

**SIEMENS**



Edition  
11/2023

SYSTEM MANUAL

# SIMATIC

## ET 200SP

ET 200SP Distributed I/O System

# 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

<b>Easy to use</b>	<b>Compact design</b>	<b>Safety Integrated</b>	<b>Communication standards</b>	<b>Energy efficiency</b>
<ul style="list-style-type: none"><li>Compact modules, fixed wiring with single-cable and multi-cable connection</li><li>Less time due to connection technology with push-in terminals and without tools</li><li>Adaptation of the configuration for future expansions through integrated configuration control</li></ul>	<ul style="list-style-type: none"><li>Small size and high variability through scalability</li><li>Maximum level of clarity through innovative labeling system in minimum space</li><li>System-integrated load current supply</li></ul>	<ul style="list-style-type: none"><li>Easy integration of fail-safe CPUs and modules</li><li>All F-parameters set in software</li></ul>	<ul style="list-style-type: none"><li>PROFINET IO</li><li>PROFIBUS DP</li><li>EtherNet/IP</li><li>Modbus TCP</li><li>ET-Connection</li><li>AS-Interface</li><li>IO-Link</li><li>Point-to-point (RS232, RS485)</li><li>DALI</li><li>DMX</li></ul>	<ul style="list-style-type: none"><li>PROFIsafe as integrated function</li></ul>
<b>High performance</b>				
<b>CPU</b>	<ul style="list-style-type: none"><li>Isochronous PROFINET IO with the PROFIsafe and PROFIsenergy profiles</li></ul>	<b>Motor starter</b>		
<b>Powerful technology</b>		<ul style="list-style-type: none"><li>Easy integration of motor starters with overload and short-circuit protection</li><li>Compact design with a maximum connectable motor output of up to 5.5 kW</li></ul>		
	<ul style="list-style-type: none"><li>Modules for Counting, Positioning, Weighing and Measuring functions of electrical parameters</li></ul>	<b>Modules for hazardous area</b>		
		<ul style="list-style-type: none"><li>Modules for the connection of devices in hazardous areas of Zone 0 and Zone 1.</li></ul>		

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.

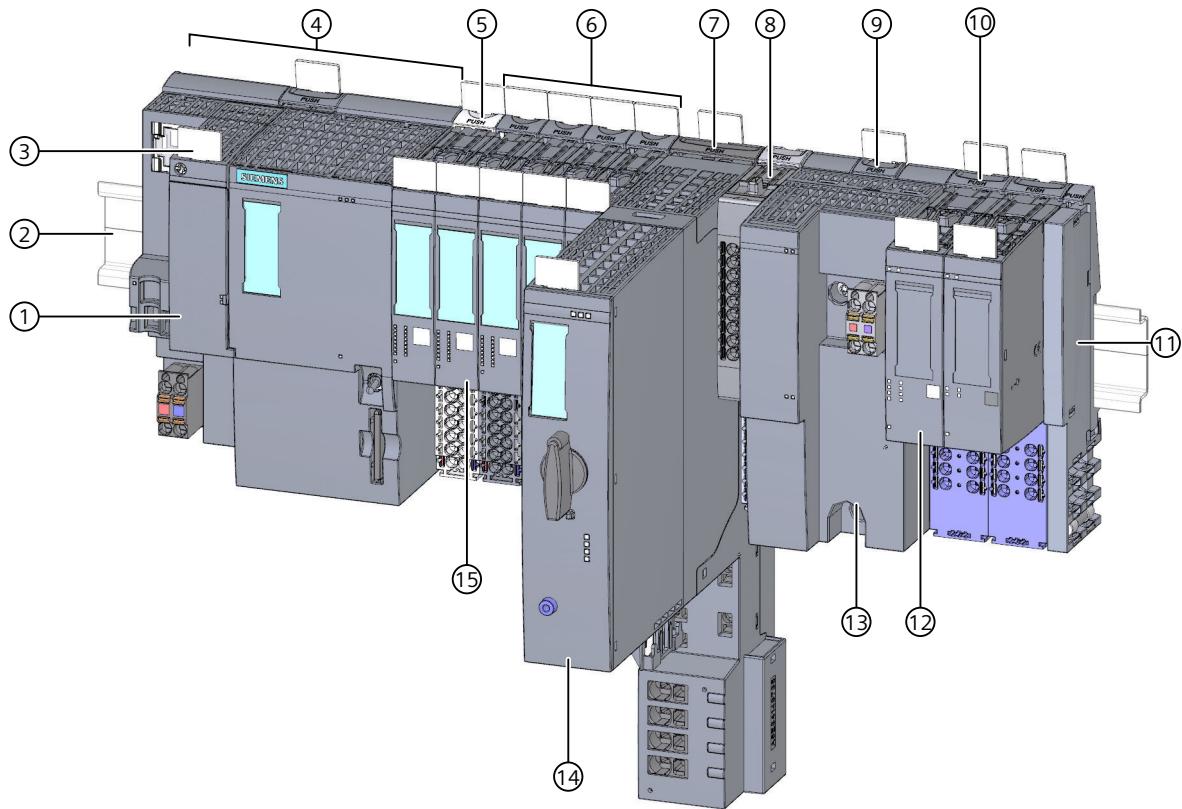
## Configuration

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

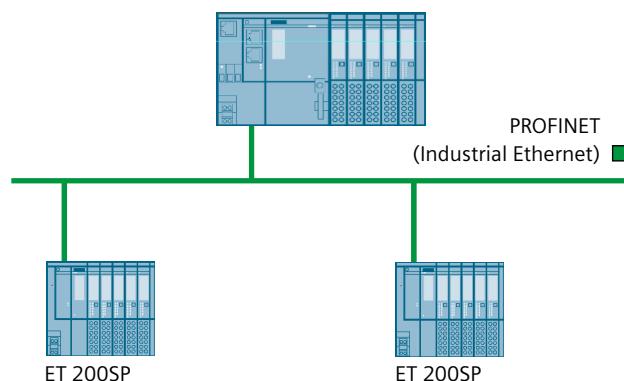


Figure 5-3 Fail-safe SIMATIC Safety automation system (sample configuration)

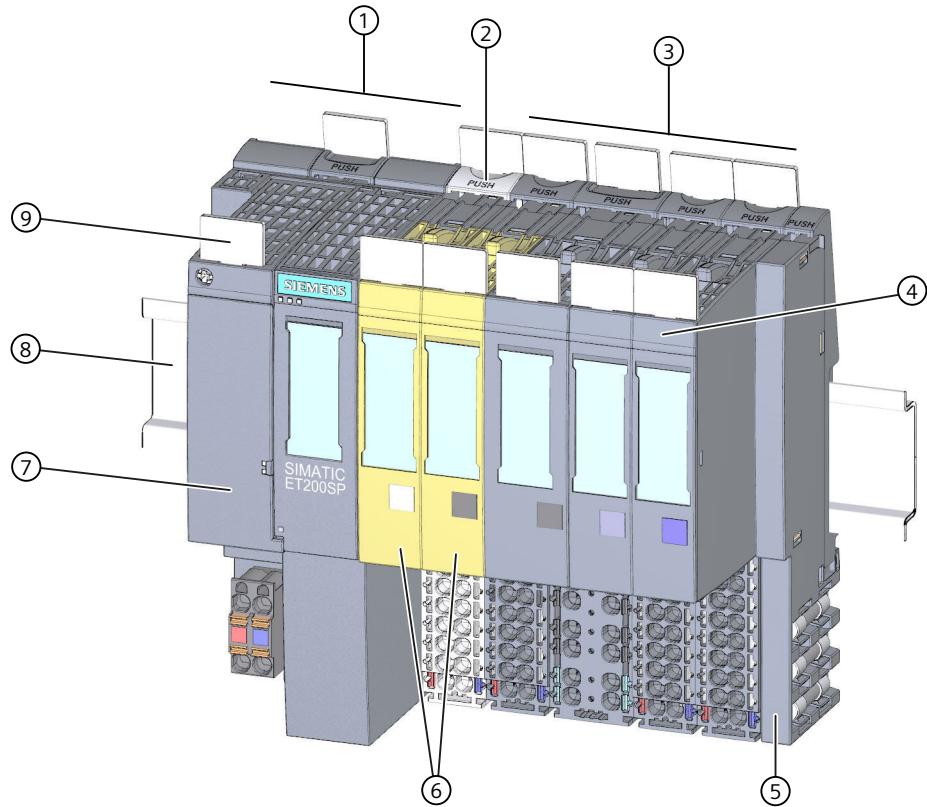
### Fail-safe ET 200SP I/O modules

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.

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### **NOTE**

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

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## **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

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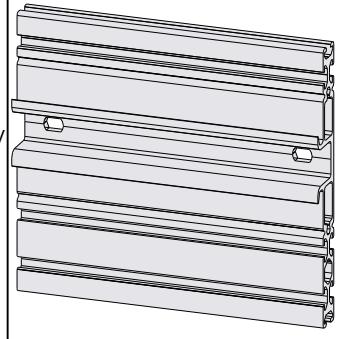
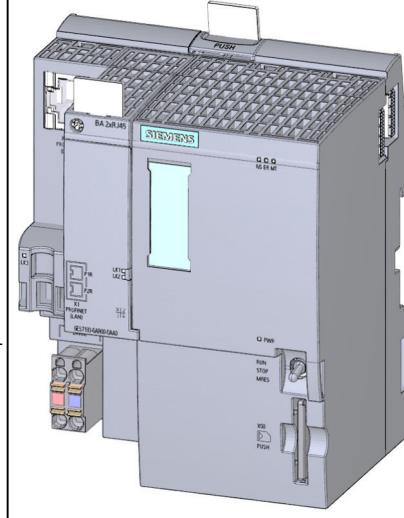
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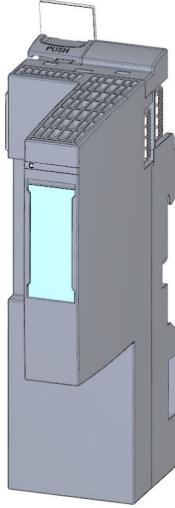
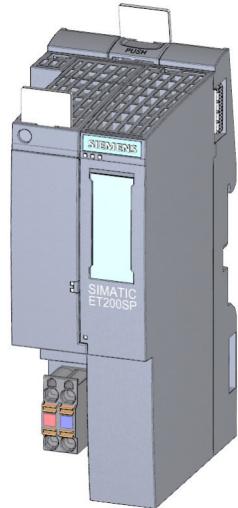
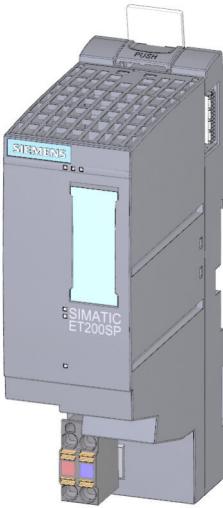
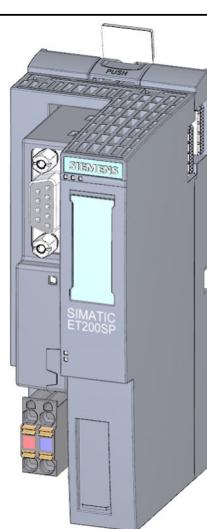
A complete overview of the ET 200SP modules and accessories is available in the Product information on documentation of the ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/de/de/view/73021864/en>).

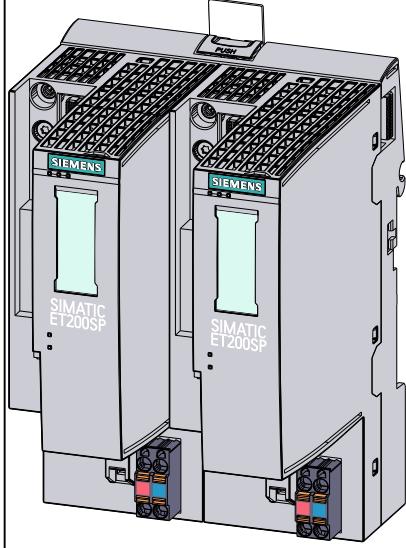
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### Basic components of the ET 200SP distributed I/O system

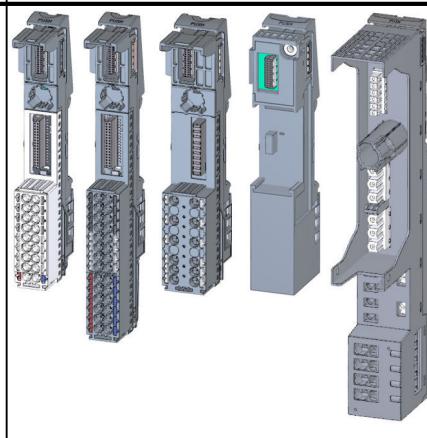
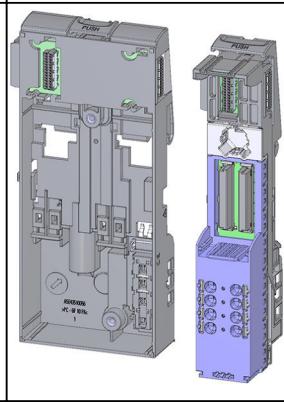
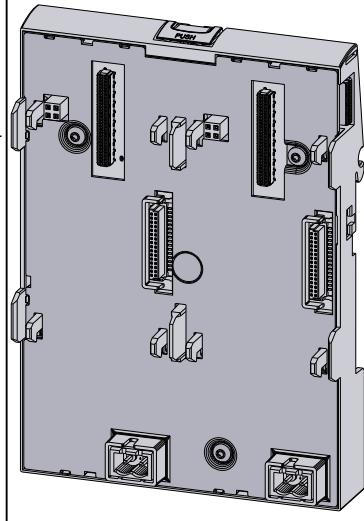
Table 5-2 Basic components of the ET 200SP

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"> <li>Runs the user program. The F-CPU also runs the safety program.</li> <li>Can be used as an IO controller or I-Device on PROFINET IO or as a standalone CPU</li> <li>Links the ET 200SP to the IO devices or the IO controller</li> <li>Exchanges data with the I/O modules via the backplane bus.</li> </ul> <p>Additional CPU functions:</p> <ul style="list-style-type: none"> <li>Communication via PROFIBUS DP (the CPU can be used as a DP master or DP slave in combination with the CM DP communication module)</li> <li>Integrated Web server</li> <li>Integrated technology</li> <li>Integrated trace functionality</li> <li>Integrated system diagnostics</li> <li>Integrated safety</li> <li>Safety mode (when using fail-safe CPUs)</li> </ul>	

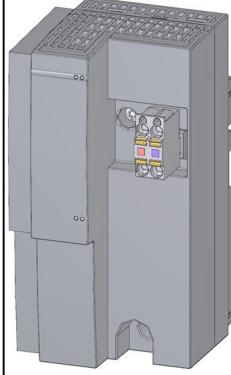
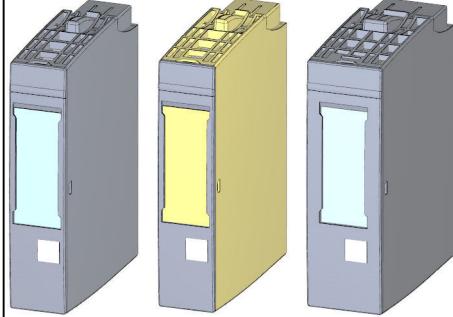
Basic component	Function	Figure
Communication module CM DP	<p>The communication module CM DP</p> <ul style="list-style-type: none"> <li>• Connects the CPU with PROFIBUS DP</li> <li>• The bus connection is an RS485 interface.</li> </ul>	
Interface module for PROFINET IO	<p>The interface module:</p> <ul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

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"> <li>• Use as redundant IO device on PROFINET IO</li> <li>• Connects the ET 200SP to the IO controller</li> <li>• Exchanges data with the I/O modules via the backplane bus.</li> </ul>	

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"> <li>• For standard RJ45 connector (BA 2xRJ45) ①</li> <li>• For direct connection of the bus cable (BA 2xFC) ②</li> <li>• For standard M12 connector (D-coded) with screw-type terminal or plug-in push-pull version (BA 2xM12) ③</li> <li>• For POF/PCF fiber-optic cable (BA 2xSCRJ) ④</li> <li>• As media converter for POF/PCF fiber-optic cable ⇔ standard RJ45 plug (BA SCRJ/RJ45) ⑤</li> <li>• As media converter for POF/PCF fiber-optic cable ⇔ direct connection of the bus cable (BA SCRJ/FC) ⑥</li> <li>• For glass fiber-optic cable (BA 2xLC) ⑦</li> <li>• As media converter for glass fiber-optic cable ⇔ standard RJ45 plug (BA LC/RJ45) ⑧</li> <li>• As media converter for glass fiber-optic cable ⇔ direct connection of the bus cable (BA LC/FC) ⑨</li> <li>• For single-mode fiber-optic cable with maximum length of 20 km (BA 2xLC-LD, long distance) ⑩</li> <li>• As media converter for glass fiber-optic cable with an LC plug connector ⇔ standard RJ45 connector (BA LC-LD/RJ45) ⑪</li> <li>• 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</li> </ul>	
	<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"> <li>• Ex BaseUnit for Ex power module</li> <li>• Ex BaseUnit for Ex I/O module</li> </ul>	
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"> <li>• If you need additional potential terminals, plug a PotDis-TerminalBlock in the PotDis-BaseUnit.</li> <li>• Alternatively, plug a BU cover (15 mm) on the PotDis-BaseUnit.</li> </ul> <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"> <li>• Digital input (DI, F-DI, Ex-DI)</li> <li>• Digital output (DQ, F-DQ PM, F-DQ PP, F-RQ, Ex-DQ)</li> <li>• Analog input (AI, F-AI, Ex-AI)</li> <li>• Analog output (AQ, Ex-AQ)</li> <li>• Technology module (TM, F-TM-C)</li> <li>• Communication module (CM)</li> <li>• Power module (F-PM-E)</li> </ul>	 Three 3D renderings of different I/O modules. From left to right: a grey digital input module with a light blue faceplate; a yellow analog output module with a yellow faceplate; and another grey digital input module with a light blue faceplate.
Motor starter/fail-safe motor starter	<p>The motor starter is a switching and protection device for 1-phase and 3-phase loads.</p> <p>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". Both have a black handle switch and various connection terminals at the bottom.

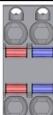
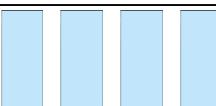
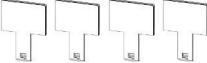
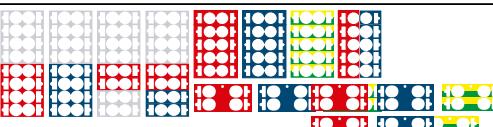
Basic component	Function	Figure
Vale terminal AirLINE SP type 8647 (Bürkert GmbH & Co. KG) <sup>1) 2)</sup>	<p>Basic component: Valve terminal AirLINE SP type 8647 (Bürkert). For more information on the AirLINE SP, type 8647 (e.g. data sheet and operating instructions), please contact Bürkert (<a href="https://www.burkert.co.uk/en/type/8647">https://www.burkert.co.uk/en/type/8647</a>) 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.<sup>1) 2)</sup></p>	
BU cover	<p>Insert the BU cover on the BaseUnits:</p> <ul style="list-style-type: none"> <li>Whose slots are not equipped with I/O modules/ motor starters//PotDis-TerminalBlocks</li> <li>Whose slots have been reserved for future expansion (as empty slots).</li> </ul> <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"> <li>For BaseUnits with a width of 15 mm ①</li> <li>For BaseUnits/Ex BaseUnits with a width of 20 mm ②</li> <li>For BaseUnits of motor starters with a width of 30 mm ③</li> </ul>	
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"> <li>Mechanical coding element ①: Ensures the coding</li> <li>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).</li> </ul>	

- 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.

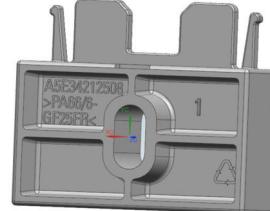
## Accessories of the ET 200SP distributed I/O system

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 (<a href="https://support.industry.siemens.com/cs/ww/en/view/109479973">https://support.industry.siemens.com/cs/ww/en/view/109479973</a>).</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".

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#### 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>).

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#### 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>).

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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"><li>• 6ES7...M0</li><li>• 24 V DC</li><li>• 100 mm wide</li></ul>	IM 155-6 PN R1 (6ES7155-6AU00-0H <del>M0</del> )	BU (6ES7193-6BR00-0H <del>M0</del> )

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 <b>A0</b> 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"><li>• 6ES7...A0</li><li>• 24 V DC</li><li>• 15 mm wide</li></ul>	DI 16x24VDC ST (6ES7131-6BH00-0BA0)	BU15-P16+A0+2D (6ES7193-6BP00-0DA0)
BU type <b>A1</b> See Analog modules with temperature measurement (Page 85)	Analog module <b>with</b> temperature measurement* <ul style="list-style-type: none"><li>• 6ES7...A1</li><li>• 24 V DC</li><li>• 15 mm wide</li></ul>	AI 4xRTD/TC 2-/3-/4-wire HF (6ES7134-6JD00-0CA1)	BU15-P16+A0+2D/T (6ES7193-6BP00-0DA1)
	Analog module <b>without</b> temperature measurement** <ul style="list-style-type: none"><li>• 6ES7...A1</li><li>• 24 V DC</li><li>• 15 mm wide</li></ul>	AI 4xU/I 2-wire ST (6ES7134-6HD00-0BA1)	
BU type <b>B0</b> (BU..B, dark-colored BaseUnit)	Digital output module with relay <ul style="list-style-type: none"><li>• 6ES7...B0</li><li>• Up to 230 V AC</li><li>• 20 mm wide</li></ul>	RQ 4x120VDC-230VAC/5A NO ST (6ES7132-6HD00-0BB0)	BU20-P12+A4+OB (6ES7193-6BP20-0BB0)
BU type <b>B1</b> (BU..B, dark-colored BaseUnit)	Digital modules <ul style="list-style-type: none"><li>• 6ES7...B1</li><li>• Up to 230 V AC</li><li>• 20 mm wide</li></ul>	DI 4x120..230VAC ST (6ES7131-6FD00-0BB1)	BU20-P12+A0+4B (6ES7193-6BP20-0BB1)
BU type <b>C0</b> (BU..D, light-colored BaseUnit)	Fail-safe power module <ul style="list-style-type: none"><li>• 6ES7...C0</li><li>• 24 V DC</li><li>• 20 mm wide</li></ul> CM AS-i Master ST/FCM AS-i Safety ST <ul style="list-style-type: none"><li>• 6ES7...C1</li><li>• Up to 30 V DC</li><li>• 20 mm wide</li></ul>	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 <b>C1</b> (BU..B, dark-colored BaseUnit)	F-CM AS-i Safety ST <ul style="list-style-type: none"><li>• 6ES7...C1</li><li>• Up to 30 V DC</li><li>• 20 mm wide</li></ul>	F-CM AS-i Safety ST (3RK7136-6SC00-0BC1)	BU20-P6+A2+4B (6ES7193-6BP20-0BC1)
BU type <b>D0</b>	AI Energy Meter <ul style="list-style-type: none"><li>• 6ES7...D0</li><li>• Up to 400 V AC/ 480 V AC</li><li>• 20 mm wide</li></ul>	AI Energy Meter 480VAC ST (6ES7134-6PA20-0BD0)	BU20-P12+A0+0B (6ES7193-6BP00-0BD0)
BU type <b>F0</b>	F-RQ 1×24VDC/24..23-0VAC/5A <ul style="list-style-type: none"><li>• 6ES7...F0</li><li>• Up to 230 V AC</li><li>• 20 mm wide</li></ul>	F-RQ 1×24VDC/24..230VA-C/5A (6ES7136-6RA00-0BF0)	BU20-P8+A4+0B (6ES7193-6BP20-0BF0)
BU type <b>U0</b>	DQ 4×24...230VAC/2A HF <ul style="list-style-type: none"><li>• 6ES7...U0</li><li>• Up to 400 V AC/480 V AC</li><li>• 20 mm wide</li></ul>	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-B00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
DS 0.9 - 3A HF	3RK1308-0A-C00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
DS 2.8 - 9A HF	3RK1308-0A-D00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
DS 4.0 - 12A HF	3RK1308-0AE-00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 0.1 - 0.4 A HF	3RK1308-0B-A00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 0.3 - 1A HF	3RK1308-0BB-00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 0.9 - 3A HF	3RK1308-0BC-00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 2.8 - 9A HF	3RK1308-0B-D00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
RS 4.0 - 12A HF	3RK1308-0BE-00-0CPO	x	x	x	x	x*	x*	x*	x*	x*	x*
F-DS 0.1 - 0.4 A HF	3RK1308-0C-A00-0CPO	x	x	x	x	x	x	x	x	x	x
F-DS 0.3 - 1A HF	3RK1308-0CB-00-0CPO	x	x	x	x	x	x	x	x	x	x
F-DS 0.9 - 3A HF	3RK1308-0C-C00-0CPO	x	x	x	x	x	x	x	x	x	x
F-DS 2.8 - 9A HF	3RK1308-0C-D00-0CPO	x	x	x	x	x	x	x	x	x	x
F-DS 4.0 - 12A HF	3RK1308-0CE-00-0CPO	x	x	x	x	x	x	x	x	x	x
F-RS 0.1 - 0.4 A HF	3RK1308-0D-A00-0CPO	x	x	x	x	x	x	x	x	x	x
F-RS 0.3 - 1A HF	3RK1308-0D-B00-0CPO	x	x	x	x	x	x	x	x	x	x
F-RS 0.9 - 3A HF	3RK1308-0D-C00-0CPO	x	x	x	x	x	x	x	x	x	x
F-RS 2.8 - 9A HF	3RK1308-0D-D00-0CPO	x	x	x	x	x	x	x	x	x	x
F-RS 4.0 - 12A HF	3RK1308-0D-E00-0CPO	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

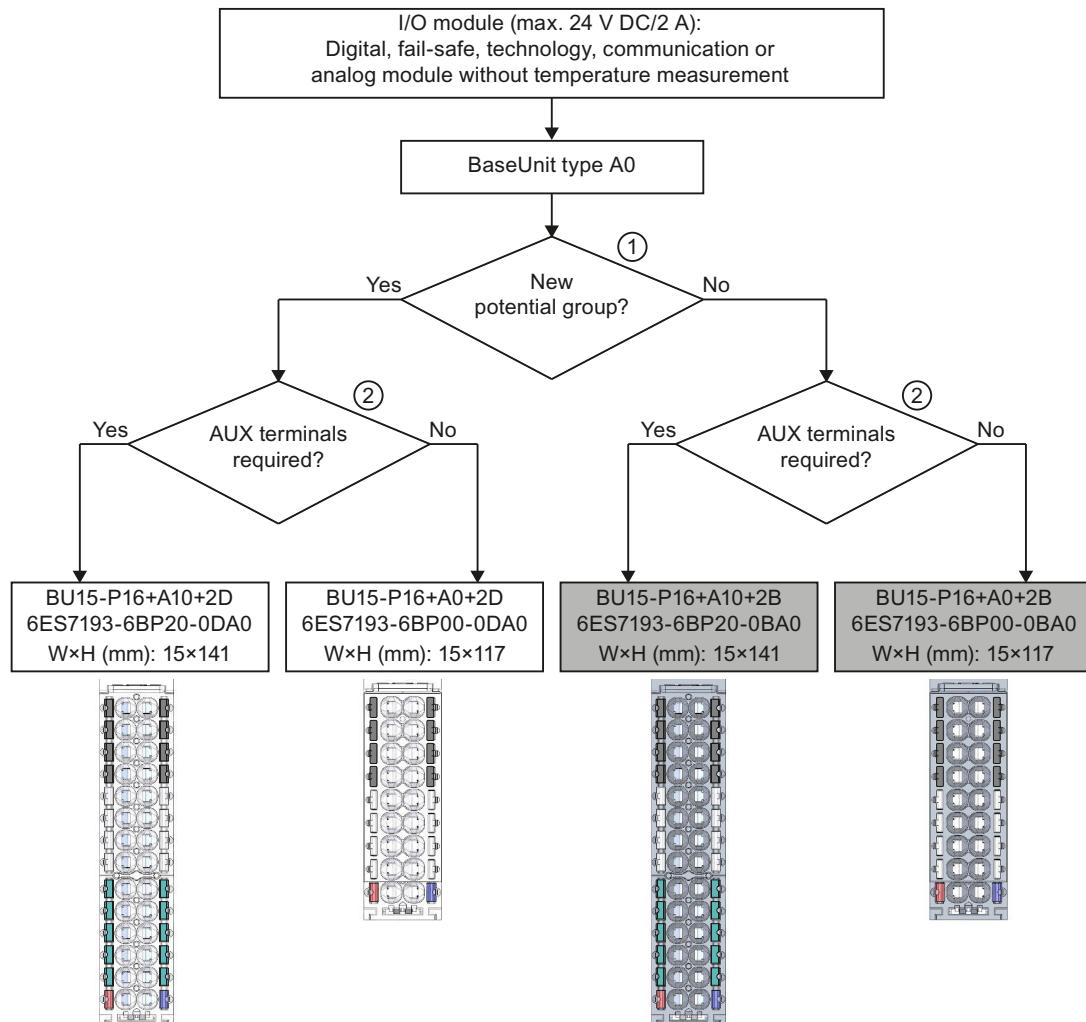
Additional information on the functional assignment of the terminals and on the associated BaseUnits can be found in one of the following manuals:

- 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

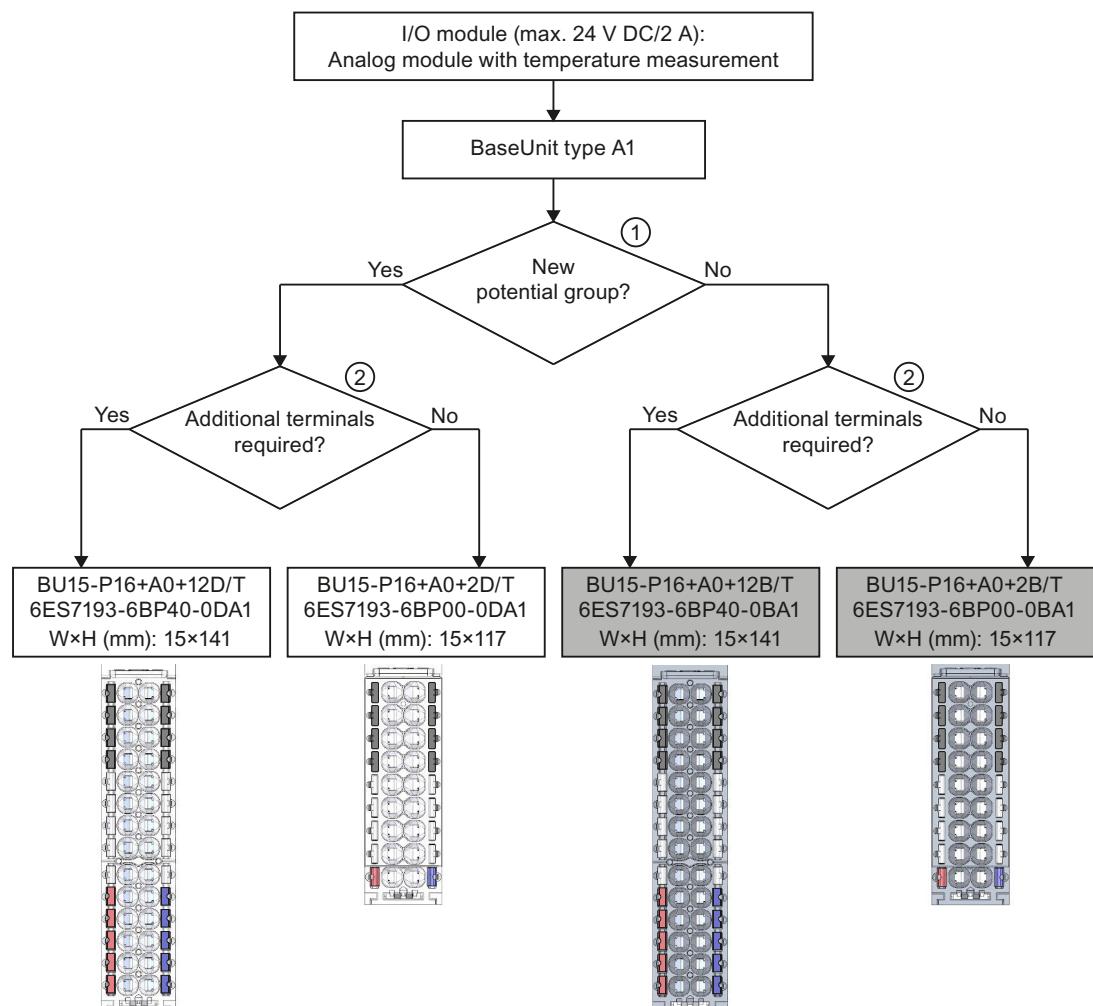


- ① Light-colored BaseUnit: Configuration of a new potential group, electrical isolation from adjacent module on the left. The first BaseUnit of the ET 200SP is usually a light-colored BaseUnit for feeding the supply voltage L+. A potential group opened with a light-colored BU type U0 must not contain 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**

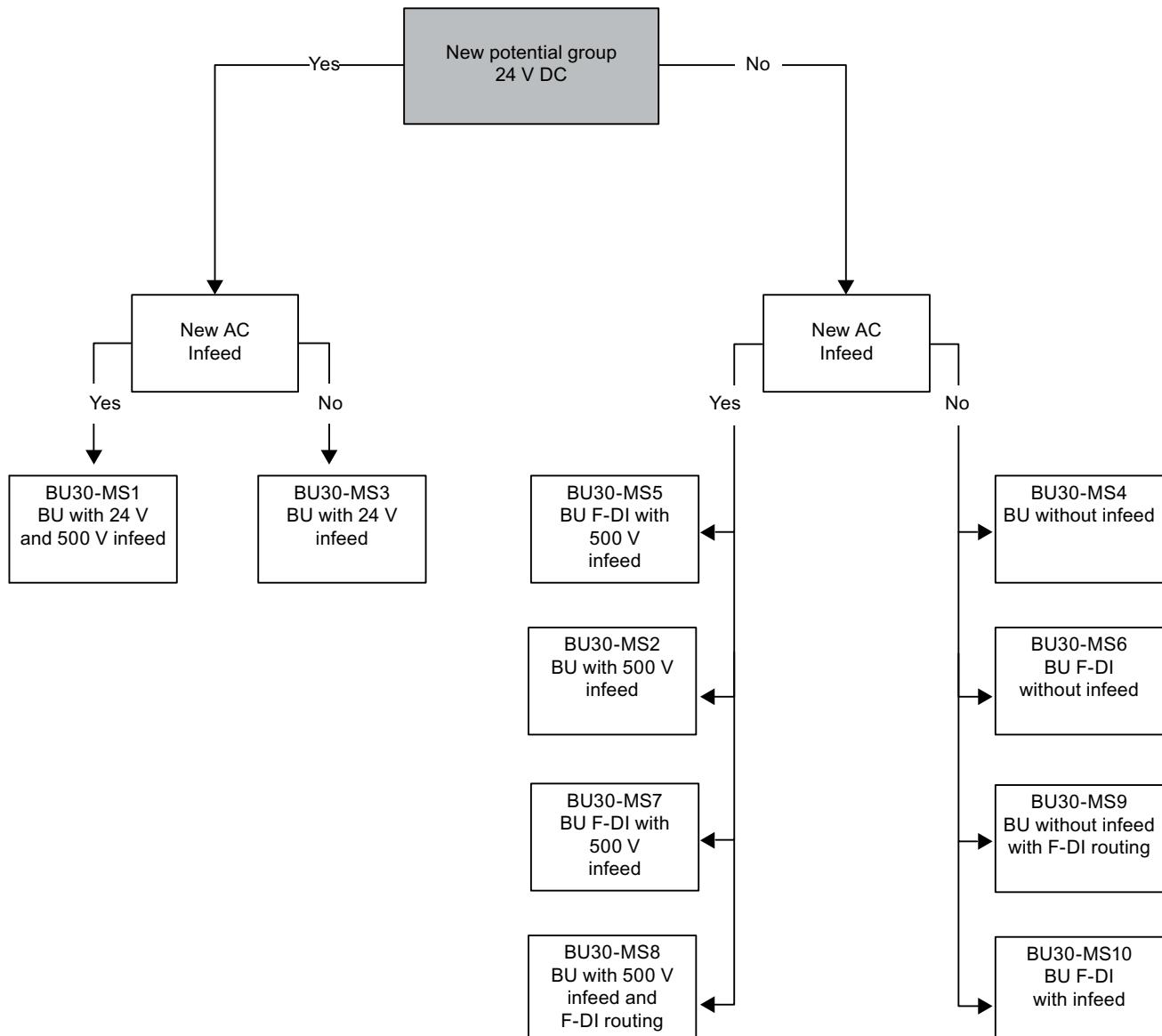
The motor starter BaseUnits "BU30-MS1", "BU30-MS2", "BU30-MS3" and "BU30-MS4" are compatible with all non-fail-safe motor starters. The motor starter BaseUnits "BU30-MS1", "BU30-MS2", "BU30-MS3", "BU30-MS4", "BU30-MS5", "BU30-MS6", "BU30-MS7", "BU30-MS8", "BU30-MS9" and "BU30-MS10" are compatible with 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

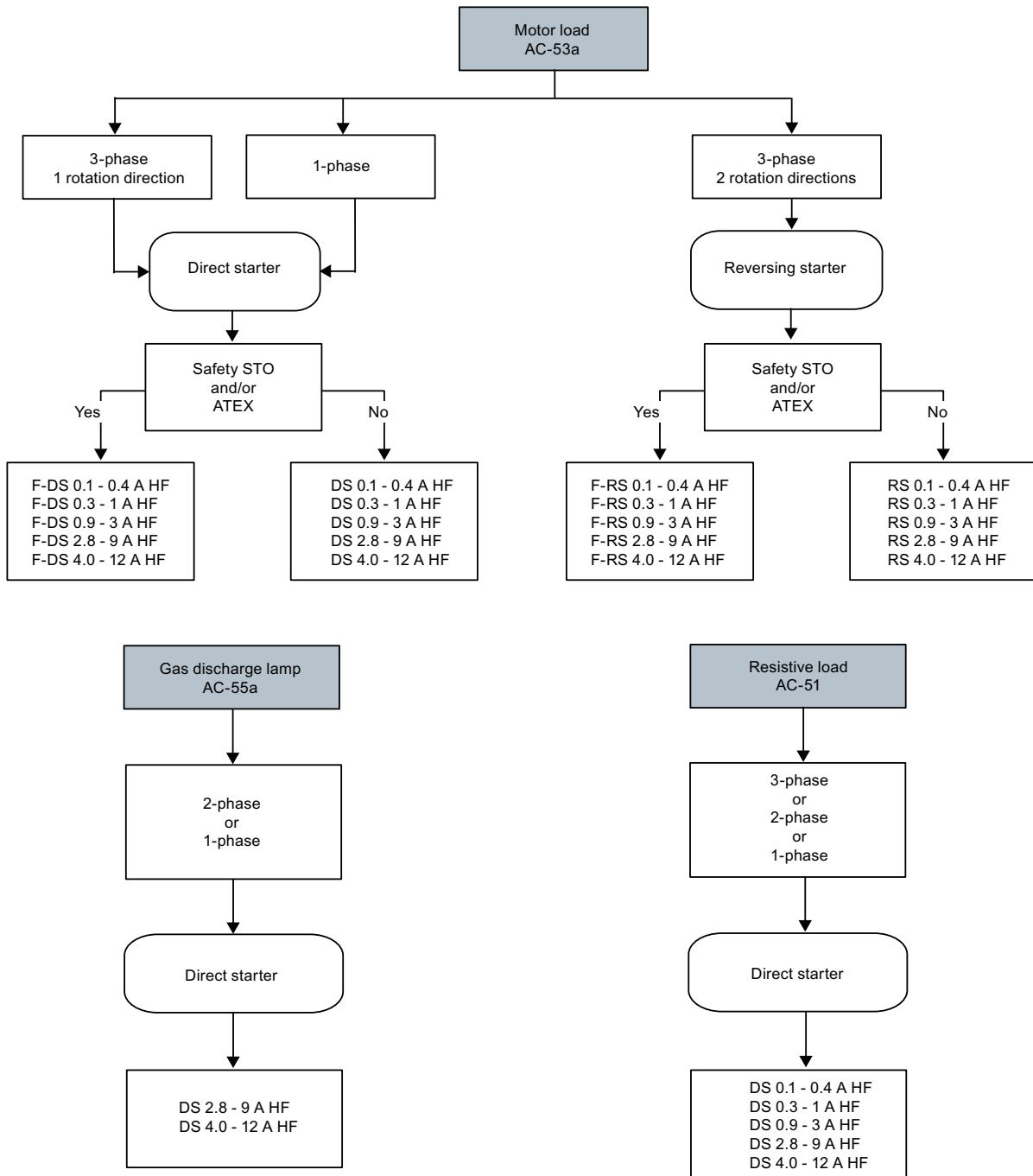
The figure below shows the criteria you use to select the appropriate BaseUnit:



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

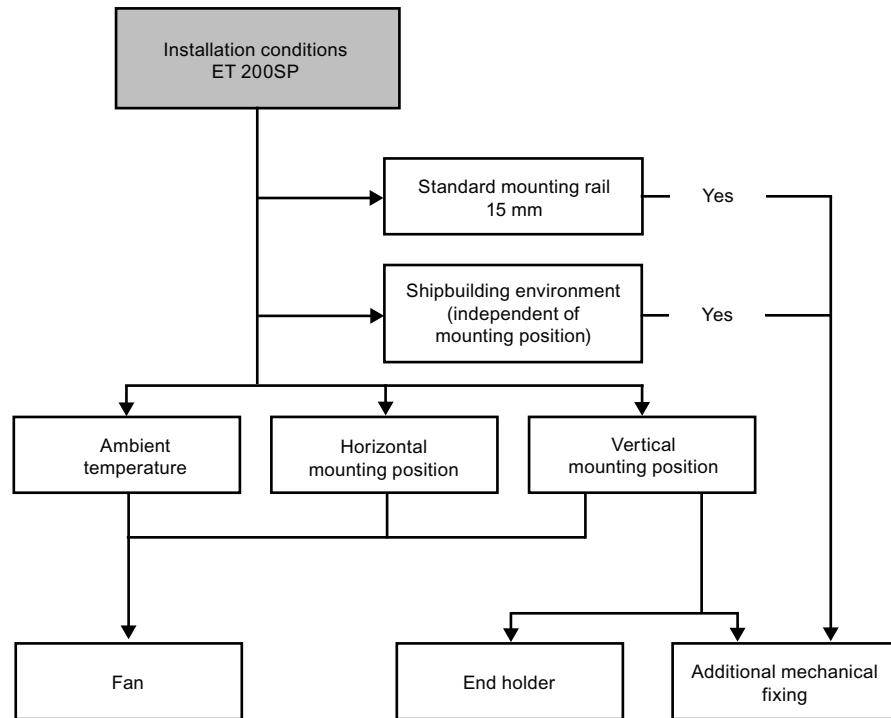
### 6.2.2 Selecting the motor starter

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



### 6.2.3 Selecting accessories for motor starters

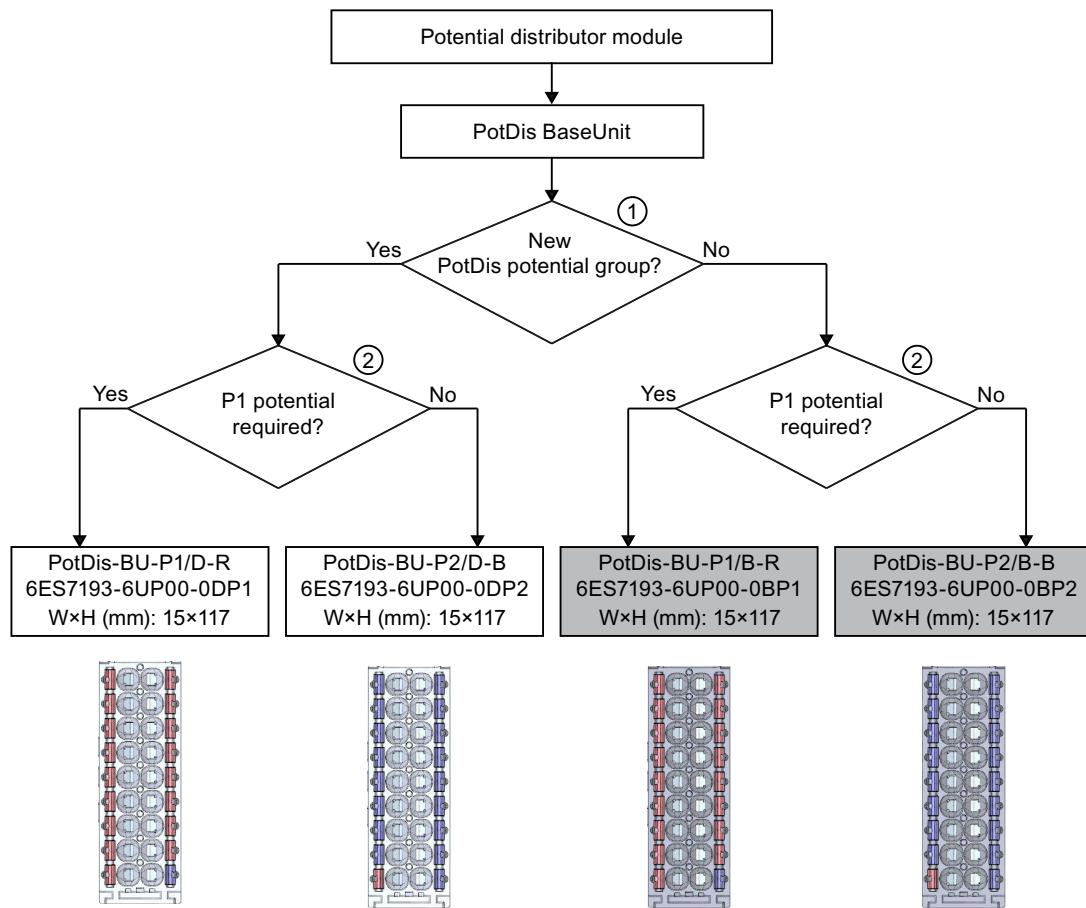
Observe the installation conditions of the station with ET 200SP motor starters. The figure below shows the criteria the station must meet:



## 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 ( <a href="https://support.automation.siemens.com/WW/view/en/90466439/133300">https://support.automation.siemens.com/WW/view/en/90466439/133300</a> ) and interface module ( <a href="https://support.automation.siemens.com/WW/view/en/55683316/133300">https://support.automation.siemens.com/WW/view/en/55683316/133300</a> ) 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>))

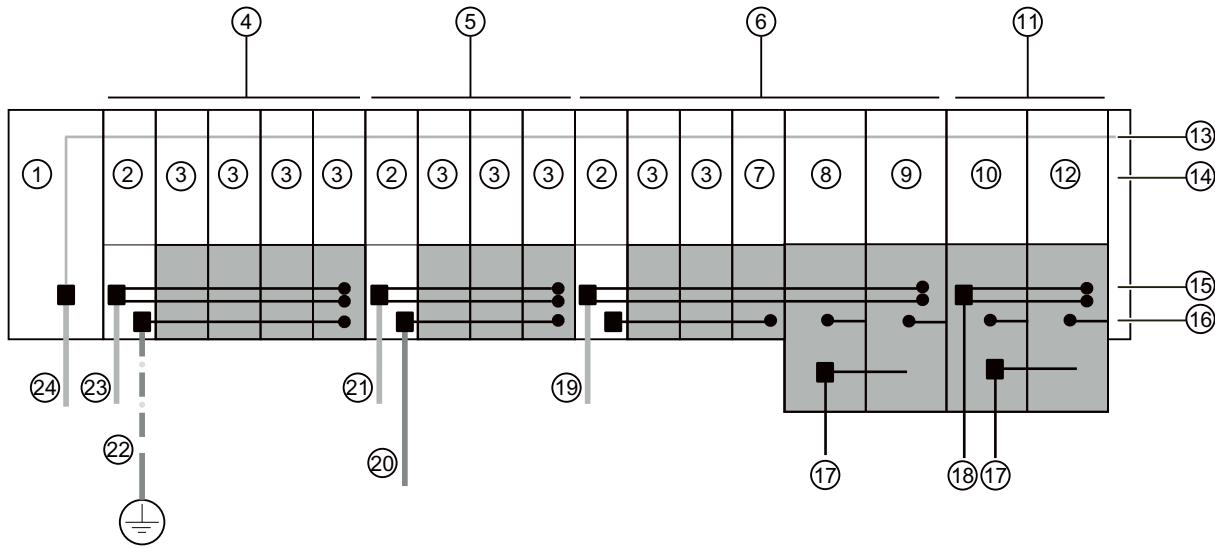
### NOTE

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.
-

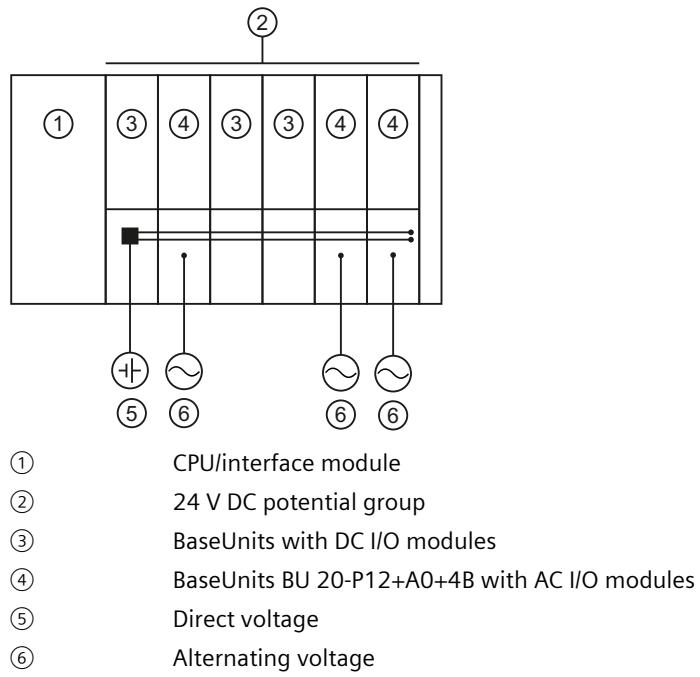


Figure 6-5 Placing the BaseUnits for the AC I/O modules

### 6.5.3 Forming potential groups with fail-safe modules

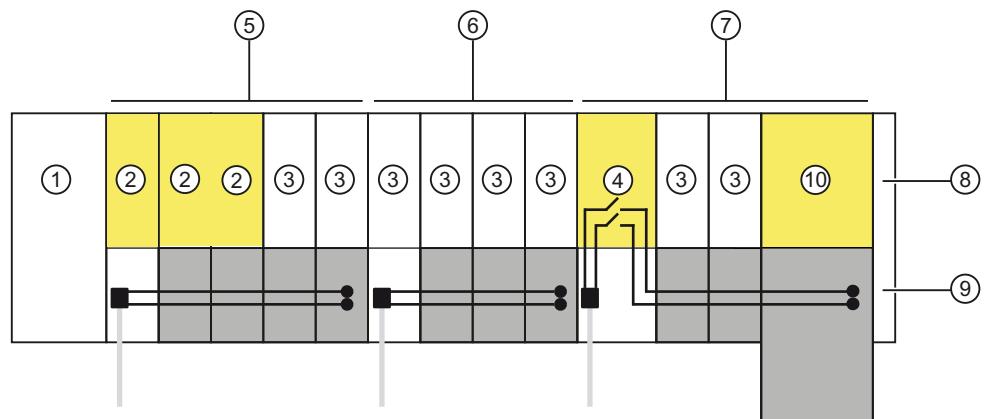
#### Introduction

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.

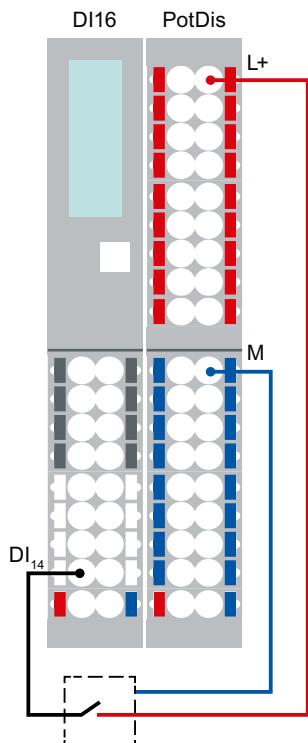


Figure 6-7 Example: 3-wire connection

## 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.

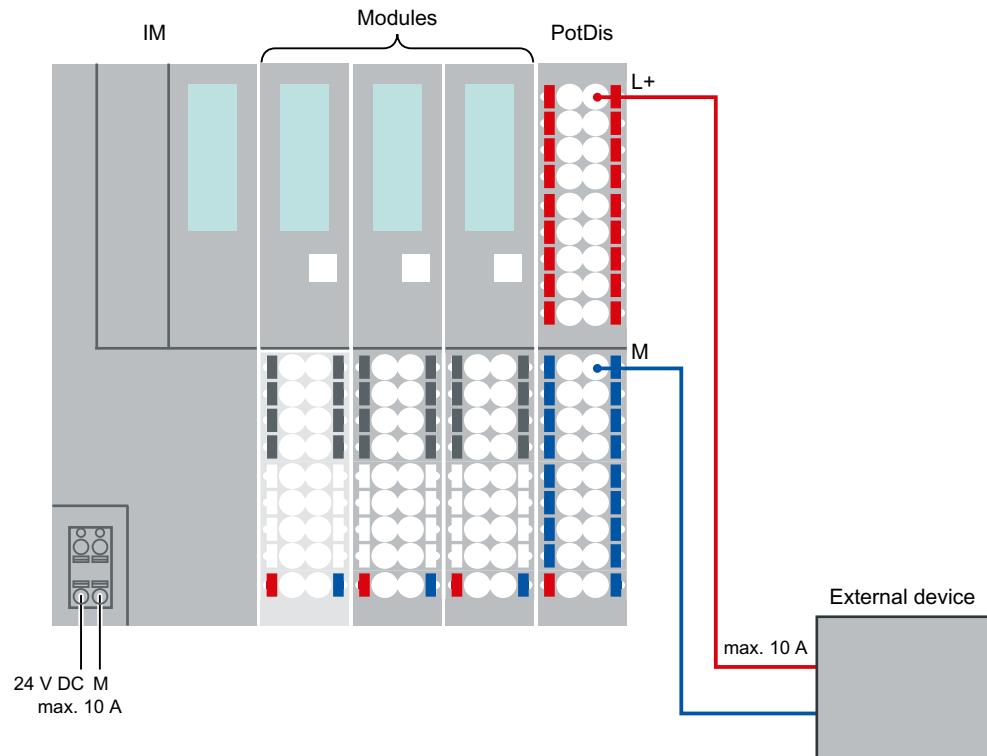


Figure 6-8 Example: Supply of external components

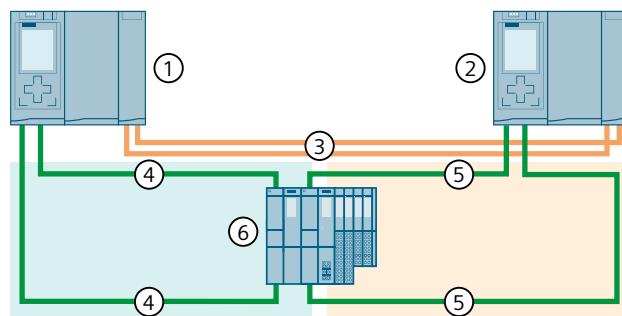
## 6.7 System redundancy R1

### 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.

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### 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.

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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.

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**Minimum clearances**

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

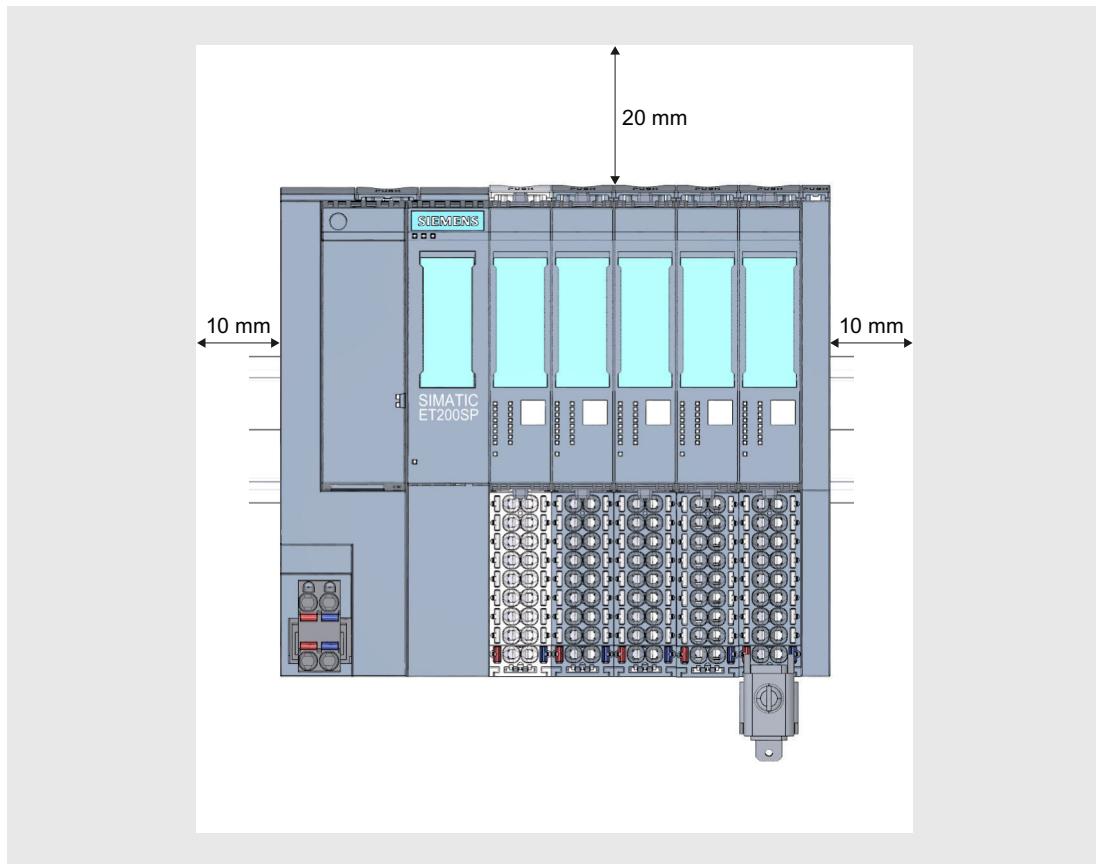


Figure 7-1 Minimum clearances

**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.

- 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:

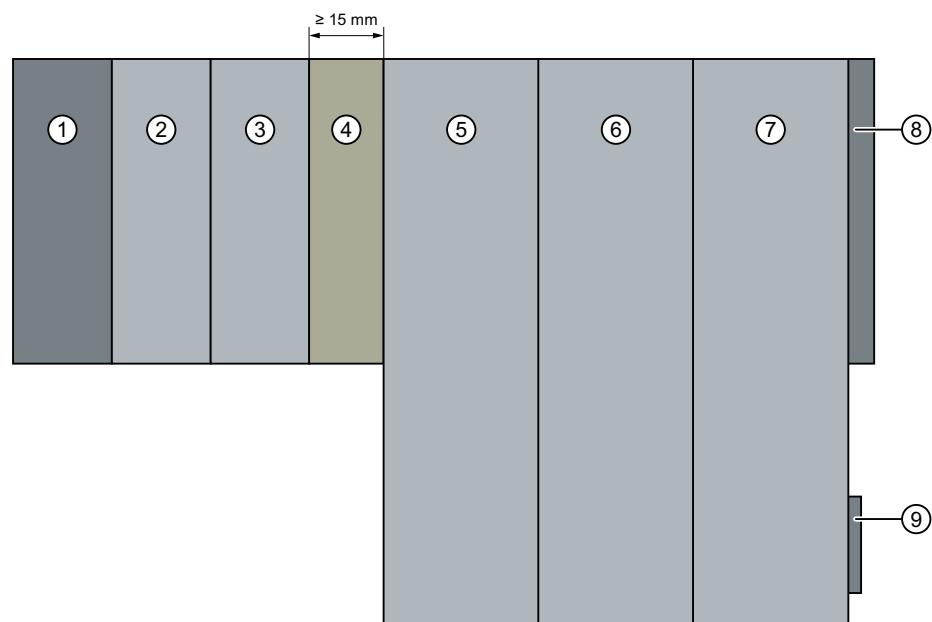
BU cover 15 mm: 6ES7133-6CV15-1AM0 with BaseUnit 6ES7193-6BP00-0BA0

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.

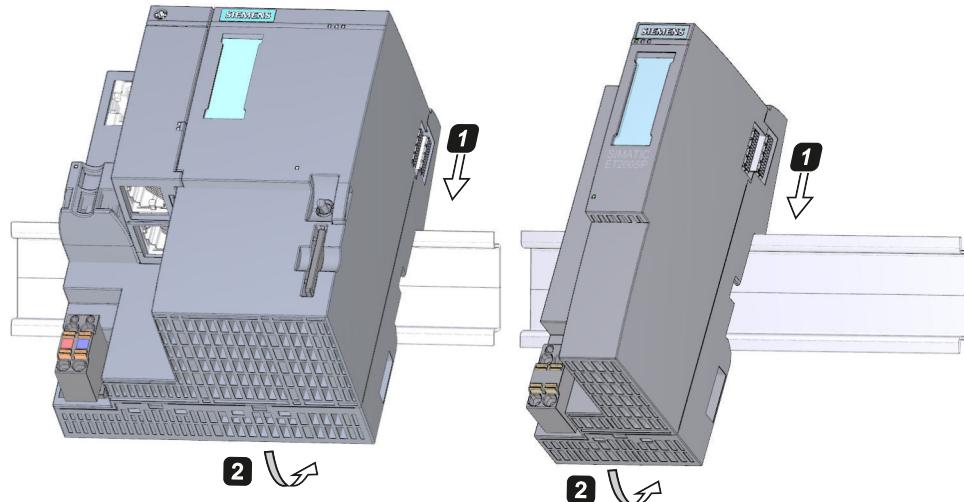


Figure 7-2 Mounting the CPU/interface module

## 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.

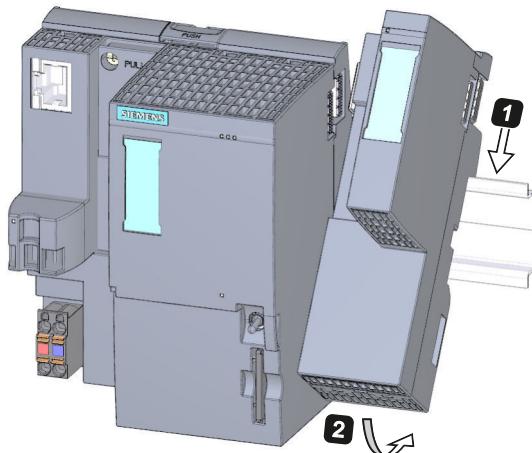


Figure 7-3 Installing CM DP

## **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.

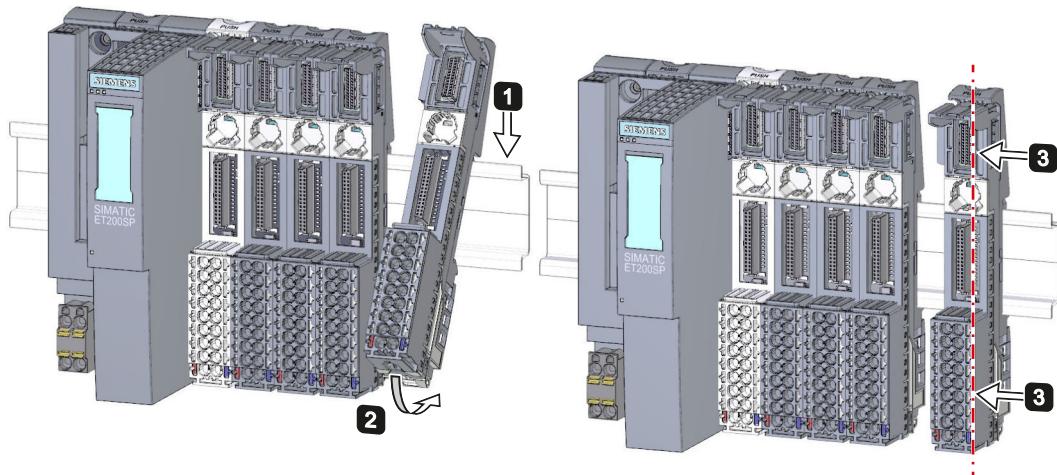


Figure 7-4 Installing a BaseUnit

## 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

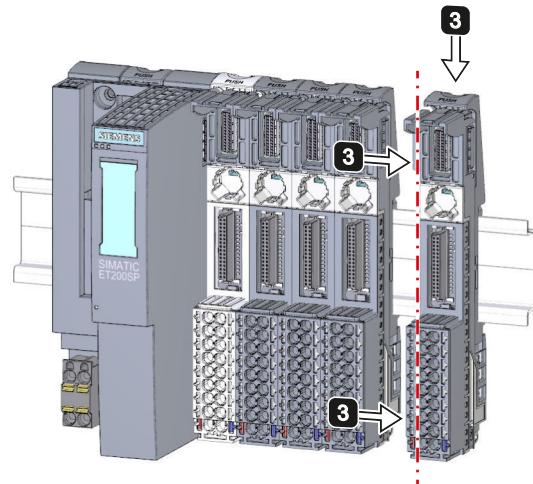


Figure 7-5 Removing the BaseUnit (removing from the right)

## 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 [\(Page 129\)](#)".

---

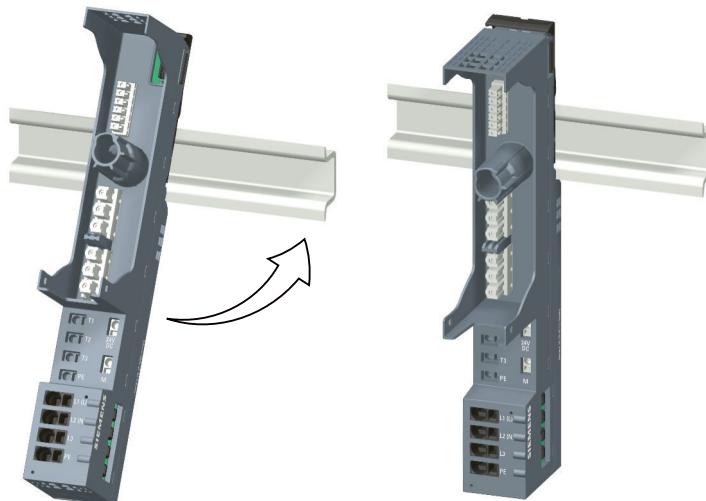
**CAUTION****Protection against electrostatic charge**

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.

---

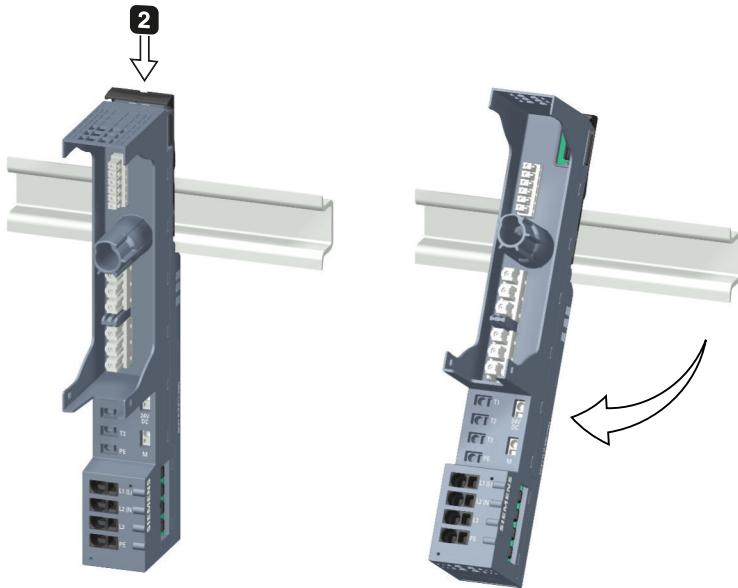
## Disassembling the BaseUnit

<b>⚠️ WARNING</b>
<b>Hazardous Voltage</b>
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.

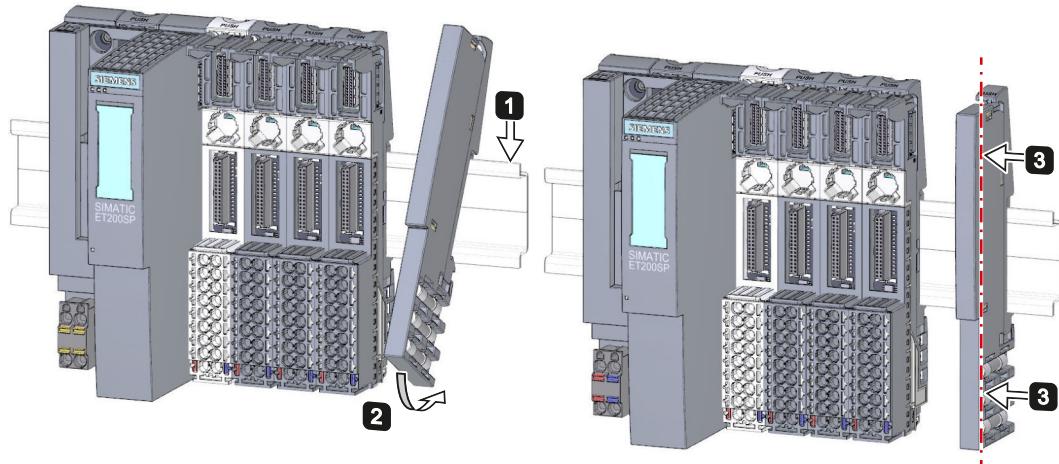


Figure 7-6 Installing the server module

### 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**

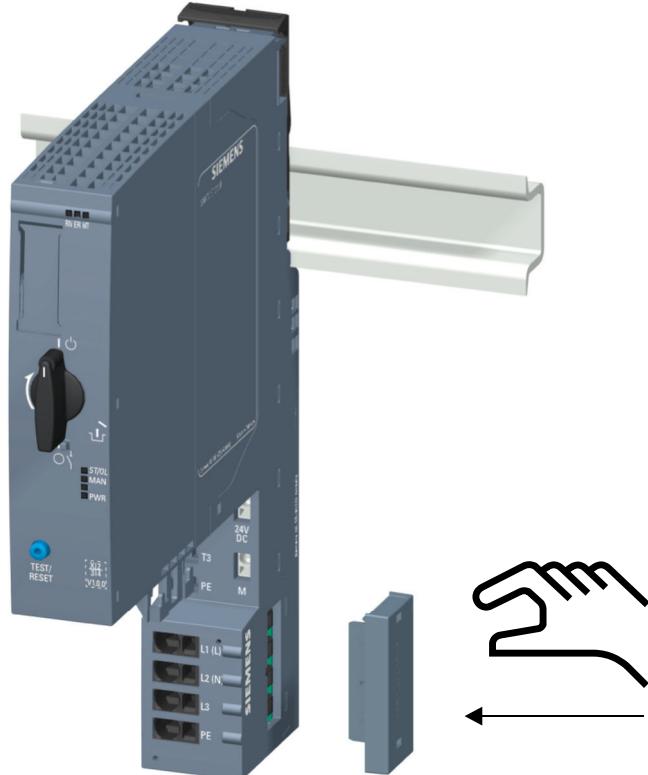
##### **Personal injury may occur**

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.

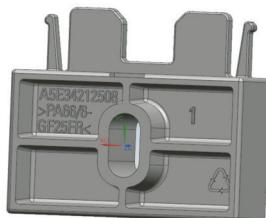


The cover can be removed again using 2 fingers and without tools.

### 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

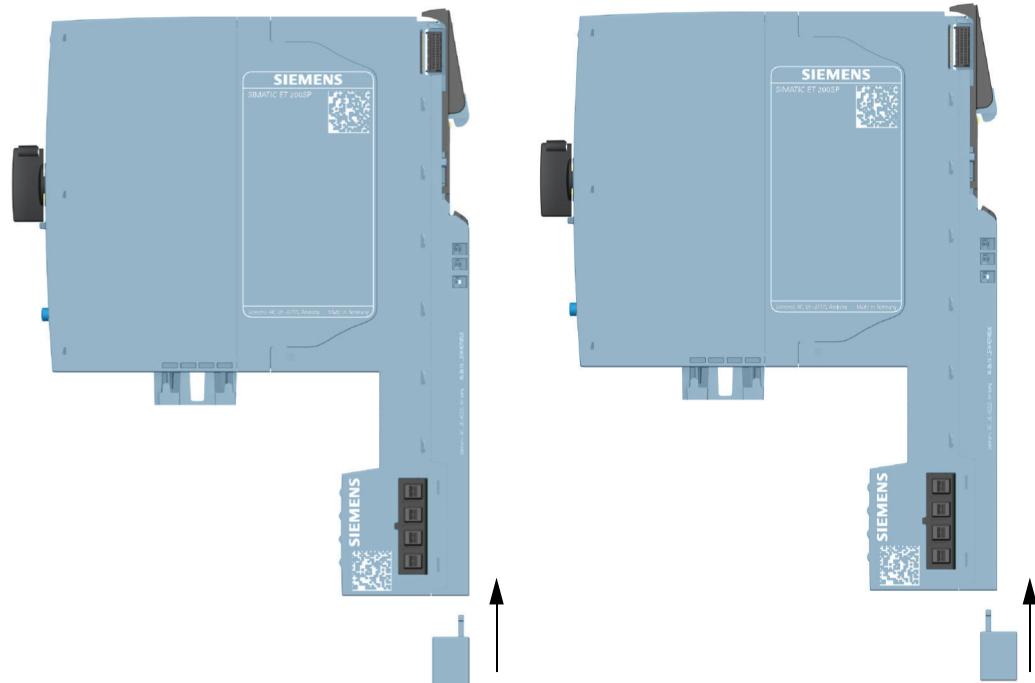
You can find further information on the mechanical bracket in chapter "Installation conditions for motor starters [\(Page 116\)](#)".

### Procedure

To mount the mechanical bracket, proceed as follows:

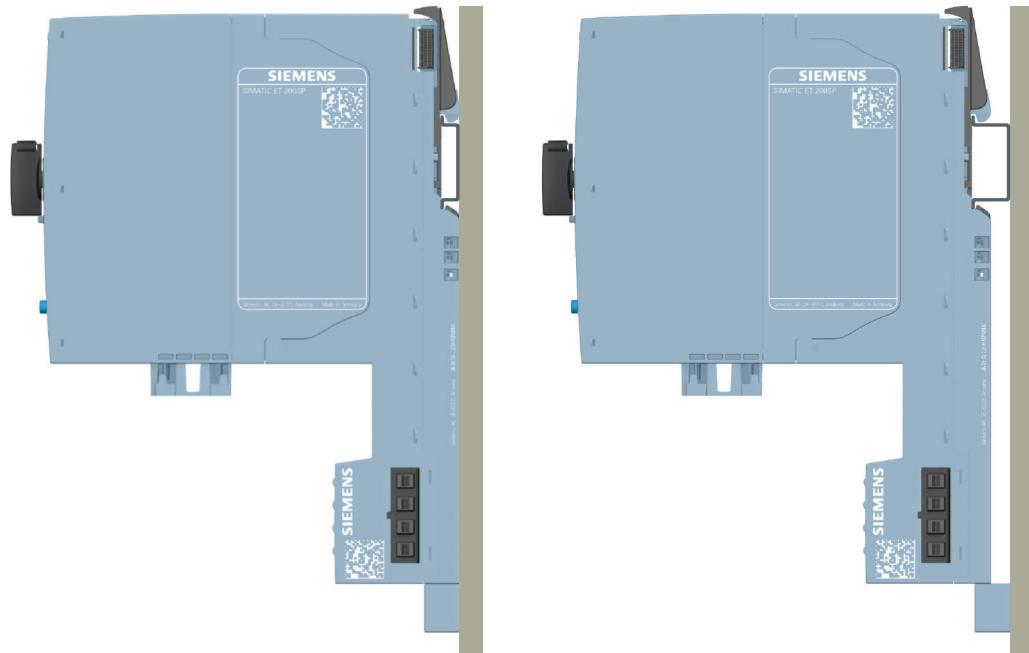
1. Insert the mechanical bracket into the opening at the bottom of the BaseUnit.

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.

## 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.

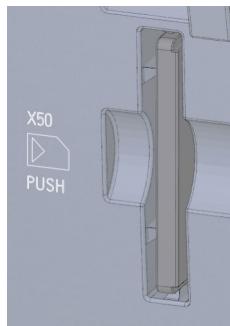


Figure 13-7 Slot for the SIMATIC memory card

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.

## 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.

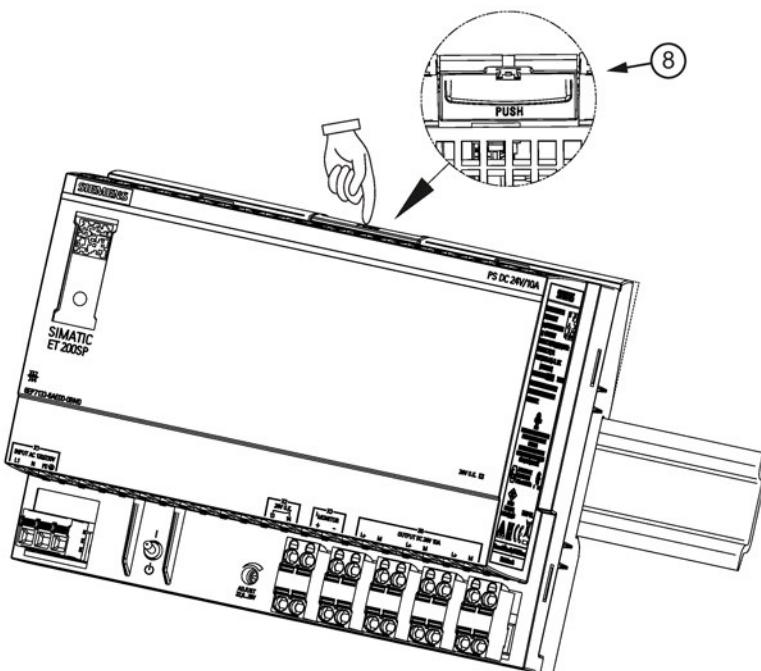


Figure 3-1 Removal

# 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

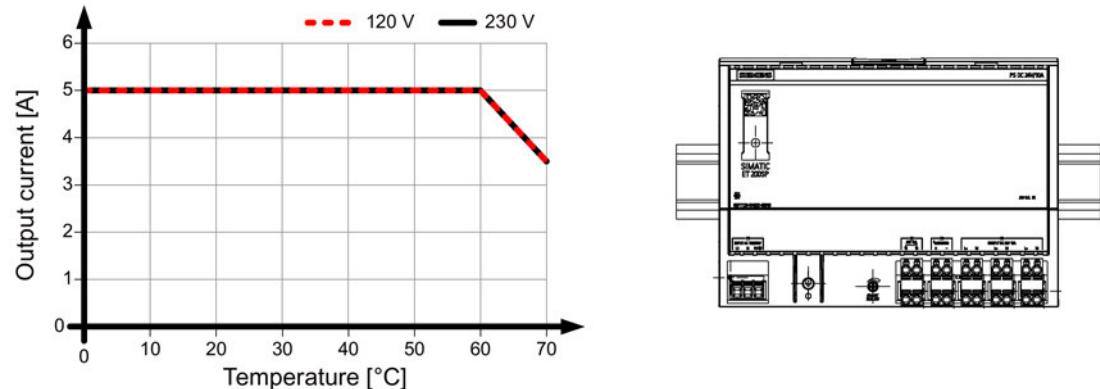


Figure 4-1 6EP7133-6AB00-0BN0: Output current in the standard mounting position

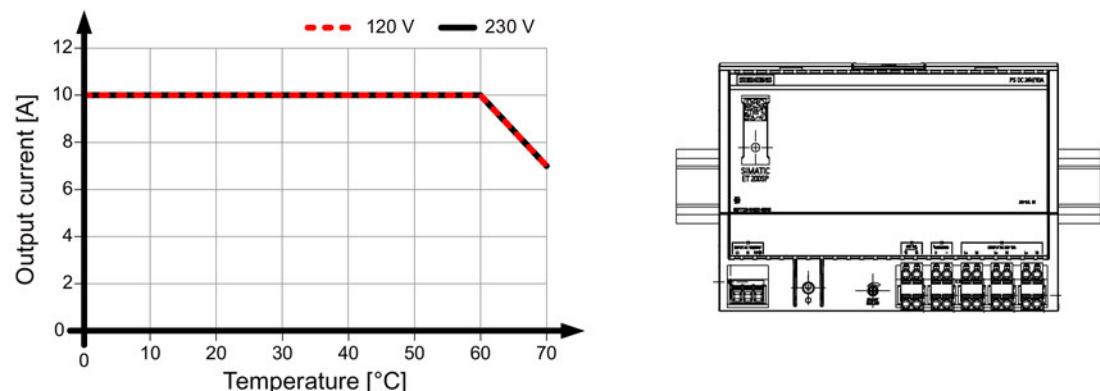


Figure 4-2 6EP7133-6AE00-0BN0: Output current in the standard mounting position

## 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

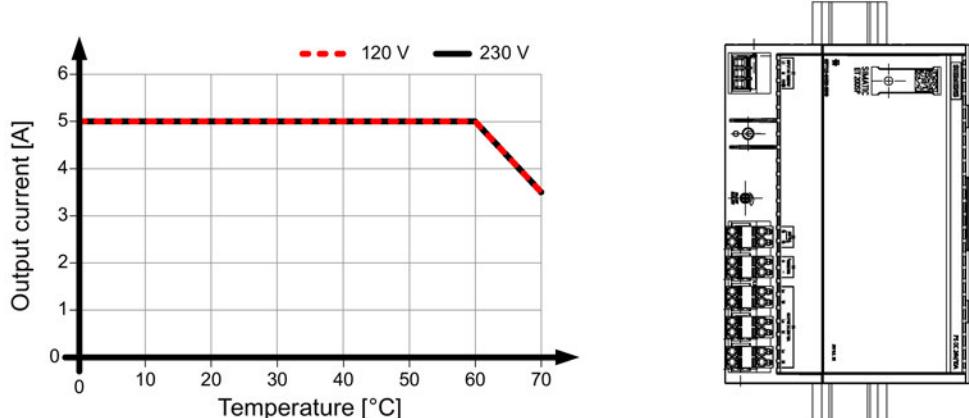


Figure 4-3 Mounting position (2)

### Note

Other mounting positions are not permissible!

#### 4.2.2 6EP7133-6AE00-0BN0

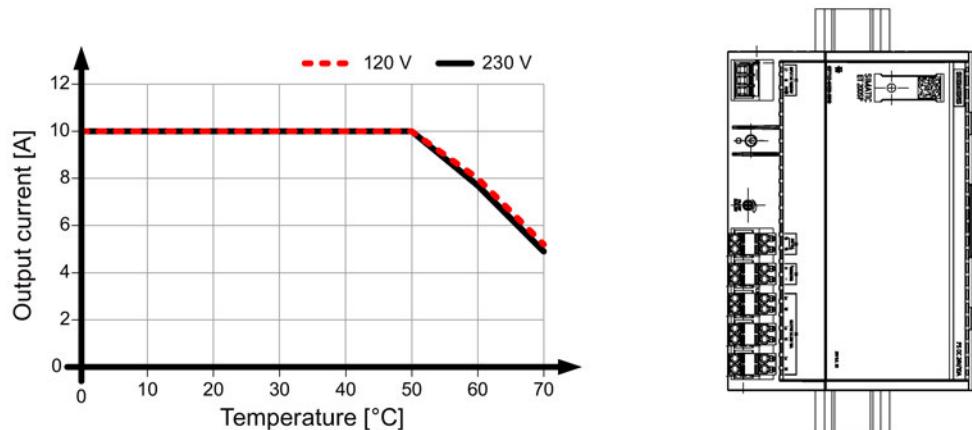
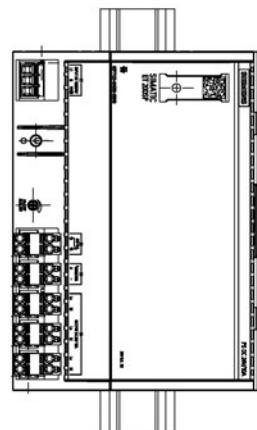


Figure 4-4 Mounting position (2)



---

#### Note

Other mounting positions are not permissible!

---

# 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**

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### **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.

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## 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	Single-pole protection of circuits	With grounded secondary circuit: <b>single-pole</b> protection otherwise: <b>all-pole</b> protection
	③		
Load current supply for AC load circuits with more than five items of electromagnetic equipment	②	Galvanic isolation by transformer <b>recommended</b>	Galvanic isolation by transformer <b>recommended</b>

## Cable temperature measurement threshold

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### 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.

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## 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

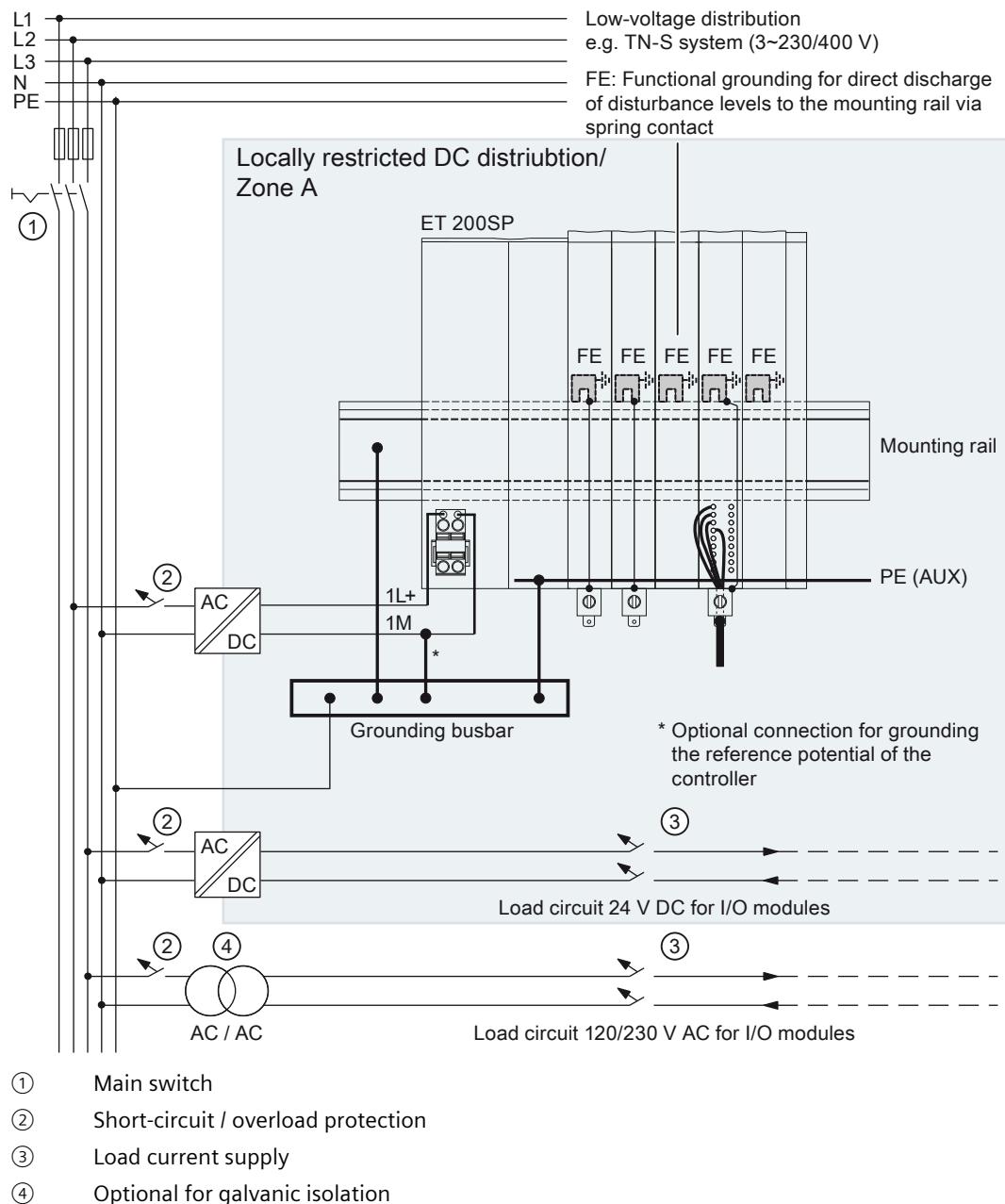


Figure 8-1 ET 200SP in the total configuration

**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.

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## 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.

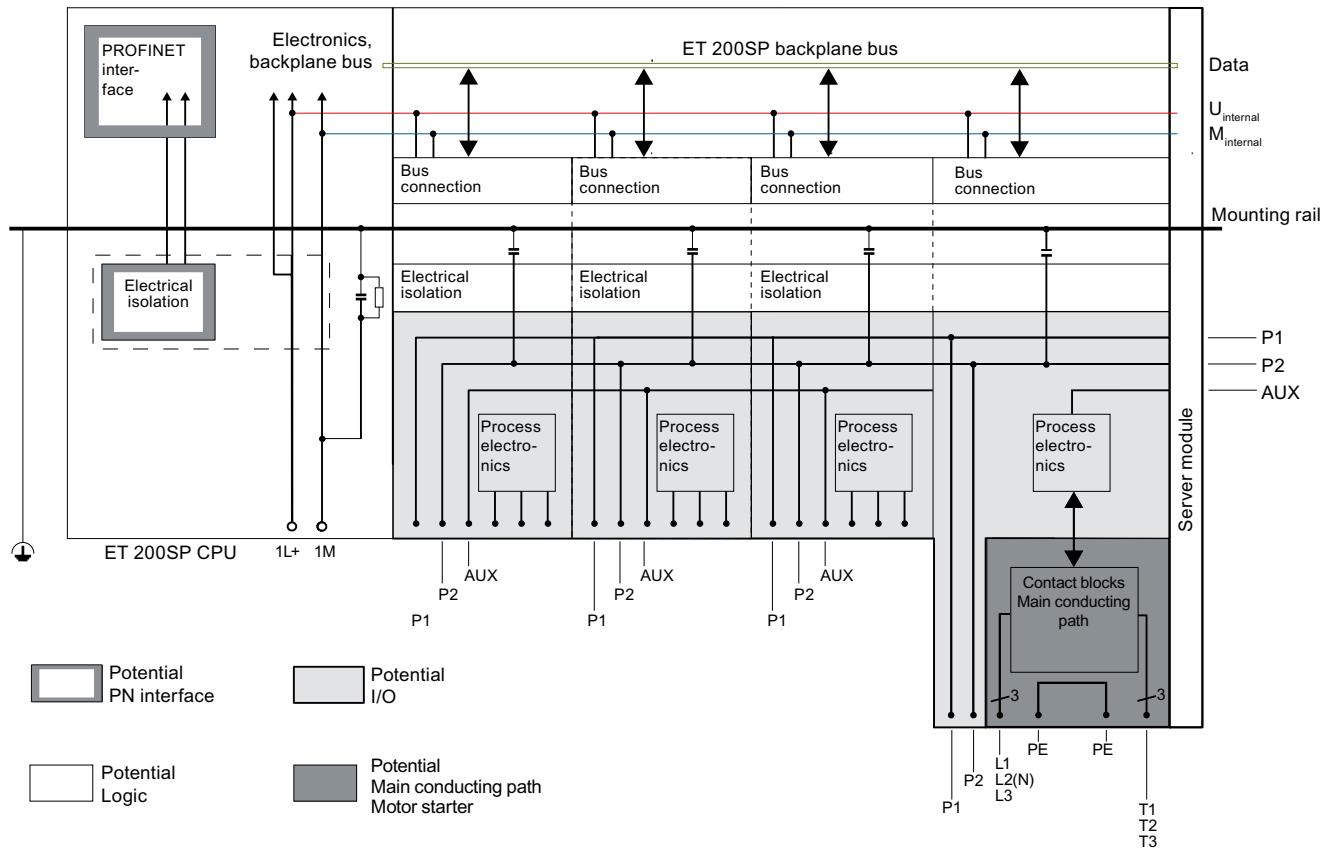


Figure 8-2 Electrical relationships for ET 200SP with CPU

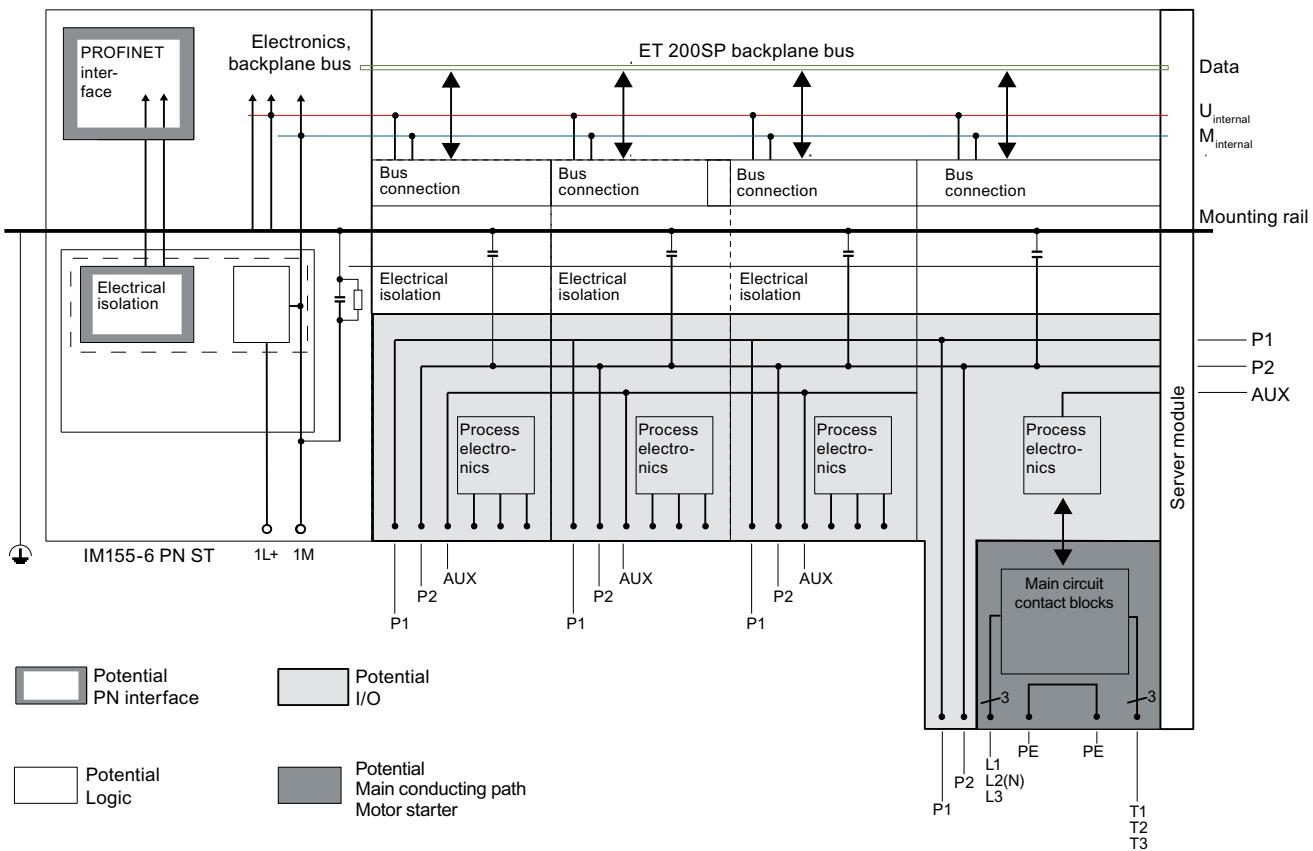


Figure 8-3 Electrical relationships for ET 200SP with interface module (using IM 155-6 PN ST as an example)

## 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 <sup>2</sup> AWG*: 24 to 13	
Permitted cable cross-sections of solid cables (Cu) Without end sleeve	0.2 to 2.5 mm <sup>2</sup>	

\* AWG: American Wire Gauge

\*\* End sleeves without plastic sleeve: 0.25 to 2.5 mm<sup>2</sup>/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 <sup>2</sup> **	0.14 mm to 1.5 mm <sup>2</sup>
		AWG*: 24 to 16	AWG*: 26 to 16
	With TWIN end sleeve***	0.5 mm to 1 mm <sup>2</sup>	0.5 to 0.75 mm <sup>2</sup> (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 mm<sup>2</sup>/AWG: 24 to 13

\*\*\* See note on end sleeves

#### Note the following for BaseUnits with function version < FS10:

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##### NOTE

##### End sleeves

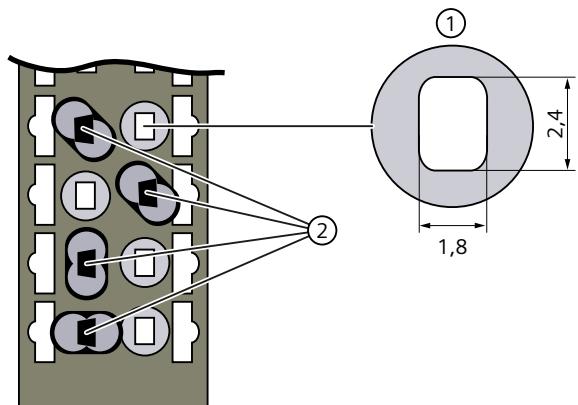
Optimum results with respect to a high-quality and permanent electrical connection with maximum conductor pull forces at the same time can be achieved by using crimping dies, preferably with smooth surfaces, which are provided, for example, with rectangular and trapezoidal crimp cross-sections.

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  $0.75 \text{ mm}^2$  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)	Without end sleeve	1 to 6 $\text{mm}^2$ AWG: 18 to 10	0.5 to 2.5 $\text{mm}^2$ AWG: 20 to 12	0.2 to 1.5 $\text{mm}^2$ AWG: 24 to 16
	With end sleeve	1 to 6 $\text{mm}^2$ AWG: 18 to 10	0.5 to 2.5 $\text{mm}^2$ AWG: 20 to 12	0.2 to 1.5 $\text{mm}^2$ AWG: 24 to 16
Permitted cable cross-sections of flexible cables (Cu)	With end sleeve (with plastic sleeve)	1 to 4 $\text{mm}^2$ AWG: 18 to 11	0.5 to 1.5 $\text{mm}^2$ AWG: 20 to 16	0.25 to 0.75 $\text{mm}^2$ AWG: 24 to 18
	Without end sleeve	1 to 6 $\text{mm}^2$	0.5 to 2.5 $\text{mm}^2$	0.2 to 1.5 $\text{mm}^2$
	Without end sleeve	AWG: 18 to 10	AWG: 20 to 12	AWG: 24 to 16
	With end sleeve (without plastic sleeve)	1 to 6 $\text{mm}^2$	0.5 to 2.5 $\text{mm}^2$	0.2 to 1.5 $\text{mm}^2$
	With end sleeve (without plastic sleeve)	AWG: 18 to 10	AWG: 20 to 12	AWG: 24 to 16
	With end sleeve (without plastic sleeve)	1 to 4 $\text{mm}^2$	0.5 to 1.5 $\text{mm}^2$	0.25 to 0.75 $\text{mm}^2$
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

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### 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.

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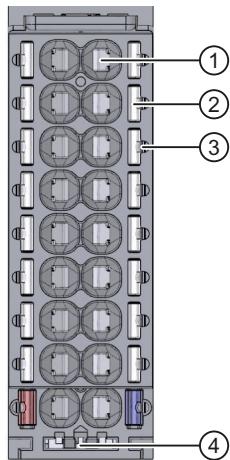
## 8.8 Wiring BaseUnits for I/O modules

### 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 mm<sup>2</sup> 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.

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### 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.

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## 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.

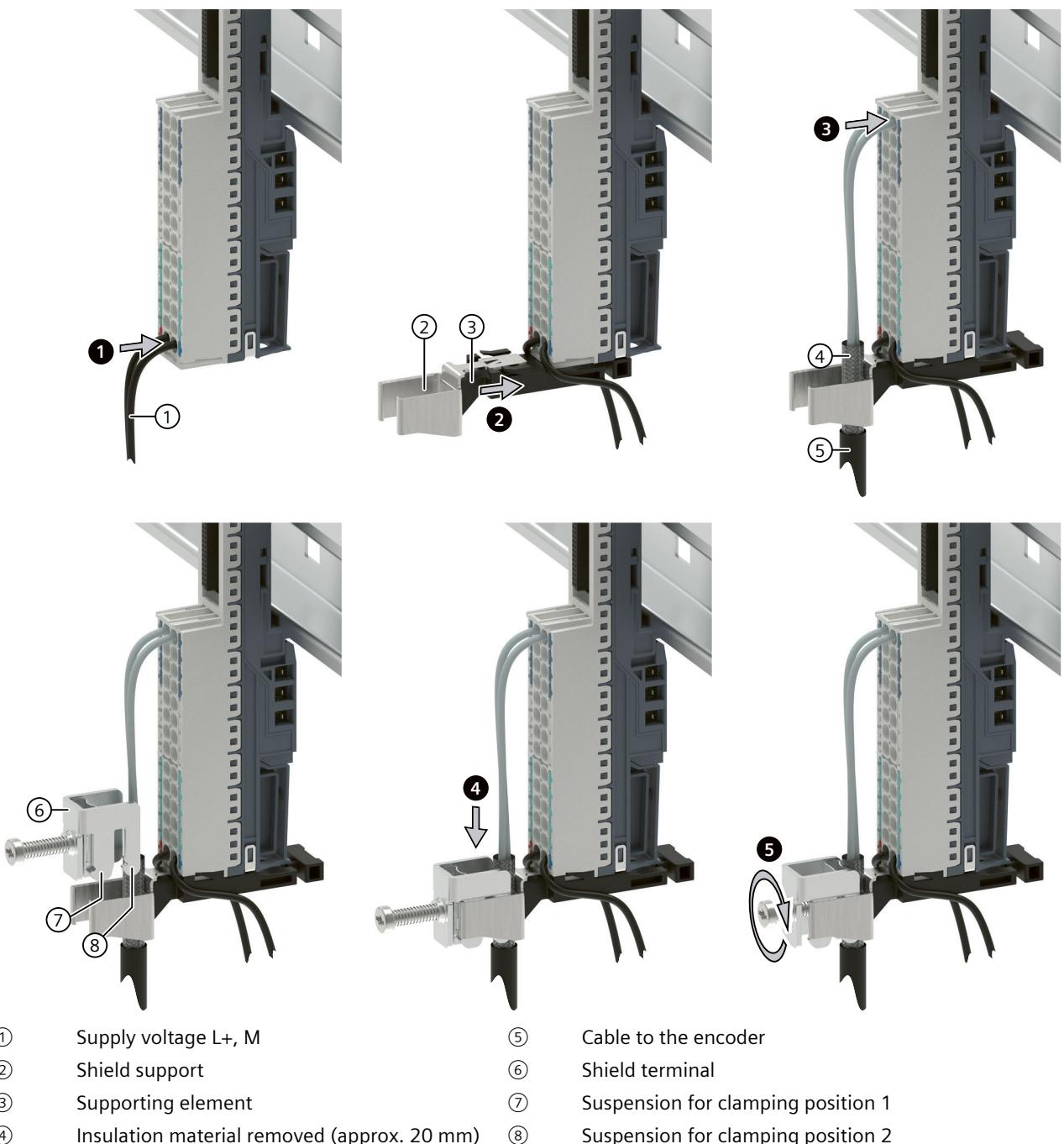


Figure 8-6 Mounting the shield contact

**NOTE**

**Shield terminal does not have a null terminal.**

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

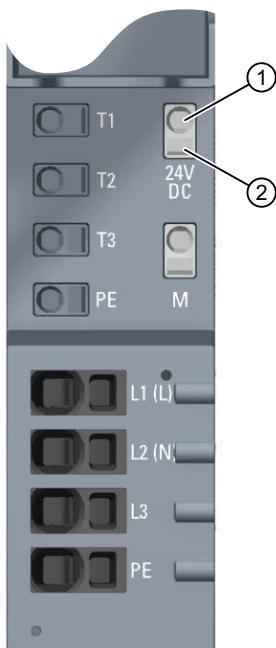
## 8.10 **Wiring BaseUnits for motor starters**

### 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)

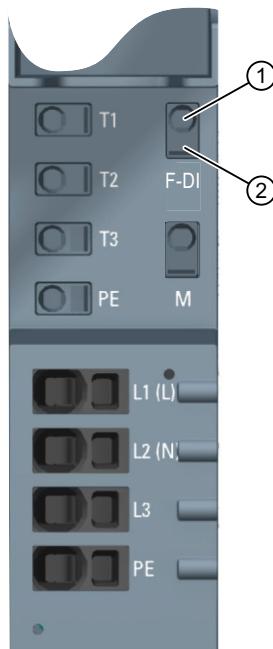
The following figure shows an example of a BaseUnit BU30-MS1 (with the maximum number of terminals):



- 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.

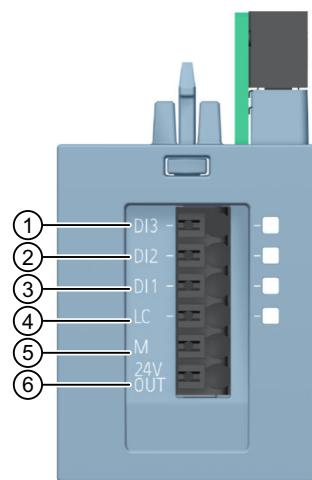
---

## 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:

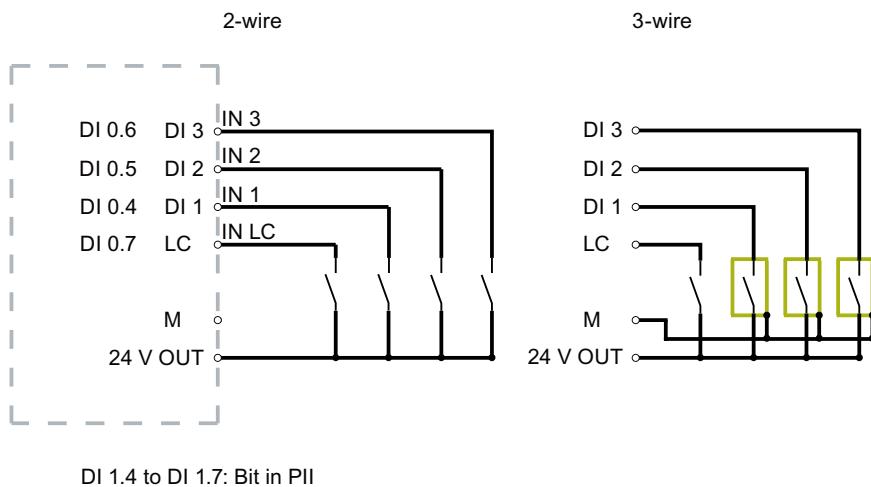


Figure 8-9 Connection example of inputs

## 8.12 Connecting the supply voltage to the CPU/interface module

### Introduction

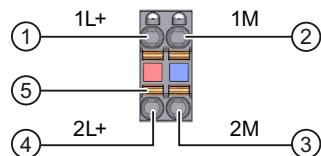
The supply voltage of the CPU/interface module is supplied by means of a 4-pin connector plug located on the front of the CPU/interface module.

### Power supply unit

Only use power supply units of type SELV/PELV with safe electrically isolated functional extra low voltage ( $\leq 28.8$  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).

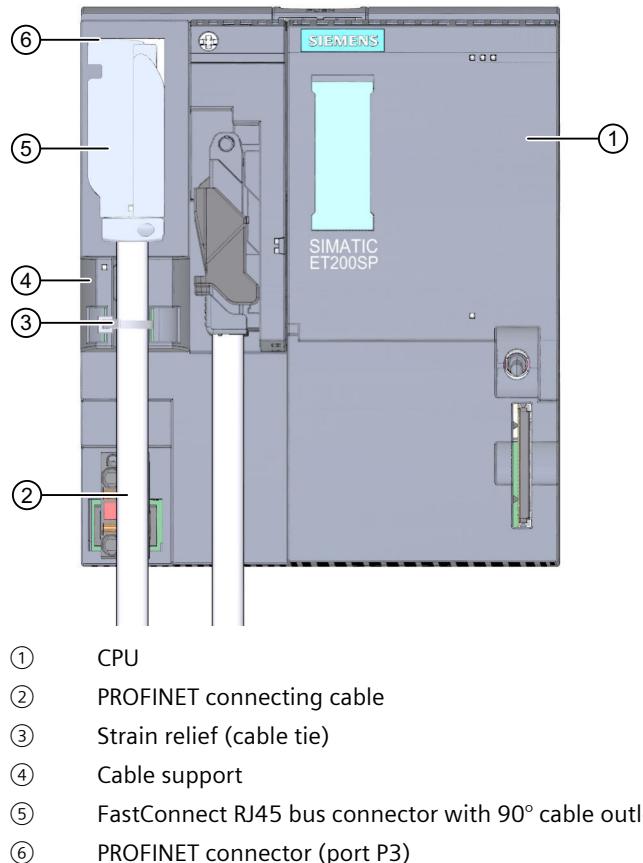


Figure 8-11 Connecting PROFINET IO (port P3) to the CPU

### 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).

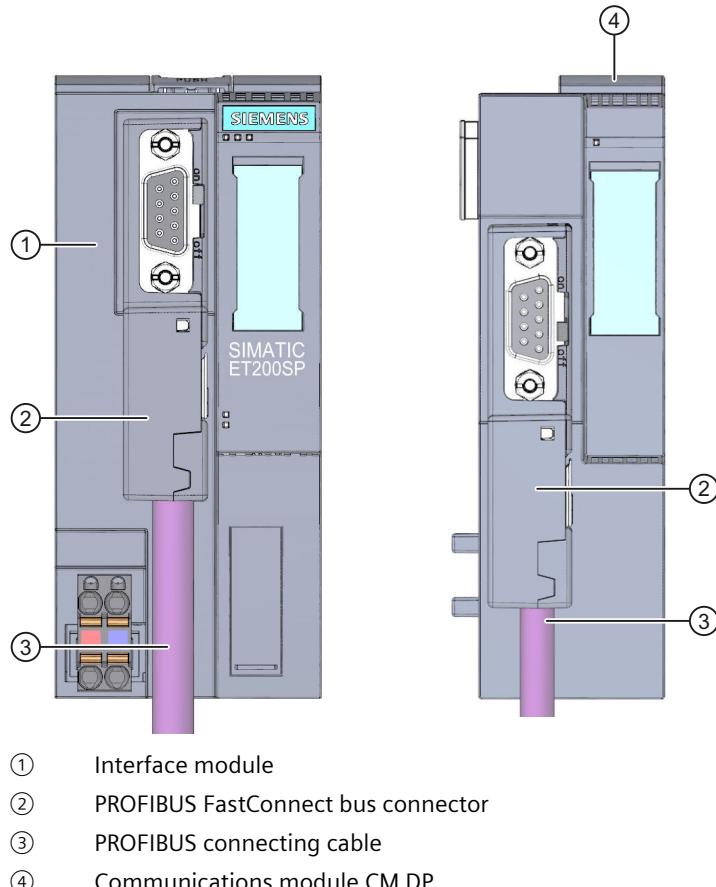


Figure 8-12 Connect PROFIBUS DP to the interface module/communications module CM DP

## 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.

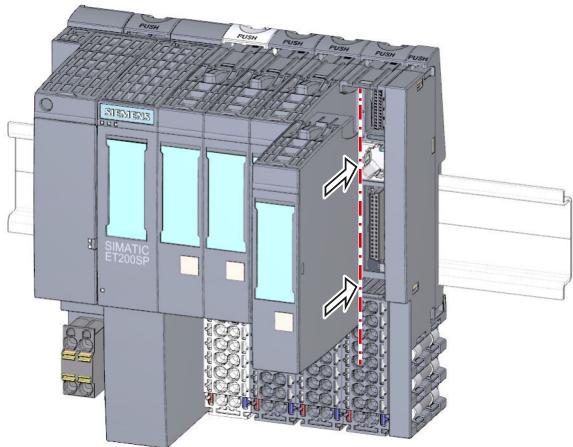


Figure 8-13 Plugging in I/O modules or BU covers (using an I/O module as example)

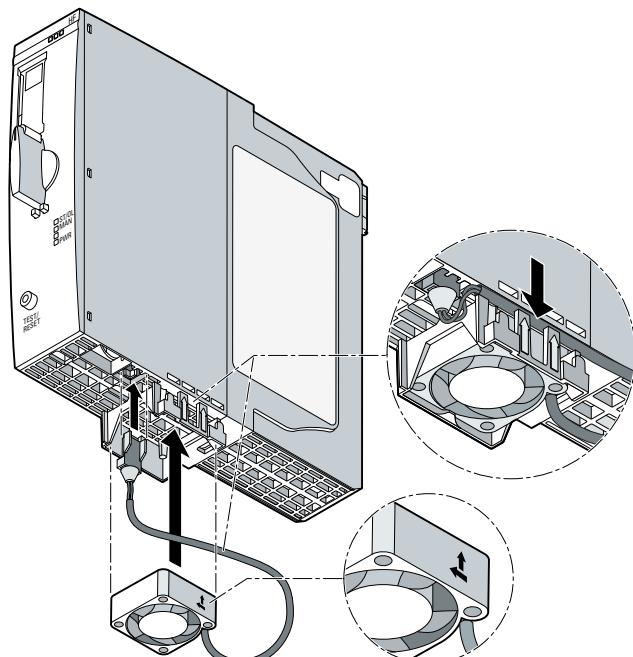
## 8.15 Mounting/disassembly of motor starters

### 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.

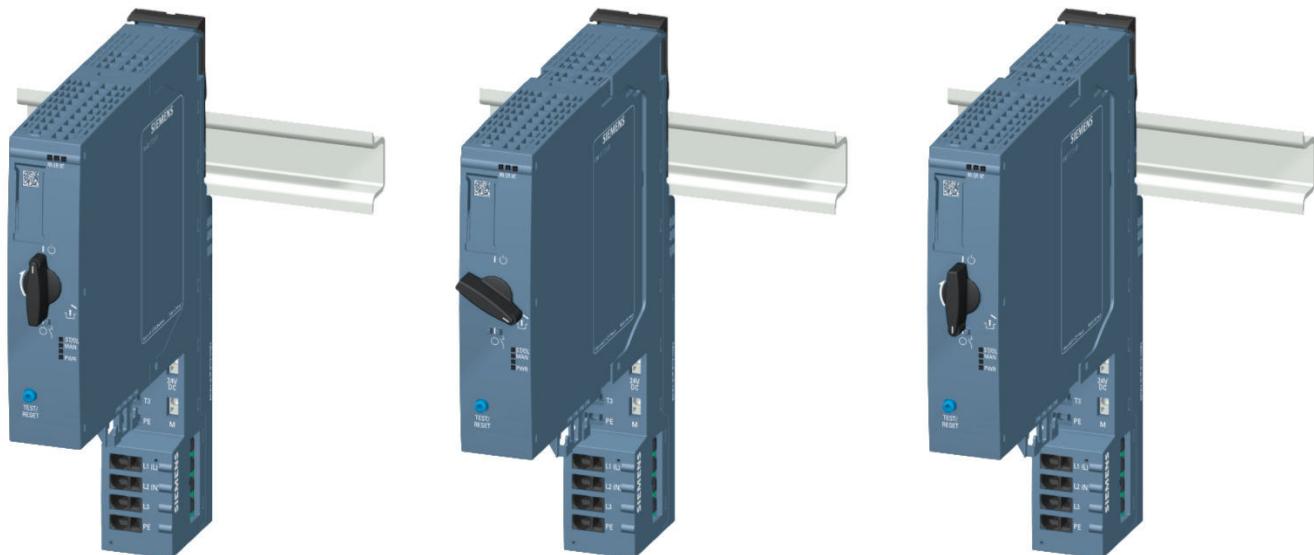
To assemble a SIMATIC ET 200SP motor starter, proceed as follows:

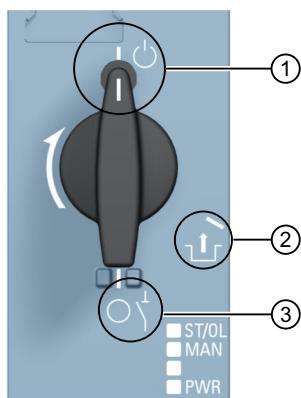
- Position the mechanical interlock of the SIMATIC ET 200SP motor starter in the assembly/disassembly position ②
- Place the SIMATIC ET 200SP motor starter onto the BaseUnit.
- Turn the mechanical interlock clockwise to the parking position ③
- Turn the mechanical interlock counterclockwise to the operating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




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#### 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.

---

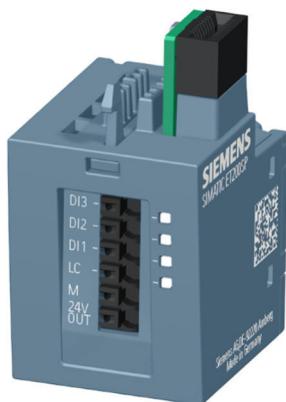
**NOTE**

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.

---

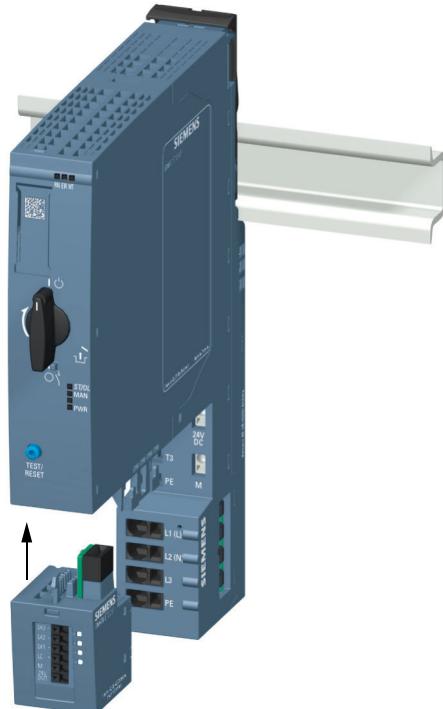
#### **NOTE**

#### **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.



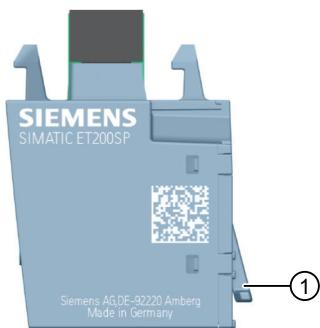
The figure below shows a motor starter with a mounted 3DI/LC module.



## 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

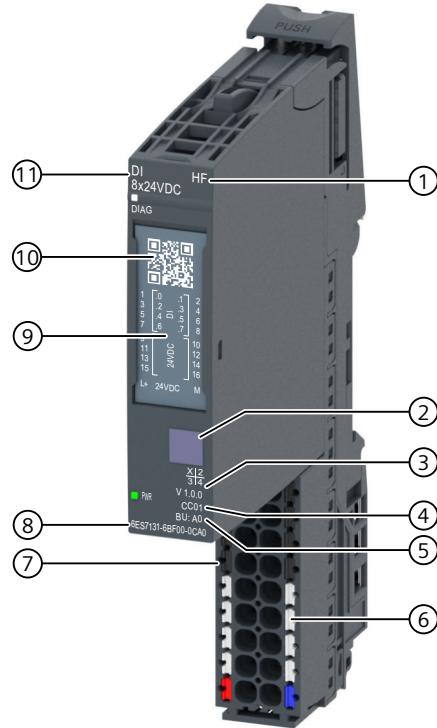
#### Introduction

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

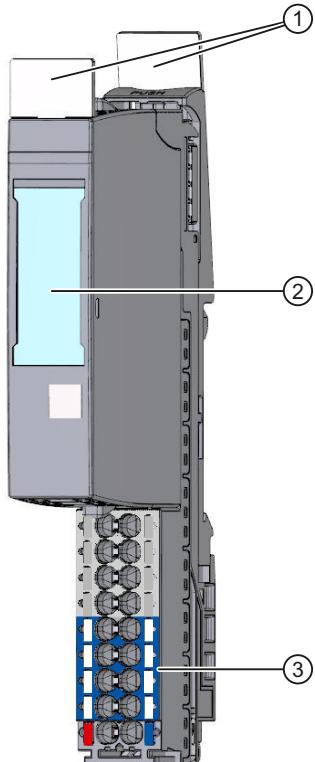
#### Reference identification labels

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

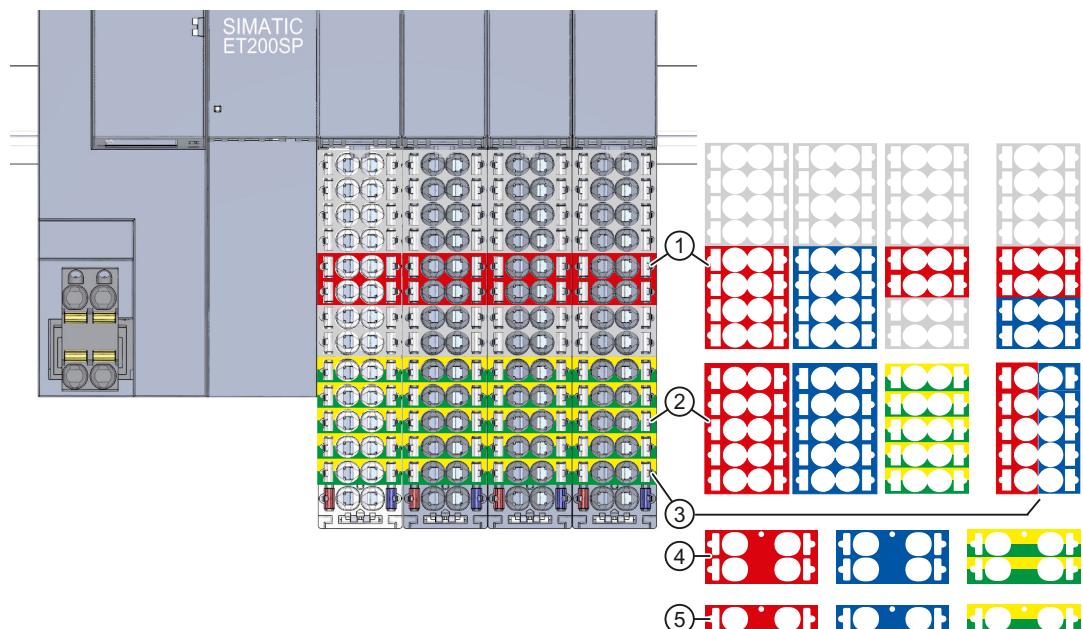
Press color identification labels into the terminal box of the BaseUnit.

---

##### 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:

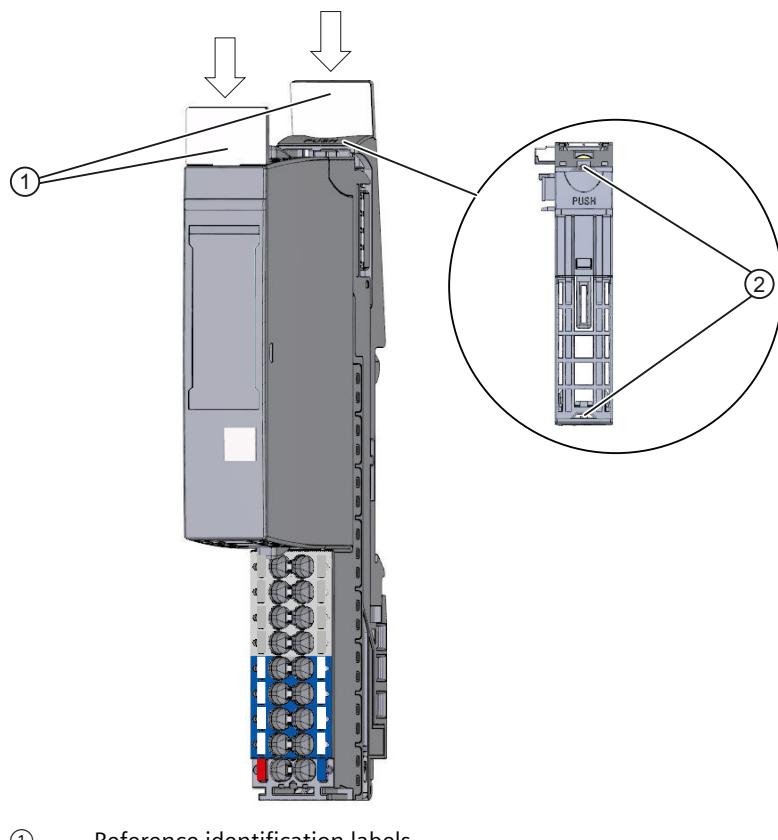
1. Break off the reference identification labels from the sheet.
2. Insert the reference identification labels into the opening on the CPU/interface module, BusAdapter, BaseUnit, I/O module and PotDis-TerminalBlock. The insertion opening is located on top of the BaseUnit or the I/O module/PotDis-TerminalBlock.

---

**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

## 13.5 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.

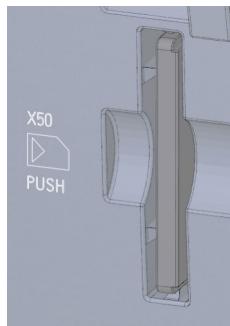


Figure 13-7 Slot for the SIMATIC memory card

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.