group are not interrupted when you replace the terminal box.

Requirements

- The BaseUnit is mounted, wired and fitted with an I/O module.
- The terminal may only be replaced when the supply voltage is switched off.

Required tools

3 to 3.5 mm screwdriver

Procedure

Watch the video sequence: "Replace terminal box on BaseUnit"
(<https://support.automation.siemens.com/WW/view/en/95886218>)

Proceed as follows to replace the terminal box on a BaseUnit:

1. If present, turn off the supply voltage on the BaseUnit.
2. Simultaneously press the top and bottom release buttons of the I/O module and pull the module out of the BaseUnit.
3. Disconnect the wiring on the BaseUnit.
4. The release button of the terminal box is located on the underside of the BaseUnit. Use a screwdriver to push in the small opening at an angle from above.
5. Swivel the screwdriver slightly upwards to loosen the locking mechanism of the terminal box and lever the terminal box up out of the BaseUnit at the same time.
6. Remove the coding element (part) from the terminal box and press it onto the coding element (part) of the I/O module that you removed in step 2.
7. Insert the new terminal box into the BaseUnit at the top and swivel it downwards until it clips into the BaseUnit.
8. Wire up the BaseUnit.
9. Insert the I/O module into the BaseUnit.

10. Switch on a supply voltage on the BaseUnit.

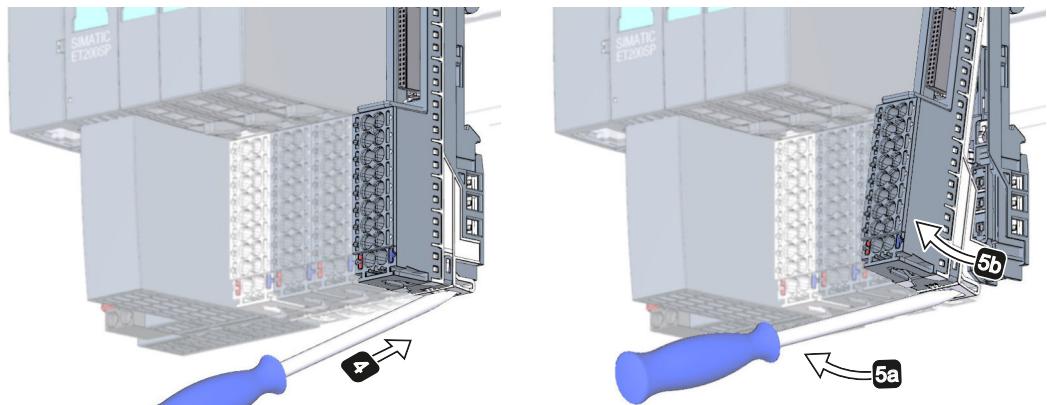


Figure 14-3 Replacing the terminal box on the BaseUnit

NOTE

When replacing the terminal box outside the control cabinet, make sure that you only mount light-colored terminal boxes on the matching BaseUnits with light-colored latch.

14.6 Firmware update

Introduction

During operation it may be necessary to update the firmware (e.g. to extend the available functions).

Update the firmware of the CPU/interface module and the I/O modules using firmware files. The retentive data is retained after the firmware has been updated.

We recommend that you always update to the latest firmware version available for the respective article number. The previous versions of the firmware are only intended as a backup to enable you to downgrade to the original version.

A firmware update has no effects on the user program of the CPU on which the update was performed. However, a downgrade can have effects on the user program if you use new functions in the user program which were not yet supported by the firmware of the CPU.

The following entry (<https://support.industry.siemens.com/cs/ww/en/view/109804718>) contains the current firmware statuses of the interface modules and modules of the ET 200SP.

The following entry (<https://support.industry.siemens.com/cs/de/en/view/109478459>) lists all firmware versions for the CPUs. You will also find a description of the new functions of the respective firmware versions.

Requirement

- You have downloaded the file(s) for the firmware update from the Product Support (<https://support.industry.siemens.com/cs/ww/en/ps>) web page.
On this web page, select:
 - Automation Technology > Automation Systems > Industrial Automation Systems SIMATIC > SIMATIC ET 200 I/O Systems > ET 200 systems for the cabinet > ET 200SP.

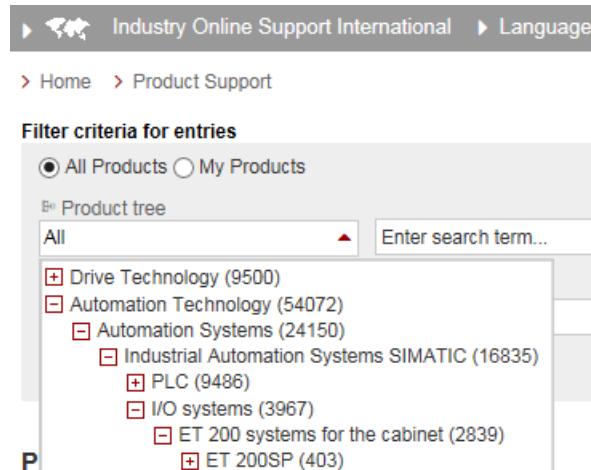


Figure 14-4 ET 200SP in the product tree

From this position, navigate to the specific type of module that you want to update. To continue, click on the "Software downloads" link under "Support". Save the desired firmware update files.

All information on ET 200SP

- [+ Presales info](#)
- [+ Catalog and ordering system online](#)
- [+ Technical info](#)
- [- Support](#)
 - [↗ Product support](#)
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Figure 14-5 Selecting the software downloads

- Before installing the firmware update, make sure that the modules are not being used.
- Modules with firmware version V0.0.0 do not support the "firmware update" function.

NOTE**Firmware update of I/O modules**

The L+ supply voltage must be present on the module at the start of and during the firmware update.

Additional requirement for fail-safe modules**WARNING****Check the firmware version for fail-safe approval**

When using a new firmware version, always check that the version is approved for use in the module in question.

The attachments of the certificate

(<https://support.automation.siemens.com/WW/view/en/49368678/134200>) for SIMATIC Safety specify the firmware version that is approved.

Options for the firmware update

The following options are available for updating firmware:

- Online in STEP 7 via Online & Diagnostics
- Online in STEP 7 via accessible devices (PROFINET)
- Online with the MultiFieldbus Configuration Tool (MFCT) (<https://support.industry.siemens.com/cs/ww/en/view/109781837>)
- Using a SIMATIC memory card (possible for CPU and central I/O modules)
- Via the integrated Web server (possible for CPU as well as centralized and distributed I/O modules)
- Online via the SIMATIC Automation Tool

NOTE**Firmware files of the CPU**

If you perform a CPU update with STEP 7, you require STEP 7 (TIA Portal as of V13 Update 3).

The table below provides an overview of the media that can be used to update the firmware of a specific module.

Table 14-2 Overview of firmware update options

Firmware update	CPU	Interface module	I/O module
STEP 7 (TIA Portal)	✓ ¹⁾	✓	✓
STEP 7 (V5.5 SP2 or higher) ²⁾	--	✓	✓
Accessible devices	✓	✓	✓
MFCT	--	✓	✓

¹⁾ V13 update 3 or higher

²⁾ If the firmware files are only available in this format, you can also install the files using STEP 7 (TIA Portal) but not the SIMATIC memory card or the Web server.

Firmware update	CPU	Interface module	I/O module
SIMATIC memory card	✓	--	✓
Web server of the CPU	✓	--	✓
SIMATIC Automation Tool	✓	✓	✓

- 1) V13 update 3 or higher
 2) If the firmware files are only available in this format, you can also install the files using STEP 7 (TIA Portal) but not the SIMATIC memory card or the Web server.

Firmware update for the motor starter

The following options are available for updating firmware for the motor starter.

- Online via PROFINET IO/PROFIBUS DP (with STEP 7)
- Via the integrated Web server (possible for CPU as well as centralized and distributed I/O modules)
- With the TIA Portal:
 - As of SIMATIC STEP 7 V13 SP1 with installed HSP for the ET 200SP motor starter
 - SIMATIC STEP 7 V14 and higher
- Over a SIMATIC memory card
- With SIMATIC STEP 7 version V5.5 SP4 and higher
- For fail-safe motor starters with the TIA Portal Version V14 SP1 or higher and installed HSP.

NOTE

The firmware update for fail-safe motor starters must take place in a separate ET 200SP system in which only the fail-safe motor starter that is to be updated is inserted.

Installation of the firmware update



WARNING

Risk of impermissible system states

The CPU switches to STOP mode or the interface module to "station failure" as a result of the firmware update being installed. STOP or station failure can have an adverse effect on 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.

Make sure that the CPU/interface module is not executing any active process before installing the firmware update.

Procedure online in STEP 7 via Online & Diagnostics

Requirements: There is an online connection between the CPU/module and PG/PC.

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 to select the path to the firmware update files in the "Firmware update" area.
5. Select the suitable 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 "Run update" button. If the module can interpret the selected file, the file is downloaded to the module.

Updating the firmware

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

When the loading process is complete, the CPU adopts the firmware and then operates with this new firmware.

NOTE

If a firmware update is interrupted, you need to remove and insert the module before starting the firmware update again.

Procedure online in STEP 7 via accessible devices

To perform a firmware update online via accessible devices, follow these steps:

1. From the "Online" menu, select the "Accessible devices" menu item.
2. In the "Accessible devices" dialog, search for the accessible devices for the selected PROFINET interface.
3. To go to a device in the project tree, select the desired device from the list of accessible devices and click the "Show" button.
4. In the project tree, select the "Online & diagnostics" option of the relevant device and perform the firmware update under the category "Functions/Firmware Update" (CPU, Local modules).

You can find information on how to perform a firmware update when your project has no connection to a CPU in the following FAQ on the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/89257657>).

Procedure using the SIMATIC memory card

To perform a firmware update using the SIMATIC memory card, follow these steps:

1. Insert a SIMATIC memory card into the SD card reader of your programming device/computer.
2. To store the update file on the SIMATIC memory card, select the SIMATIC memory card in the "Card Reader/USB memory" folder in the project tree.
3. Select the "Card Reader/USB memory > Create firmware update memory card" command in the "Project" menu.
4. Use a file selection dialog to navigate to the firmware update file. In a further step you can decide whether you want to delete the content of the SIMATIC memory card or whether you want to add the firmware update files to the SIMATIC memory card.
5. Insert the SIMATIC memory card with the firmware update files into the CPU.

Point to note when updating firmware for analog modules and the IO-Link Master CM 4xIO-Link communication module

If you want to update firmware for analog modules or the IO-Link Master CM 4xIO-Link communication module, you must supply a load current of 24 V DC to the modules through the infeed element.

Procedure

1. Remove any inserted SIMATIC memory card.
 2. Insert the SIMATIC memory card with the firmware update files into the CPU.
 3. The firmware update begins shortly after the SIMATIC memory card has been inserted.
 4. Remove the SIMATIC memory card after the firmware update has been completed.
The RUN LED on the CPU lights up yellow, the MAINT LED flashes yellow.
- If you want to use the SIMATIC memory card later as a program card, delete the firmware update files manually.

NOTE

If your hardware configuration contains several modules, the CPU updates all affected modules in the slot sequence, which means in ascending order of the module position in the STEP 7 device configuration.

NOTE

Memory size of the SIMATIC memory card

If you perform a firmware update via the SIMATIC memory card, you must use a large enough card based on the CPU used and the associated I/O modules.

Note the specified file sizes of the update files when downloading them from Siemens Industry Online Support. The file size information is especially important when you perform the firmware update not only for the CPU but also for the associated I/O modules, communication modules, etc. The total size of the update files must not exceed the available memory size of your SIMATIC memory card.

You can find more information on the capacity of SIMATIC memory cards in the section Accessories/spare parts (Page 339) and in the function manual Structure and use of the CPU memory (<https://support.industry.siemens.com/cs/de/en/view/59193101>).

Procedure: via the integrated Web server

The procedure is described in the Web server (<https://support.automation.siemens.com/WW/view/en/59193560>) function manual.

Procedure: online via the SIMATIC Automation Tool

The procedure is described in the SIMATIC Automation Tool (<https://support.industry.siemens.com/cs/ww/en/view/98161300>) manual (included in the SIMATIC Automation Tool).

Behavior during the firmware update

Note the following behavior of the relevant I/O module when carrying out a firmware update:

- The DIAG LED display flashes red.
- The I/O module retains its current diagnostic status.
- Diagnostics alarm: Channel temporarily unavailable (error code $31_{D}/1F_{H}$)
- All outputs are in a current-free/voltage-free state

Note the following behavior when carrying out the firmware update of the motor starter:

- RN flashes green and ER flashes red.
- ST/OL flashes green and MAN flashes yellow.
- The motor starter powers up after completion of the firmware update. Diagnoses are reset. The firmware update does not affect the TMM and the cooling time.
- The sensor supply of the DI module remains active.

Behavior after the firmware update

After the firmware update, check the firmware version of the updated module.

Reference

You will find more information on these procedures in the STEP 7 online help.

14.7 Resetting CPU/interface module (PROFINET) to factory settings

14.7.1 Resetting the CPU to factory settings

Introduction

The CPU can be reset to its delivery state using "Reset to factory settings". The function deletes all information saved internally on the CPU.

If you want to remove a PROFINET CPU and use it elsewhere with a different program, or put it into storage, we recommend that you reset the CPU to its factory settings. When restoring the factory settings, remember that you also delete the IP address parameters.

Recommendation

Put the CPU into its delivery state if:

- You remove a CPU and use it elsewhere with a different program
- You return the CPU to stock

When resetting to factory settings, remember that the IP address parameters are also deleted.

Options for resetting a CPU to factory settings

The following options are available for resetting the CPU to its factory settings:

- Using the mode selector
- Using STEP 7
- Using the SIMATIC Automation Tool

Procedure using the mode selector

Make sure that there is no SIMATIC memory card in the CPU and that the CPU is in STOP mode (the RUN/STOP LED is lit yellow).

NOTE

Reset to factory settings ↔ Memory reset

The procedure described below also corresponds to the procedure for a memory reset:

- Selector operation with inserted SIMATIC memory card: CPU executes a memory reset
- Selector operation without inserted SIMATIC memory card: CPU executes reset to factory settings

Perform a reset to factory settings when there is no SIMATIC memory card inserted as follows:

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 lit (this takes 3 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 "Reset to factory settings", during which time the RUN/STOP LED flashes yellow. When the RUN/STOP LED lights up yellow, the CPU has been reset to factory settings and is in the STOP mode. The "Reset to factory settings" event is entered in the diagnostics buffer.

NOTE

The IP address of the CPU is also deleted when the CPU is reset to the factory settings through the mode selector.

For information on the memory reset of the CPU, refer to the section CPU memory reset ([Page 265](#)).

Procedure using STEP 7

Make sure that an online connection to the CPU exists.

To reset a CPU to factory settings using STEP 7, follow these steps:

1. Open the Online and Diagnostics view of the CPU.
2. In the "Functions" folder, select the "Reset to factory settings" group.
3. If you want to keep the IP address, select the "Retain IP address" option button. If you want to delete the IP address, select the "Reset IP address" option button.

NOTE

"Delete IP address" deletes all IP addresses, regardless of how you established the online connection.

If there is a SIMATIC memory card inserted, selecting the "Delete IP address" option has the following effect:

- The IP addresses are deleted and the CPU is reset to factory settings.
- The configuration (including IP address) on the SIMATIC memory card is then downloaded to the CPU. If there is no saved configuration (because the SIMATIC memory card has been cleared or formatted, for example), no new IP address is assigned.

-
4. Click the "Reset" button.

5. Click "OK" in response to the confirmation prompts.

Result: The CPU executes the "Reset to factory settings", during which time the RUN/STOP LED flashes yellow. When the RUN/STOP LED lights up yellow, the CPU has been reset to factory settings and is in the STOP mode. The "Reset to factory settings" event is entered in the diagnostics buffer.

Procedure using the SIMATIC Automation Tool

The procedure is described in the SIMATIC Automation Tool (<https://support.industry.siemens.com/cs/ww/en/view/98161300>) manual (included in the SIMATIC Automation Tool).

Result after resetting to factory settings

The following table provides an overview of the contents of the memory objects after the reset to factory settings.

Table 14-3 Result after resetting to factory settings

Memory object	Content
Actual values of the data blocks, instance data blocks	Initialized
Bit memory, timers and counters	Initialized
Certain retentive tags from technology objects (e.g. adjustment values of absolute encoders)	Initialized
Diagnostics buffer entries	Initialized
IP address	Depends on the procedure: <ul style="list-style-type: none"> Using mode switch: is deleted Using STEP 7: Depending on the setting of the "Keep IP address"/"Delete IP address" option buttons
Device name	Is set to "CPU"
Counter readings of the runtime meters	Initialized
Time of day	Is set to "00:00:00, 01.01.2012"

If a SIMATIC memory card was inserted prior to the factory reset, the CPU downloads the configuration contained on the SIMATIC memory card (hardware and software). A configured IP address then becomes valid again.

NOTE

Password for protection of confidential configuration data

The password for protection of confidential configuration data is retained after the CPU is reset to factory settings. The password is only deleted when the "Delete password for protection of confidential PLC configuration data" option is set.

You can find additional information on the password for protection of confidential configuration data in the Communication (<https://support.industry.siemens.com/cs/ww/en/view/59192925>) function manual.

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.

14.7.2 Resetting interface module (PROFINET IO) to factory settings

Function

The "Reset to factory settings" function returns the interface module (PROFINET) to its delivery state.

Reset options

- Using STEP 7 (online via PROFINET IO)
- Using a reset button on the interface module (on rear). Exception: There is no reset button on the IM 155-6 PN BA and the IM 155-6 PN R1. See section Resetting the interface module (PROFINET IO) to factory settings with a RESET button ([Page 302](#)).

Procedure using STEP 7

To reset an interface module to factory settings using STEP 7, follow these steps:

Make sure that an online connection to the interface module exists.

1. Open the online and diagnostics view of the interface module.
2. In the "Functions" folder, select the "Reset to factory settings" group.
3. Click the "Reset" button.
4. Click "OK" in response to the confirmation prompt.

Result: The interface module then performs "Reset to factory settings".

Result after resetting to factory settings

The following table shows the values of the interface module properties after a factory reset:

Table 14-4 Properties of the interface module as shipped

Properties	Value
Parameters	Default setting
IP address	Not available
Device name	Not available
MAC address	Available
I&M data	Identification data (I&M0) available Maintenance data (I&M1, 2, 3, 4) reset *
Firmware version	Available

NOTE

Failure of downstream stations is possible

Downstream stations on a bus segment can fail when the factory settings are restored on an interface module.

NOTE

Behavior of the installed I/O modules during reset to factory settings

The I/O modules of the ET 200SP distributed I/O system assume the unconfigured state after a reset to factory settings. The interface module does not acquire any input data and does not output any output data.

Reference

You will find more information on the procedure in the STEP 7 online help.

14.7.3 Resetting the interface module (PROFINET IO) to factory settings with a RESET button

Requirement

The supply voltage to the interface module is turned on.

Required tools

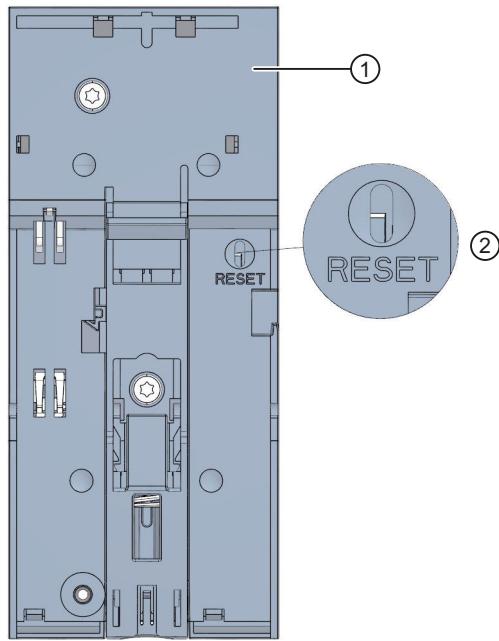
3 to 3.5 mm screwdriver (for resetting with a RESET button)

Procedure

Proceed as follows to reset an interface module to factory settings by means of the RESET button:

1. Remove the interface module from the mounting rail (see Mounting the CPU/interface module ([Page 118](#))) and swivel it downwards.
2. The RESET button is located on the rear of the interface module behind a small opening: Press a screwdriver into the small opening for at least 3 seconds to activate the RESET button.
3. Install the interface module back on the mounting rail (see Mounting the CPU/interface module ([Page 118](#))).

4. Assign parameters to the interface module again.



- ① Rear of the interface module
② RESET button

Figure 14-6 RESET button

14.8 Reaction to faults in fail-safe modules and fail-safe motor starters

Safe state (safety concept)

The basic principle behind the safety concept is the existence of a safe state for all process variables.

NOTE

For digital F-modules, this safe state is the value "0". This applies to both sensors and actuators. In the case of the fail-safe motor starters, the load is shut down in a fail-safe manner.

Fault reactions and startup of the F-system

The safety function means that fail-safe modules use substitute values (safe state) instead of process values (**passivation of the fail-safe module**) in the following situations:

- When the F-system is started up
- If errors are detected during safety-related communication between the F-CPU and the F-module via the PROFI safe safety protocol (communication error)
- If F-I/O faults or channel faults are detected (e.g. crossover or discrepancy errors)

Detected faults are written to the diagnostic buffer of the F-CPU and communicated to the safety program in the F-CPU.

F-modules cannot save errors as retentive data. After a POWER OFF / POWER ON, any faults still existing are detected again during startup. However, you have the option of saving faults in your safety program.

WARNING

For channels that you set to "deactivated" in STEP 7, no diagnostic response or error handling is triggered when a channel fault occurs, not even when such a channel is affected indirectly by a channel group fault ("Channel activated/deactivated" parameter).

Remedying faults in the F-system

To remedy faults in your F-system, follow the procedure described in IEC 61508-1:2010 section 7.15.2.4 and IEC 61508-2:2010 section 7.6.2.1 e.

The following steps must be performed:

1. Diagnosing and repairing the fault
2. Revalidation of the safety function
3. Recording in the service report

Substitute value output for fail-safe modules

In the case of F-modules with inputs, if there is passivation, the F-system provides substitute values (0) for the safety program instead of the process data pending at the fail-safe inputs.

In the case of F-modules with outputs, if there is passivation, the F-system transfers substitute values (0) to the fail-safe outputs instead of the output values provided by the safety program. The output channels are de-energized. This also applies when the F-CPU goes to STOP mode. Assignment of substitute values is not possible.

Substitute values are used either for the relevant channel only or for all channels of the relevant failsafe module depending on:

- The F-system used
- The type of error that occurred (F-I/O, channel fault or communication error)
- The F-module parameter assignment

Reintegration of a fail-safe module

The system changes from fail-safe to process values (reintegration of an F-module) either automatically or only after user acknowledgment in the safety program. If channel faults occur, it may be necessary to remove and reinsert the F-module. A detailed listing of faults requiring removal and insertion of the F-module can be found in the section Diagnostic messages of the respective F-module.

After reintegration, the following occurs:

- In the case of an F-module with inputs, the process data pending at the fail-safe inputs is made available to the safety program again
- In the case of an F-module with outputs, the output values provided in the safety program are transferred to the fail-safe outputs again

Additional information on passivation and reintegration

For additional information on passivation and reintegration of F-I/O, refer to the SIMATIC Safety, Configuring and Programming

(<https://support.automation.siemens.com/WW/view/en/54110126>) manual.

Behavior of the fail-safe module with inputs in the event of a communication disruption

F-modules with inputs respond differently to communication errors compared to other errors. If a communication error is detected, the current process values remain set at the inputs of the F-module. There is no passivation of the channels. The current process values are passivated in the F-CPU.

14.9 Maintenance and repair

The components of the ET 200SP distributed I/O system are maintenance-free.

NOTE

Repairs to a SIMATIC ET 200SP system may only be carried out by the manufacturer.

NOTE

Cleaning the ET 200SP

Requirement: All supply voltages on the ET 200SP distributed I/O system are switched off. Observe the five safety rules for working in and on electrical installations.

If you need to clean the devices, use dry ESD cleaning cloths (observing the ESD protective measures).

14.10 Warranty

To meet the conditions of the warranty, you must observe the safety and commissioning instructions.

SIMATIC system power supply

SIMATIC ET200SP PS

Manual

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SIMATIC ET200SP PS
6EP7133-6AB00-0BN0 24 V/5 A
SIMATIC ET200SP PS
6EP7133-6AE00-0BN0 24 V/10 A

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.

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:

WARNING

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.

Overview



The 1-phase ET200SP PS from the SIMATIC ET200SP product line is a powerful regulated system power supply for automated systems and machines. In addition to a high efficiency, these power supply units have an outstanding overload behavior.

The key benefits of the product include:

- 1-phase 120/230 V AC input voltage with automatic switchover function allowing the units to be connected to almost any 1-phase line supply around the world.
- The output voltage can be adjusted in the range 22.8 - 28 V
- Brief overload capability of 150% for 5 s/min (extra power)
- Integrated signaling contact for "24 V O.K."
- Ambient temperature -30 ... 70 °C

Ordering data

The following device options are available:

Regulated power supply unit ET200SP PS	
Type	Order number
1-phase 120/230 V AC input, 24 V/5 A DC output	6EP7133-6AB00-0BN0
1-phase 120/230 V AC input, 24 V/10 A DC output	6EP7133-6AE00-0BN0

Validity

This manual provides information on the following products:

- SIMATIC ET200SP PS 24 V DC/5 A, SIMATIC ET200SP PS 24 V DC/10 A
Article number: 6EP7133-6AB00-0BN0, 6EP7133-6AE00-0BN0
Product state (PS): 1

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Safety instructions

1.1 General safety instructions



WARNING

Correct handling of the devices

When operating electrical devices, it is inevitable that certain components will carry dangerous voltages.

Therefore, failure to handle the units properly can result in death or serious physical injury as well as extensive property damage.

Only appropriately qualified personnel may work on or in the vicinity of this equipment.

Perfect, safe, and reliable operation of this equipment is dependent on proper transportation, storage, installation and mounting.

Before installation or maintenance work can begin, the system's main switch must be switched off and measures taken to prevent it being switched on again.

If this instruction is not observed, touching live parts can result in death or serious injury.

1.2 Safety instructions for hazardous zones



WARNING

OPERATE POTENTIOMETERS OR SWITCHES IN NON-HAZARDOUS AREAS ONLY!

Safety instructions

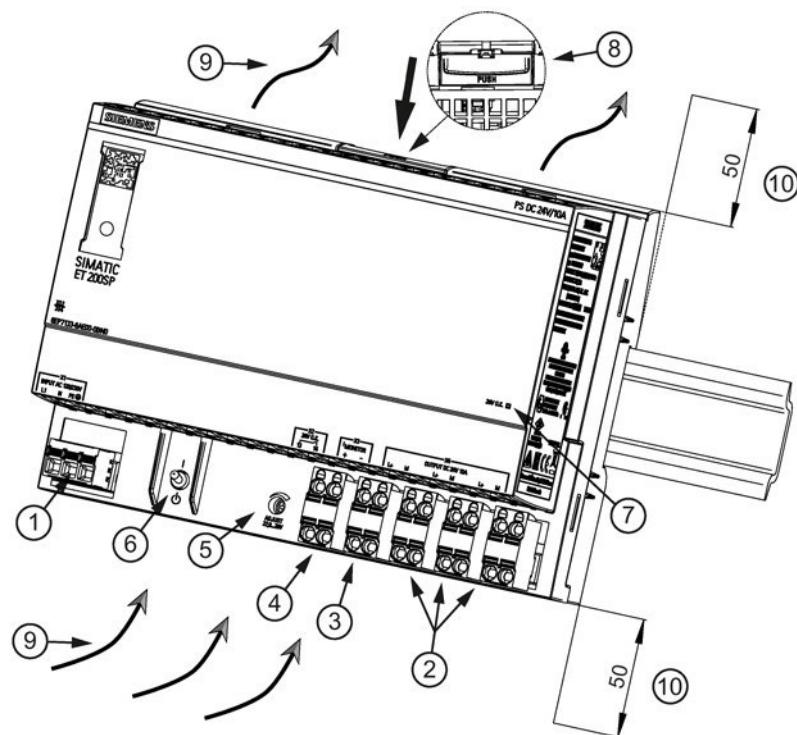
1.2 Safety instructions for hazardous zones

Description, device design, dimension drawing

2.1

Device description

The SIMATIC ET200SP PS is a primary-clocked power supply for connection to a 1-phase AC line supply. An electronically regulated DC voltage that can be set via a potentiometer is available at the output of the device. The output of the device is isolated, no-load proof and short-circuit proof. The LED display indicates the operating status. The current monitoring terminal is used to sense the output current. The operating state of the device can be processed via the signaling contact.



- (1) AC input
- (2) DC output
- (3) Current monitoring terminals I_{Monitor} ($1 \text{ V} \leq I_{\text{out rated}}$)
- (4) Signaling contact (13, 14)
- (5) Potentiometer 22.8 – 28 V
- (6) ON/OFF switch
- (7) Indicator light (24 V O.K.)
- (8) Button to manually release
- (9) Convection
- (10) Clearance above/below

Figure 2-1 Design

2.2 Connections and terminal designation

The line input terminals ① can be used to establish the connection to supply voltage. The output terminals ② are used to connect to the loads to be supplied (see also Section Installation (Page 23)).

The output current can be sensed via current monitoring terminal ③. The operating state of the device can be processed via the signaling contact ④ (function and contact rating, see Chapter Status displays and signaling (Page 12)).

Connections and terminal designations	
① Line input L1, N, PE	One spring-loaded terminal each
② Output +	3 spring-loaded terminals
② Output -	3 spring-loaded terminals
③ Current monitoring terminals	One spring-loaded terminal each
④ Signaling contact 13, 14	One spring-loaded terminal each

	①	② + ③ + ④	⑤
	-	-	0,4 x 4 / PZ1 / PH0 max. Ø 3,5 mm
	1 x 0,2 - 1,5 mm²	1 x 0,2 - 2,5 mm²	-
	1 x 0,2 - 2,5 mm²	1 x 0,2 - 2,5 mm²	-
	1 x 0,2 - 1,5 mm²	1 x 0,25 - 2,5 mm²	-
AWG	24 - 16	24 - 13	-
Nm	-	-	0,04 Nm ^{*1)}
	10 mm	10 mm	-

^{*1)} Do not subject the end stop to higher loads

Figure 2-2 Terminal data

2.3 Potentiometer

The potentiometer ⑤ on the front of the device is used to set the output voltage. The output voltage is set to the rated value at the factory and can be set within certain limits; for example, to compensate voltage drops across long supply lines to the connected load.

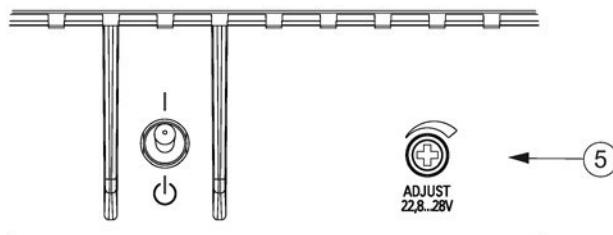


Figure 2-3 Potentiometer

Type	Factory setting	Adjustment range
6EP7133-6AB00-0BN0	24 V	22.8 - 28 V
6EP7133-6AE00-0BN0		

NOTICE

Thermal overload possible

When adjusting the output voltage to greater than the rated voltage, the output current must be derated by 4 %/V, or the permissible ambient temperature must be taken into account with 3° C/V.

Note

It is only permissible to use an insulated screwdriver when actuating the potentiometer.

For information on actuating the potentiometer (screwdriver, torque), see Figure 2-2 Terminal data (Page 10).

2.4 Status displays and signaling

6EP7133-6AB00-0BN0 (24 V/5 A)
6EP7133-6AE00-0BN0 (24 V/10 A)

Status display	LED green for 24 V O.K.
Signaling contact (13,14)	Contact rating (isolated): 30 V AC/0.5 A, 60 V DC/0.3 A, 30 V DC/1 A) for 24 V O.K.
Current monitoring terminals	Voltage proportional to the output current: $\sim 1 \text{ V} \leq I_{\text{out rated}} \pm 50 \text{ mV}$

Table 2- 1 I_{Monitor} conversion table

6EP7133-6AB00-0BN0 (24 V/5 A)		6EP7133-6AE00-0BN0 (24 V/10 A)	
Output current [A]	I_{Monitor} [V]	Output current [A]	I_{Monitor} [V]
0.0	0.0	0.0	0.0
0.5	0.1	1.0	0.1
1.0	0.2	2.0	0.2
1.5	0.3	3.0	0.3
2.0	0.4	4.0	0.4
2.5	0.5	5.0	0.5
3.0	0.6	6.0	0.6
3.5	0.7	7.0	0.7
4.0	0.8	8.0	0.8
4.5	0.9	9.0	0.9
5.0	1.0	10	1.0

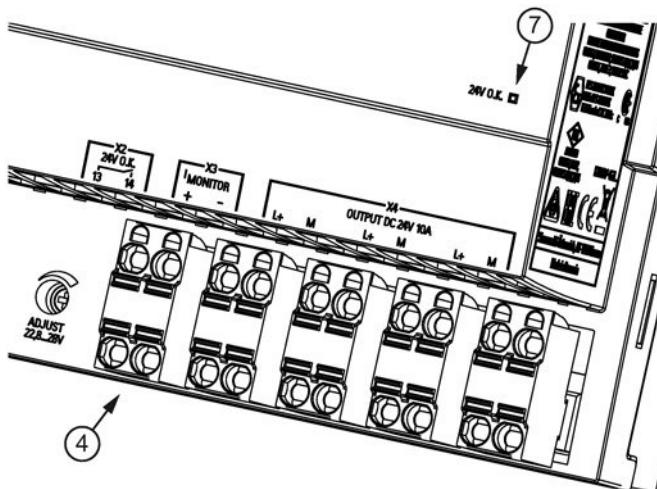


Figure 2-4 Operating displays and signaling

Signaling	6EP7133-6AB00-0BN0 (24 /5 A) 6EP7133-6AE00-0BN0 (24 V/10 A)
LED ⑦ lights up green Signaling contact ④, contact 13-14 closed	Normal operation, output voltage $> 20 \text{ V} \pm 0.5 \text{ V}$
LED ⑦ off Signaling contact ④, contacts 13-14 open (quiescent position)	Overload operation or power supply voltage missing

2.5 Block diagram

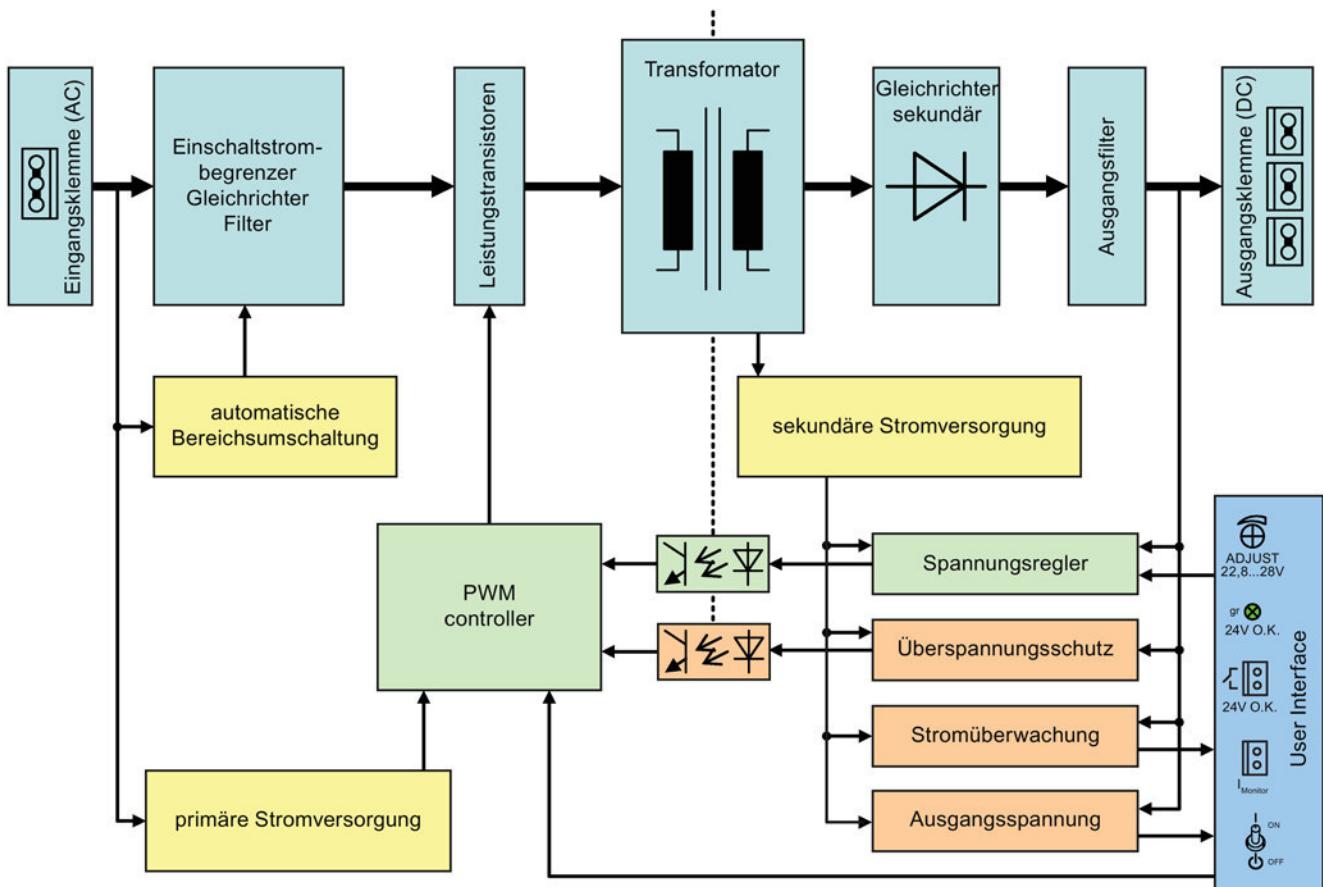


Figure 2-5 Block diagram

2.6 Dimensions and weight

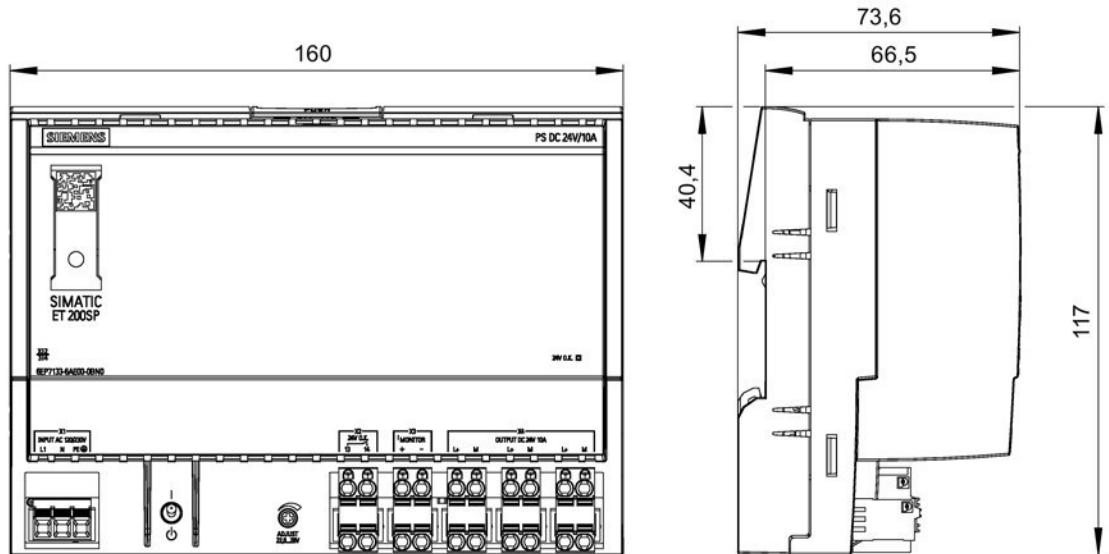


Figure 2-6 Dimensions and weight

	6EP7133-6AB00-BN0 (24 V/5 A)	6EP7133-6AE00-OBNO (24 V/10 A)
Dimensions (W × H × D) in mm	160 × 117 × 66.5	160 × 117 × 66.5
Weight	Approx. 0.5 kg	Approx. 0.72 kg

Mounting/removal

WARNING

Installing the device in a housing or a control cabinet

SIMATIC ET200SP PS power supplies are built-in devices. They must be installed in a housing or control cabinet where only qualified personnel have access.

The device can be mounted in a control cabinet on standard mounting rails (see Chapter Mechanical system (Page 34))

Mounting

To mount the device, position it with the mounting rail guide at the upper edge of the standard mounting rail and press down to lock it into place. If it is difficult to snap the device into place, press the button at the same time, as described under "Removal".

Removal

To remove, press button ⑧ (see Removal diagram (Page 17)) by hand downwards – and withdraw the device at the lower edge of the standard mounting rail. Then you can remove the device from the upper edge of the standard mounting rail.

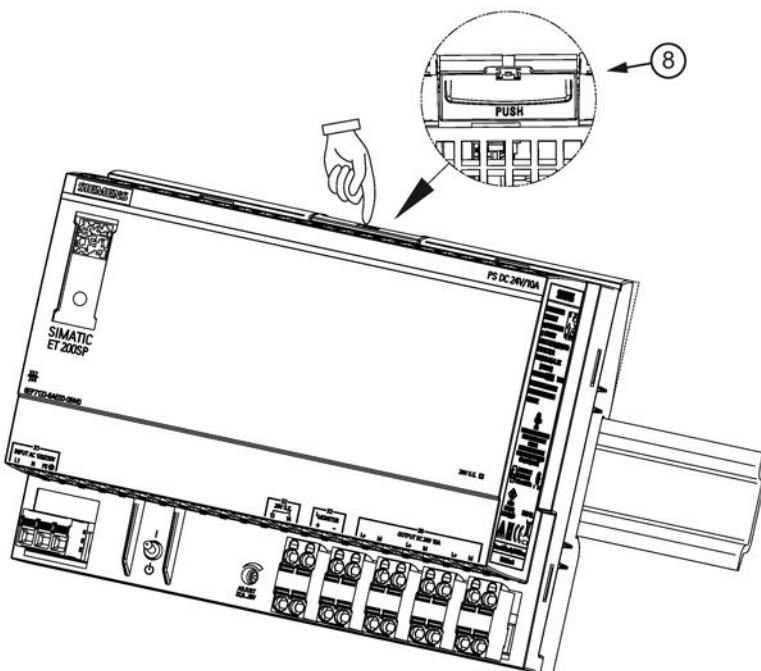


Figure 3-1 Removal



WARNING

Use in hazardous zones

If the device is to be used in a hazardous zone (Ex II 3G Ex nA nC IIC T4 Gc) it must be installed in a distributor box with degree of protection IP54 or higher.

Mounting position, mounting clearances

4.1 Standard mounting position

The device is mounted on standard mounting rails according to EN 60715 35x7,5/15.

The device must be mounted vertically in such a way that the terminals are at the bottom.

A clearance of at least 50 mm should be maintained above and below the device (maximum depth of the cable duct, 50 mm).

No space is required at the side.

Output current as a function of the ambient temperature and mounting height

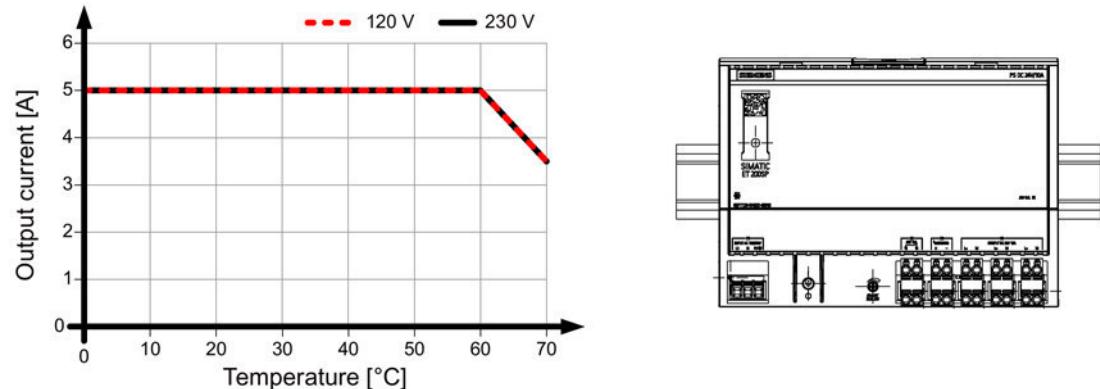


Figure 4-1 6EP7133-6AB00-0BN0: Output current in the standard mounting position

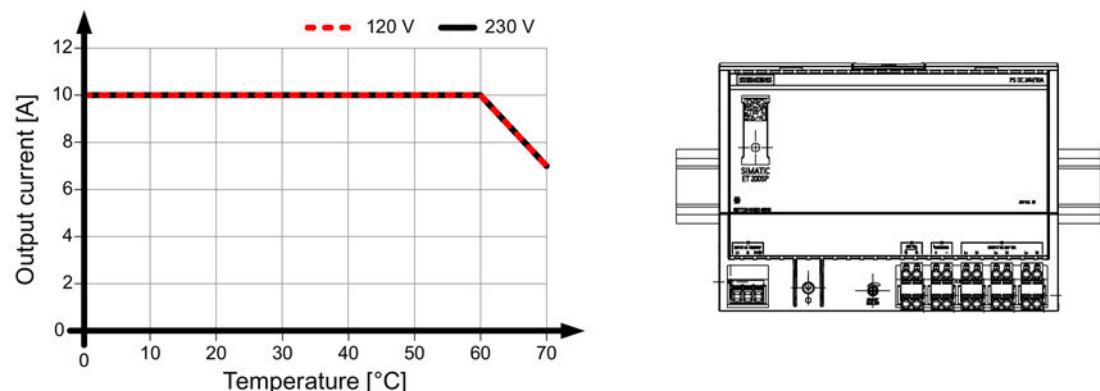


Figure 4-2 6EP7133-6AE00-0BN0: Output current in the standard mounting position

4.2 Other mounting positions

For mounting positions that deviate from the standard mounting position, derating factors (reduction of the output power or the permissible ambient temperature) must be observed in accordance with the following diagrams.

Note

In the case of mounting positions that deviate from the standard mounting position, reduced mechanical resistance of the devices against vibration and shock must be expected.

Particularly when installing on a vertically fastened standard mounting rail, additional measures may be required, e.g. to prevent the device from slipping on the standard mounting rail.

4.2.1 6EP7133-6AB00-0BN0

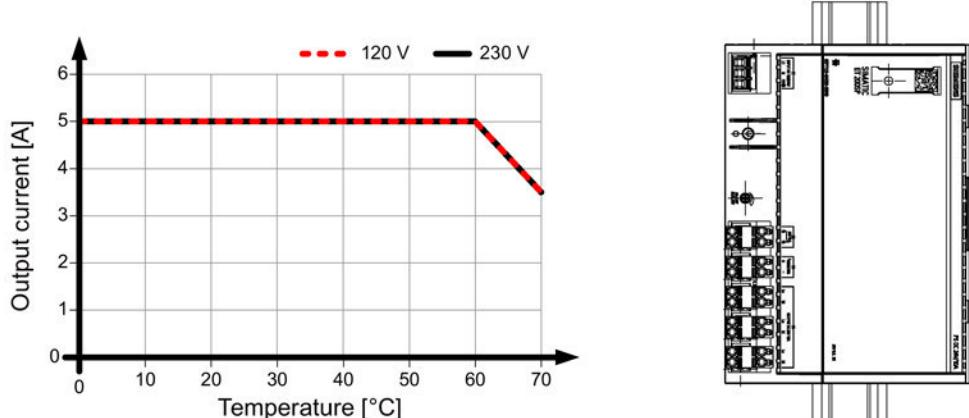
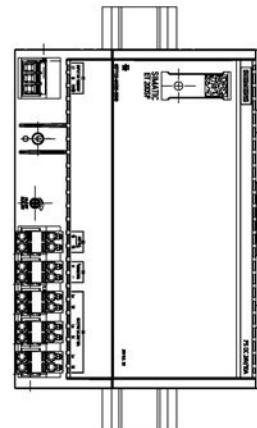
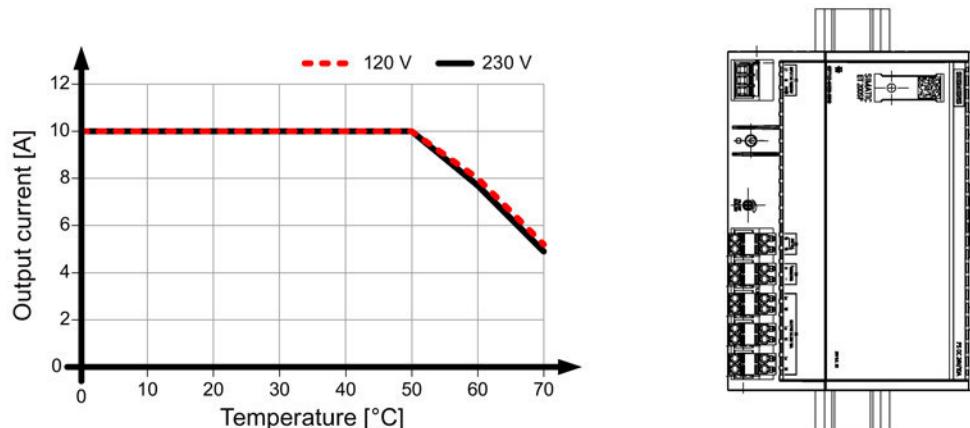


Figure 4-3 Mounting position (2)

Note

Other mounting positions are not permissible!

4.2.2 6EP7133-6AE00-0BN0



Note

Other mounting positions are not permissible!

Installation

WARNING

Hazard due to electric shock

Before installation or maintenance work can begin, the system's main switch must be switched off and measures taken to prevent it being switched on again. If this instruction is not observed, touching live parts can result in death or serious injury.

5.1 Line-side connection

SIMATIC ET200SP PS power supplies are designed for connection to a 1-phase AC line supply (TN or TT system according to IEC 60364-1) with a rated voltage of 120/230 V AC, 50/60 Hz.

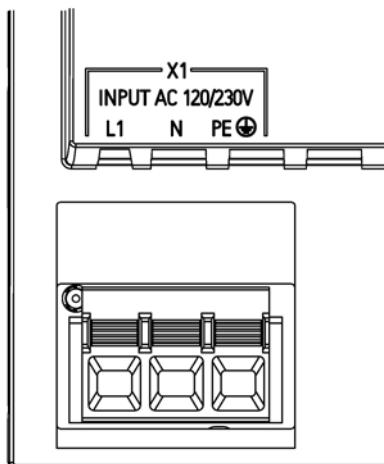


Figure 5-1 Line supply connection

The line supply is connected using terminals L1, N and PE (see Figure 5-1 Line supply connection (Page 23)), and must be implemented according to IEC 60364 . A protective device (miniature circuit-breaker or circuit-breaker) and a disconnection unit for the power supply must be provided. A ground-fault circuit interrupter is not permissible against indirect contact as the only protective measure. This is true for the complete line supply protected by the ground-fault circuit interrupter.

Protection

SIMATIC ET200SP PS	Recommended line-side protection
6EP7133-6AB00-0BN0	Miniature circuit breaker (IEC 898) characteristic B, 6 A and C, 3 A
6EP7133-6AE00-0BN0	Miniature circuit breaker (IEC 898) characteristic B, 10 A and C, 6 A

The protective conductor of the line supply must be connected at the PE terminal.

NOTICE

Country-specific regulations must be observed when installing.

5.2 Output-side connection

SIMATIC ET200SP PS power supplies provide an isolated (= non-grounded) SELV output voltage (Safety Extra Low Voltage). The output of the power supply is no-load, overload, and short-circuit proof. If an overload occurs, the electronic current limitation limits the output current to a maximum value (refer to chapter Technical data (Page 27)).

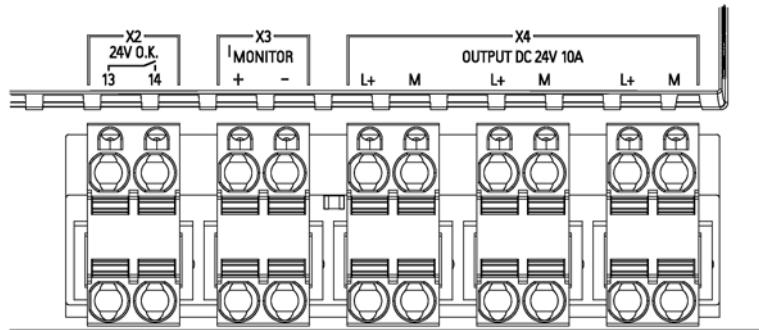


Figure 5-2 Connecting the output voltage

The output voltage is connected via the + and - terminals at the output of the power supply (see Figure Connecting the output voltage (Page 25)). Ensure that the output cables are dimensioned correctly for the maximum output current rms value and fused accordingly.

Note

If the safety concept of the plant or system specifies that the DC output circuit should be grounded (PELV), then it is permissible that the output voltage of the SIMATIC power supply is grounded. In this case, ideally, the grounding at the output should be directly connected from terminal "-" of the power supply to a suitable connection point of the protective conductor system (PE) of the plant or system.
