SIEMENS

SIPROTEC 5
Hardware Description

V9.70 and higher

Manual

C53000-G5040-C002-U

NOTE

For your own safety, observe the warnings and safety instructions contained in this document, if available.

Disclaimer of Liability

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

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Version of the product described: V9.70 and higher

Preface

Purpose of the Manual

This manual describes the hardware of the SIPROTEC 5 device family and provides general information on the product structure, the modules and technical data.

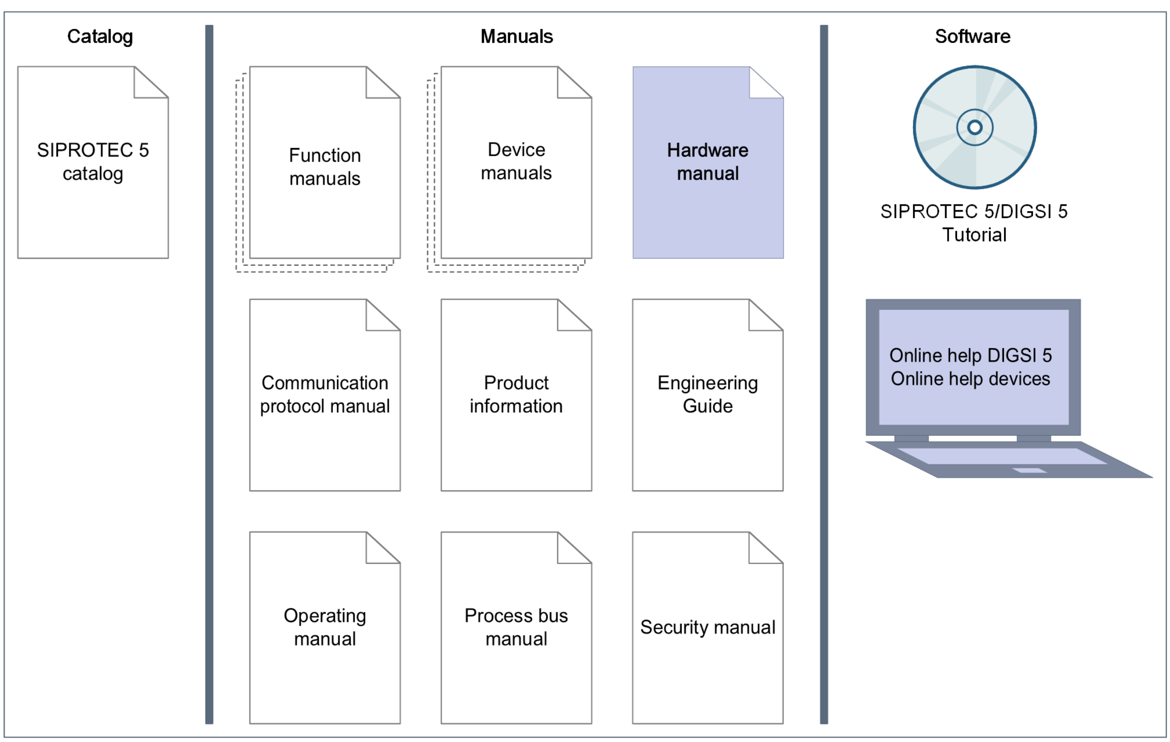
Target Audience

Protection system engineers, commissioning engineers, persons entrusted with the setting, testing and maintenance of automation, selective protection and control equipment, and operational crew in electrical installations and power plants.

Scope

This manual applies to the SIPROTEC 5 device family.

Further Documentation



[dw_product-overview_SIP5_hardware-manual, 5, en_US]

- Device manuals
  Each Device manual describes the functions and applications of a specific SIPROTEC 5 device. The printed manual and the online help for the device have the same informational structure.

- Hardware manual
  The Hardware manual describes the hardware building blocks and device combinations of the SIPROTEC 5 device family.
- Operating manual
  The Operating manual describes the basic principles and procedures for operating and assembling the devices of the SIPROTEC 5 range.
- Communication protocol manual
  The Communication protocol manual contains a description of the protocols for communication within the SIPROTEC 5 device family and to higher-level network control centers.
- Security manual
  The Security manual describes the security features of the SIPROTEC 5 devices and DIGSI 5.
- Process bus manual
  The process bus manual describes the functions and applications specific for process bus in SIPROTEC 5.
- Product information
  The Product information includes general information about device installation, technical data, limiting values for input and output modules, and conditions when preparing for operation. This document is provided with each SIPROTEC 5 device.
- Engineering Guide
  The Engineering Guide describes the essential steps when engineering with DIGSI 5. In addition, the Engineering Guide shows you how to load a planned configuration to a SIPROTEC 5 device and update the functionality of the SIPROTEC 5 device.
- DIGSI 5 online help
  The DIGSI 5 online help contains a help package for DIGSI 5 and CFC.
  The help package for DIGSI 5 includes a description of the basic operation of software, the DIGSI principles and editors. The help package for CFC includes an introduction to CFC programming, basic examples of working with CFC, and a reference chapter with all the CFC blocks available for the SIPROTEC 5 range.
- SIPROTEC 5/DIGSI 5 Tutorial
  The tutorial on the DVD contains brief information about important product features, more detailed information about the individual technical areas, as well as operating sequences with tasks based on practical operation and a brief explanation.
- SIPROTEC 5 catalog
  The SIPROTEC 5 catalog describes the system features and the devices of SIPROTEC 5.

Indication of Conformity

This product complies with the directive of the Council of the European Communities on harmonization of the laws of the Member States concerning electromagnetic compatibility (EMC Directive 2014/30/EU), restriction on usage of hazardous substances in electrical and electronic equipment (RoHS Directive 2011/65/EU), and electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU).

This conformity has been proved by tests performed according to the Council Directive in accordance with the product standard EN 60255-26 (for EMC directive), the standard EN IEC 63000 (for RoHS directive), and with the product standard EN 60255-27 (for Low Voltage Directive) by Siemens.

The device is designed and manufactured for application in an industrial environment.

The product conforms with the international standards of IEC 60255 and the German standard VDE 0435.

Standards

IEEE Std C 37.90

The technical data of the product is approved in accordance with UL.
For more information about the UL database, see *ul.com*
You can find the product with the **UL File Number E194016**.

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Additional Support

For questions about the system, contact your Siemens sales partner.

Customer Support Center

Our Customer Support Center provides a 24-hour service.

Siemens Electrification & Automation
Global Support
Single entry point
Phone: +49 9131 1743072
E-mail: *support.ea.si@siemens.com*

Training Courses

Inquiries regarding individual training courses should be addressed to our Training Center:

Siemens AG
Siemens Power Academy TD
Humboldtstraße 59
90459 Nuremberg
Germany

Phone: +49 911 9582 7100
E-mail: *poweracademy@siemens.com*
Internet: *www.siemens.com/poweracademy*

Notes on Safety

This document is not a complete index of all safety measures required for operation of the equipment (module or device). However, it comprises important information that must be followed for personal safety, as well as to avoid material damage. Information is highlighted and illustrated as follows according to the degree of danger:

DANGER

DANGER means that death or severe injury **will** result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid death or severe injuries.

WARNING

WARNING means that death or severe injury **may** result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid death or severe injuries.

CAUTION

CAUTION means that medium-severe or slight injuries **can** occur if the specified measures are not taken.

✧ Comply with all instructions, in order to avoid moderate or minor injuries.

NOTICE

NOTICE means that property damage **can** result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid property damage.

NOTE

Important information about the product, product handling or a certain section of the documentation which must be given attention.

Qualified Electrical Engineering Personnel

Only qualified electrical engineering personnel may commission and operate the equipment (module, device) described in this document. Qualified electrical engineering personnel in the sense of this document are people who can demonstrate technical qualifications as electrical technicians. These persons may commission, isolate, ground and label devices, systems and circuits according to the standards of safety engineering.

Proper Use

The equipment (device, module) may be used only for such applications as set out in the catalogs and the technical description, and only in combination with third-party equipment recommended and approved by Siemens.

Problem-free and safe operation of the product depends on the following:

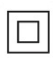
- Proper transport
- Proper storage, setup and installation
- Proper operation and maintenance

When electrical equipment is operated, hazardous voltages are inevitably present in certain parts. If proper action is not taken, death, severe injury or property damage can result:

- The equipment must be grounded at the grounding terminal before any connections are made.
- All circuit components connected to the power supply may be subject to dangerous voltage.
- Hazardous voltages may be present in equipment even after the supply voltage has been disconnected (capacitors can still be charged).
- Operation of equipment with exposed current-transformer circuits is prohibited. Before disconnecting the equipment, ensure that the current-transformer circuits are short-circuited.
- The limiting values stated in the document must not be exceeded. This must also be considered during testing and commissioning.

Selection of Used Symbols on the Device

Nr.	Symbol	Beschreibung
1	⎓	Direct current, IEC 60417, 5031
2	∼	Alternating current, IEC 60417, 5032

Nr.	Symbol	Beschreibung
3		Direct and alternating current, IEC 60417, 5033
4		Earth (ground) terminal, IEC 60417, 5017
5		Protective conductor terminal, IEC 60417, 5019
6		Caution, risk of electric shock
7		Caution, risk of danger, ISO 7000, 0434
8		Protective insulation, IEC 60417, 5172, safety class II devices
9		Guideline 2002/96/EC for electrical and electronic devices
10		Guideline for the Eurasian market
11		Mandatory conformity mark for electronics and electrotechnical products in Morocco
12		Extra low voltage (ELV), IEC 60417, 5180, Safety Class III devices

OpenSSL

This product includes software developed by the OpenSSL Project for use in OpenSSL Toolkit (*http://www.openssl.org/*).

This product includes software written by Tim Hudson (*tjh@cryptsoft.com*).

This product includes cryptographic software written by Eric Young (*eay@cryptsoft.com*).

Table of Contents

1 Introduction

1.1 Advantages of SIPROTEC 5

The devices in the SIPROTEC 5 series are based on the many years of experience gathered with SIPROTEC 4. Extensive improvements have also been integrated. Take note of the differences between the modular and non-modular systems.

The SIPROTEC 5 series is based on a newly developed, flexible modular system that is applicable to all the devices. This results in the following advantageous new features:

- You save time because of jumperless devices.
  You can set the rated current ranges (1 A, 5 A) electronically. You do not need to open the devices to do this. You can set the thresholds of the binary inputs by setting parameters.
- The freely configurable, modular device design creates more flexibility.
  You can configure your own device variants in addition to the standard variants. The modular system consists of base and expansion modules, and optional plug-in modules. Thus, you can combine the devices exactly as desired, and the standard variants are expandable. Devices with a size of up to 2-row 19-inches are possible.
- You save time because of prewired terminal blocks.
  The terminal blocks for connection of the relays, of the binary inputs and outputs and of the current and voltage transformers can be removed and fitted again while wired. This enables the possibility of pre-wiring in the cabinet construction phase. Device replacement is uncomplicated and is possible in a short time.
- You do not need to open the device to install and replace plug-in modules.
  The slots for the plug-in modules are externally accessible. Communication modules and measuring-transducer modules (for example, 4 x 20-mA measuring-transducer input) can be plugged in at these plug-in module positions.
- Operation is uncomplicated and intuitive.
  For all modular devices, it is possible to select whether to use a large graphical display, a small display, or no display. The non-modular devices are available with large or small graphical display. The key switches on the expansion module can be selected optionally. The 9 function keys enable a safe and uncomplicated procedure for important operator actions.
- Multi-colored LEDs ensure safe system management.
  The 16 LEDs on the base module are 2-colored (green/red). Thus, the status of a signal (OK/disrupted) can be shown clearly, for example. There can also be 16 red LEDs on each expansion module.
- Up to 40 analog channels per device create a greater scope of functions than in SIPROTEC 4.
  Thus, even complex applications such as the 1 1/2 circuit-breaker layout are possible.

NOTE

For the central busbar protection 7SS85, up to 80 analog channels are possible.

1.2 Modular Systems and Hardware Characteristics

The SIPROTEC 5 series includes both modular and non-modular devices.

Modular devices consist of a base module (1/3 of 19 inches) and can be expanded with expansion modules (1/6 of 19 inches). The device type identifier for modular devices is XXX85, XXX86, or XXX87, for example, 7SA86.

Type xxx84 devices have the same hardware properties as the modular devices, but they cannot be expanded with expansion modules.

All non-modular devices consist of just a base module (1/3 of 19 inches) and **cannot** be expanded with expansion modules (1/6 of 19 inches). The device type identifier for non-modular devices is 7XX81 or 7XX82, for example 7SJ81 and 7SJ82.

Modular System for Modular Devices

The system is based on a modular structure. A modular device always consists of a base module and optionally of expansion modules. The modules can be selected according to hardware characteristics. These characteristics are:

- Module size
- Type of construction
- Fastening of the on-site operation panel
- Operation of the on-site operation panel
- Input and output module
- Plug-in modules

The modules are available in 2 sizes:

- Base module (1/3 of 19 inches)
- Expansion module (1/6 of 19 inches)

The devices are available in 3 designs: These are:

- Flush-mounting devices with on-site operation panel fitted directly on the device
- Surface-mounted devices with integrated on-site operation panel
- Surface-mounted devices with detached on-site operation panel

The on-site operation panels of the base modules can be selected from 3 variants:

- With a large display, keypad with function keys and 16 two-colored LEDs
- With a small display, keypad with function keys and 16 two-colored LEDs
- Without a display, without a keypad (standard), but with 16 two-colored LEDs

The on-site operation panels of the expansion modules can be selected from 3 variants:

- With 16 monochrome LEDs and 2 key switches
- With 16 monochrome LEDs
- With 8 LEDs and 8 function keys
- Without display elements

The base modules always contain the power-supply module PS201 and an input and output module IO2XX.

The expansion modules contain an input and output module IO2XX or a plug-in module assembly with integrated power supply CB202. The 1st expansion module in the 2nd device row always contains the power-supply module PS203.

The plug-in modules are available for various applications. Plug-in modules can be installed in 1 base module or in 1 expansion module with 1 plug-in module assembly with integrated power supply CB202. You can find more information on the available plug-in module types in chapter *4 Plug-In Modules*.

Hardware Characteristics for Non-Modular Devices (7xx81)

A non-modular device always consists of just 1 module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). The hardware characteristics are:

- Module size: 1/3 of 19 inch
- Type of construction: Flush-mounting devices with on-site operation panel fitted directly on the device

The on-site operation panels can be selected from 2 variants:

- With a large display, keypad without function keys and 12 two-colored LEDs
- With a small display, keypad without function keys and 12 two-colored LEDs

The module always contains the power-supply module PS101 and an input and output module IO10X. The input and output module IO10X includes the terminals for current and voltage transformers. Optionally, the module can be equipped with an additional input and output module IO112 or IO113 for extra binary inputs and outputs.

The plug-in modules are available for various applications. You can find more information on the available plug-in module types in chapter *4 Plug-In Modules*.

Hardware Characteristics for Non-Modular Devices (7xx82)

A non-modular device always consists of 1 module (1/3 of 19 inches) and cannot be expanded with expansion modules (1/6 of 19 inches). The hardware characteristics are:

- Module size: 1/3 of 19 inch
- Type of construction: Flush-mounting devices with on-site operation panel fitted directly on the device

The on-site operation panels can be selected from 2 variants:

- With a large display, keypad with function keys and 16 two-colored LEDs
- With a small display, keypad with function keys and 16 two-colored LEDs

The module always contains the power-supply module PS101 and an input and output module IO10X. The input and output module IO10X includes the terminals for current and voltage transformers. Optionally, the module can be equipped with an additional input and output module IO110 for extra binary inputs and outputs, or with a temperature measurement module IO111 (for 7SK82 only).

The plug-in modules are available for various applications. You can find more information on the available plug-in module types in chapter *4 Plug-In Modules*.

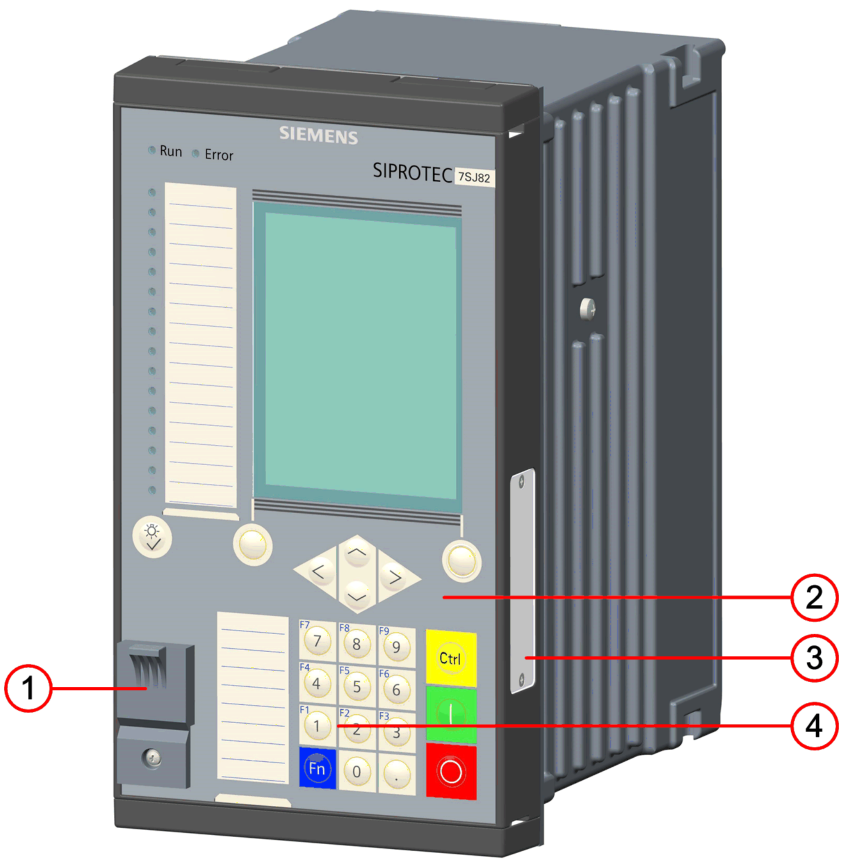
2 Forms of Devices and On-Site Operation Panels

2.1 Flush-Mounting Devices

2.1.1 Description

The flush-mounting devices were conceived for installation in 19-inch racks or special openings in control desks and cabinets. The on-site operation panel is linked permanently to the device.

Base Module



[le_surface_mounting_front, 3, --_--]

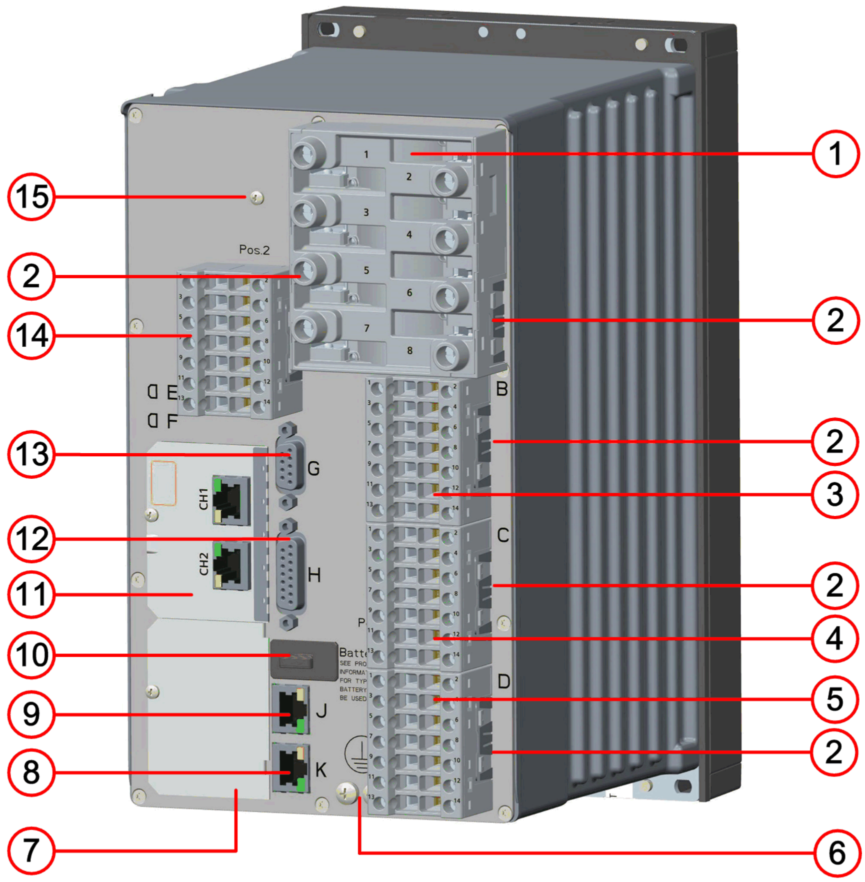
Figure 2-1 Front View – Standard

(1)	USB connection, type B
(2)	On-site operation panel
(3)	Bus terminal for expansion module, only possible for modular devices
(4)	Keypad with function keys

[le_surface_mounting_front_7SJ81, 1, --_--]

Figure 2-2 Front View – 7xx81

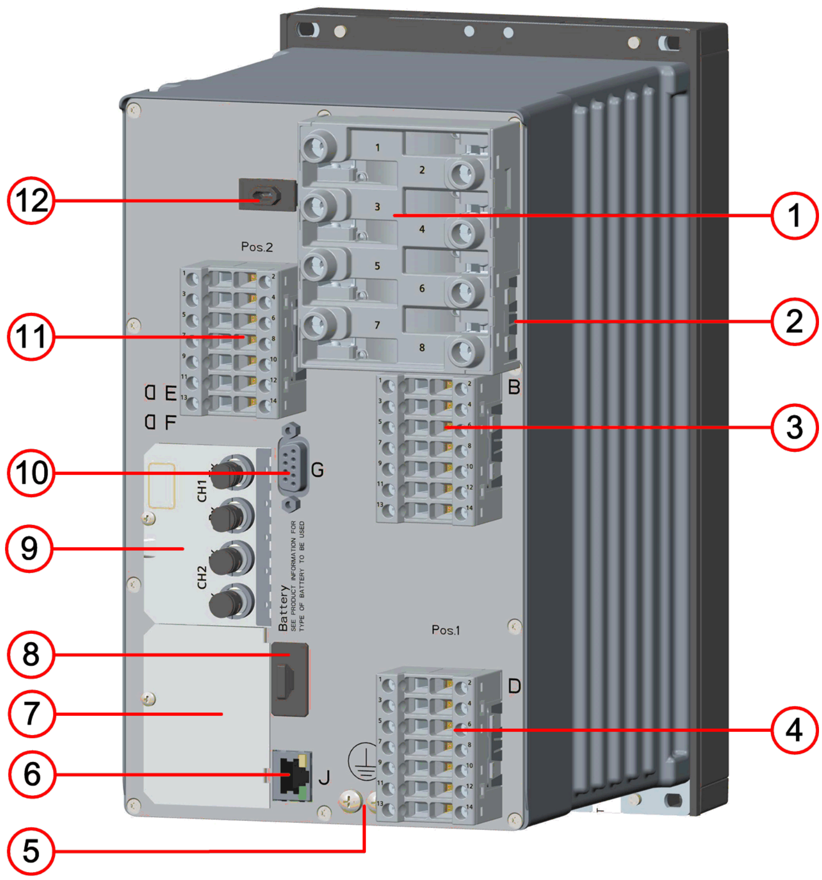
(1) USB connection, type B
(2) On-site operation panel
(3) Bus terminal for expansion module, only possible for modular devices
(4) Keypad without function keys



[le_rear modular device, 3, --_--]

Figure 2-3 Rear View of a Modular Device, Terminals of a Typical Device with IO202

(1)	Current terminal 1A
(2)	Spring clip
(3)	Voltage terminal 1B
(4)	Voltage terminal 1C
(5)	Voltage terminal 1D
(6)	Protective grounding terminals
(7)	Plug-in module position F
(8)	Terminal for COM link K
(9)	Terminal for integrated Ethernet interface J
(10)	Battery compartment
(11)	Plug-in module position E
(12)	Terminal for detached on-site operation panel H
(13)	Terminal for time synchronization G
(14)	Voltage terminal 2B
(15)	For module fastening inside the device, no user function (existence depending on the device version)



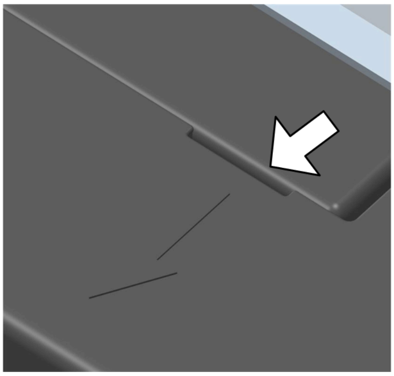
[le_rear non modular, 3, --_--]

Figure 2-4 Rear View of a Non-Modular Device (7xx81, 7xx82), Terminals of a Typical Device with IO102

(1)	Current terminal A
(2)	Spring clip
(3)	Voltage terminal B
(4)	Voltage terminal D
(5)	Protective grounding terminals
(6)	Terminal for integrated Ethernet interface J
(7)	Plug-in module position F (not applicable to 7xx81)
(8)	Battery compartment
(9)	Plug-in module position E
(10)	Time synchronization G
(11)	Voltage terminal L
(12)	For module fastening inside the device, no user function

Fastening Openings of the Base and 1/3 Module

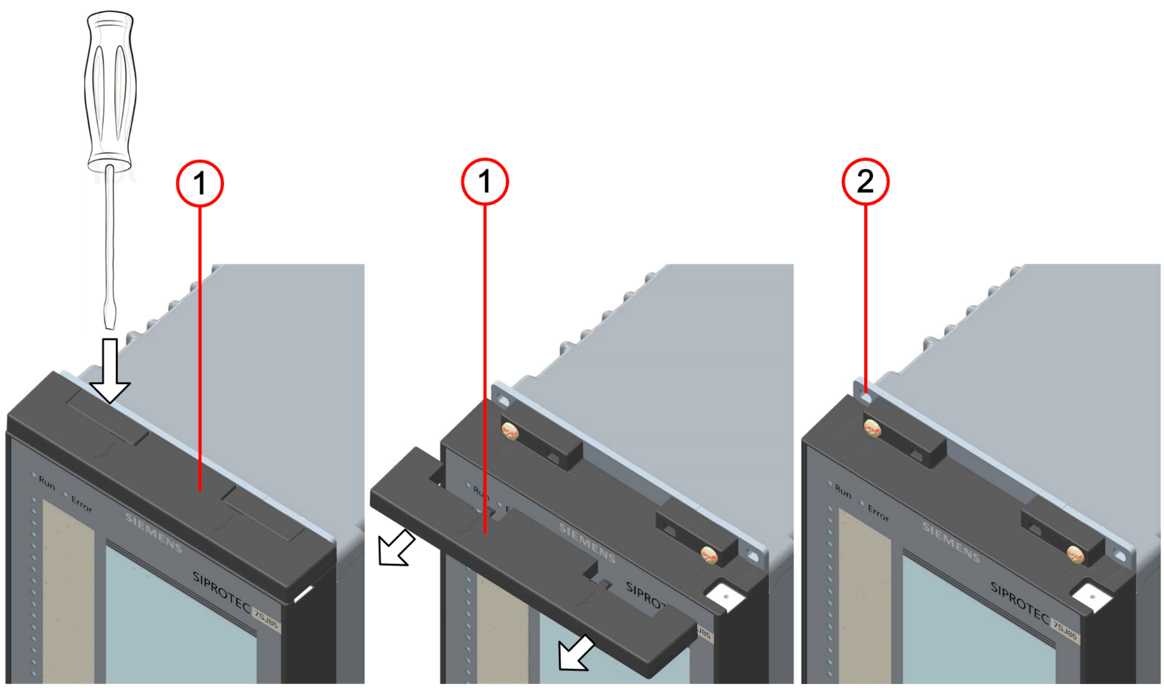
To remove the screw covers, introduce the screwdriver into the provided slot.



[dw_screwdriver, 1, --_--]

Figure 2-5 Slot for Introducing the Screwdriver

Loosen the cover by turning slightly. Then pull off the cover to the front.



[le_osobep, 1, --_--]

Figure 2-6 Fastening Openings of the Base and 1/3 Module Shown, for Example, on the Top Fastening

(1) Screw cover
(2) Fastening opening

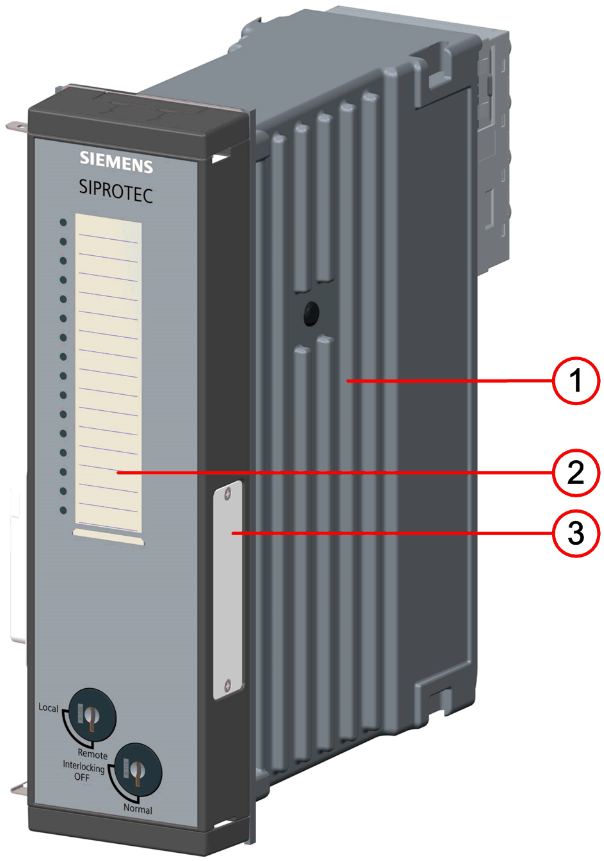
NOTICE

The screw cover can be damaged if improperly removed.

Noncompliance with the specified safety instructions means that material damage can occur.

✧ Use a screwdriver to remove the screw cover.

Expansion Module

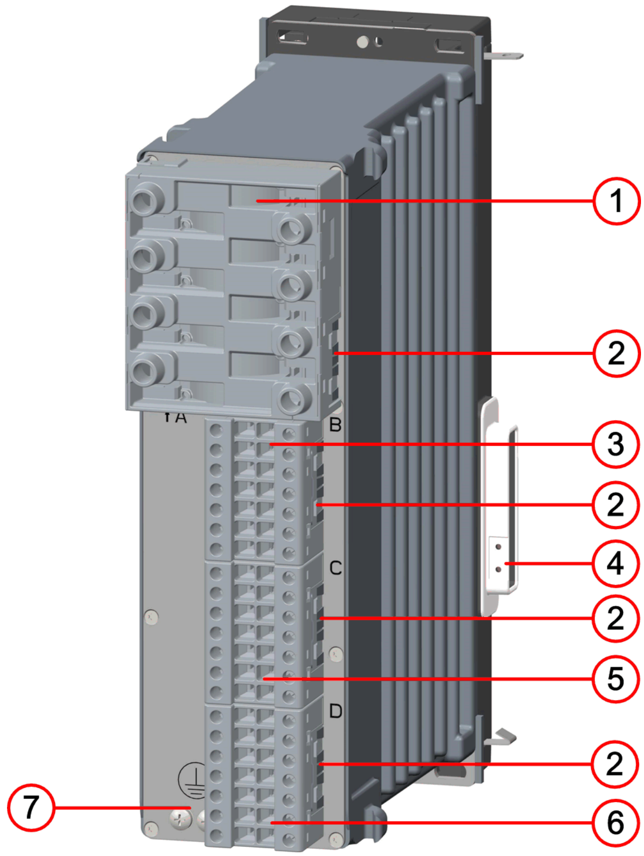


[le_front expansion module, 1, --_--]

Figure 2-7 Front View of the Expansion Module

(1) Device housing
(2) On-site operation panel
(3) Bus terminal for an additional expansion module (shown with bus termination plate)

Unused bus terminals are sealed with a cover.



[le_rear expansion module, 1, --_--]

Figure 2-8 Rear View of the Expansion Module

(1)	Current terminal xA
(2)	Spring clip
(3)	Voltage terminal xB
(4)	Bus terminal to the base module
(5)	Voltage terminal xC
(6)	Voltage terminal xD
(7)	Protective grounding terminals

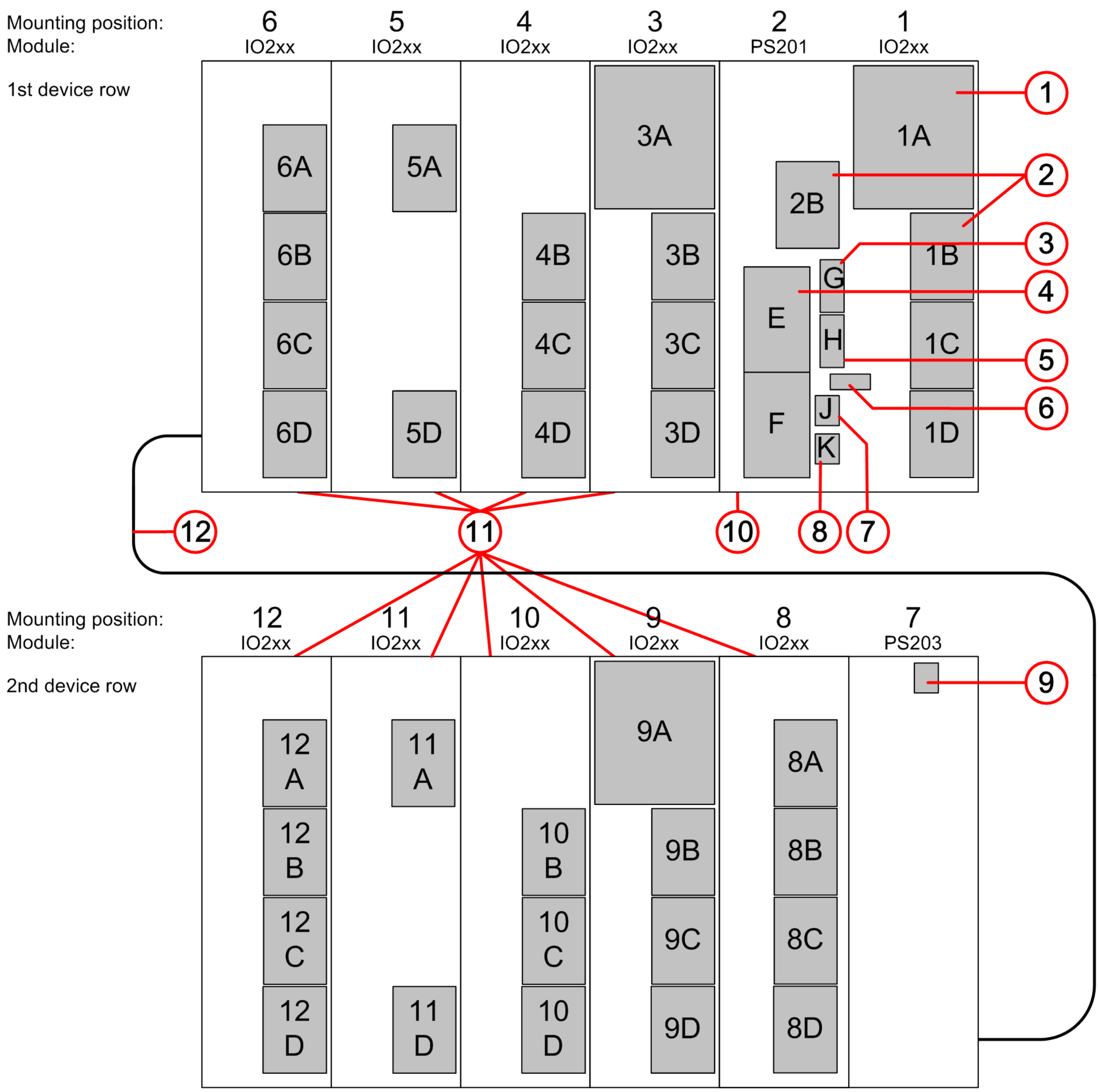
NOTE

It is possible to install these modules in the 1st and 2nd device row. x corresponds to the slot in the 19-inch rack.

Possible values in the 1st device row: x = 3, 4, 5, or 6

Possible values in the 2nd device row: x = 8, 9, 10, 11 or 12

Counting Method for Modules in 19-Inch Rack (View of the Rear of the Device)



[dwbgrpos-170713-01.tif, 3, en_US]

Figure 2-9 Counting Method for Modules in 19-Inch Rack (Example)

(1) Current terminal A
(2) Voltage terminal A, B, C, D
(3) Terminal for time synchronization G
(4) Plug-in module E, F
(5) Terminal for detached on-site operation panel H
(6) Battery compartment
(7) Terminal for integrated Ethernet interface J
(8) Terminal for COM link K
(9) 2-pole terminal to connect power supply
(10) Base module 1/3 of 19 in
(11) Expansion module 1/6 of 19 in
(12) Connecting cable between 1st and 2nd device row

> **NOTE**
>
> The structure of the 2nd device row is described in chapter *5.2.1.3 Expanding Devices with 2nd Device Row*.

Connection Systems

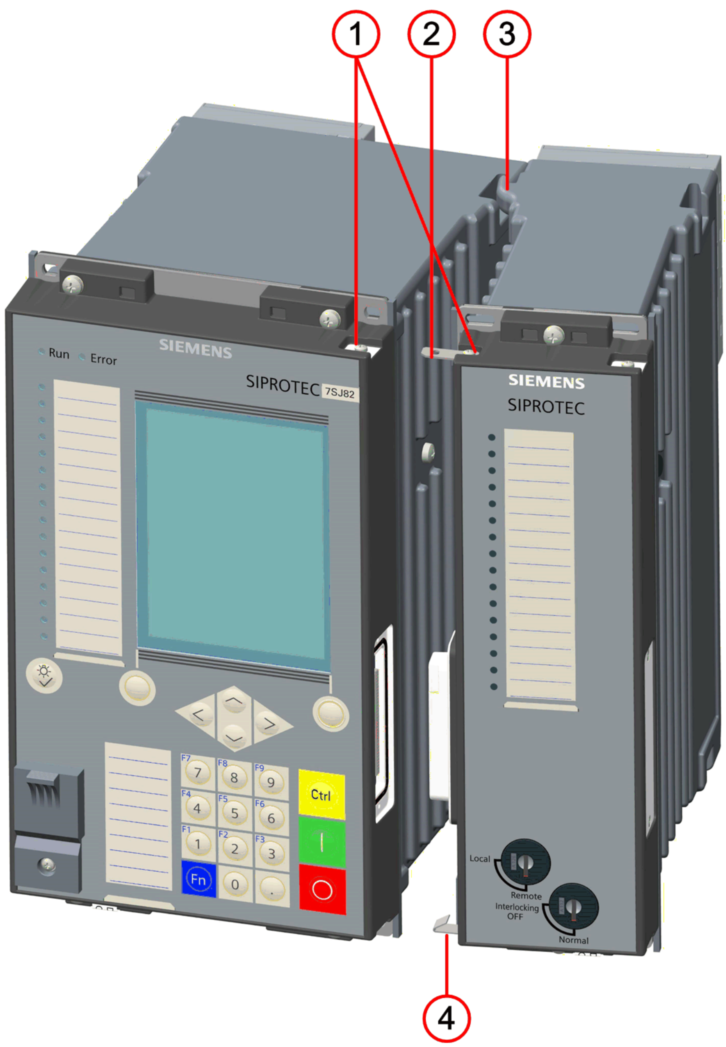


Figure 2-10 Connection Systems

(1)	Cut-out for contact tab
(2)	Contact tab (prefitted on the expansion module)
(3)	Hinged angle clip
(4)	Snap-in spring

> **NOTE**
>
> All on-site operation panels must be connected to one another via the bolt-on contact tabs. The contact tabs are delivered with the expansion modules.

2.2 Surface-Mounted Devices with Integrated On-Site Operation Panel

2.2.1 Description of the Modular Device

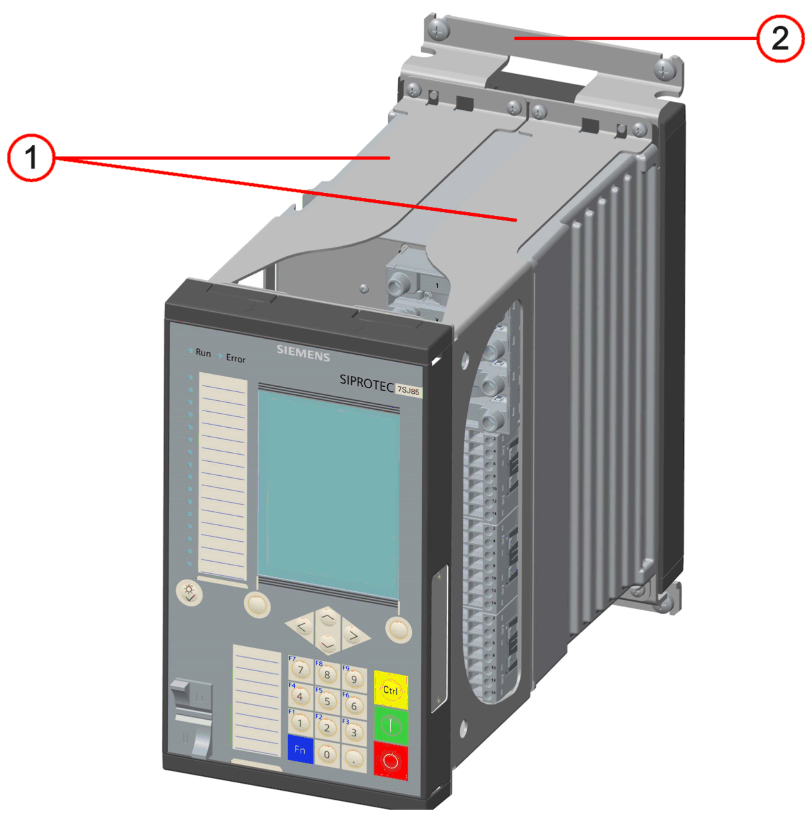
NOTE

The basic device structure is described in chapter *2.1.1 Description* .

The surface-mounting devices with integrated on-site operation panel were conceived for fitting on a flat wall surface. The on-site operation panel is fastened on the device with a distance frame. The distance frame creates the necessary wiring space for the cable connections.

The integrated operation panel always has the size (width) of the complete device consisting of base module and expansion modules.

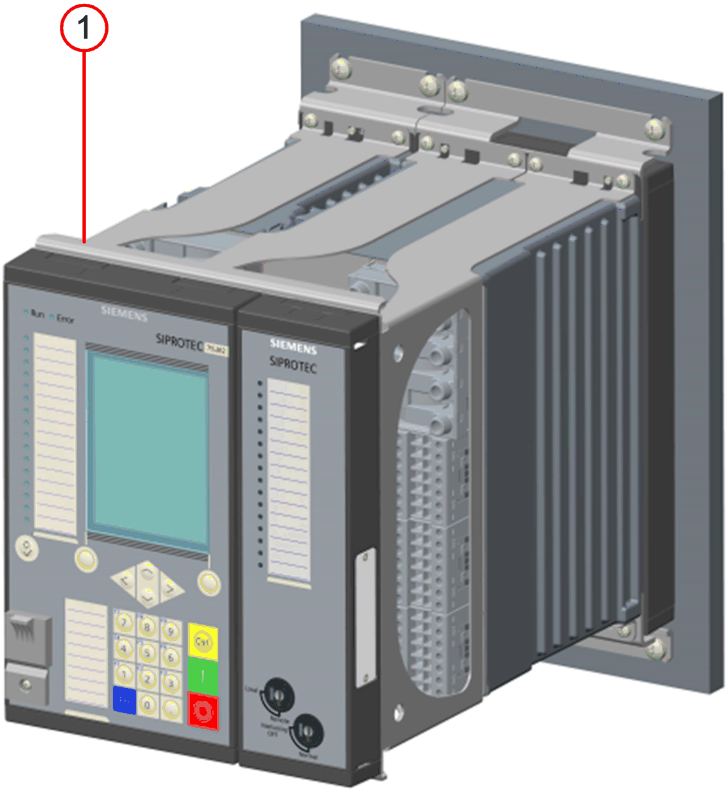
Base Module



[le_device mounting, 2, --_--]

Figure 2-11 Device Structure

(1)	Outer distance frame
(2)	Fixing bracket



[dwauzeil-040211-01.tif, 2, --_--]

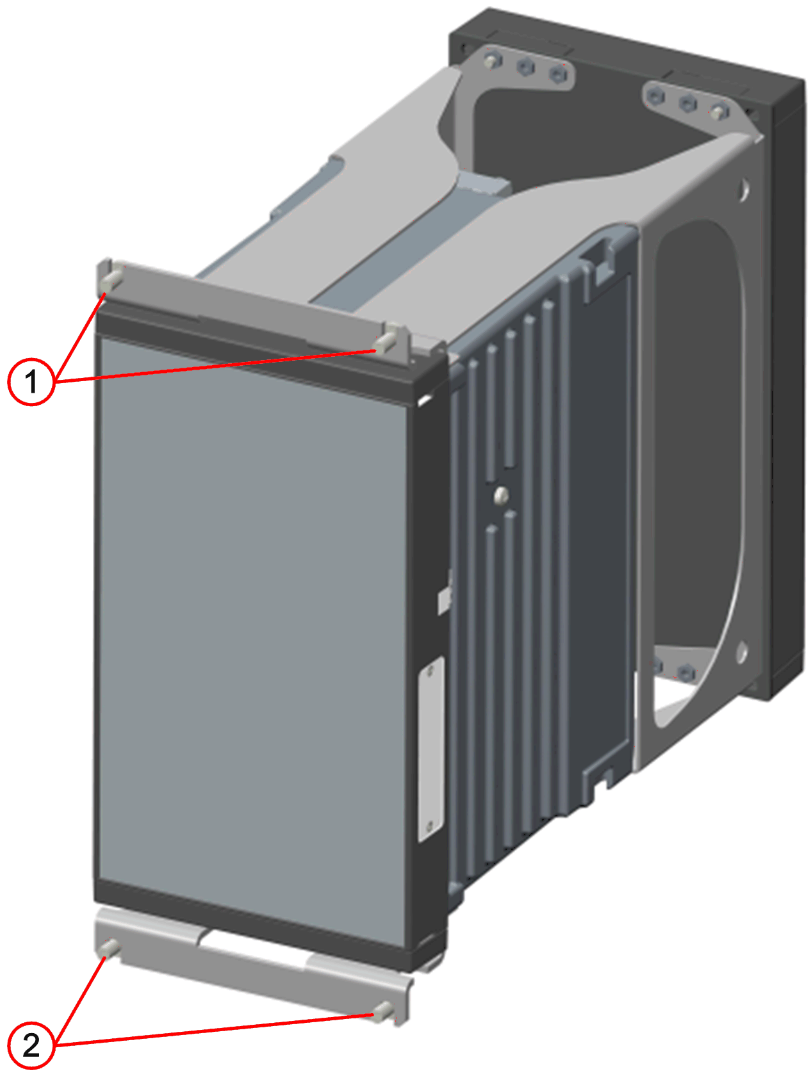
Figure 2-12 Basic and Expansion Module of the Surface-Mounting Device

(1) Mounting bracket

NOTE

When a base module is expanded, 2 mounting brackets must be fitted between the on-site operation panels and the distance frame. The mounting bracket stabilizes the device. The length of the mounting bracket corresponds to the width of the device.

Fastening Openings



[dwbaaube-040211-01.tif, 2, --_--]

Figure 2-13 Fastening Openings of the Base Module

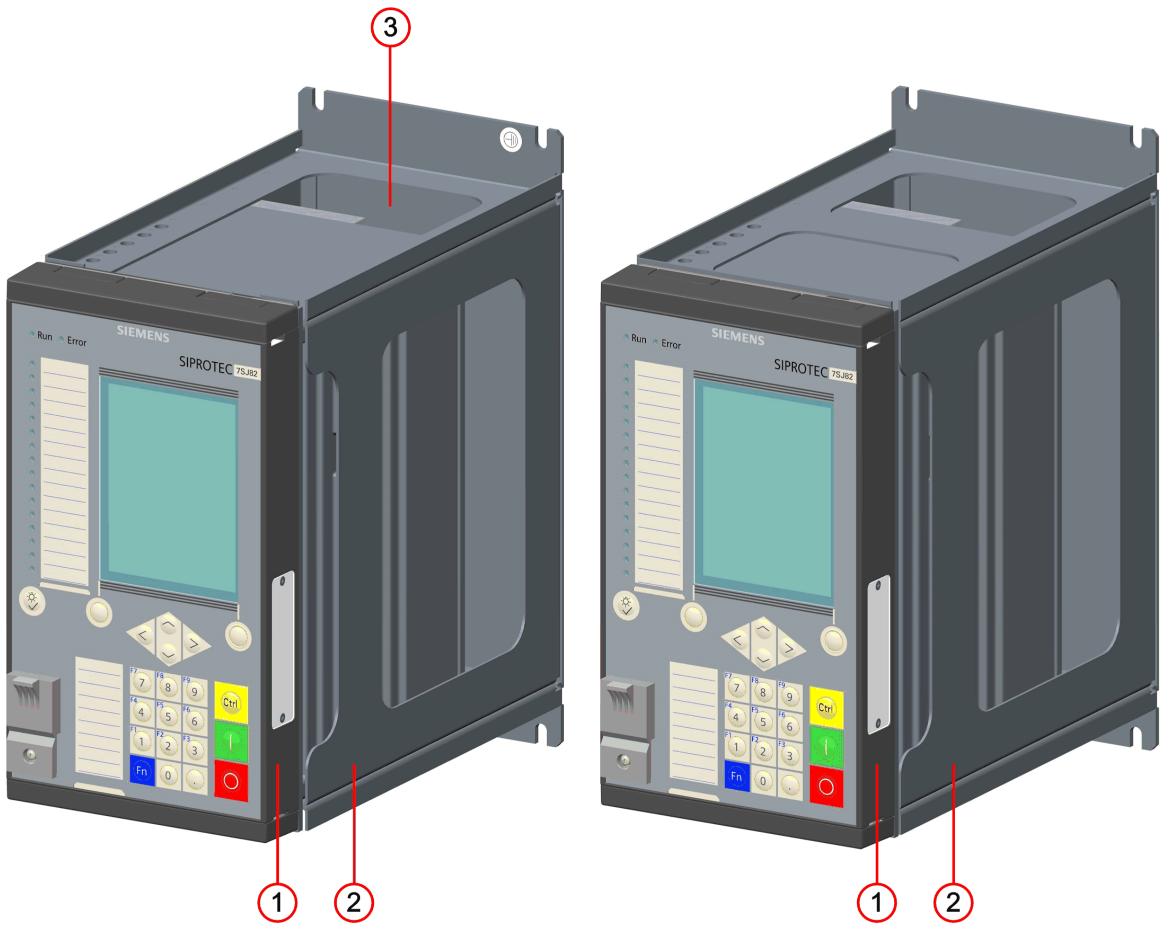
(1) Top fastening openings
(2) Bottom fastening openings

2.2.2 Description of the Non-Modular Surface-Mounted Device

NOTE

The basic device structure is described in chapter *2.1.1 Description* .

The non-modular device variant is designed for mounting to a flat wall surface. This variant is created by flush-mounting the non-modular device into the surface-mounting bracket. In this process, you may face the opening as needed upward (cables coming from above) or downward (cables coming from below) as shown in the following figure. You can order the surface-mounting bracket individually.



[le_device with console above and below, 1, --_--]

Figure 2-14 Bracket with the Opening Upward (Left) and the Opening Downward (Right)

(1) Flush-mounting device

(2) Bracket for the surface-mounting variant

(3) Bracket opening for cable entry or exit when mounting or dismantling the device

[sc device mounting, 2, --_--]

Figure 2-15 Surface-Mounted Version of the Non-Modular Device, Mounted

Fastening Openings

[sc fixing console, 2, --_--]

Figure 2-16 Fastening Openings of the Bracket

2.3 Surface-Mounted Devices with Detached On-Site Operation Panel

2.3.1 Description

NOTE

The basic device structure is described in *2.1.1 Description* .

The surface-mounting devices with detached on-site operation panel are a variant of the surface-mounting devices with an integrated on-site operation panel. The essential difference is that you can fit the on-site operation panel separately from the device. The distance frames are not assembled in this device type.

For surface-mounting devices with detached operation panel, the detached operation panel has the size (width) of the front elements equipped with a functionality, but at least that of the base module (1/3). Meaning that expansion modules with fronts equipped with a functionality (for example LEDs, key switches, push-buttons) are part of the detached operation panel. Blind front panels are not included. Thus, the device can be wider than the detached operation panel.

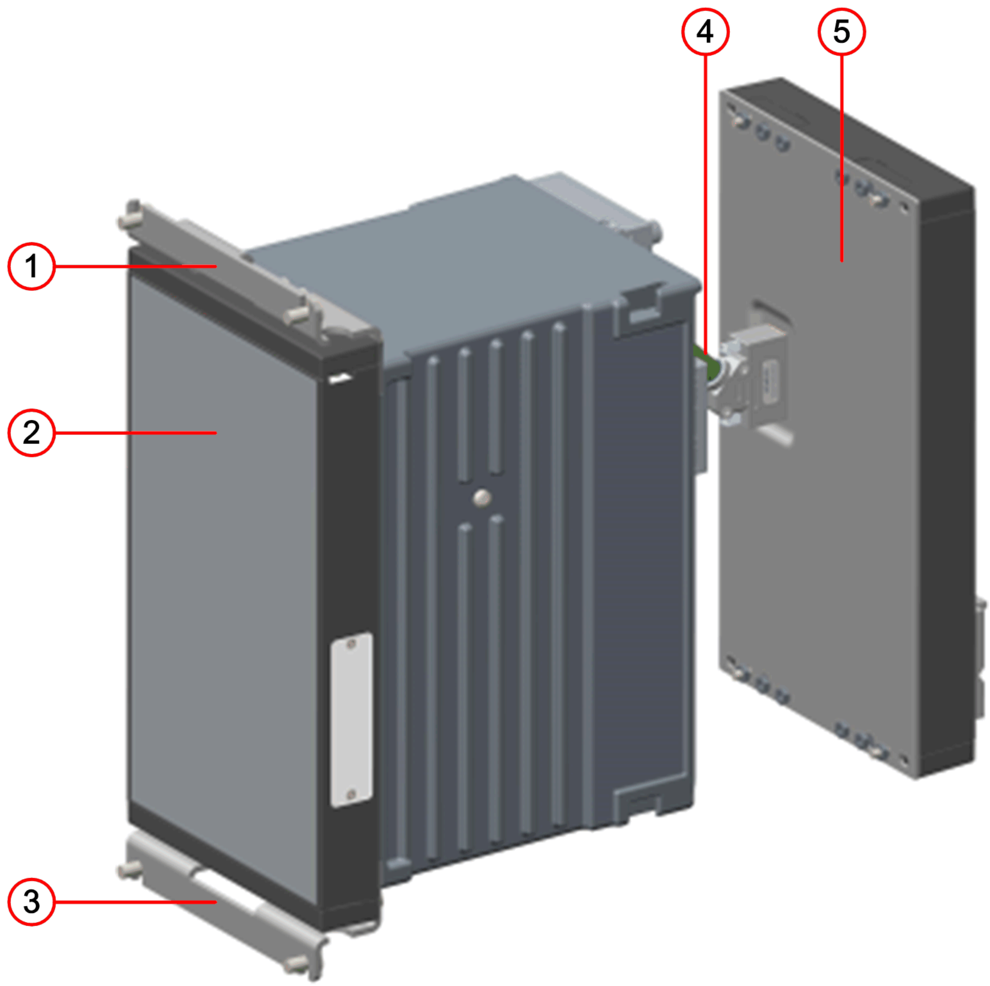
Base Module

The distance between the installation location of the device and that of the on-site operation panel is limited to not more than 5 m by the length of the connecting cable. The on-site operation panel must be grounded. For information on grounding, see *5.1.1 Electrical Inspection*.

NOTE

Cables with a length of 5 m (196.85 in) are only specified for PCs and laptop computers using USB 2.0. These cables are not specified for PCs and laptop computers with USB ports using USB 3.0 and above.

Cables with a length of 2.5 m (98.43 in) are specified for USB 2.0 and from USB 3.0.

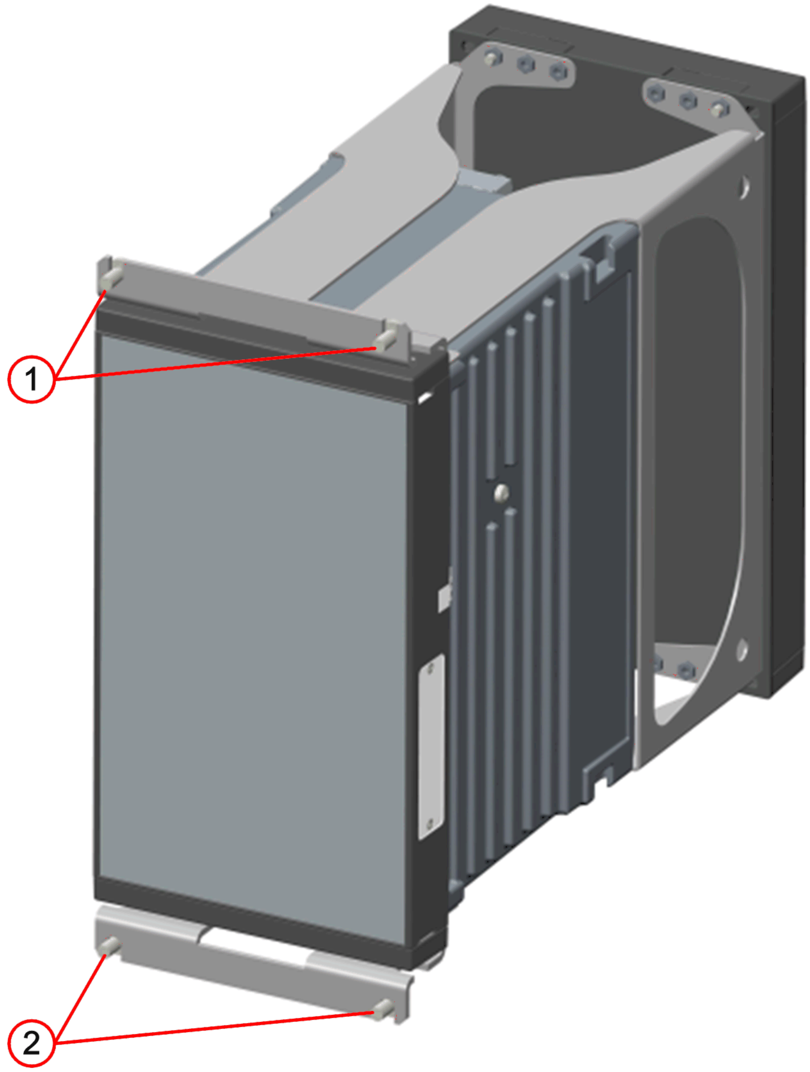


[le_device mounting base module, 2, --_--]

Figure 2-17 Device Structure of the Base Module

(1)	Top fixing bracket
(2)	Cover
(3)	Bottom fixing bracket
(4)	Connecting cable between the base module and the on-site operation panel
(5)	Rear plate of the on-site operation panel

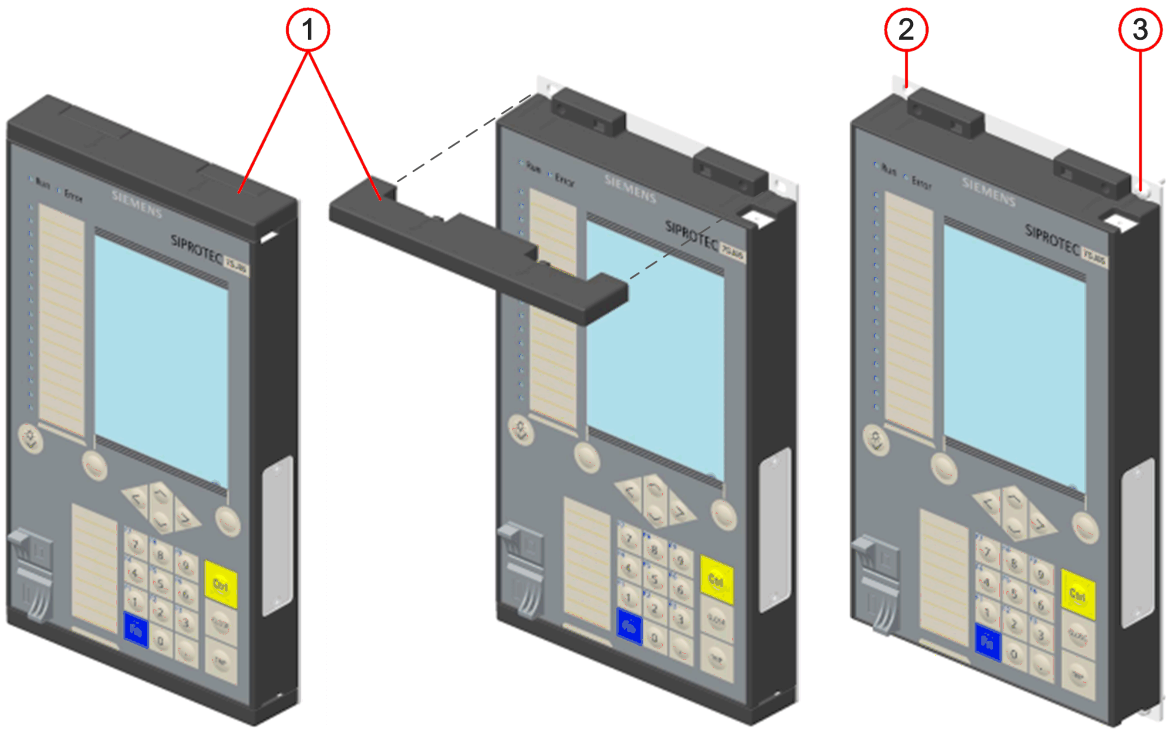
Mounting Holes



[dwbaaube-040211-01.tif, 2, --_--]

Figure 2-18 Device Structure of the Base Module

(1) Top mounting holes with fastening screw
(2) Bottom mounting holes with fastening screw



[dwosobb1-040211-01.tif, 2, --_--]

Figure 2-19 Mounting Holes of the On-Site Operation Panel

(1) Screw cover (pull towards you to remove)
(2) Mounting hole
(3) Mounting hole with fastening screw

2.4 On-Site Operation Panels

2.4.1 Description

Operating Concept

The operating concept is based on 4 groups:

- Navigation in the menu tree
- Modification of settings
- Display of measured values and protocols
- Control function from menu bar or control display

Operating personnel are informed about the current state of important measured data, indications, and parameters. The data can be read out. You can perform parameterization and switching operations directly on the device.

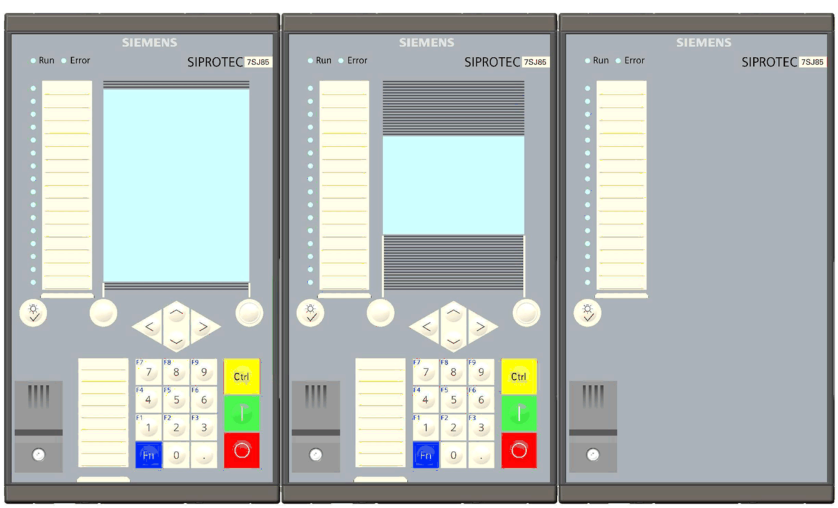
User Interface Language

You can set the user interface language to the following:

- Local language
- US English

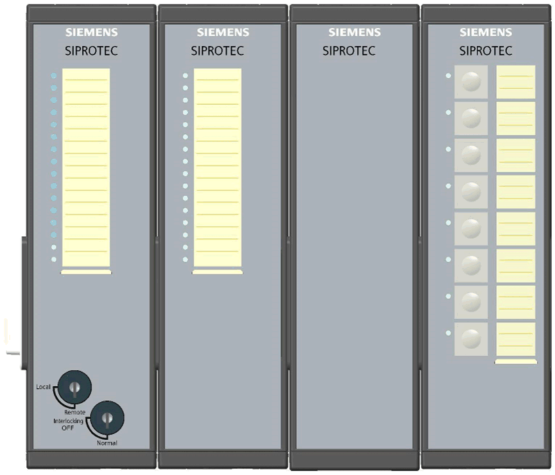
Variants

Corresponding to the equipment configuration, 3 variants are available for each size. In the case of the non-modular devices, only the front variants with small and large display are available.



[dwvaosop-080211-01.tif, 3, --_--]

Figure 2-20 Variants 1/3 Views

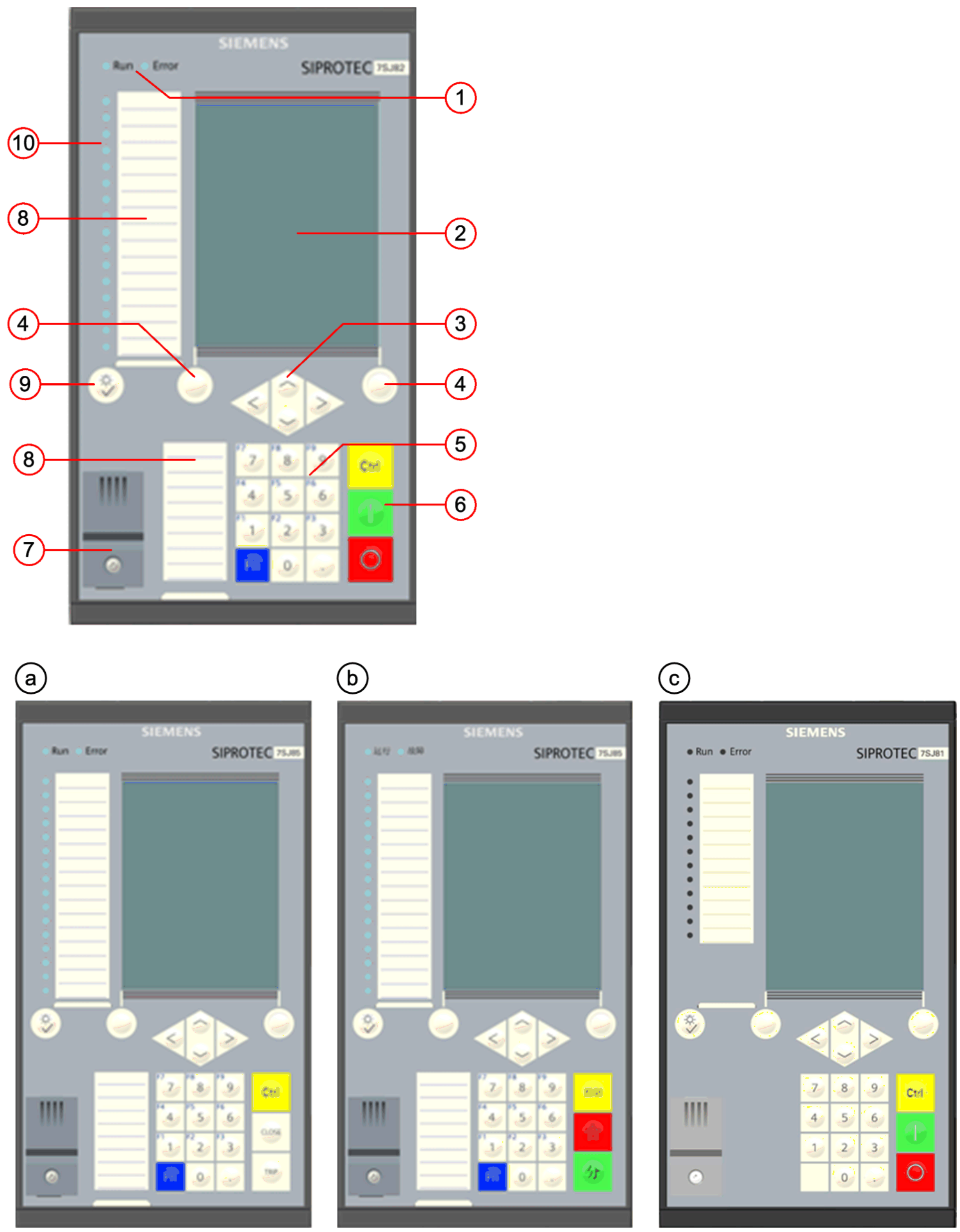


[dw_osop_with_pushbutton, 2, --_--]

Figure 2-21 Variants 1/6 Views

2.4.2 Overview of Operating Elements and Display Elements

On-Site Operation Panel of the Base 1/3 Module



[le_base_module, 3, --_--]

Figure 2-22 Base 1/3 Module in Standard Design, US Design (a), China Design (b), and for 7xx81 (c)

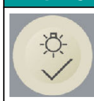
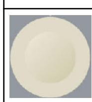
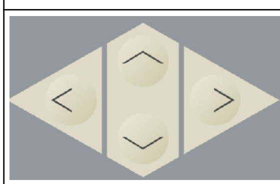
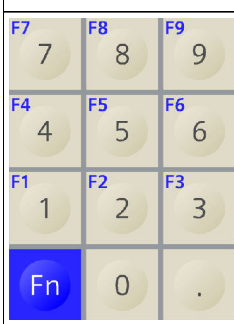
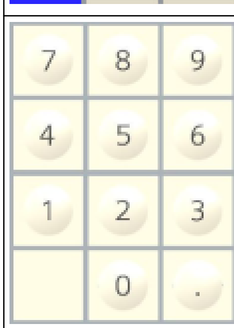
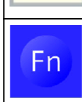
(1)	Operating state display
(2)	Display in 2 design variants
(3)	Keypad with navigation keys
(4)	Softkey
(5)	Keypad with numerical keys and convertible function keys (for 7xx81: without function keys)
(6)	Keypad of control keys
(7)	USB-port cover
(8)	Labeling strips

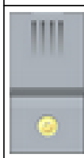
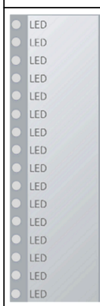
(9) Reset and LED test key
(10) 16 two-colored LEDs (for 7xx81: 12 two-colored LEDs)

The on-site operation panels are distinguished by the following characteristics:

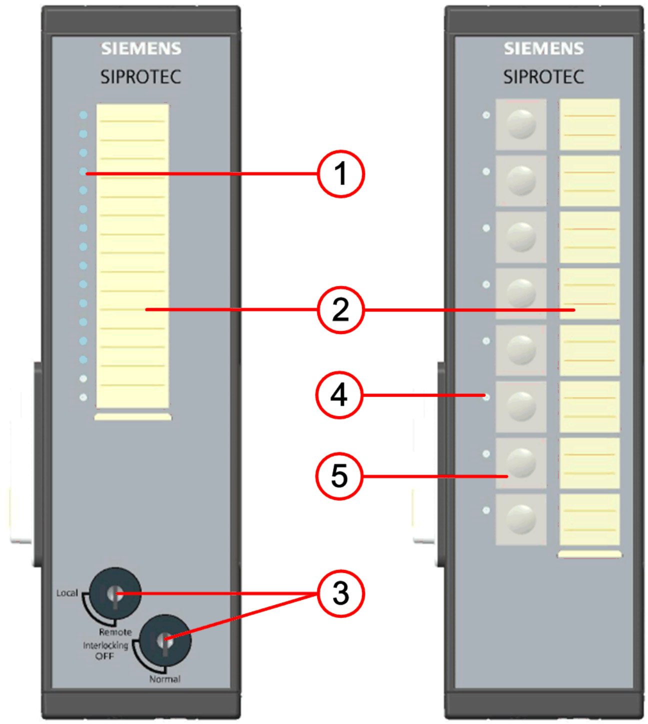
- Flat and compact design
- LCD (Liquid Crystal Display) graphic display
  Small with 192 x 128 pixels for showing measured values and small control displays
  Large with 240 x 320 pixels for showing measured values and control displays
- Membrane keypad
- Menu navigation function keys (not for 7xx81)
- USB port, type A for laptop computer/PC
- 16 two-colored LEDs (parameterizable)
  For 7xx81: 12 two-colored LEDs

The operating elements and display elements of the on-site operation panel for base modules are explained in the following table.

Operating Elements/ Display Elements	Function
	Testing LED functionality and resetting the LEDs to the original state
	Softkey for confirming command prompts On the left and right underneath the display
	Keypad with navigation keys for navigating in the menus or in the graphical displays (control displays)
	Keypad with numerical keys for the entry of values and with programmable function keys for fast execution of actions Next to the keypad, there are labeling strips for user-defined labels.
	Keypad with numerical keys for entering values
	Activating the function keys

Operating Elements/ Display Elements	Function
	Control key for activating the control display
	Control key for activating the switching object
	Control key for deactivating the switching object
	Display of readiness for operation Run: ready to operate, the green LED is lit. Error: not ready to operate, the red LED is lit.
	USB port with protective cover Type B for laptop computer/PC
	16 two-colored parameterizable LEDs

On-Site Operation Panel of Expansion Modules



[le_expansion modules, 1, --_--]

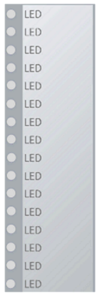
Figure 2-23   Expansion Module

(1)	16 monochrome LEDs
(2)	Labeling strips
(3)	2 key switches
(4)	8 monochrome LEDs
(5)	8 push-buttons

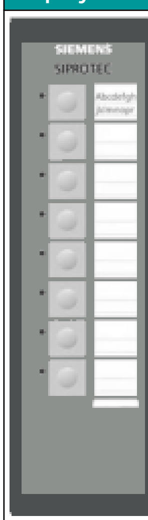
The on-site operation panels are distinguished by the following characteristics:

- Flat and compact design
- 16 monochrome parameterizable LEDs
- Decorative film
- 2 key switches for setting the operating mode

Besides the base module, you can add an expansion module with key switches. The following table explains the meanings of the switch positions.

Operating Elements/ Display Elements	Meaning
	16 monochrome parameterizable LEDs
	Local: On-site operation Remote: Remote control
	Interlocking OFF: Unlocked operation Normal: locked operation with the configured interlocking conditions

The on-site operation panel with push-buttons is equipped with 8 LEDs and 8 function keys. It can be used as an on-site operation panel by almost all of the I/O modules (except for the modules IO230, IO231, IO232, IO233). The push-button module must be placed at position 3 in the 1st row. If the device has a key switch, then the push-button module must be placed at position 4 in the 1st row. One push-button module is permitted per device.

Operating Elements/ Display Elements	Meaning
	8 monochrome parameterizable LEDs Keypad with programmable function keys for fast execution of actions. Next to the keypad, there are labeling strips for user-defined labels.

3 Electronic Modules

3.1 Power-Supply Modules of the Modular Devices

3.1.1 Function Description of the Power-Supply Modules of the Modular Devices

Module Designation	Function Description
PS201	• Power-supply module • Plug-in module assembly • DC 24 V/DC 48 V or DC 60 V to 250 V and AC 100 V to 230 V • In the base module 1/3 of 19 in • Assembled with 3 binary inputs, 2 binary outputs, and one status life contact
PS203	• Power-supply module for supplying the 2nd device row • DC 24 V/DC 48 V or DC 60 V to 250 V and AC 100 V to 230 V • In the expansion module, 1/6 of 19 in
PS204	• Power-supply module as redundancy for the printed circuit board assemblies PS201 and PS203 • DC 24 V/DC 48 V or DC 60 V to 250 V and AC 100 V to 230 V • In the expansion module, 1/6 of 19 in
CB202	• Plug-in module assembly with internal power supply • DC 24 V/DC 48 V or DC 60 V to 250 V and AC 100 V to 230 V • In the expansion module, 1/6 of 19 in

3.1.2 Power-Supply Module PS201

3.1.2.1 Description

The power-supply module PS201 is always permanently installed in the base module. The central task is to supply power to all modules. The following can be found on the PS201 module:

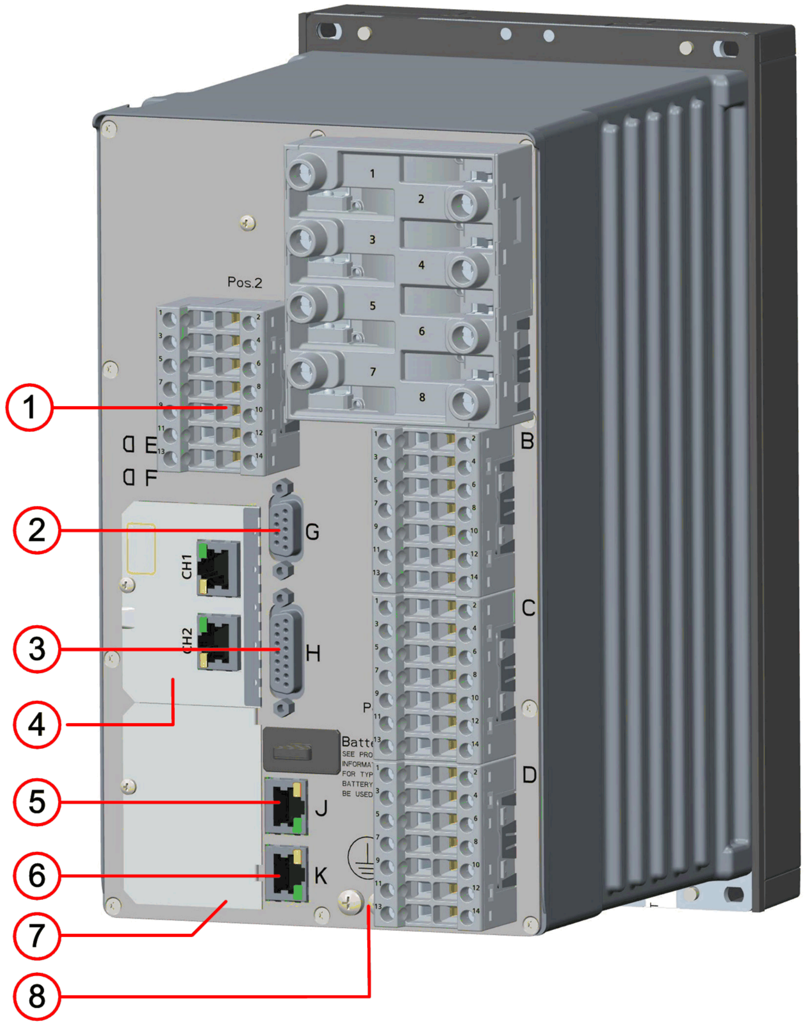
- 2 positions for plug-in modules (communication modules, measuring-transducer modules)
- Terminals for time synchronization, the on-site operation panel, an integrated Ethernet interface, and a COM link interface
- A 14-pole voltage terminal (3 binary inputs and 3 binary outputs)
- Battery for the CPU.

The power supply of the other modules is established automatically through the plug-in bus connection when they are assembled.
The following 2 variants are available for the rated voltage range:

- DC 24 V to 48 V
- DC 60 V to DC 250 V and AC 100 V to AC 230 V (50 Hz and 60 Hz)

3.1.2.2 Terminals

Overview of Terminals

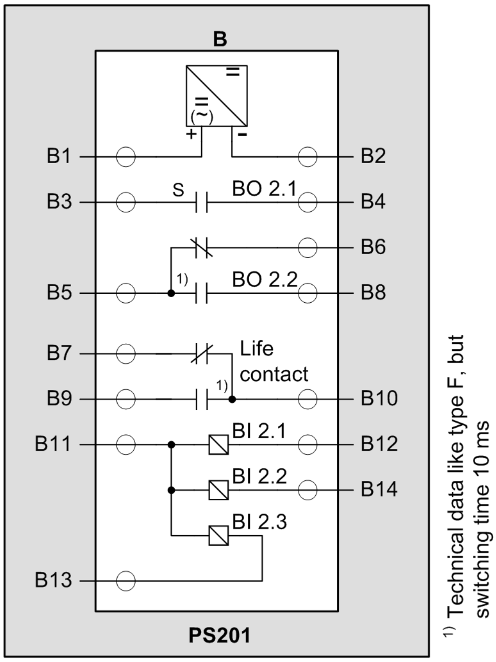


[le_ps201, 3, --_--]

Figure 3-1 PS201 – Terminals

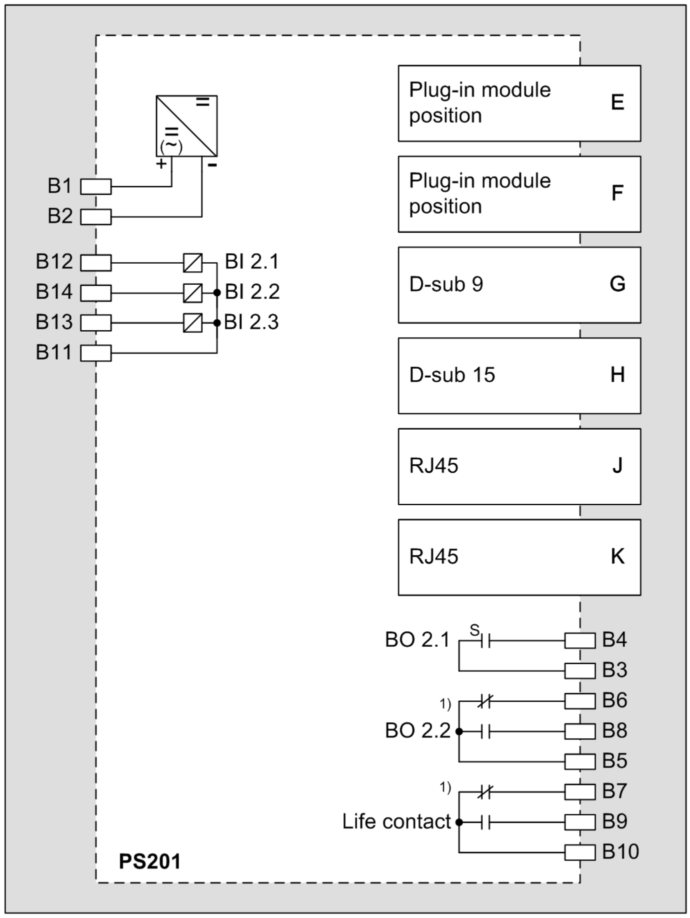
(1)	Voltage terminal 2B
(2)	Time synchronization G
(3)	Terminal for detached on-site operation panel H
(4)	Plug-in module position E
(5)	Integrated Ethernet interface J
(6)	COM link K, connection to the CB202 plug-in module assembly, position K
(7)	Plug-in module position F
(8)	Protective grounding terminals

Terminal and Connection Diagram



[cdps201x-270912-01.tif, 1, en_US]

Figure 3-2 PS201 – Terminal Diagram



1) Technical data like type F, but switching time 10 ms

[tdps201x-270812-01.tif, 1, en_US]

Figure 3-3 PS201 – Connection Diagram

Time-Synchronization Terminal

The terminal for time synchronization is located on the D-sub 9 interface (position G). Time synchronization signals for DC 5 V, DC 12 V, and DC 24 V can be processed as an option.

For further information on connecting to the time synchronization, see chapter *6.6 Communication Interfaces* in the Technical Data.

On-Site Operation Panel Terminal

The terminal for the on-site operation panel of surface-mounted devices is located on the D-sub 15 interface (position H). The on-site operation panel of surface-mounted devices with the on-site operation panel integrated or detached is connected to this interface.

For further information on connecting to the on-site operation panel, see chapter *6.6 Communication Interfaces* in the Technical Data.

Integrated Ethernet Interface J(RJ45)

This terminal is used to load the device with DIGSI 5 using Ethernet. This terminal also enables straightforward IEC 61850 Ethernet communication or communication with another protocol via Ethernet, for example, for connecting an external RTD unit.

For further information on the integrated Ethernet interface, see chapter *6.6 Communication Interfaces* in the Technical Data.

Ethernet COM Link

The Ethernet connection to the CB202 plug-in module assembly with integrated power supply is realized using the RJ45 interface.

The RJ45 interface can be used exclusively for the connection of the CB202 plug-in module assembly. This terminal is left unused when no CB202 plug-in module assembly is in use.

For further information on the Ethernet COM link, see chapter *6.6 Communication Interfaces* in the Technical Data.

3.1.3 Power-Supply Module PS203 for the 2nd Device Row

3.1.3.1 Description

If you expand the device into the 2nd device row, you need the PS203 power-supply module.

NOTE

The PS203 power-supply module is always supplied with the expansion module and must always be mounted at position 7.

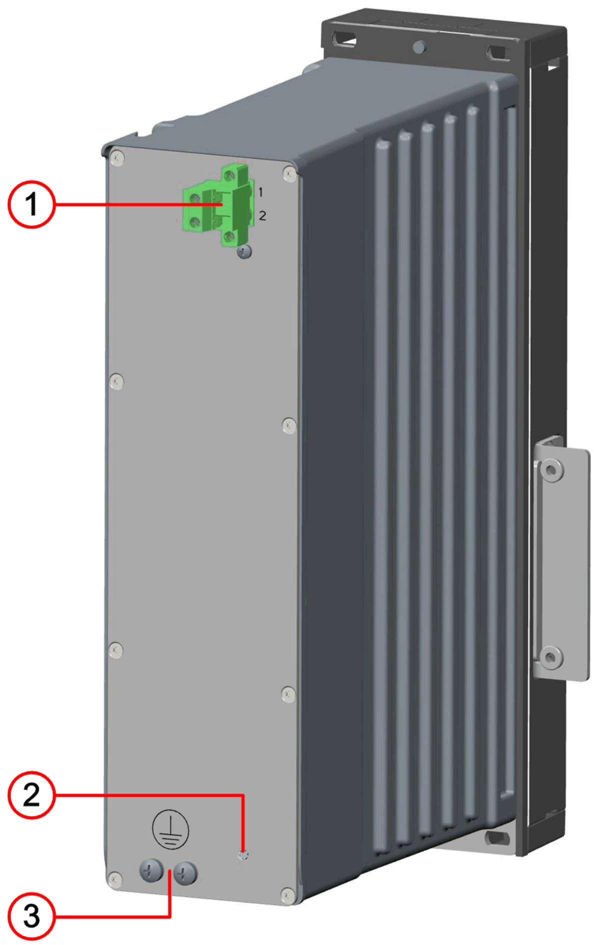
Up to 5 additional expansion modules are possible in the 2nd device row. The scope of delivery of the PS203 power-supply module includes 1 connecting cable for the 2nd device row, 1 angle rail, 1 sealing panel and 1 adaptor bracket.

The PS203 power-supply module has no additional functionality. It is used exclusively to supply power to the 2nd device row.

The rated voltage variant of the PS203 power-supply module must always match the PS201 power-supply module of the base module.

3.1.3.2 Terminals

Overview of Terminals

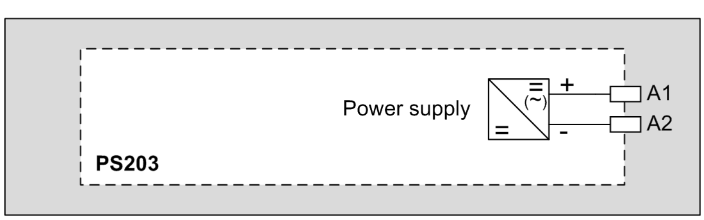


[le_ps203, 2, --_--]

Figure 3-4 PS203 – Terminals

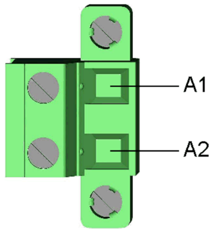
(1) 2-pole terminal to connect power supply
(2) LED: Power On
(3) Protective grounding terminals

Connection Diagram



[tdps203x-030713-01.tif, 2, en_US]

Figure 3-5 PS203 – Connection Diagram

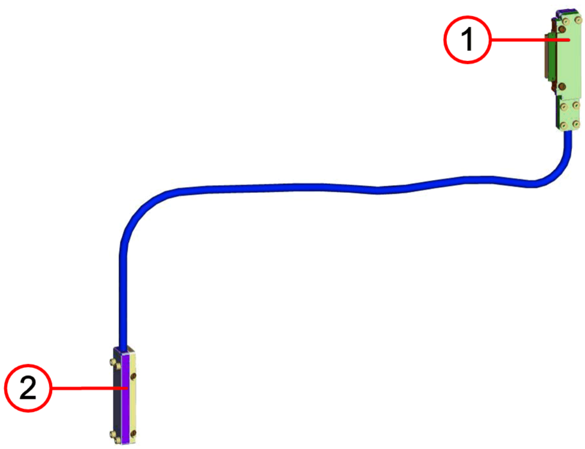


[dwkl2pol-030211-01.tif, 1, --_--]

Figure 3-6 Connection of External Power Supply

NOTE

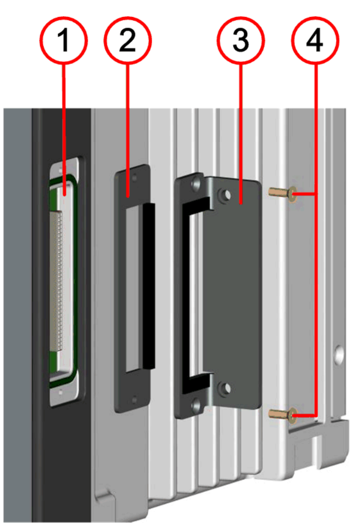
When expanding a device with the 2nd device row, you must install the connecting cable for the 2nd device row with the corresponding angle rail. All required components are included in the scope of delivery of a power-supply module PS203.



[dw_kabel1-020414-01, 1, --_--]

Figure 3-7 Connecting Cable for the Connection of a 2nd Device Row

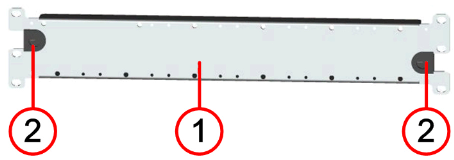
(1) Handle mold for the connection to the 1st device row
(2) Handle mold for the connection to the 2nd device row



[dw_winkel-020414-01, 1, --_--]

Figure 3-8 Sealing Plate and Adaptor Bracket for the Expansion Module of the 1st Device Row

(1) Device bus of the outermost right expansion module of the 1st device row
(2) Sealing plate
(3) Adaptor angle
(4) 2 fastening screws



[dw_schiene-020414-01, 1, --_--]

Figure 3-9 Angle Rail

(1) Angle rail
(2) 2 rubber seals

3.1.4 Power-Supply Module PS204 for Redundant Power Supply

3.1.4.1 Description

If you want to equip a SIPROTEC 5 device with a redundant power supply, you need the power-supply module PS204. For devices with a 2nd row, a 2nd PS204 module is necessary additionally to the PS203 module.

The power-supply module PS204 has no additional functionality. It functions exclusively as a redundant power supply in the device and is only active if the main power supply or its auxiliary voltage supply fails.

The rated-voltage variant of the power-supply module PS204 must always match the power-supply module PS201 of the base module.

Device Prerequisites for Redundancy

- The base module must be device version **C** or later. You can find the device version on the name plate (see the figure in the chapter *6.16 Modular Device Name Plate*). For older devices (older than release status **C**), it is not possible to achieve redundancy by retrofitting a PS204.
- The firmware and configuration of the device must be version V7.82 or higher.

NOTE

The CB202 PCB assembly is not supported by the redundant power supply. If the power supply of the CB202 fails, a PS204 in the device does not function as a redundant power supply. The device goes into fallback mode.

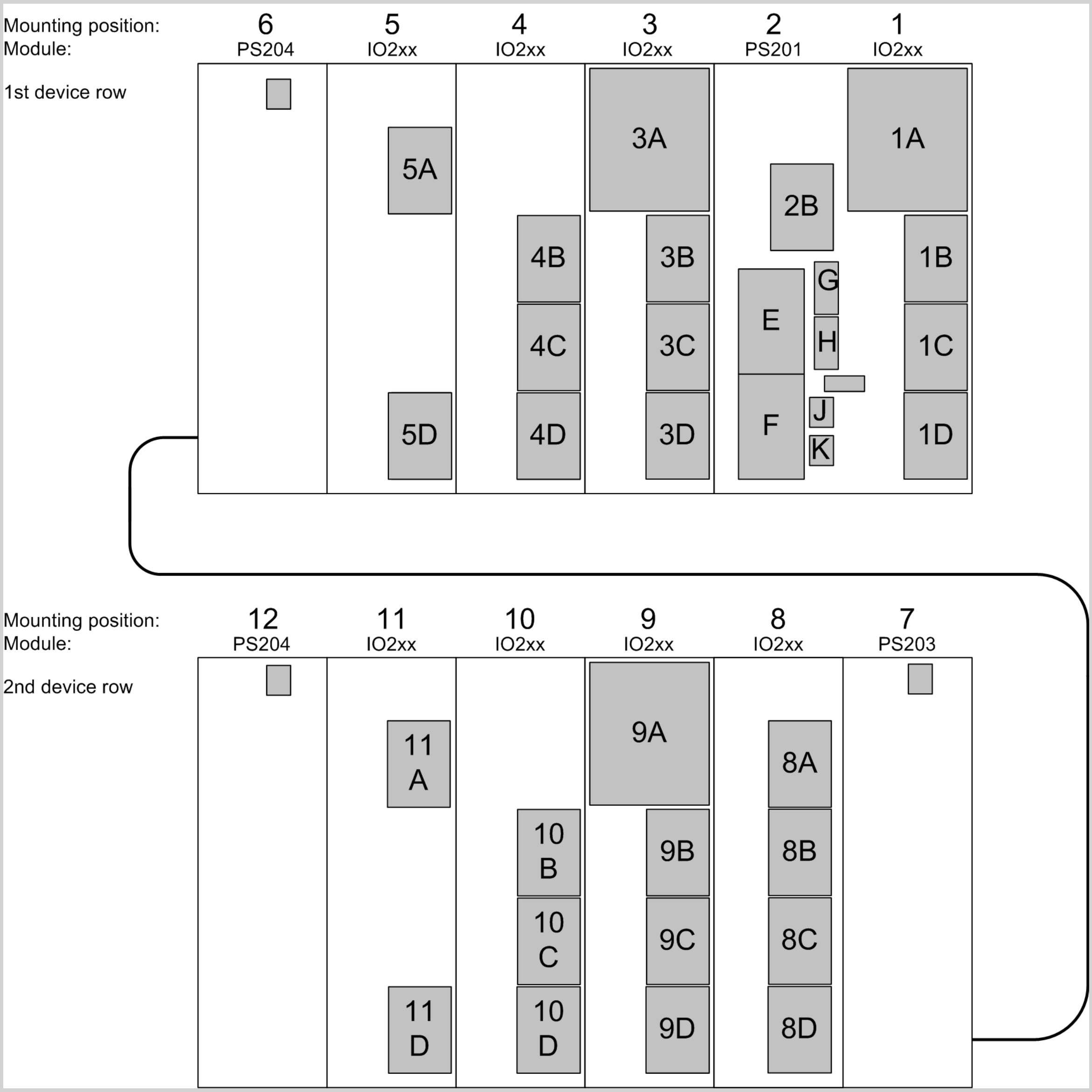
3.1.4.2 Positioning Specifications

The power-supply module PS204 is always provided as part of the expansion module and must always be mounted on the very right position (front view) in the corresponding row, for example, at position 3 for a 1/2 device.

Example Installation of the PS204 in a 2-Row Device with Complete Configuration

- 1st device row:
  - Mounting position 1: IO2xx
  - Mounting position 2: PS201
  - Mounting positions 3 to 5: IO2xx
  - Mounting position 6: PS204

- 2nd device row:
  - Mounting position 7: PS203
  - Mounting positions 8 to 11: IO2xx
  - Mounting position 12: PS204



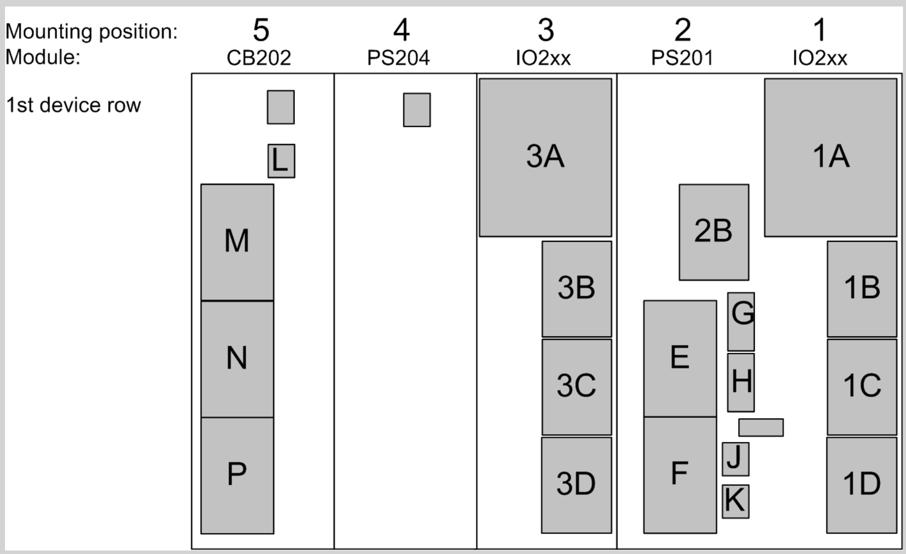
[dw_module_position_PS204, 1, en_US]

Figure 3-10 Arrangement of Modules with 2 PS204 Modules – Rear View

There is an exception if a CB202 PCB assembly with integrated power supply is to be used: The CB202 PCB assembly with integrated power supply must always be positioned to the right (front view) of the PS204 module in the 1st or 2nd row.

Example Installation of the PS204 with a CB202 in a 1-Row Device with 5/6 Configuration

- 1st device row:
  - Mounting position 1: IO2xx
  - Mounting position 2: PS201
  - Mounting position 3: IO2xx
  - Mounting position 4: PS204
  - Mounting position 5: CB202

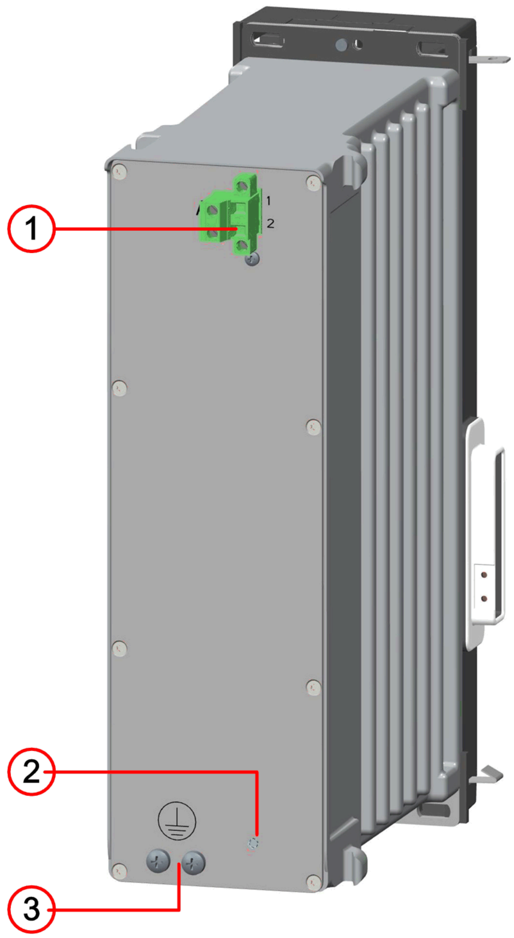


[dw_module_position_PS204_w_CB202, 1, en_US]

Figure 3-11 Arrangement of Modules with PS204 Module and a CB202 – Rear View

3.1.4.3 Terminals

Overview of Terminals

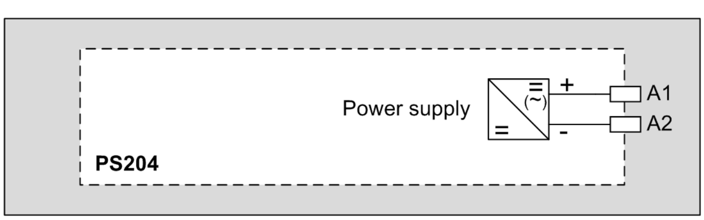


[le_ps204, 1, --_--]

Figure 3-12 PS204 – Terminals

(1) 2-pole terminal to connect power supply
(2) LED: Power On
(3) Protective grounding terminal

Connection Diagram



[tdps204x, 1, en_US]

Figure 3-13 PS204 – Connection Diagram

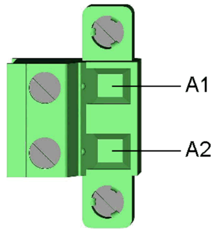


Figure 3-14 Connection of External Power Supply

3.1.5 Plug-In Module Assembly with Integrated Power Supply CB202

3.1.5.1 Description

The plug-in module assembly CB202 is a PCB assembly with an internal power supply. The plug-in module assembly CB202 is used in an expansion module. 3 plug-in module positions (M, N and P) are available for installation of plug-in modules. The plug-in modules can be installed in the following arrangements:

	Plug-In Module Position		
	M	N	P
Configured with 3 measuring-transducer modules	Measuring-transducer module	Measuring-transducer module	Measuring-transducer module
Configured with 2 measuring-transducer modules and 1 communication module	Measuring-transducer module	Measuring-transducer module	Communication module
	Measuring-transducer module	Communication module	Measuring-transducer module
Configured with 1 measuring-transducer module and 2 communication modules	Measuring-transducer module	Communication module	Communication module

Combinations that do not occupy all plug-in module positions are also possible.

NOTE

A communication module cannot be plugged into the plug-in module position M.

The CB202 plug-in module assembly communicates with the base module using a communication connection. This communication connection is established with a special connecting cable. This connecting cable (CAT5 FTP patch cable) is always included in the scope of delivery of the CB202 plug-in module assembly and need not be ordered separately.

The following 2 variants are available for the rated voltage range:

- DC 24 V to 48 V
- DC 60 V to 250 V and AC 100 V to 230 V (50 Hz and 60 Hz)

The CB202 plug-in module assembly can be used in the 1st and 2nd device rows.

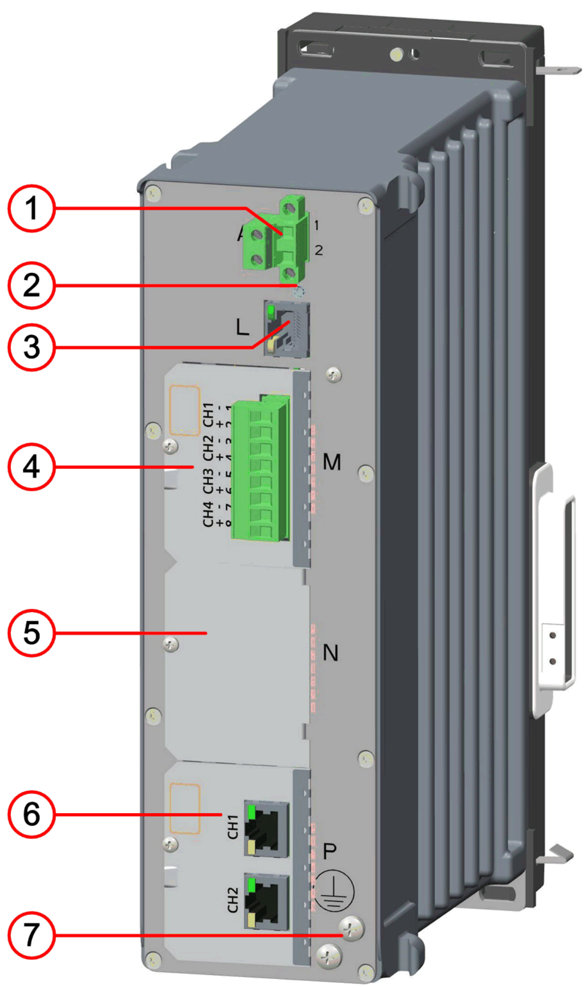
LEDs of the RJ45 Terminals

The light-emitting diodes (LEDs) signal the operating state of the communication connection. The operating states are explained in the following table.

COM Link (RJ45)	Signal	Color	Operating State
LED 1	CL2_LED0_N	Yellow	Flashes when a communication module is inserted in plug-in module position P.
LED 2	CL3_LED0_N	Green	Flashes when a communication module is inserted in plug-in module position N.

3.1.5.2 Terminals

Overview of Terminals



[le_cb202, 1, --_--]

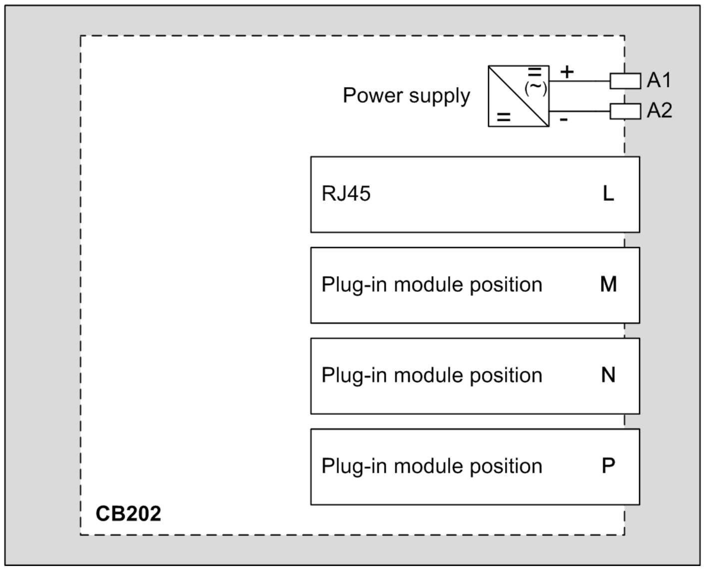
Figure 3-15 CB202 – Terminals

(1) 2-pole terminal to connect power supply
(2) LED: Power On
(3) COM link
(4) Plug-in module position M (for measuring-transducer modules only – equipped in this example with an ANAI module)
(5) Plug-in module position N (for measuring-transducer or communication modules)
(6) Plug-in module position P (for measuring-transducer or communication modules – equipped in this example with an ETH-BA-2EL module)
(7) Protective grounding terminals

The Ethernet connection to the base module is established at the COM link terminal.

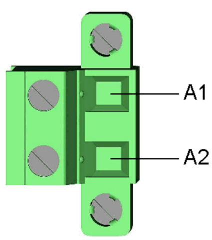
The 2-pole voltage terminal is used for the external power supply (see *Figure 3-17*).

Connection Diagram



[tdcb202x-100713-01.tif, 2, en_US]

Figure 3-16 CB202 – Connection Diagram



[dwkl2pol-030211-01.tif, 1, --_--]

Figure 3-17 Connection of External Power Supply

3.2 Input and Output Modules of the Modular Devices

3.2.1 Function Description of the Input and Output Modules of the Modular Devices

Module Designation	Function Description
IO201	• Input and output module • 4 current measuring inputs, 8 binary inputs, 6 binary outputs
IO202	• Input and output module • 4 current measuring inputs, 4 voltage measuring inputs, 8 binary inputs, 6 binary outputs
IO203	• Input and output module • 8 current measuring inputs, 4 binary inputs, 4 binary outputs
IO204	• Input and output module • 10 binary inputs, 4 binary outputs, 4 power relays for controlling 2 motors
IO205	• Input and output module • 12 binary inputs, 16 binary outputs
IO206	• Input and output module • 6 binary inputs, 7 binary outputs
IO207	• Input and output module • 16 binary inputs, 8 binary outputs
IO208	• Input and output module • 4 current measuring inputs, 4 voltage measuring inputs, 4 binary inputs, 11 binary outputs
IO209	• Input and output module • 8 binary inputs, 4 high-speed binary outputs (semiconductor accelerated)
IO210	• Input and output module • 4 current measuring inputs, 3 voltage measuring inputs, 4 high-speed measuring-transducer inputs for current or voltage, 7 binary outputs
IO211	• Input and output module • 8 voltage inputs, 8 binary inputs
IO212	• Input and output module • 8 high-speed measuring-transducer inputs for current or voltage, 8 binary inputs
IO214	• Input and output module • 4 current measuring inputs, 4 voltage measuring inputs, 2 binary inputs, 5 binary outputs
IO215	• Input and output module • 4 current measuring inputs, 4 voltage measuring inputs (measuring range: 7.07 V), 8 binary inputs, 6 binary outputs
IO216	• Input module • 16 special binary inputs with maximized robustness against electrical disturbances and failures

Module Designation	Function Description
IO218	• Input and output module • 3 direct-voltage analog inputs 300 V • 3 fast 0-mA to 20-mA analog inputs • 4 standard 0-mA to 20-mA analog inputs • 1 x 24-V auxiliary-voltage output for external instrument transformers • 1 RTD temperature input
IO230	• Input module • 48 binary inputs
IO231	• Input and output module • 24 binary inputs • 24 binary outputs
IO232	• Input and output module • 24 binary inputs • 15 binary outputs
IO233	• Input module with special version for binary inputs. For more information, refer to *6 Technical Data*. • 48 binary inputs
IO240	• Input module • 4 current measuring inputs (GIS LPIT Rogowski coil or LPCT) • 4 voltage measuring inputs (GIS LPIT volt. or LPVT) • 4 temperature inputs (PT100)
IO245	• LPIT Input Module IO245 • 3 fiber-optic current inputs for measuring channels • 3 fiber-optic current inputs for protection channels • 3 fiber-optic temperature measuring channels • 3 voltage inputs (LPIT, RC voltage divider)[1]

3.2.2 Input and Output Module IO201

3.2.2.1 Description

The terminals for the following are located on the input and output module IO201:

- 4 current transformers (optionally protection-class current transformers or instrument transformers)
- 8 binary inputs
- 6 binary outputs, of which:
  - 4 high-speed make contacts (type F)
  - 2 high-speed change-over contacts (type F)

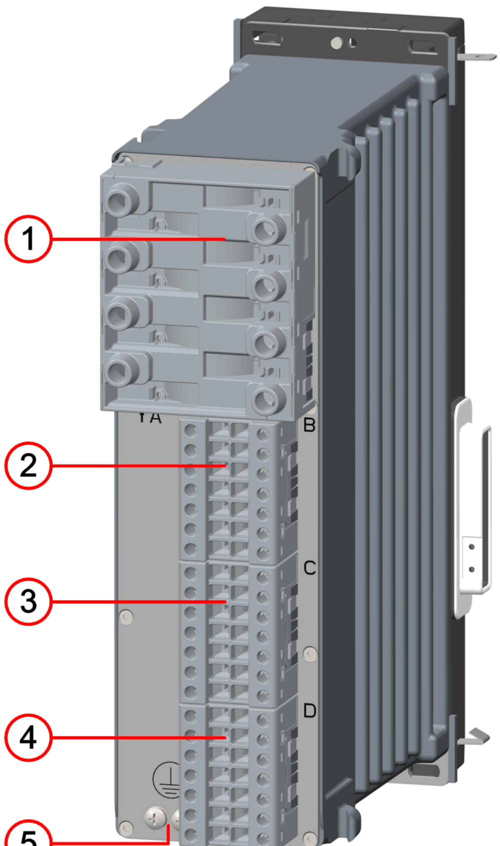
The connections are distributed over:

- 1 x 8-pole current terminal
- 3 x 14-pole voltage terminal

1 Under preparation

3.2.2.2 Terminals

Overview of Terminals



[le_io201, 2, --_--]

Figure 3-18 IO201 – Terminals

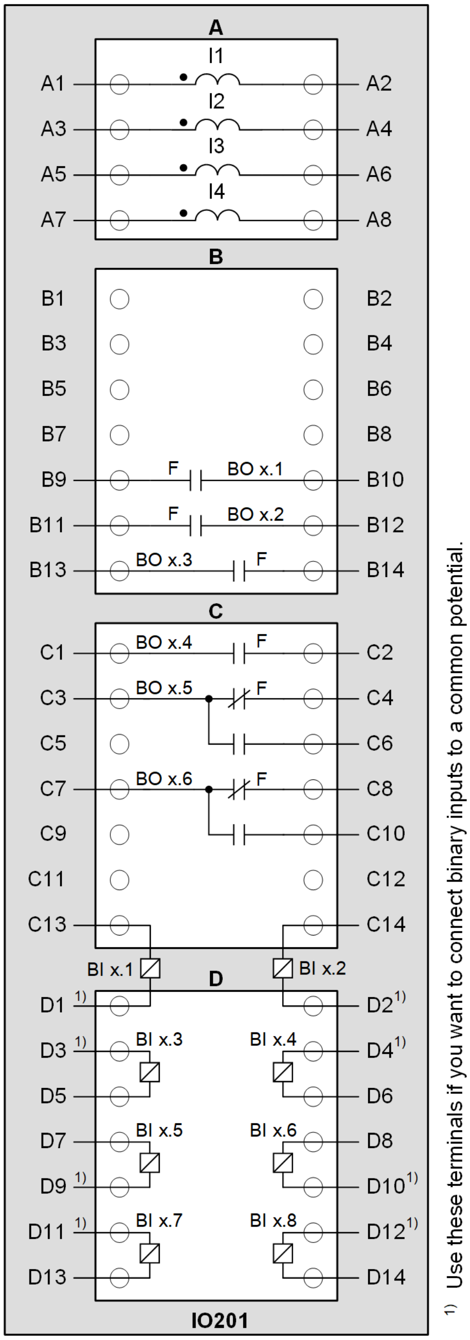
(1)	Current terminal xA
(2)	Voltage terminal xB
(3)	Voltage terminal xC
(4)	Voltage terminal xD
(5)	Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

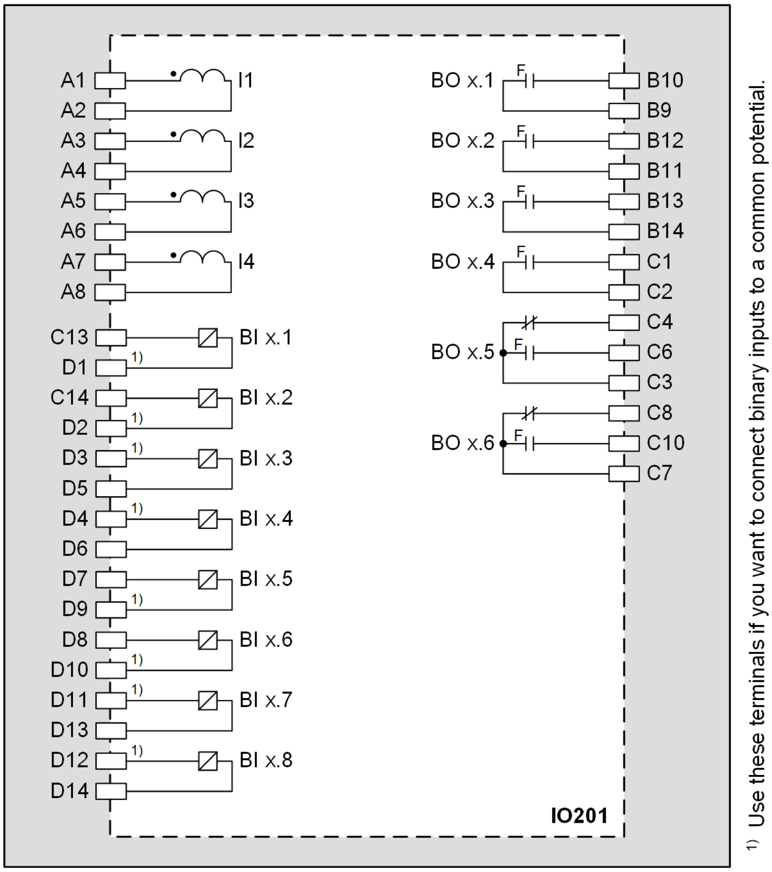
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio201x-290812-01.tif, 2, en_US]

Figure 3-19 IO201 – Terminal Diagram



[tdio201x-290812-01.tif, 2, en_US]

Figure 3-20 IO201 – Connection Diagram

3.2.3 Input and Output Module IO202

3.2.3.1 Description

The terminals for the following are located on the input and output module IO202:

- 4 current transformers (optionally protection-class current transformers or instrument transformers)
- 4 voltage transformers
- 8 binary inputs
- 6 binary outputs, of which:
  - 4 high-speed make contacts (type F)
  - 2 high-speed change-over contacts (type F)

The connections are distributed over:

- 1 x 8-pole current terminal
- 3 x 14-pole voltage terminal

3.2.3.2 Terminals

Overview of Terminals

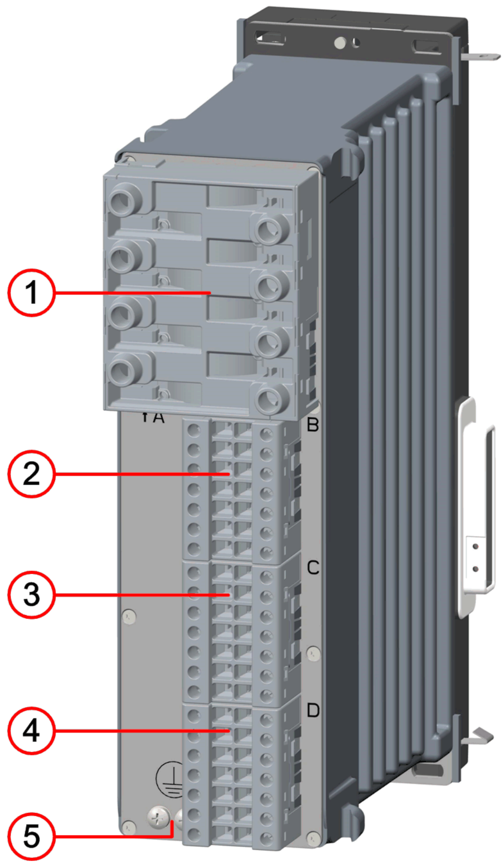


Figure 3-21 IO202 – Terminals

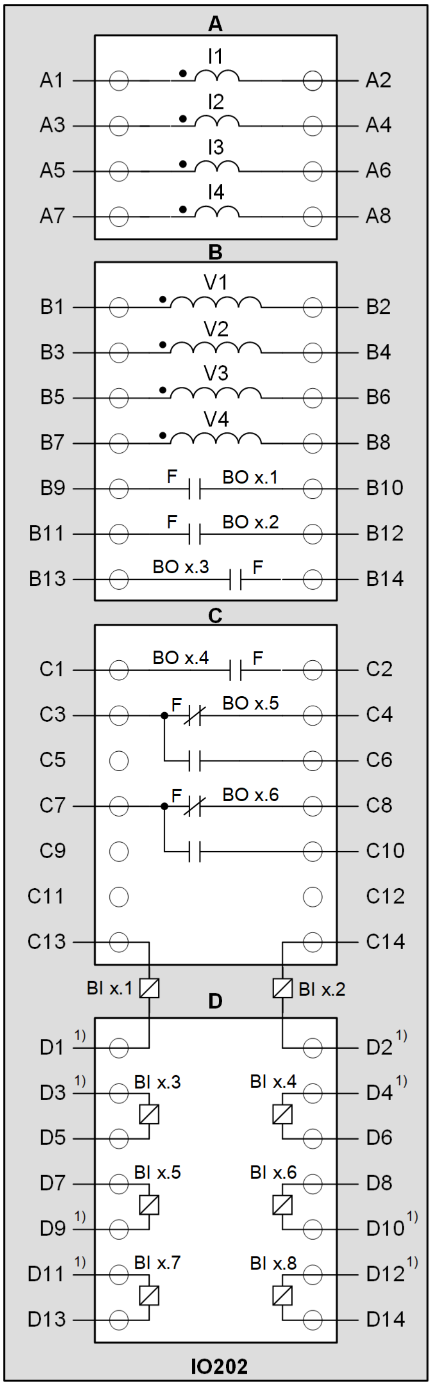
(1)	Current terminal xA
(2)	Voltage terminal xB
(3)	Voltage terminal xC
(4)	Voltage terminal xD
(5)	Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

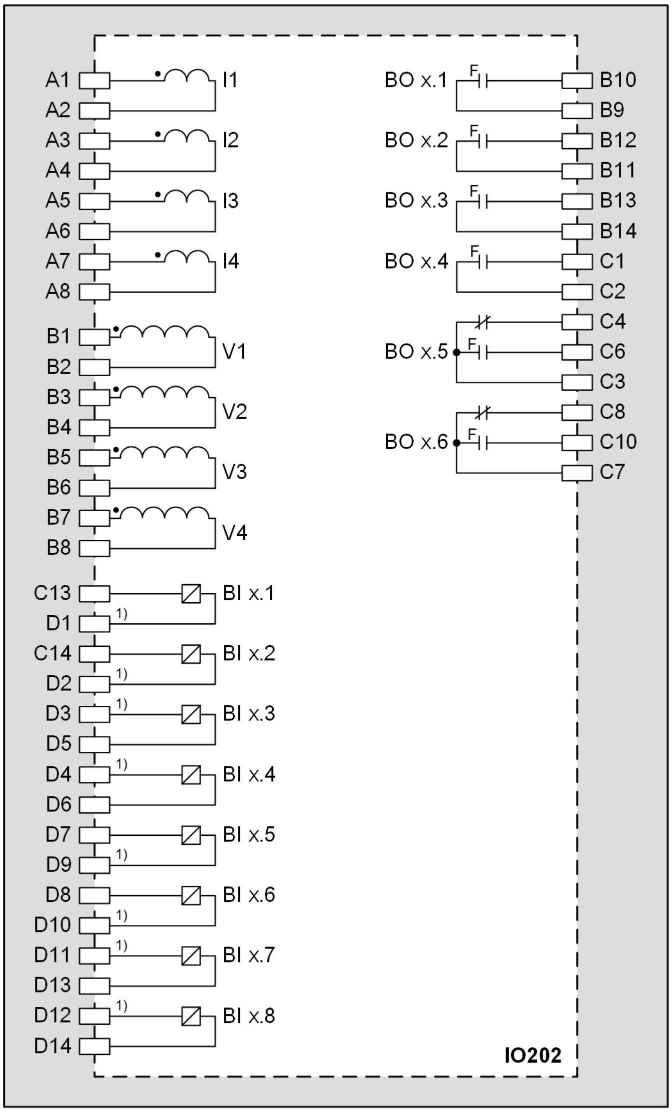
For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



1) Use these terminals if you want to connect binary inputs to a common potential.

[cdio202x-300812-01.tif, 2, en_US]

Figure 3-22 IO202 – Terminal Diagram



1) Use these terminals if you want to connect binary inputs to a common potential.

[tdio202x-240812-01.tif, 2, en_US]

Figure 3-23 IO202 – Connection Diagram

3.2.4 Input and Output Module IO203

3.2.4.1 Description

The terminals for the following are located on the input and output module IO203:

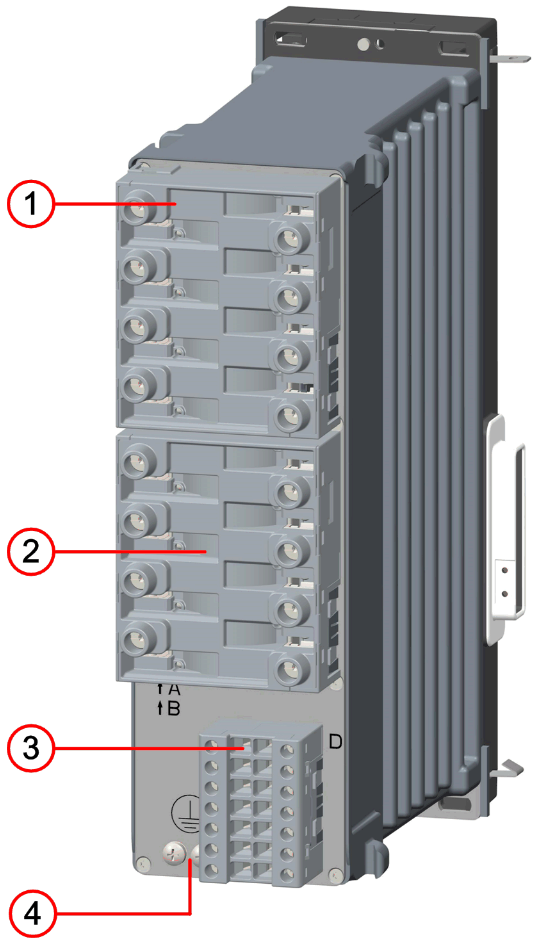
- 8 current transformers (optionally protection-class current transformers or instrument transformers)
- 4 binary inputs (2 binary inputs each with common connection)
- 4 binary outputs with 4 high-speed make contacts (type F)

The connections are distributed over:

- 2 x 8-pole current terminal
- 1 x 14-pole voltage terminal

3.2.4.2 Terminals

Overview of Terminals



[le_io203, 1, --_--]

Figure 3-24 IO203 – Terminals

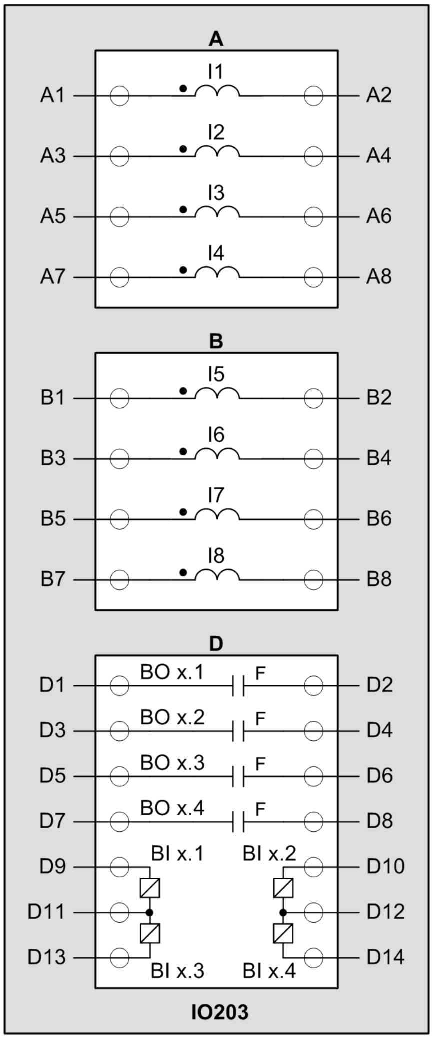
(1) Current terminal xA
(2) Current terminal xB
(3) Voltage terminal xD
(4) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

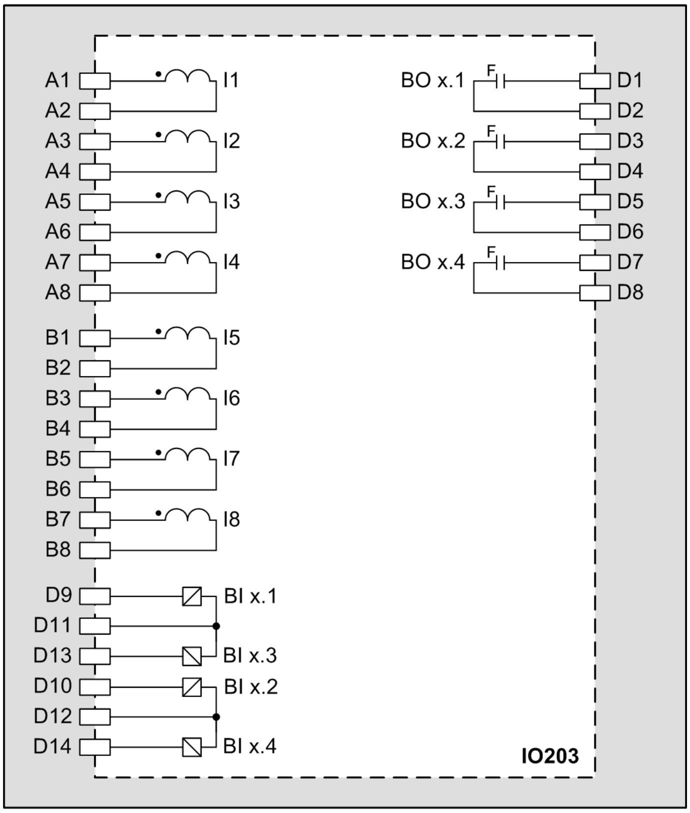
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio203x-280812-01.tif, 1, en_US]

Figure 3-25 IO203 – Terminal Diagram



[tdio203x-110313-01.tif, 1, en_US]

Figure 3-26 IO203 – Connection Diagram

3.2.5 Input and Output Module IO204

3.2.5.1 Description

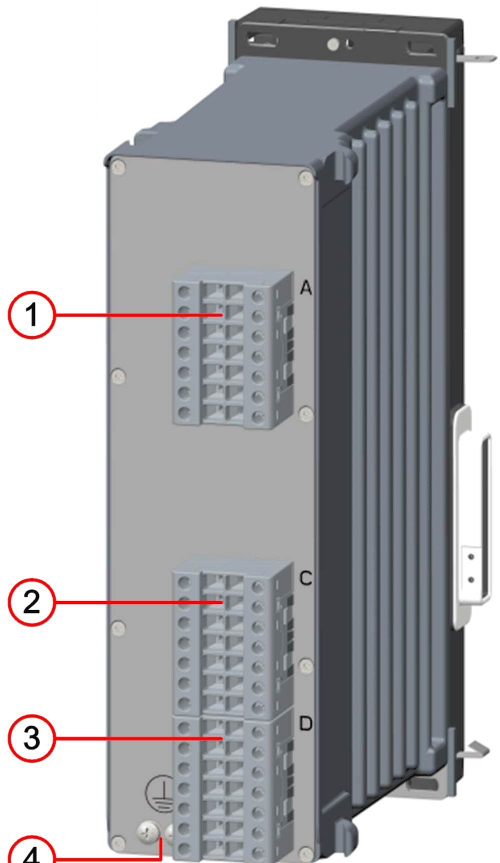
The terminals for the following are located on the input and output module IO204:

- 10 binary inputs
- 4 binary outputs with 4 standard make contacts (type S)
- 4 power relays for controlling 2 motors (forward/backward) with a common auxiliary voltage supply V_{aux}+, V_{aux}-
  The power relays operate in interlocked mode, that is, only one relay of each switching pair picks up at a time thereby avoiding a power-supply short circuit. Note the polarity specified in the terminal and connection diagram.

The connections are distributed over three 14-pole voltage terminals.

3.2.5.2 Terminals

Overview of Terminals



[le_io204, 2, --_--]

Figure 3-27 IO204 – Terminals

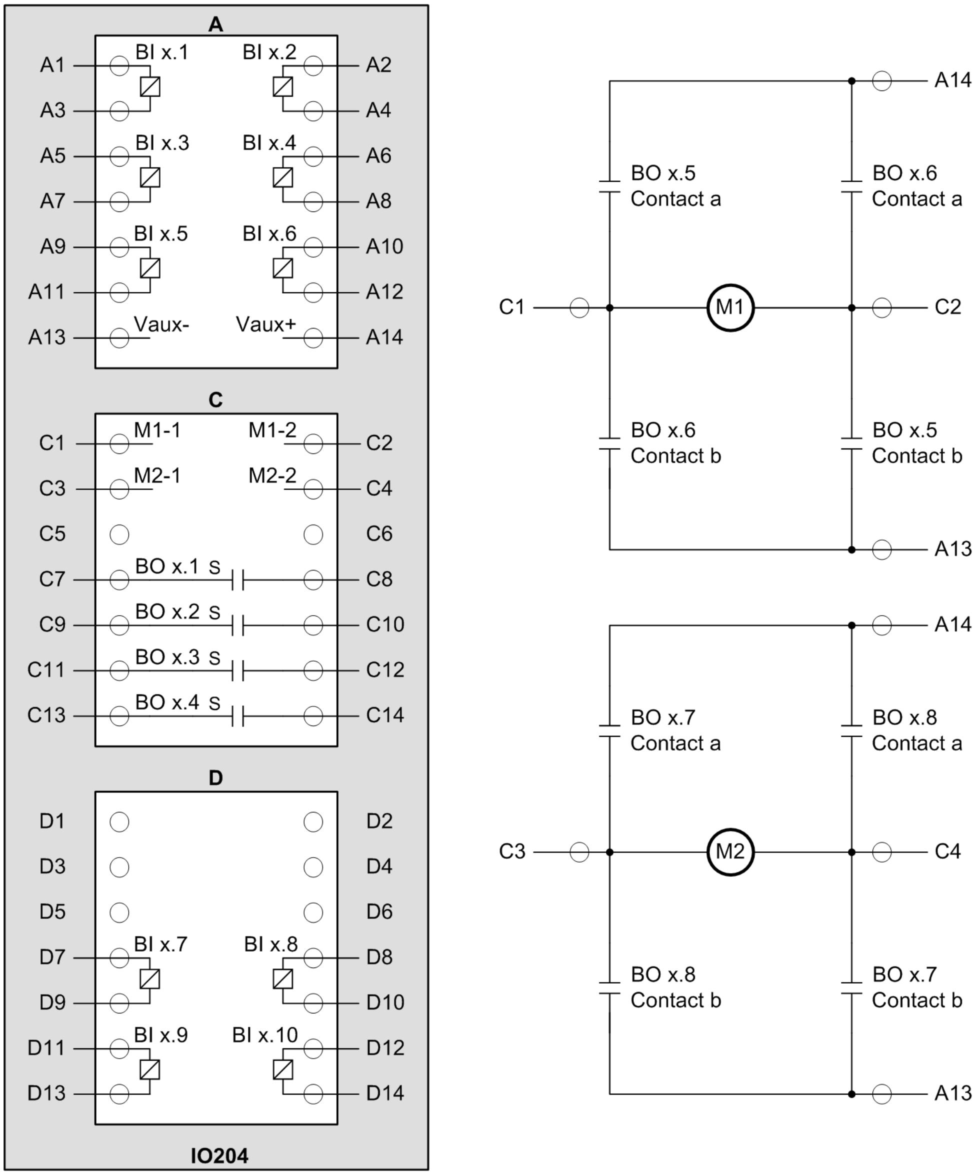
(1)	Voltage terminal xA
(2)	Voltage terminal xC
(3)	Voltage terminal xD
(4)	Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

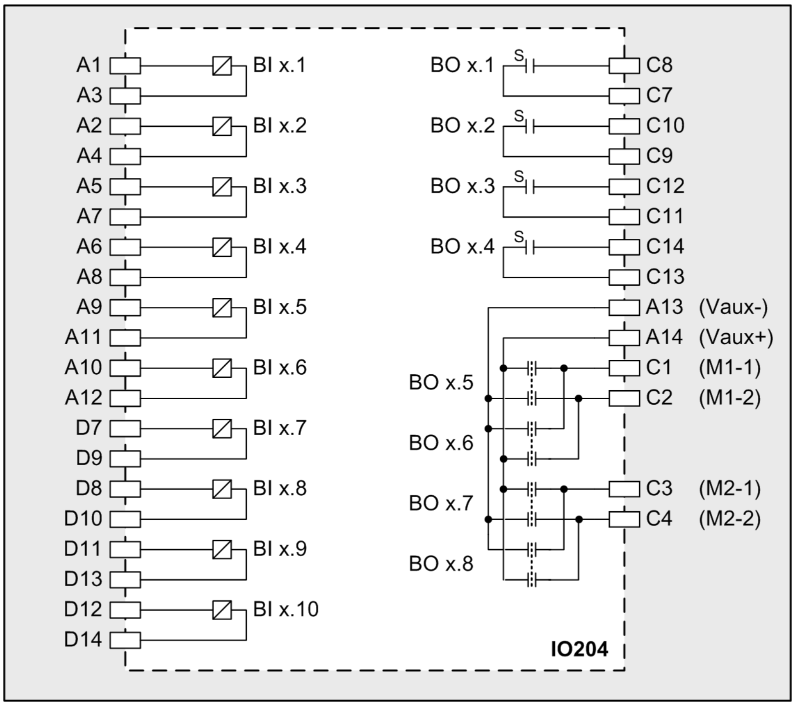
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio204x-201112-01.tif, 1, en_US]

Figure 3-28 IO204 – Terminal Diagram



[tdio204x-201112-01.tif, 1, en_US]

Figure 3-29 IO204 – Connection Diagram

3.2.6 Input and Output Module IO205

3.2.6.1 Description

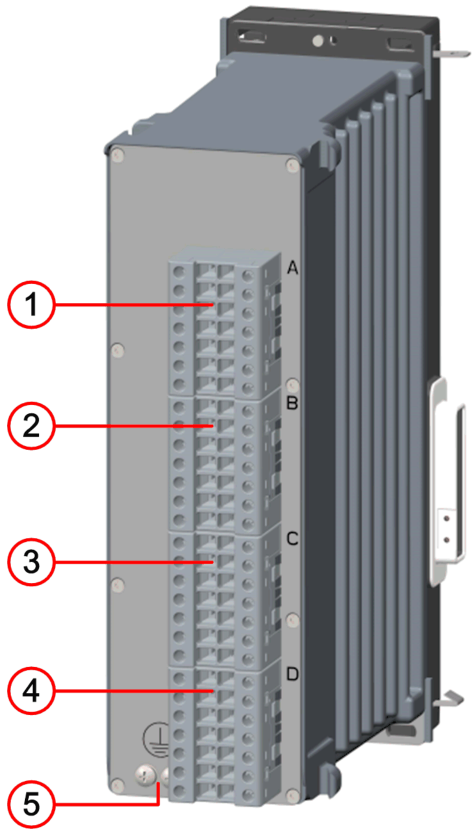
The terminals for the following are located on the input and output module IO205:

- 12 binary inputs
- 16 binary outputs with 16 standard make contacts (type S)

The connections are distributed over four 14-pole voltage terminals.

3.2.6.2 Terminals

Overview of Terminals



[dwio205p-030211-01.tif, 2, --_--]

Figure 3-30 IO205 – Terminals

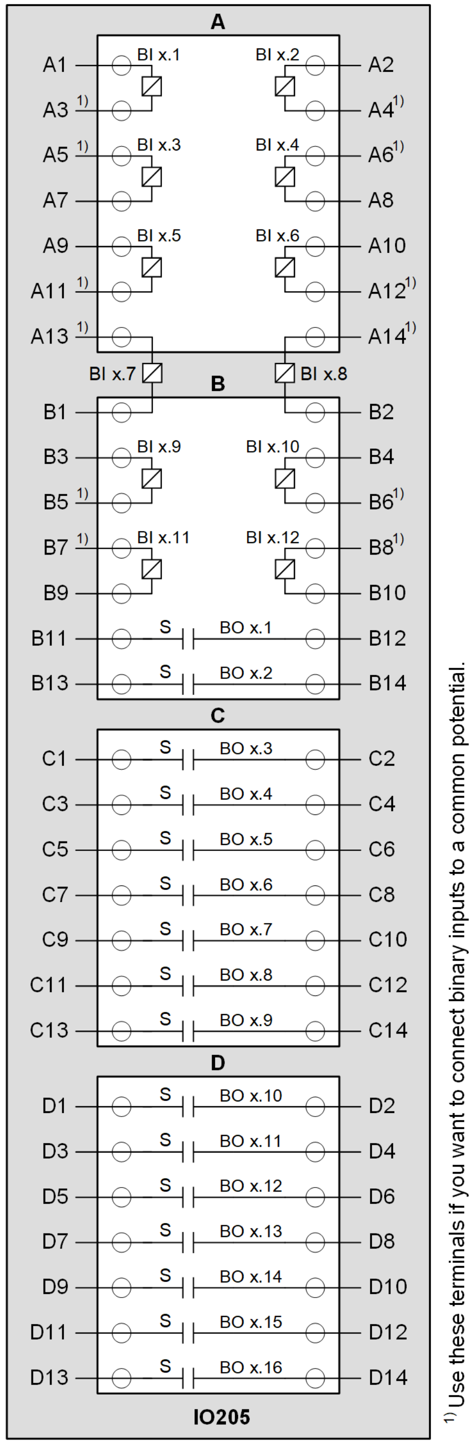
(1) Voltage terminal xA
(2) Voltage terminal xB
(3) Voltage terminal xC
(4) Voltage terminal xD
(5) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

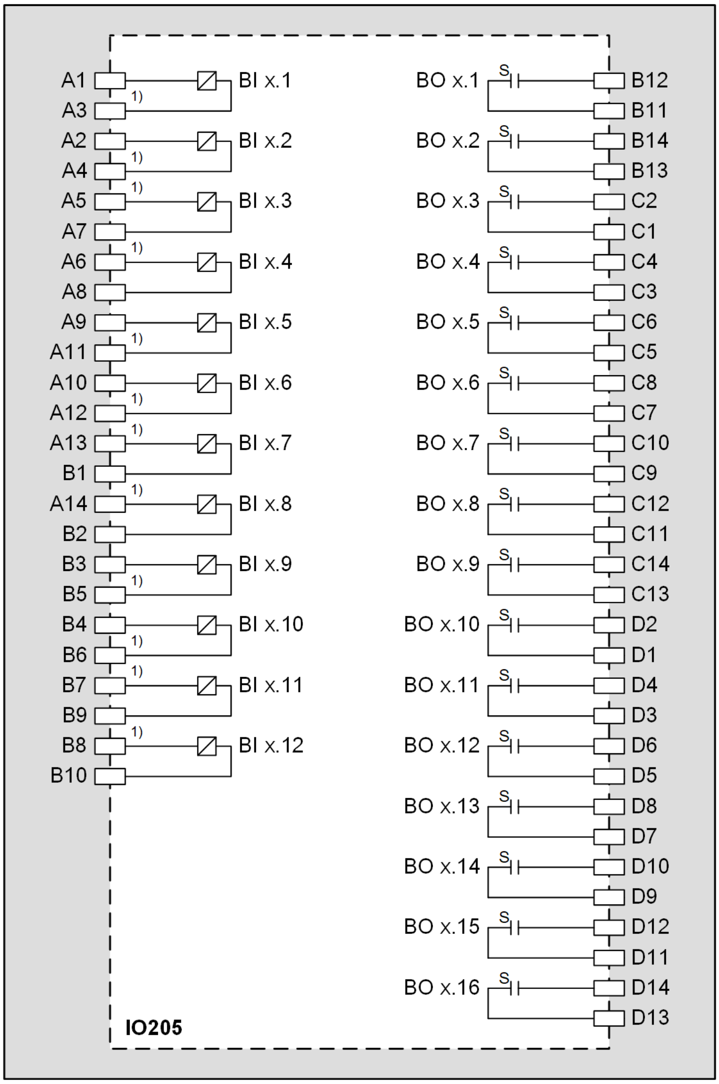
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio205x-260213-01.tif, 2, en_US]

Figure 3-31 IO205 – Terminal Diagram



1) Use these terminals if you want to connect binary inputs to a common potential.

[tdio205x-240812-01.tif, 2, en_US]

Figure 3-32 IO205 – Connection Diagram

3.2.7 Input and Output Module IO206

3.2.7.1 Description

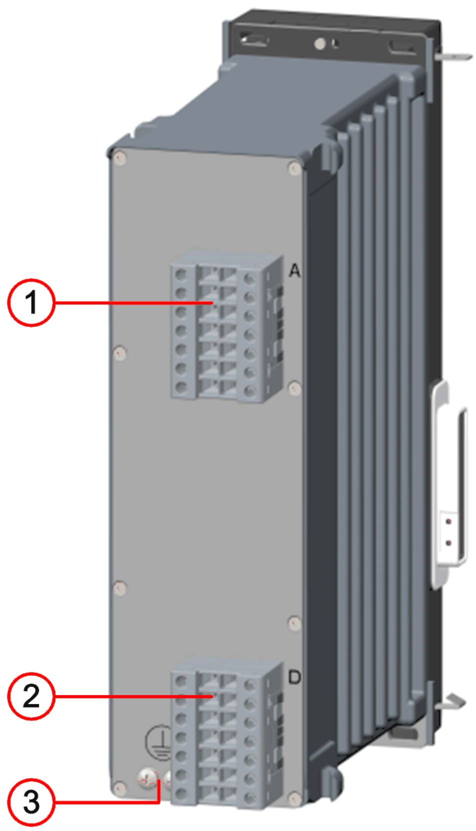
The terminals for the following are located on the input and output module IO206:

- 6 binary inputs
- 7 binary outputs with 7 standard make contacts (type S)

The connections are distributed over two 14-pole voltage terminals.

3.2.7.2 Terminals

Overview of Terminals



[dwio206p-030211-01.tif, 2, --_--]

Figure 3-33 IO206 – Terminals

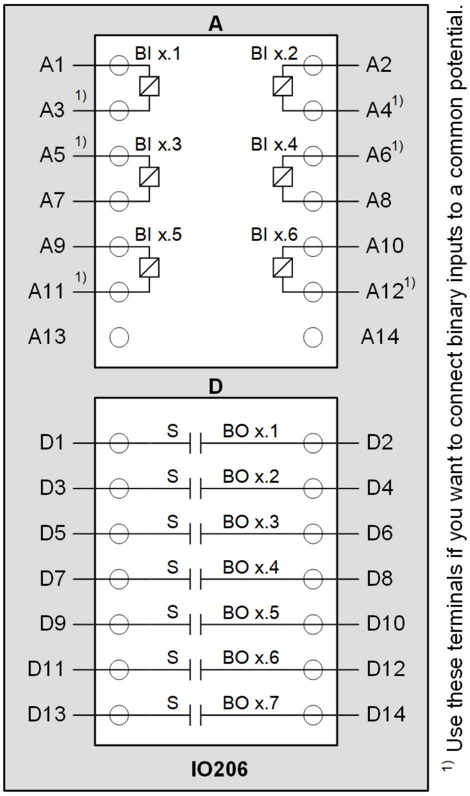
(1) Voltage terminal xA
(2) Voltage terminal xD
(3) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

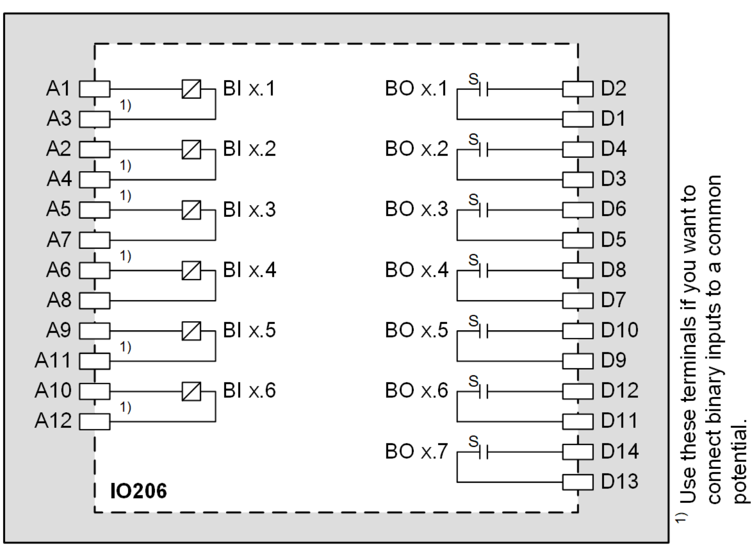
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio206x-280812-01.tif, 2, en_US]

Figure 3-34 IO206 – Terminal Diagram



[tdio206x-050313-02.tif, 2, en_US]

Figure 3-35 IO206 – Connection Diagram

3.2.8 Input and Output Module IO207

3.2.8.1 Description

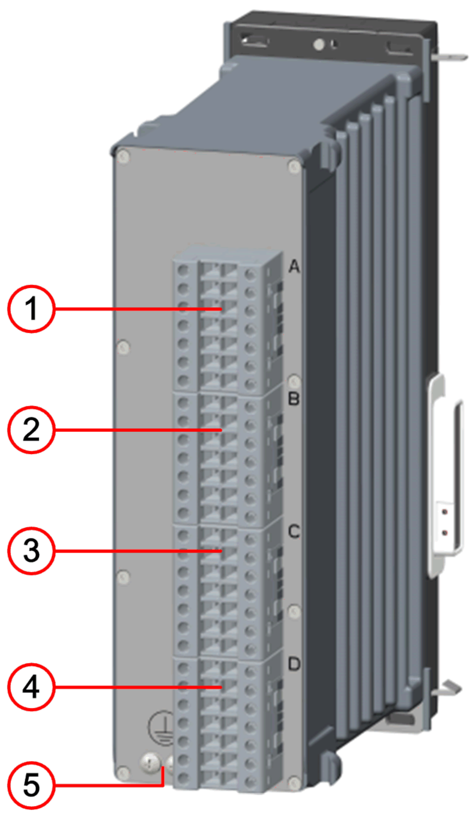
The terminals for the following are located on the input and output module IO207:

- 16 binary inputs
- 8 binary outputs with 8 standard make contacts (type S)

The connections are distributed over four 14-pole voltage terminals.

3.2.8.2 Terminals

Overview of Terminals



[dwio207p-030211-01.tif, 2, --_--]

Figure 3-36 IO207 – Terminals

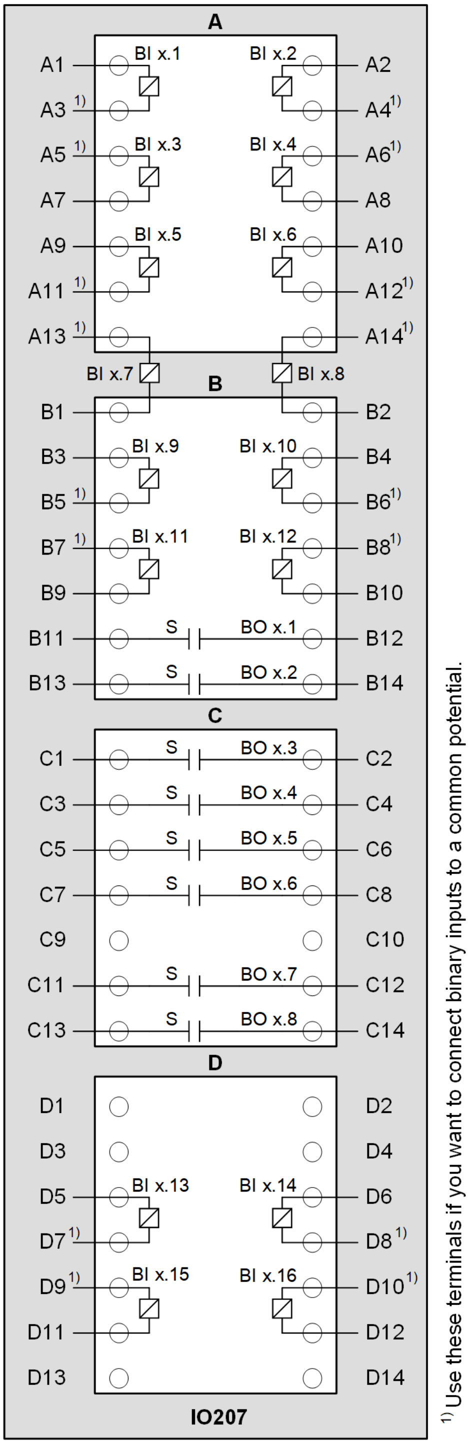
(1) Voltage terminal xA
(2) Voltage terminal xB
(3) Voltage terminal xC
(4) Voltage terminal xD
(5) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

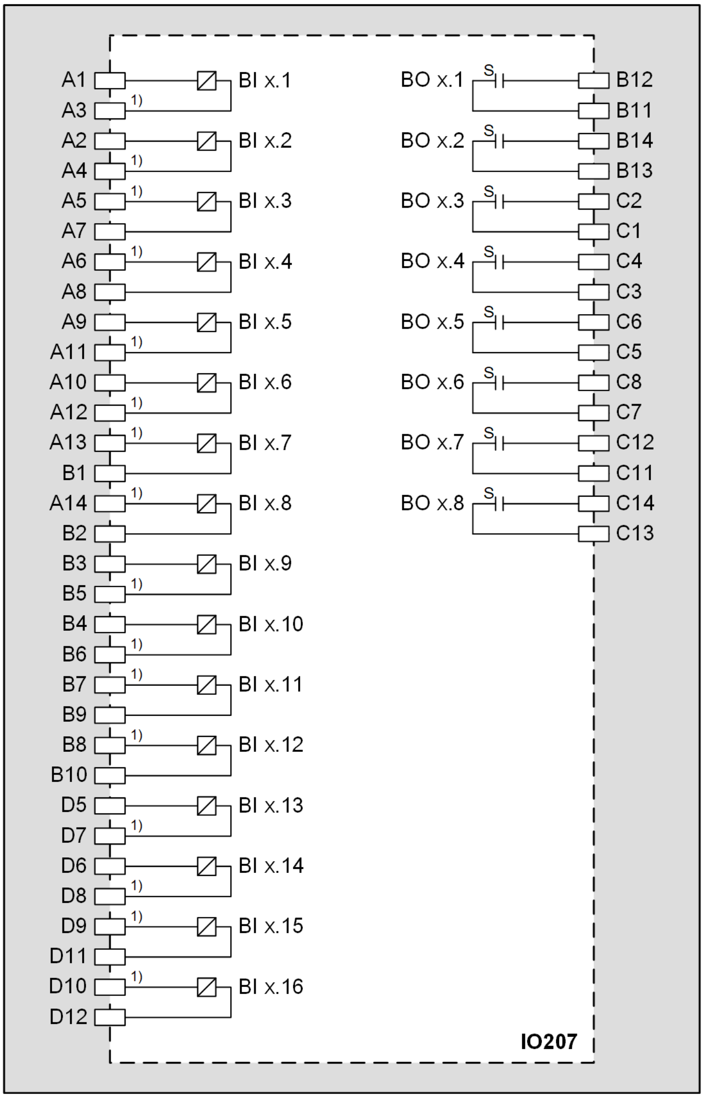
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio207x-260213-01.tif, 2, en_US]

Figure 3-37 IO207 – Terminal Diagram



1) Use these terminals if you want to connect binary inputs to a common potential.

[tdio207x-300812-01.tif, 2, en_US]

Figure 3-38 IO207 – Connection Diagram

3.2.9 Input and Output Module IO208

3.2.9.1 Description

The terminals for the following are located on the input and output module IO208:

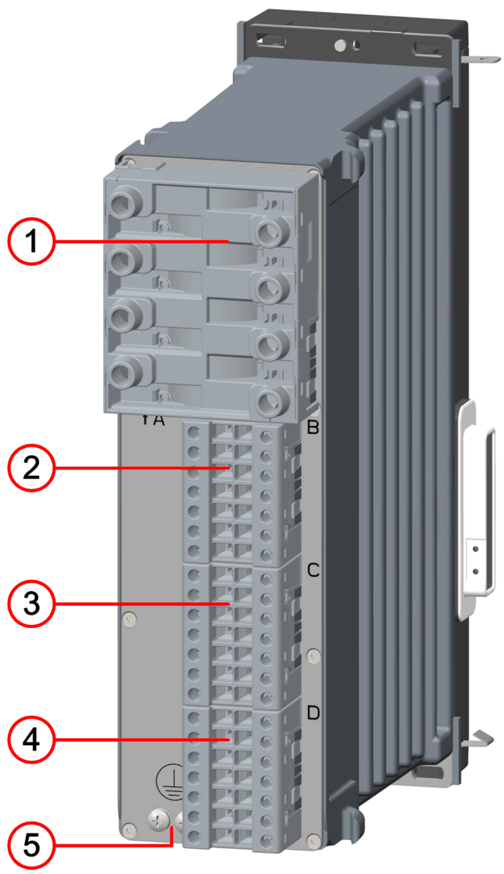
- 4 current transformers (optionally protection-class current transformers or instrument transformers)
- 4 voltage transformers
- 4 binary inputs
- 11 binary outputs with 3 standard make contacts (type S), 6 high-speed make contacts (type F), and 2 high-speed change-over contacts (type F)

The connections are distributed over:

- 1 x 8-pole current terminal block
- 3 x 14-pole voltage terminal blocks

3.2.9.2 Terminals

Overview of Terminals



[dwio208p-030211-01.tif, 2, --_--]

Figure 3-39 IO208 – Terminals

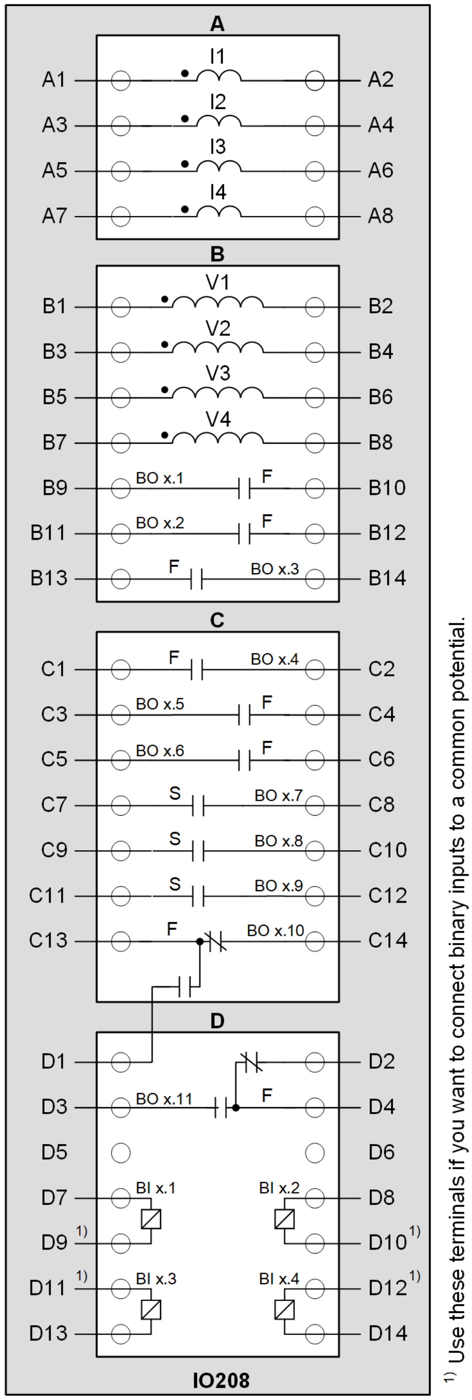
(1) Current terminal xA
(2) Voltage terminal xB
(3) Voltage terminal xC
(4) Voltage terminal xD
(5) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

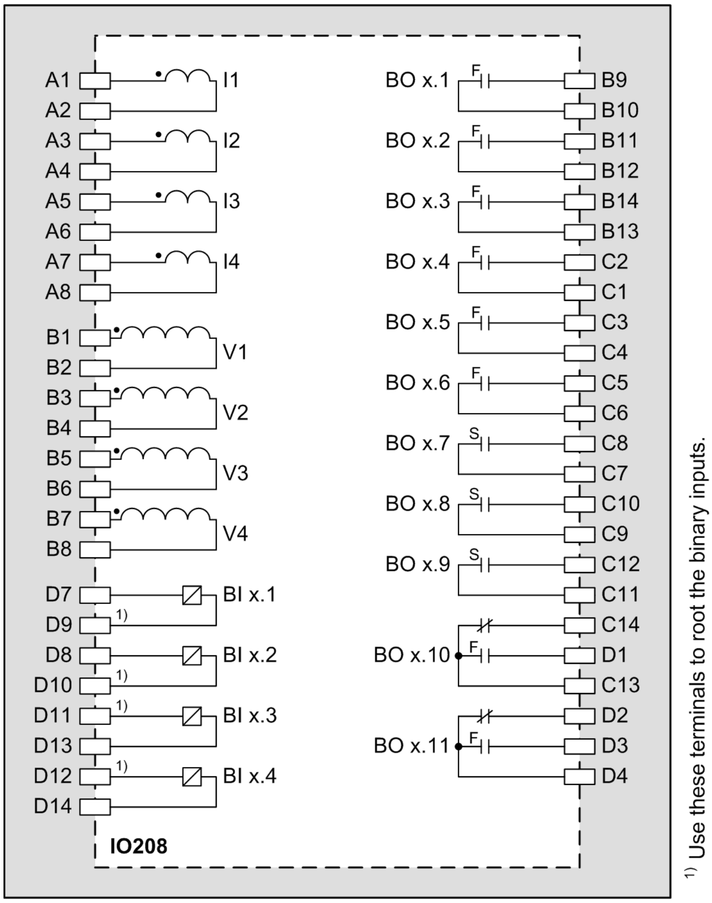
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio208x-050313-01.tif, 4, en_US]

Figure 3-40 IO208 – Terminal Diagram



[tdio208x-300812-01.tif, 1, en_US]

Figure 3-41 IO208 – Connection Diagram

3.2.10 Input and Output Module IO209

3.2.10.1 Description

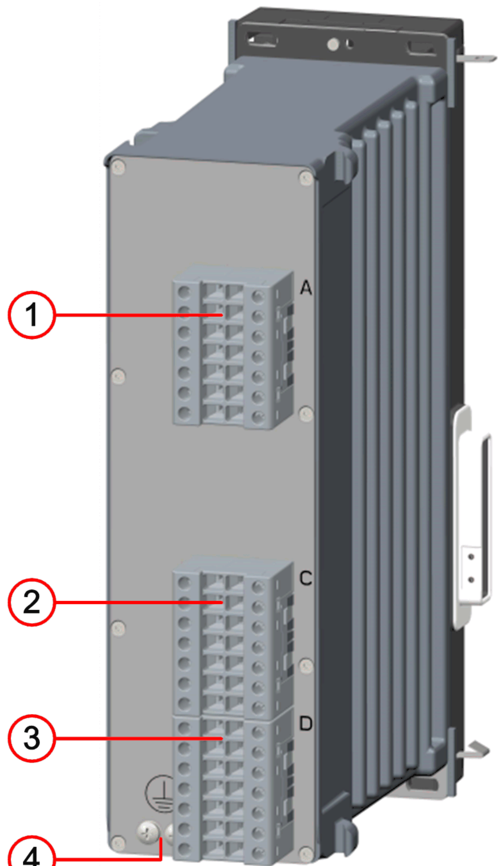
The terminals for the following are located on the input and output module IO209:

- 8 binary inputs
- 4 binary outputs with semiconductor-accelerated high-speed make contacts (type HS)

The connections are distributed over three 14-pole voltage terminals.

3.2.10.2 Terminals

Overview of Terminals



[dwio209p-030211-01.tif, 2, --_--]

Figure 3-42 IO209 – Terminals

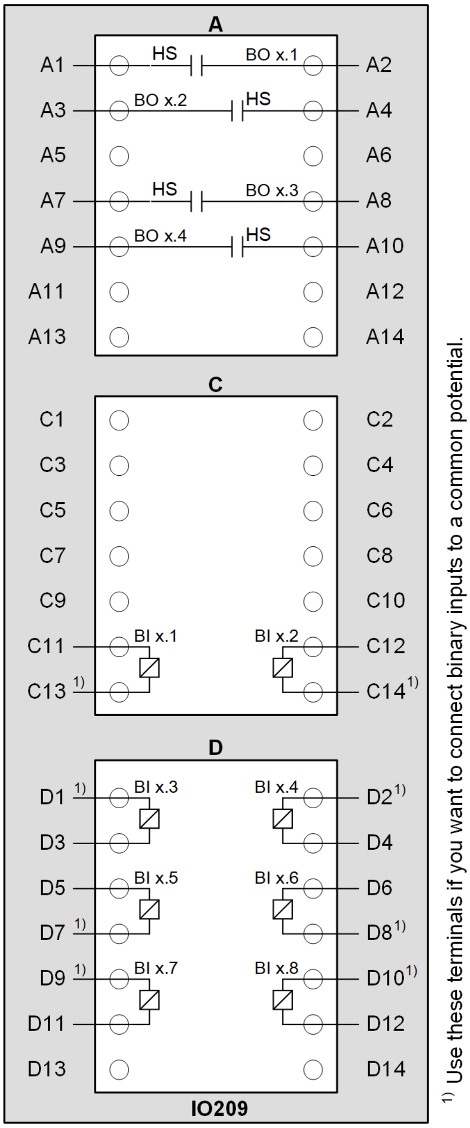
(1)	Voltage terminal xA
(2)	Voltage terminal xC
(3)	Voltage terminal xD
(4)	Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

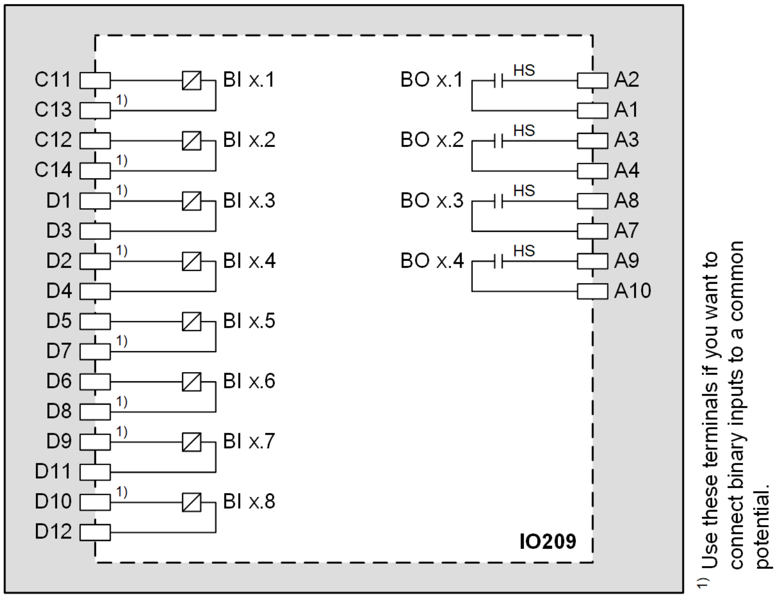
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio209x-110313-01.tif, 2, en_US]

Figure 3-43 IO209 – Terminal Diagram



[tdio209x-270812-01.tif, 2, en_US]

Figure 3-44 IO209 – Connection Diagram

3.2.11 Input and Output Module IO210

3.2.11.1 Description

The terminals for the following are located on the input and output module IO210:

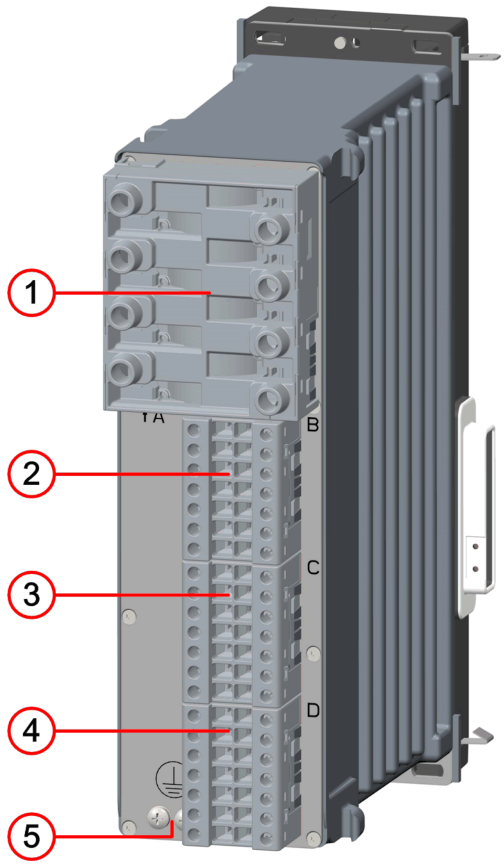
- 4 current transformers (optionally protection-class current transformers or instrument transformers)
- 3 voltage transformers
- 4 high-speed measuring transducer inputs for current (20 mA) or voltage (10 V)
- 7 binary outputs, of which:
  - 1 standard make contact (type S)
  - 4 fast make contacts (type F)
  - 2 standard change-over contacts (type S)

The connections are distributed over:

- 1 x 8-pole current terminal
- 3 x 14-pole voltage terminal

3.2.11.2 Terminals

Overview of Terminals



[le_io202, 2, --_--]

Figure 3-45 IO210 – Terminals

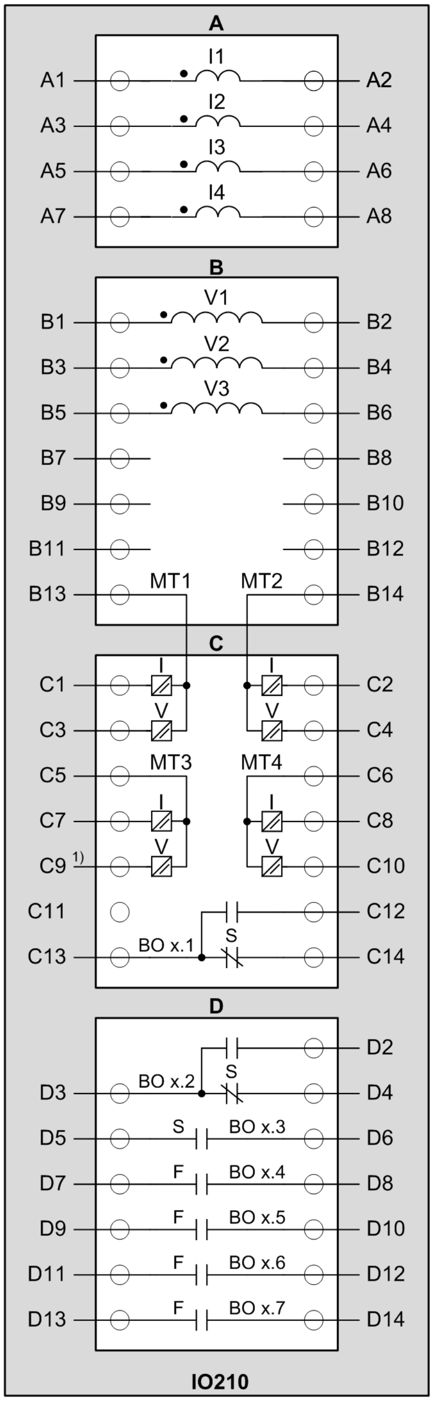
(1) Current terminal xA
(2) Voltage terminal xB
(3) Voltage terminal xC
(4) Voltage terminal xD
(5) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

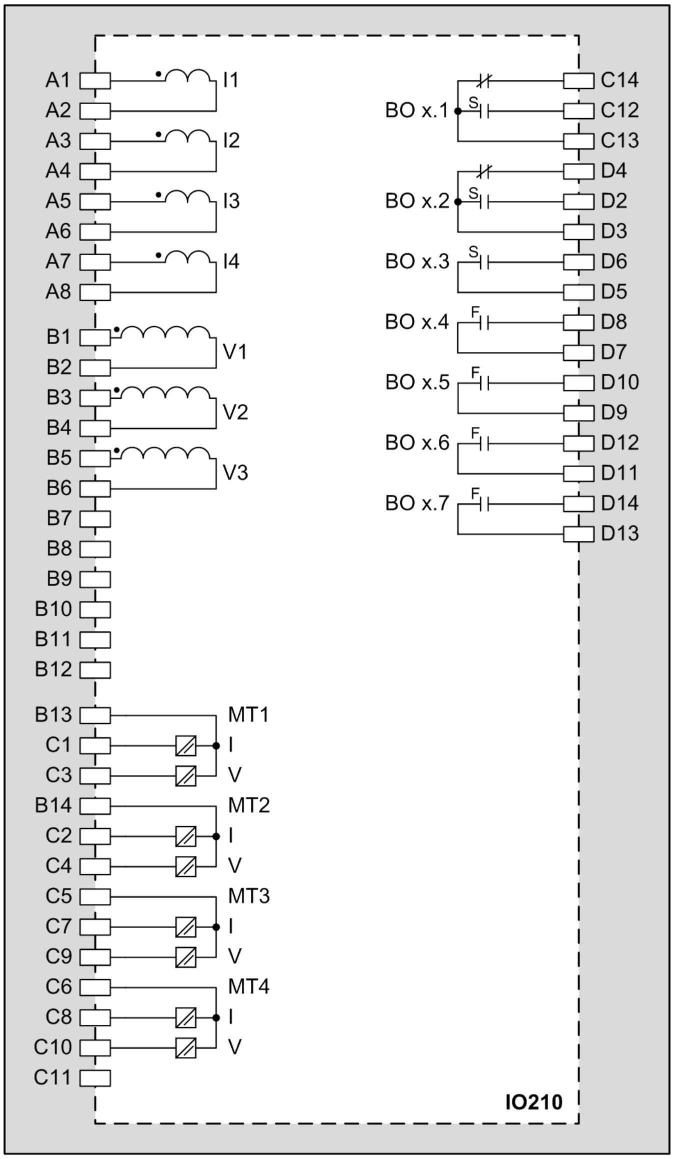
For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cd_io210, 3, en_US]

Figure 3-46 IO210 – Terminal Diagram

(1) Voltage input MT3 with higher voltage immunity (maximum continuous voltage ± 60 V)



[td_io210, 3, en_US]

Figure 3-47 IO210 – Connection Diagram

3.2.12 Input and Output Module IO211

3.2.12.1 Description

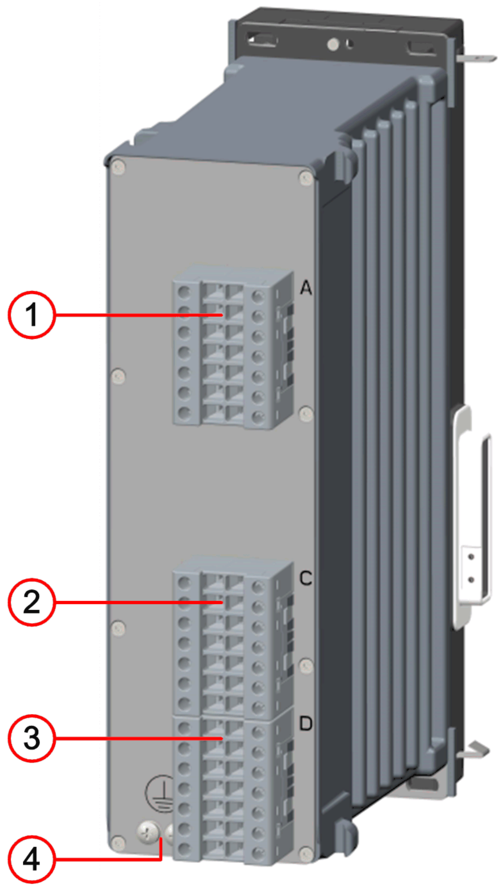
The terminals for the following are located on the input and output module IO211:

- 8 voltage inputs
- 8 binary inputs

The connections are distributed over three 14-pole voltage terminals.

3.2.12.2 Terminals

Overview of Terminals



[dwio211p-211112-01.tif, 2, --_--]

Figure 3-48 IO211 – Terminals

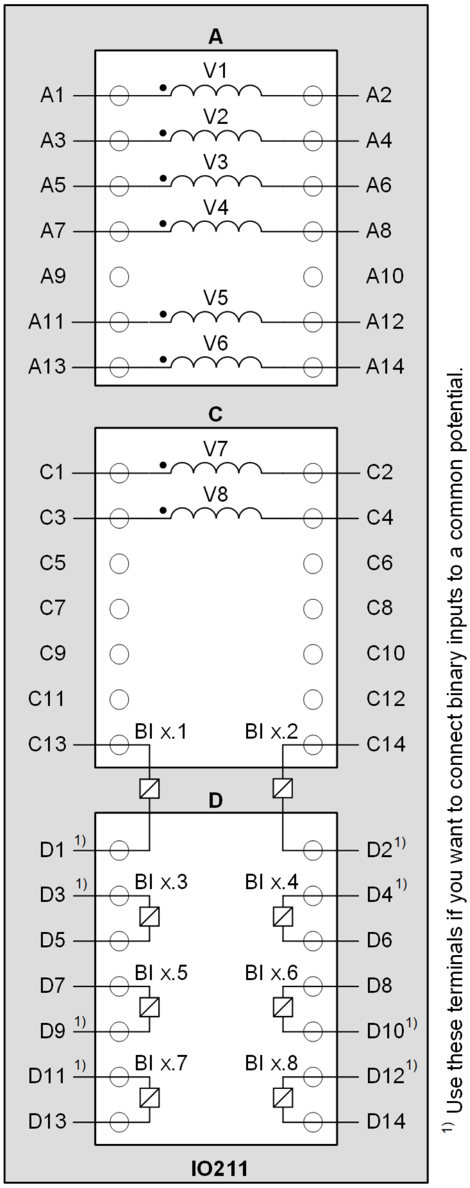
(1)	Voltage terminal xA
(2)	Voltage terminal xC
(3)	Voltage terminal xD
(4)	Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

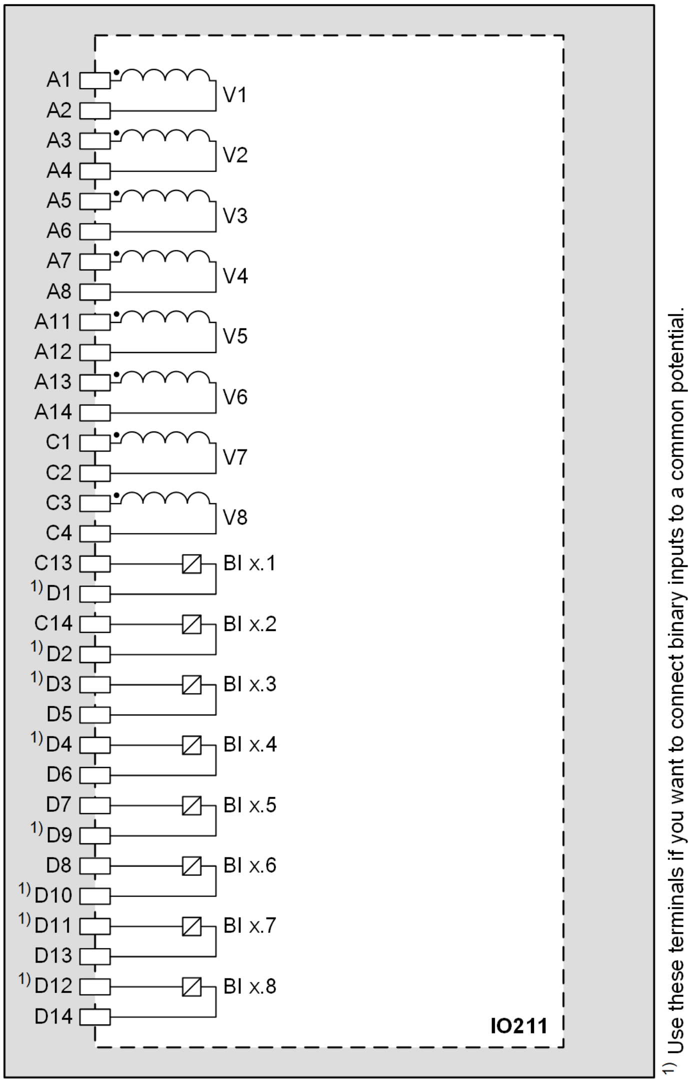
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio211x-221112-01.tif, 2, en_US]

Figure 3-49 IO211 – Terminal Diagram



[tdio211x-211112-01.tif, 2, en_US]

Figure 3-50 IO211 – Connection Diagram

3.2.13 Input and Output Module IO212

3.2.13.1 Description

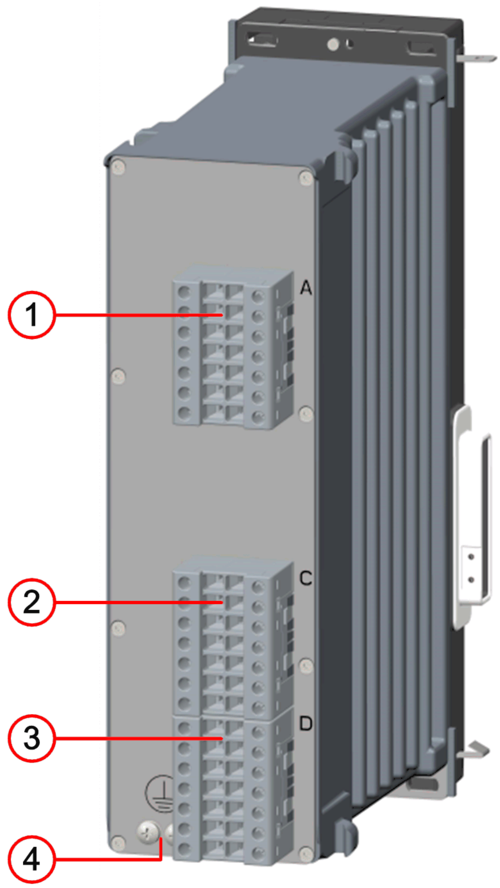
The terminals for the following are located on the input and output module IO212:

- 8 high-speed measuring-transducer inputs for current (20 mA) or voltage (10 V)
- 8 binary inputs

The connections are distributed over three 14-pole voltage terminals.

3.2.13.2 Terminals

Overview of Terminals



[le_io204, 2, --_--]

Figure 3-51 IO212 – Terminals

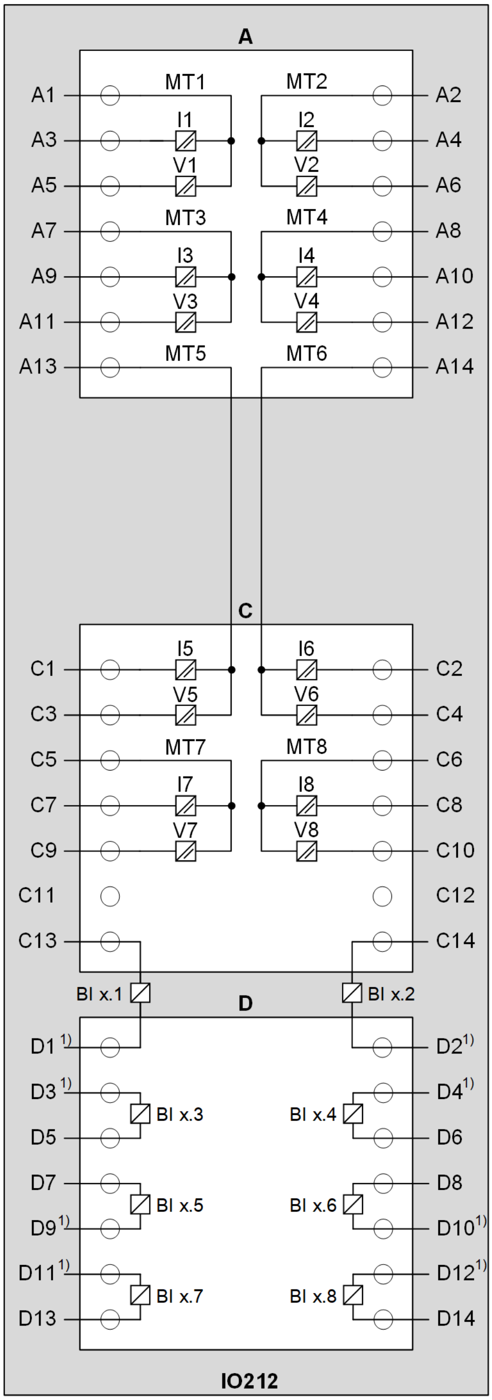
(1) Voltage terminal xA
(2) Voltage terminal xC
(3) Voltage terminal xD
(4) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

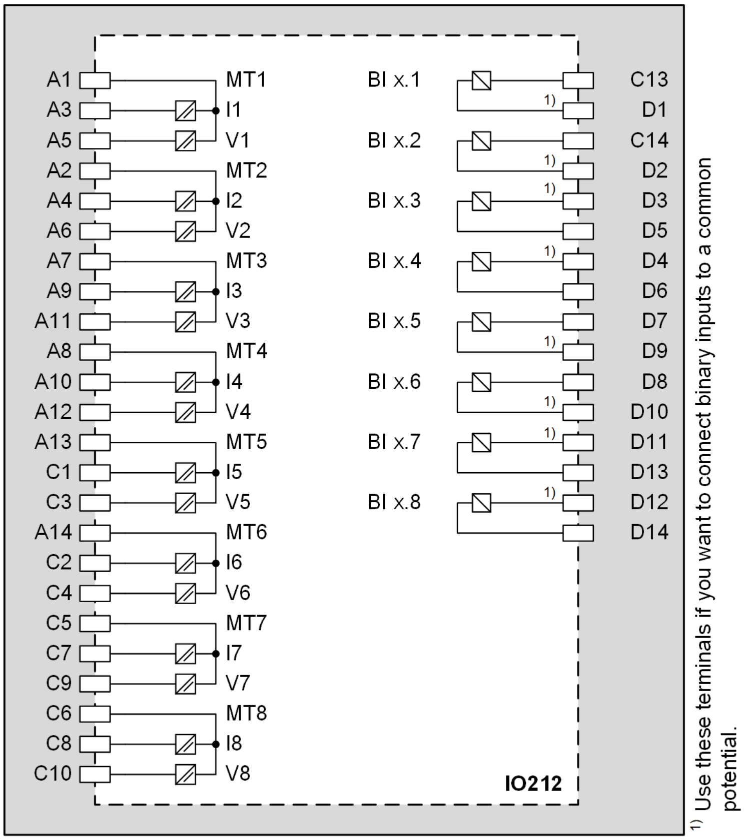
For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



1) Use these terminals if you want to connect binary inputs to a common potential.

[cd_io212, 3, en_US]

Figure 3-52 IO212 – Terminal Diagram



[tdio212x, 4, en_US]

Figure 3-53 IO212 – Connection Diagram

3.2.14 Input and Output Module IO214

3.2.14.1 Description

The terminals for the following are located on the input and output module IO214:

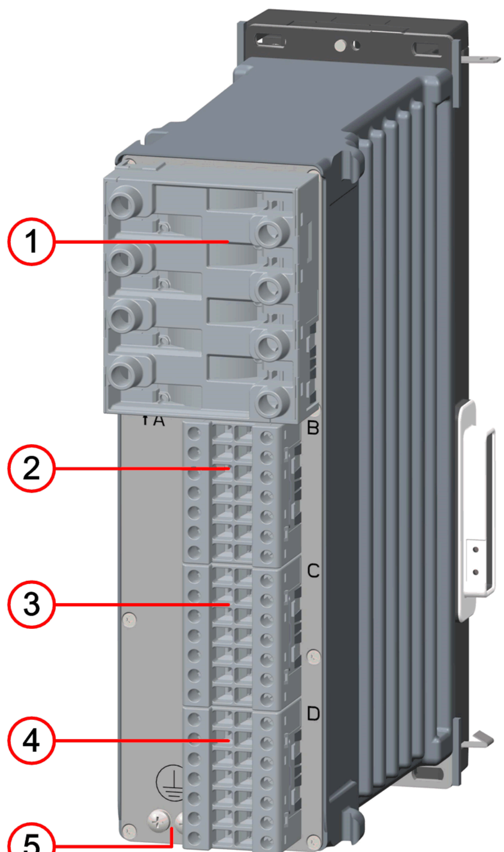
- 4 current transformers (optionally protection-class current transformers or instrument transformers)
- 4 voltage transformers
- 2 binary inputs
- 5 binary outputs with 4 high-speed make contacts (type F) and 1 high-speed change-over contact (type F)

The connections are distributed over:

- 1 x 8-pole current terminal
- 3 x 14-pole voltage terminal

3.2.14.2 Terminals

Overview of Terminals



[dwio214p-030211-01.tif, 2, --_--]

Figure 3-54 IO214 – Terminals

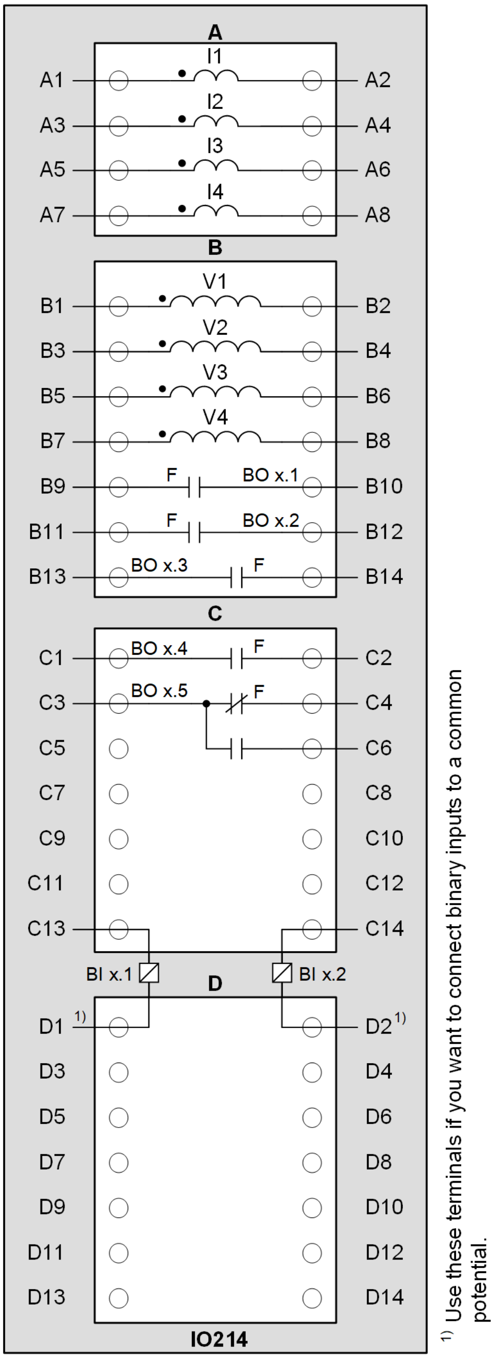
(1) Current terminal xA
(2) Voltage terminal xB
(3) Voltage terminal xC
(4) Voltage terminal xD
(5) Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

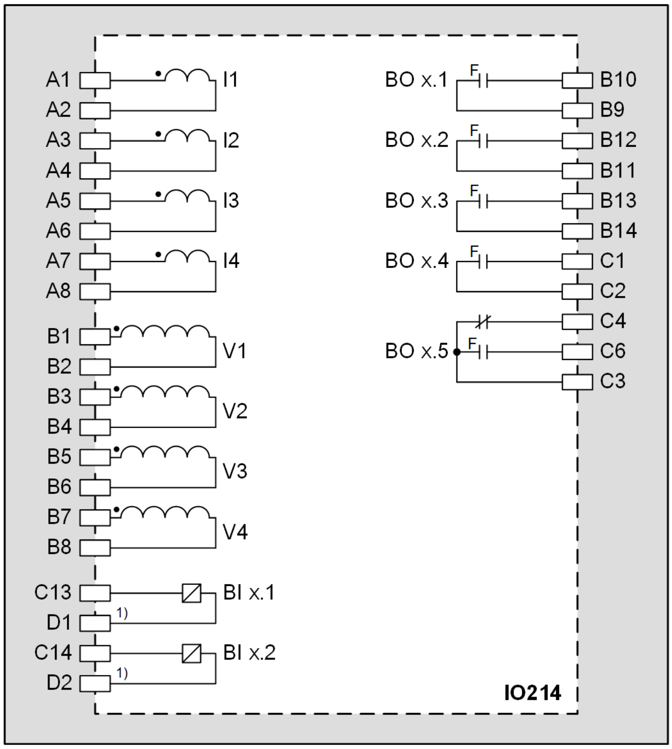
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cdio214x-260213-01.tif, 2, en_US]

Figure 3-55 IO214 – Terminal Diagram



1) Use these terminals if you want to connect binary inputs to a common potential.

[tdio214x-270812-01.tif, 2, en_US]

Figure 3-56 IO214 – Connection Diagram

3.2.15 Input and Output Module IO215

3.2.15.1 Description

The terminals for the following are located on the input and output module IO215:

- 4 current transformers (optionally protection-class current transformers or instrument transformers)
- 4 voltage transformers for the connection of an isolation amplifier P27000-H1-S011
  Connect each phase of the device via this isolation amplifier with capacitive voltage transformers from the Trench Co. The voltage input is specially designed for a measuring range of up to 7.07 V.
- 8 binary inputs
- 6 binary outputs, of which:
  - 4 high-speed make contacts (type F)
  - 2 high-speed change-over contacts (type F)

The connections are distributed over:

- 1 x 8-pole current terminal
- 3 x 14-pole voltage terminal

3.2.15.2 Terminals

The terminal and connection diagram is identical to the input and output module IO202 in the expansion module.
You can find more information in chapter *3.2.3.2 Terminals*, *Figure 3-22* and *Figure 3-23*.

3.2.16 Input Module IO216

3.2.16.1 Description

The terminals for the following are located on the input and output module IO216:

- 16 special binary inputs with maximized robustness against electrical disturbances and failures

The connections are distributed over:

- 3 x 14-pole voltage terminal

3.2.16.2 Terminals

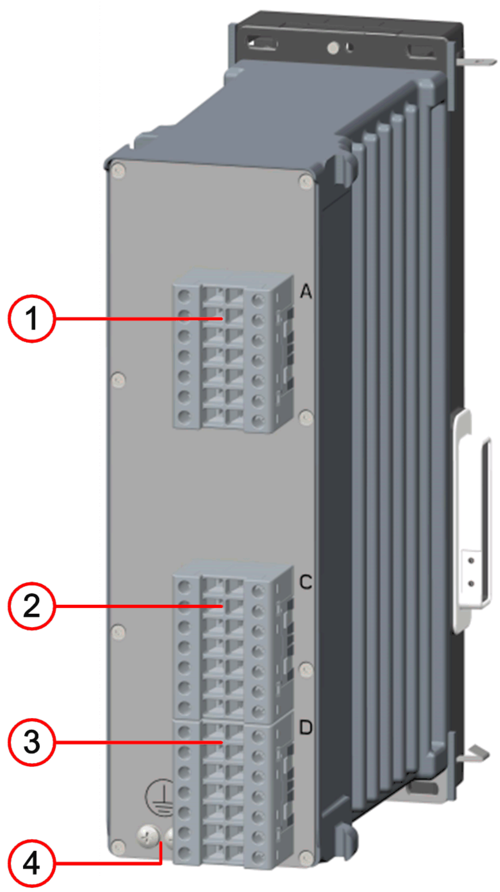


Figure 3-57 IO216 – Terminals

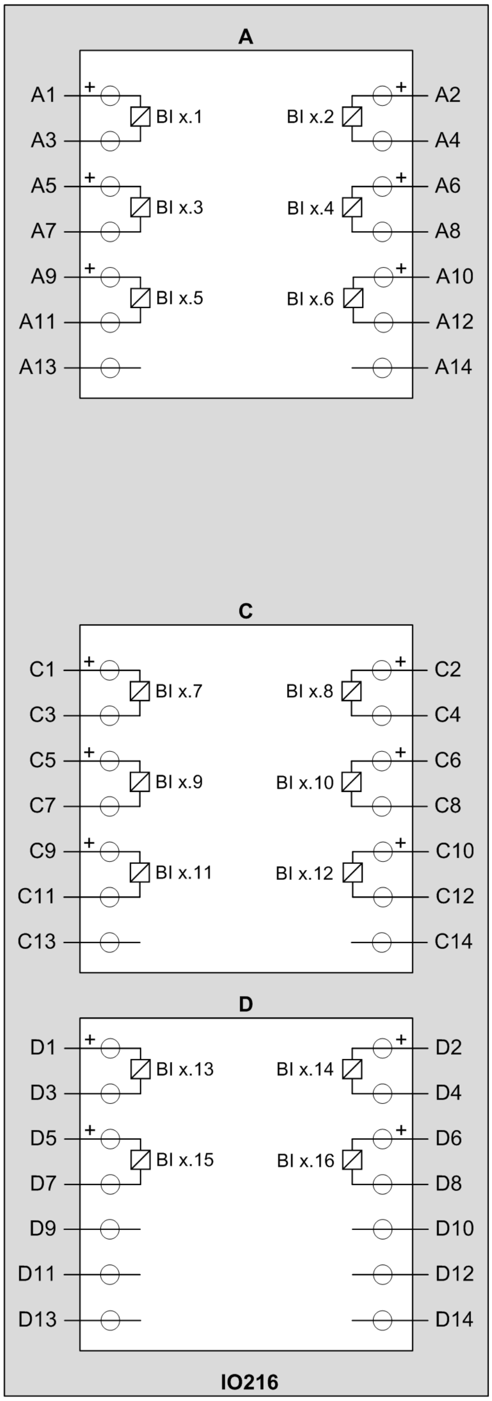
(1)	Voltage terminal xA
(2)	Voltage terminal xC
(3)	Voltage terminal xD
(4)	Protective grounding terminals

NOTE

x corresponds to the slot in the 19-inch rack.

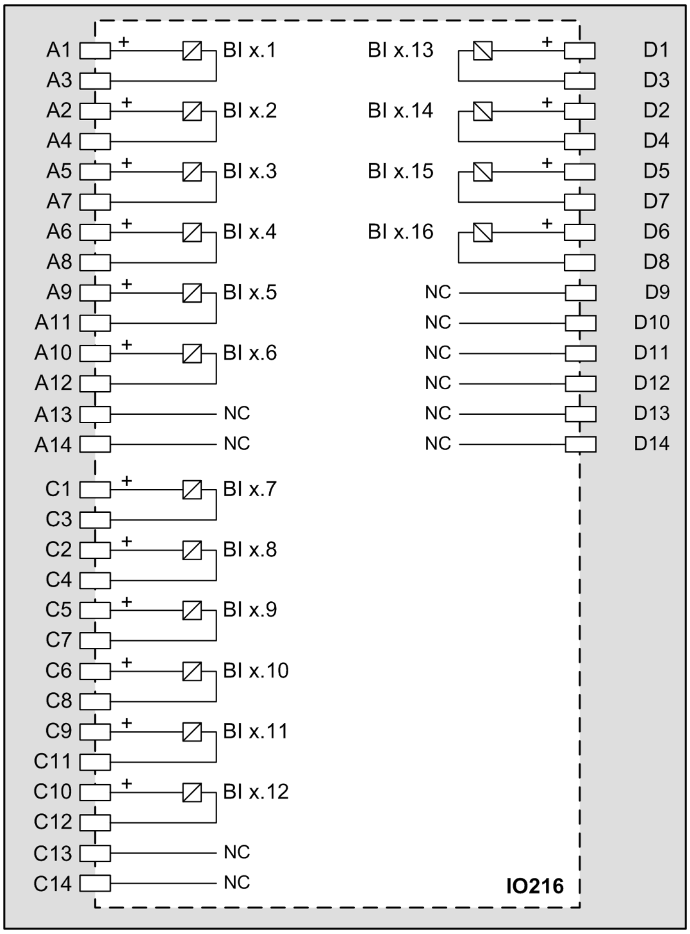
Terminal and Connection Diagram

For the binary inputs and outputs, the x corresponds to the slot in the 19-inch rack.



[cd_io216, 1, en_US]

Figure 3-58 IO216 – Terminal Diagram



[tdio216x, 1, en_US]

Figure 3-59 IO216 – Connection Diagram

3.2.17 Input and Output Module IO218

3.2.17.1 Description

The terminals for the following are located on the input and output module IO218:

- 3 direct-voltage analog inputs 300 V
- 3 fast 0-mA to 20-mA analog inputs
- 4 standard 0-mA to 20-mA analog inputs
- 1 x 24-V auxiliary-voltage output for external instrument transformers
- 1 RTD temperature input

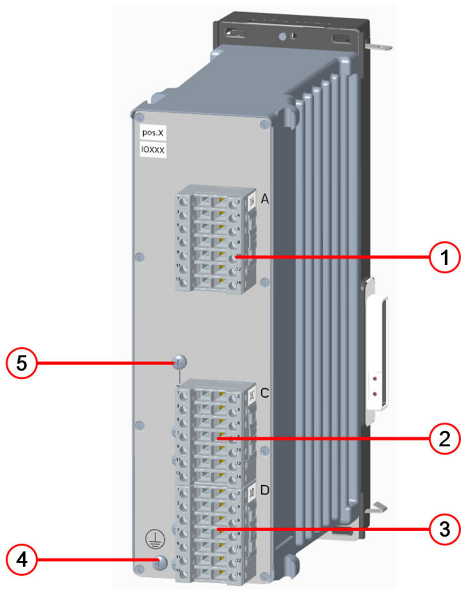
The connections are distributed over:

- 3 x 14-pole terminal

NOTE

Due to the higher power requirements of the modules IO218, IO240, and IO245, a maximum of 2 of these modules are permitted in each device row. If one of these modules is used in the 1/3 base module, then this also counts for the limit.

3.2.17.2 Terminals



[le_io218, 1, --_--]

Figure 3-60 IO218 – Terminals

(1) Terminal xA
(2) Terminal xC
(3) Terminal xD
(4) Protective grounding terminals
(5) Screwing for fastening the shielding plates

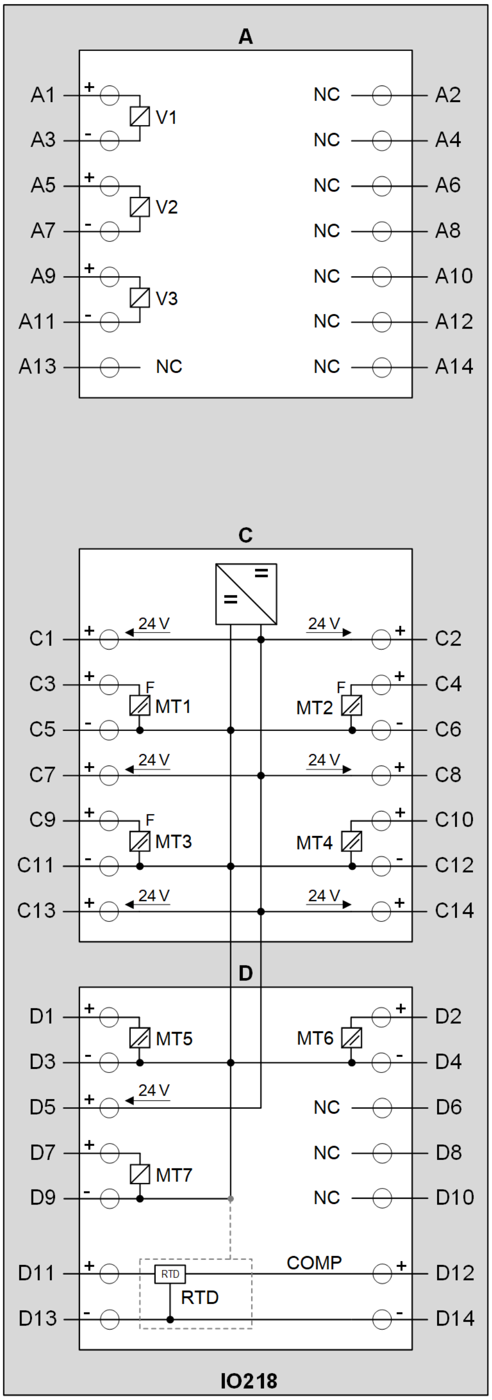
NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

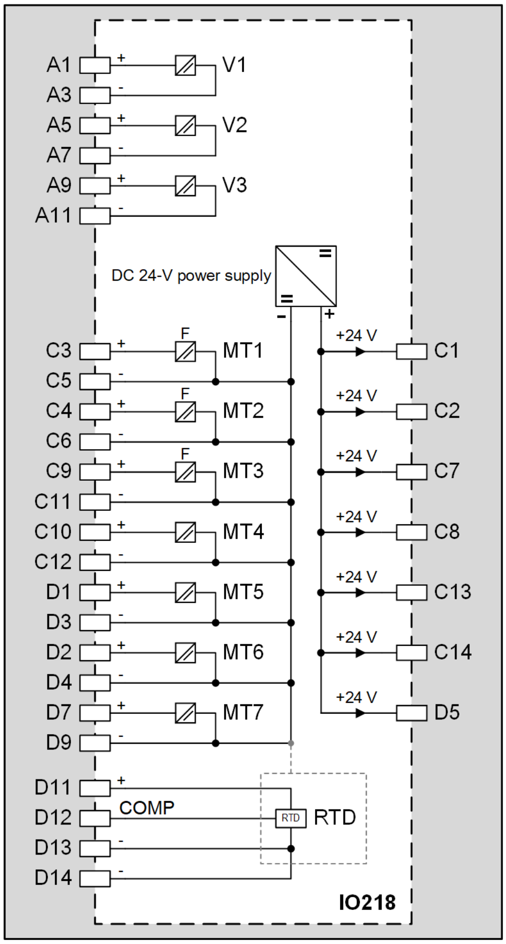
NOTE

The polarities of the voltages at the analog inputs must not be reversed!



[cd_io218, 3, en_US]

Figure 3-61 IO218 – Terminal Diagram



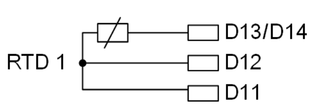
[td_io218, 2, en_US]

Figure 3-62 IO218 – Connection Diagram

3.2.17.3 Connections of Temperature Sensors and Lines

Connections of Temperature Sensors Directly to the Device

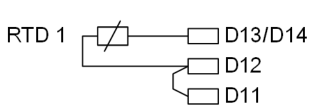
It is possible in principle to connect temperature sensors with 2-core or 3-core connections. To achieve the specified accuracy, Siemens recommends only using the 3-core connection. When using 4-core temperature sensors, the 4th core can be connected to terminal D14.



[dw_example_temp_sensor_3phase_IO218, 1, en_US]

Figure 3-63 Example: Connecting RTD Temperature Sensors (3-Core Connection) to Terminals D11 to D14

✧ If connecting with a 2-core connection, you must connect a jumper between D11 and D12.



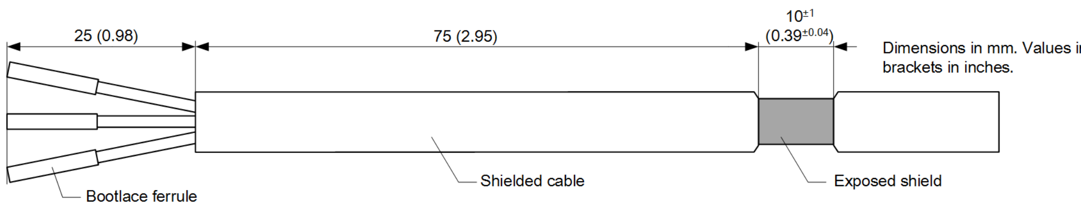
[dw_example_temp_sensor_2phase_IO218, 1, en_US]

Figure 3-64 Example: Connecting RTD Temperature Sensors (2-Core Connection) to Terminals D11 to D14.

Connecting the Lines

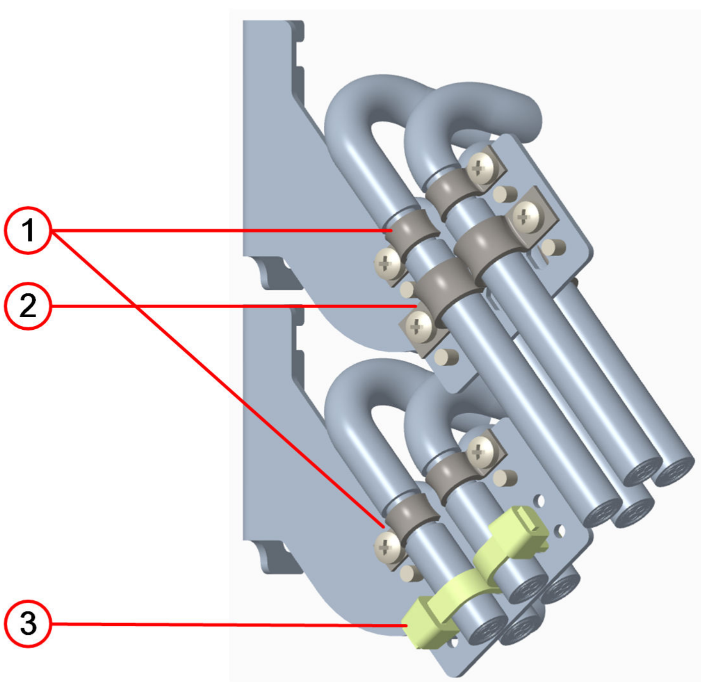
When connecting the lines, proceed as follows:

- ✧ Use lines with shielding braid (3-core AWG 20).
- ✧ Prepare the cable as shown in the following figure.



[dw_preparing a line, 1, en_US]

Figure 3-65 Preparing Line

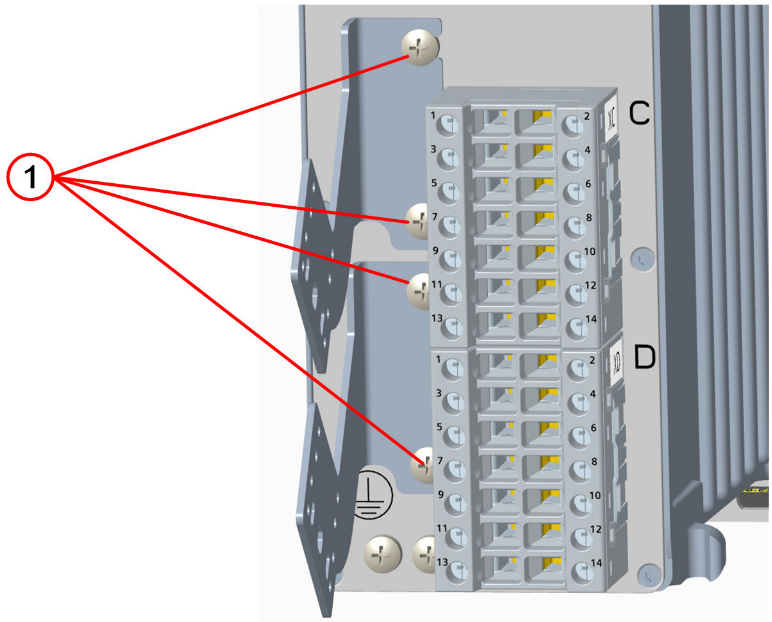


[le_shielding_plate_mounting-cutout_IO218, 1, en_US]

Figure 3-66 Using Clips and Cable Ties

(1) Cable clamps for contacting: Type SN 78550, shape A, 6 mm
(2) Cable clamps for strain relief: Type SN 78550, shape A, 8 mm
(3) Cable ties for strain relief

- ✧ Use the included 6-mm cable clamps to make contact with the cable shield.
- ✧ Use the optional 8-mm cable clamps or the included cable ties to provide strain relief for the cable.
- ✧ Fasten the 8-mm cable clamps using M3 screws (torque = 0.4 Nm).



[le_connection_IO218, 1, en_US]

Figure 3-67 Connection and Fastening

(1) Fastening screws for shielding plates

✧ Fasten the 2 shielding plates using 2 M4 screws for each (torque = 1.6 Nm).

✧ Connect the lines with bootlace ferrules.

3.2.18 Input Module IO230

3.2.18.1 Description

The terminals for the following are located on the IO230 input module:

- 48 binary inputs

The connections are distributed over six 10-pole terminals.

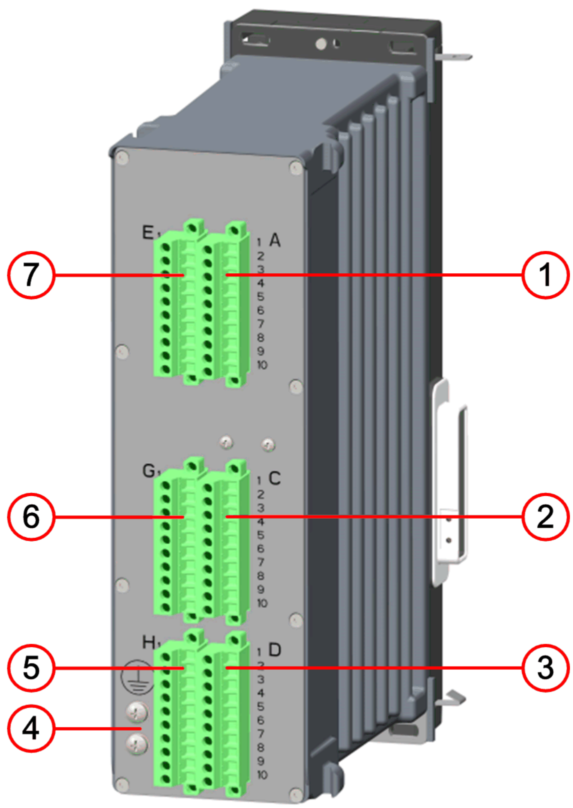
NOTE

The IO230 input module has a group switching for the switchover of threshold values. The threshold values of the binary inputs can be switched in groups of 8 only:

- Group of 8 x.1, x.2, x.3, x.4, x.25, x.26, x.27, x.28
- Group of 8 x.5, x.6, x.7, x.8, x.29, x.30, x.31, x.32
- Group of 8 x.9, x.10, x.11, x.12, x.33, x.34, x.35, x.36
- Group of 8 x.13, x.14, x.15, x.16, x.37, x.38, x.39, x.40
- Group of 8 x.17, x.18, x.19, x.20, x.41, x.42, x.43, x.44
- Group of 8 x.21, x.22, x.23, x.24, x.45, x.46, x.47, x.48

3.2.18.2 Terminals

Overview of Terminals



[dwio230x-030713-01.tif, 2, --_--]

Figure 3-68 IO230 – Terminals

(1)	Terminal xA
(2)	Terminal xC
(3)	Terminal xD
(4)	Protective grounding terminals
(5)	Terminal xH
(6)	Terminal xG
(7)	Terminal xE

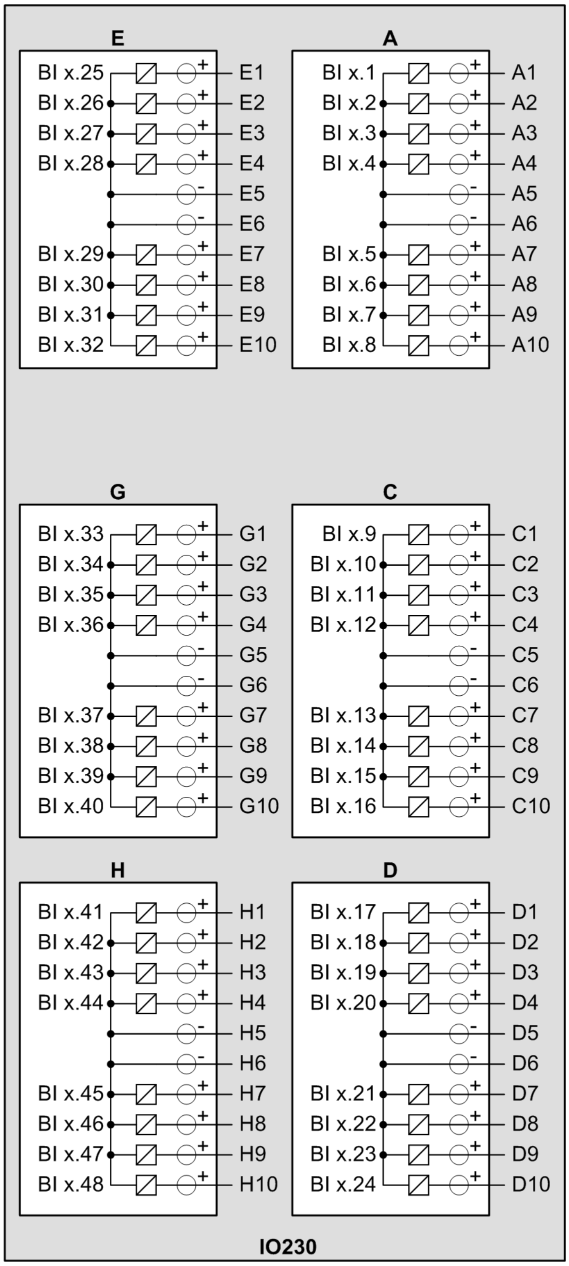
NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

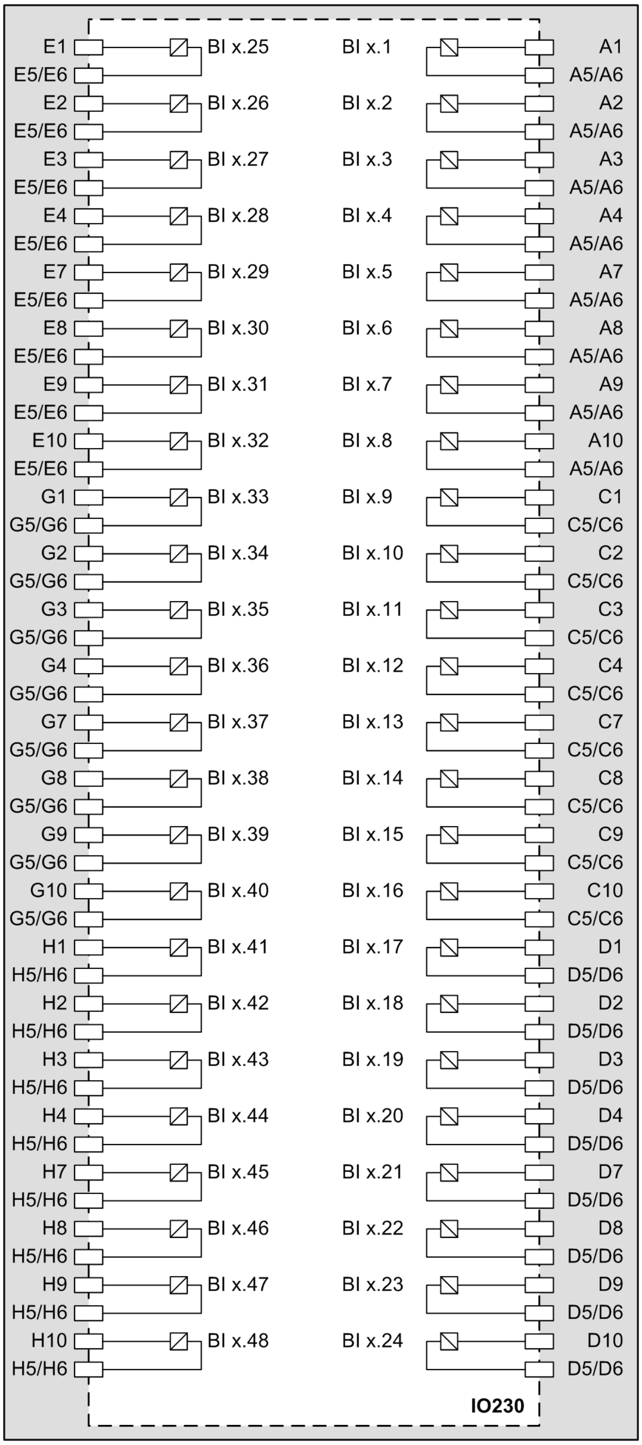
NOTE

The polarities of the voltages at the binary inputs must not be reversed!



[cdio230x-030713-01.tif, 1, en_US]

Figure 3-69 IO230 – Terminal Diagram



[tdio230x, 1, en_US]

Figure 3-70 IO230 – Connection Diagram

3.2.19 Input and Output Module IO231

3.2.19.1 Description

The terminals for the following are located on the input and output module IO231:

- 24 binary inputs
- 24 binary outputs, standard make contacts (type S)

The connections are distributed over six 10-pole connection terminals.

3.2.19.2 Terminals

Overview of Terminals

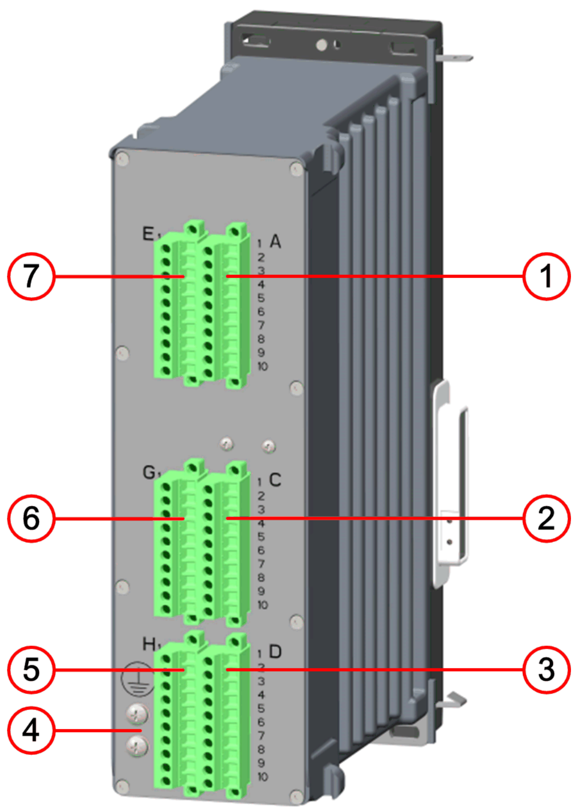


Figure 3-71 IO231 – Terminals

(1) Terminal xA
(2) Terminal xC
(3) Terminal xD
(4) Protective grounding terminals
(5) Terminal xH
(6) Terminal xG
(7) Terminal xE

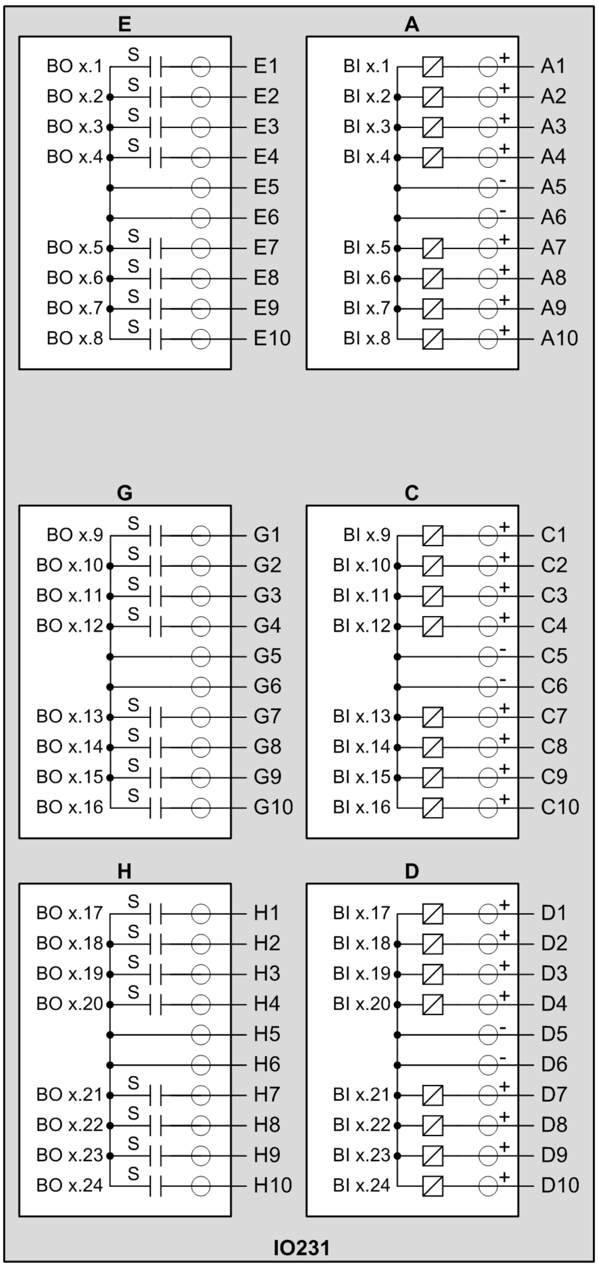
NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

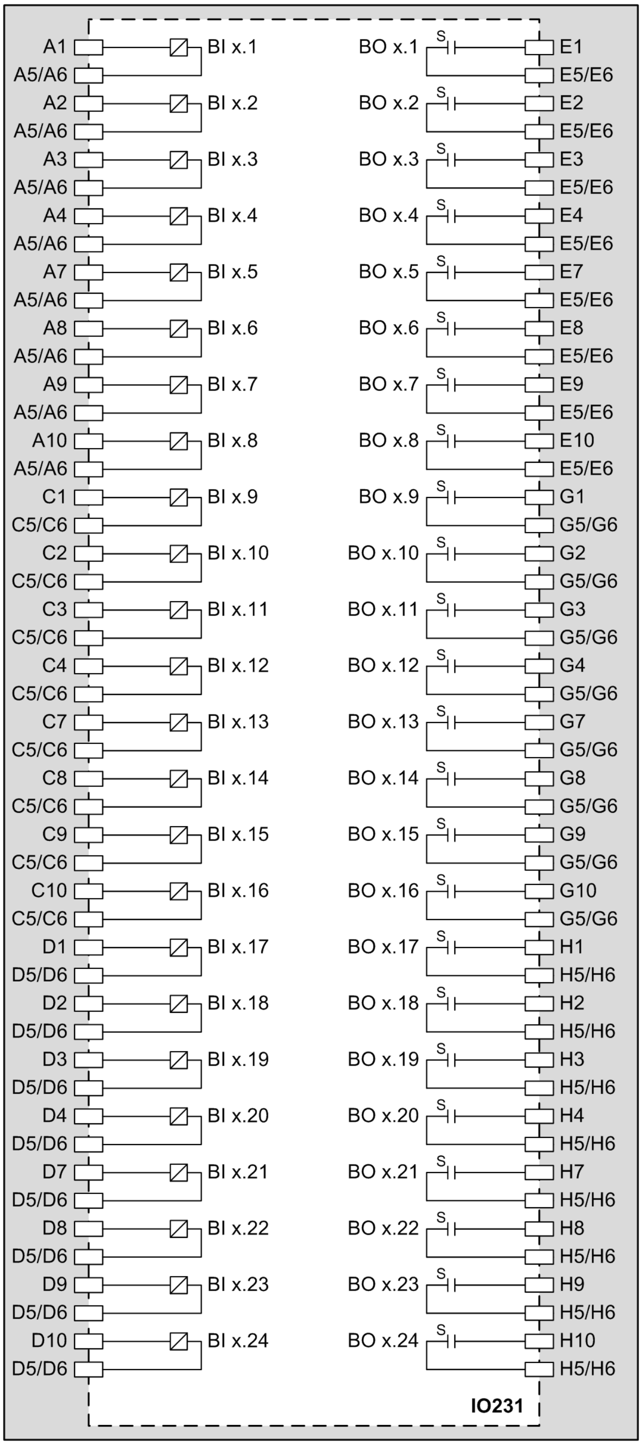
NOTE

The polarities of the voltages at the binary inputs must not be reversed!



[cd_io231x, 2, en_US]

Figure 3-72 IO231 – Terminal Diagram



[td_tdio231x, 1, en_US]

Figure 3-73 IO231 – Connection Diagram

3.2.20 Input and Output Module IO232

3.2.20.1 Description

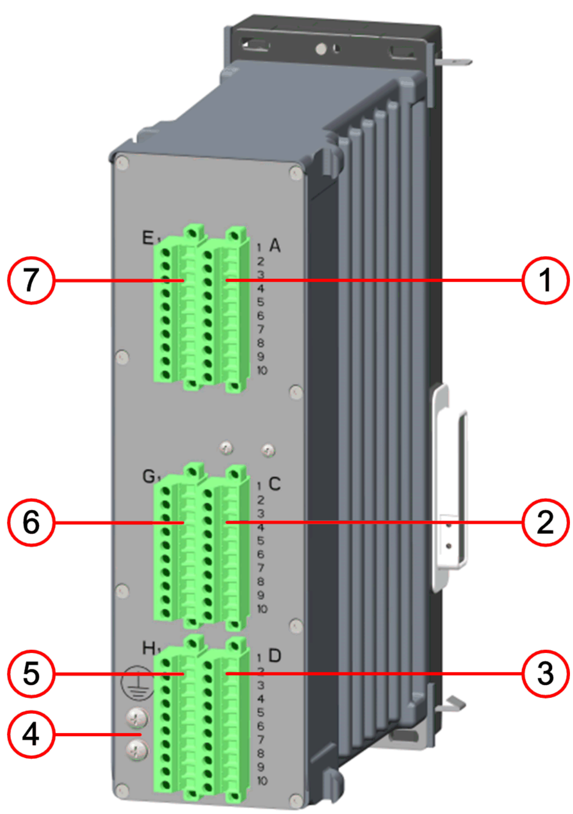
The terminals for the following are located on the input and output module IO232:

- 24 binary inputs
- 15 binary outputs, of which:
  - 12 fast make contacts (type F)
  - 3 fast change-over contacts (type F)

The terminals are distributed over six 10-pole terminals.

3.2.20.2 Terminals

Overview of Terminals



[dwio230x-030713-01.tif, 2, --_--]

Figure 3-74 IO232 – Terminals

(1)	Terminal xA
(2)	Terminal xC
(3)	Terminal xD
(4)	Protective grounding terminals
(5)	Terminal xH
(6)	Terminal xG
(7)	Terminal xE

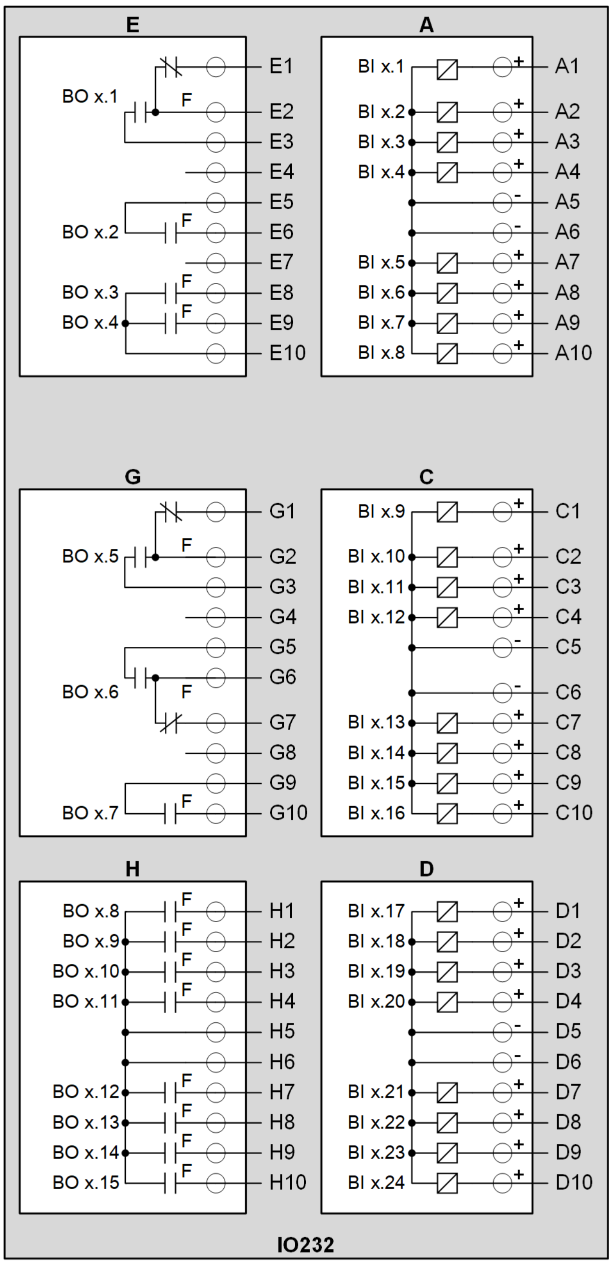
NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

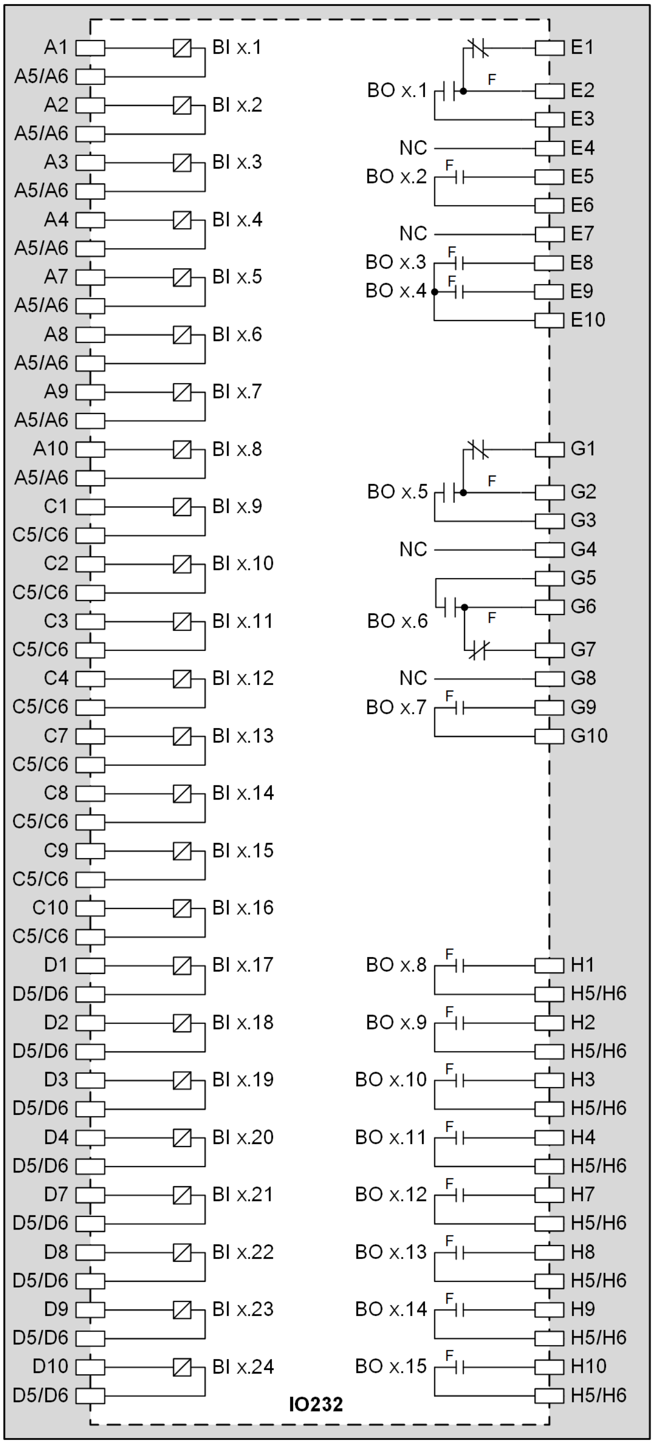
NOTE

The polarities of the voltages at the binary inputs must not be reversed!



[cd_io232x, 1, en_US]

Figure 3-75 IO232 – Terminal Diagram



[td_tdio232x, 1, en_US]

Figure 3-76 IO232 – Connection Diagram

3.2.21 Input Module IO233

3.2.21.1 Description

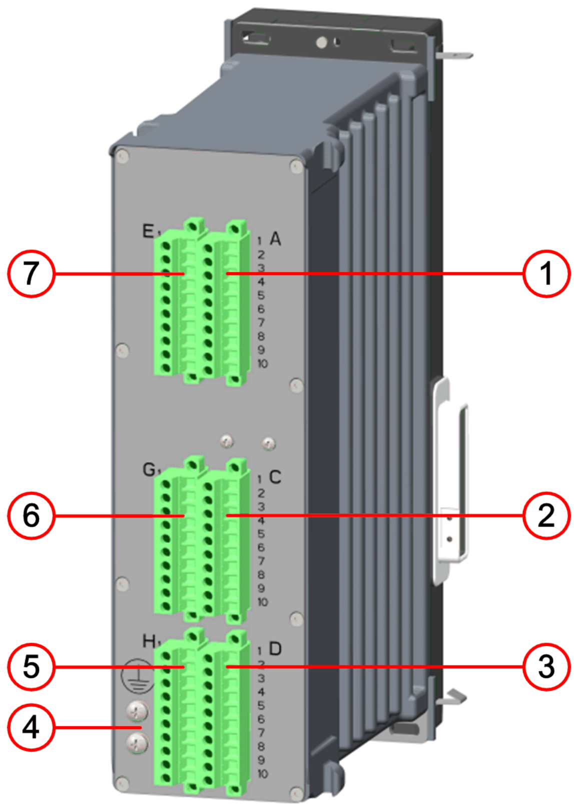
The terminals for the following are located on the input module IO233:

- 48 binary inputs

The connections are distributed over six 10-pole terminals.

3.2.21.2 Terminals

Overview of Terminals



[dw_io233x, 1, en_US]

Figure 3-77 IO233 – Terminals

(1)	Terminal xA
(2)	Terminal xC
(3)	Terminal xD
(4)	Protective grounding terminals
(5)	Terminal xH
(6)	Terminal xG
(7)	Terminal xE

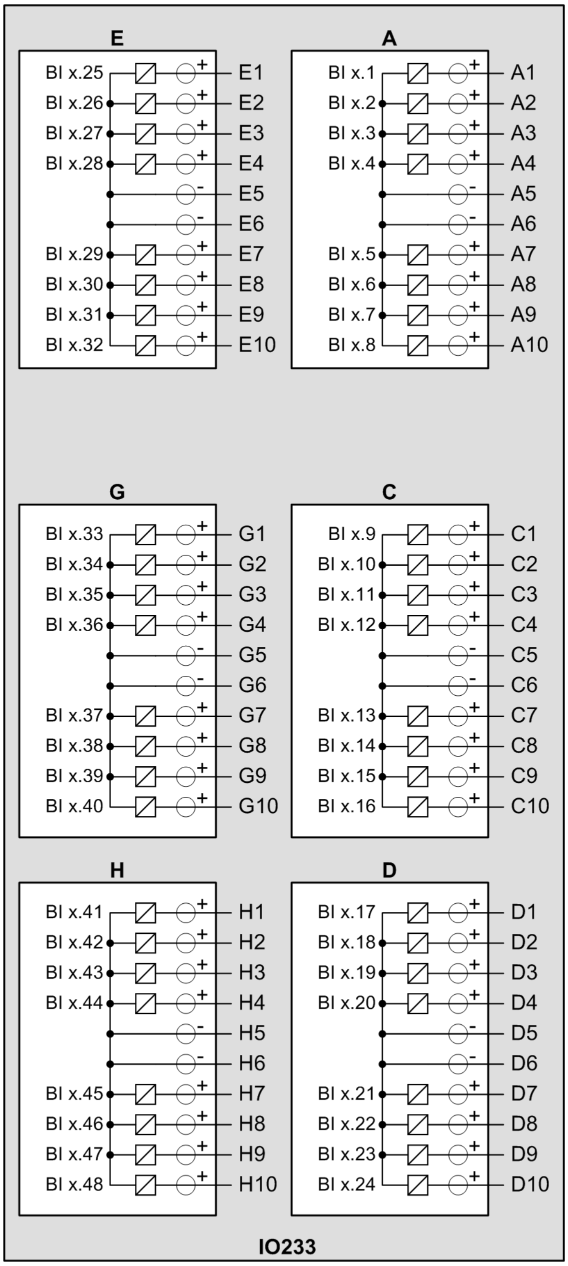
NOTE

x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram

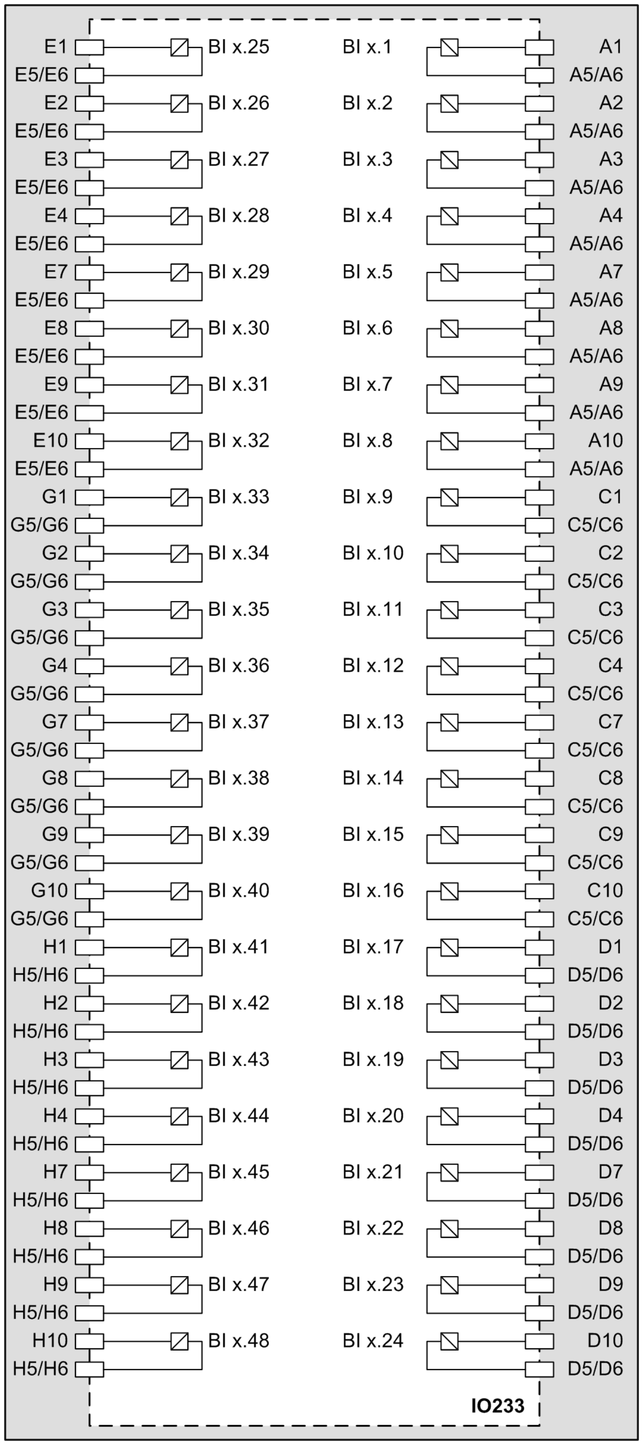
NOTE

The polarities of the voltages at the binary inputs must not be reversed!



[cd_io233x, 1, en_US]

Figure 3-78 IO233 – Terminal Diagram



[td_io233x, 1, en_US]

Figure 3-79 IO233 – Connection Diagram

3.2.22 Input Module IO240

3.2.22.1 Description

The following terminals are on the input module IO240 for the low-power instrument transformer (LPIT):

- 3 current inputs for the low-power current transformers in the gas insulated switchgears (GIS-LPCT), for example, rogowski coils
- 3 voltage inputs for either of the following transformers:
  - The low-power voltage transformers in the gas insulated switchgear (GIS-LPVT), for example, capacitive voltage sensors
  - The resistive-capacitive voltage transformer (RCVT)
- 3 temperature measuring channels (4-wire PT100 thermistor)

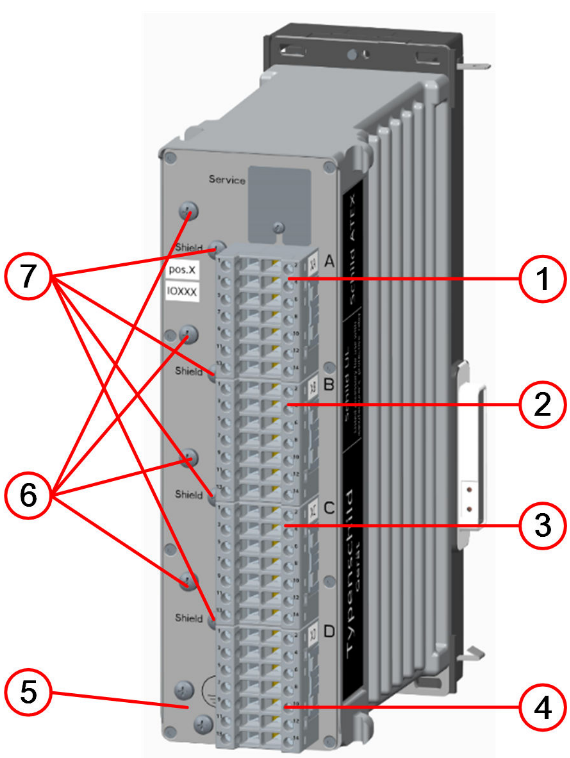
The connections are distributed over three 14-pole terminal blocks.

NOTE

Due to the higher power requirements of the modules IO218, IO240, and IO245, a maximum of 2 of these modules are permitted in each device row. If one of these modules is used in the 1/3 base module, then this also counts for the limit.

3.2.22.2 Terminals

Overview of Terminals



[le_IO240_overview, 3, --_--]

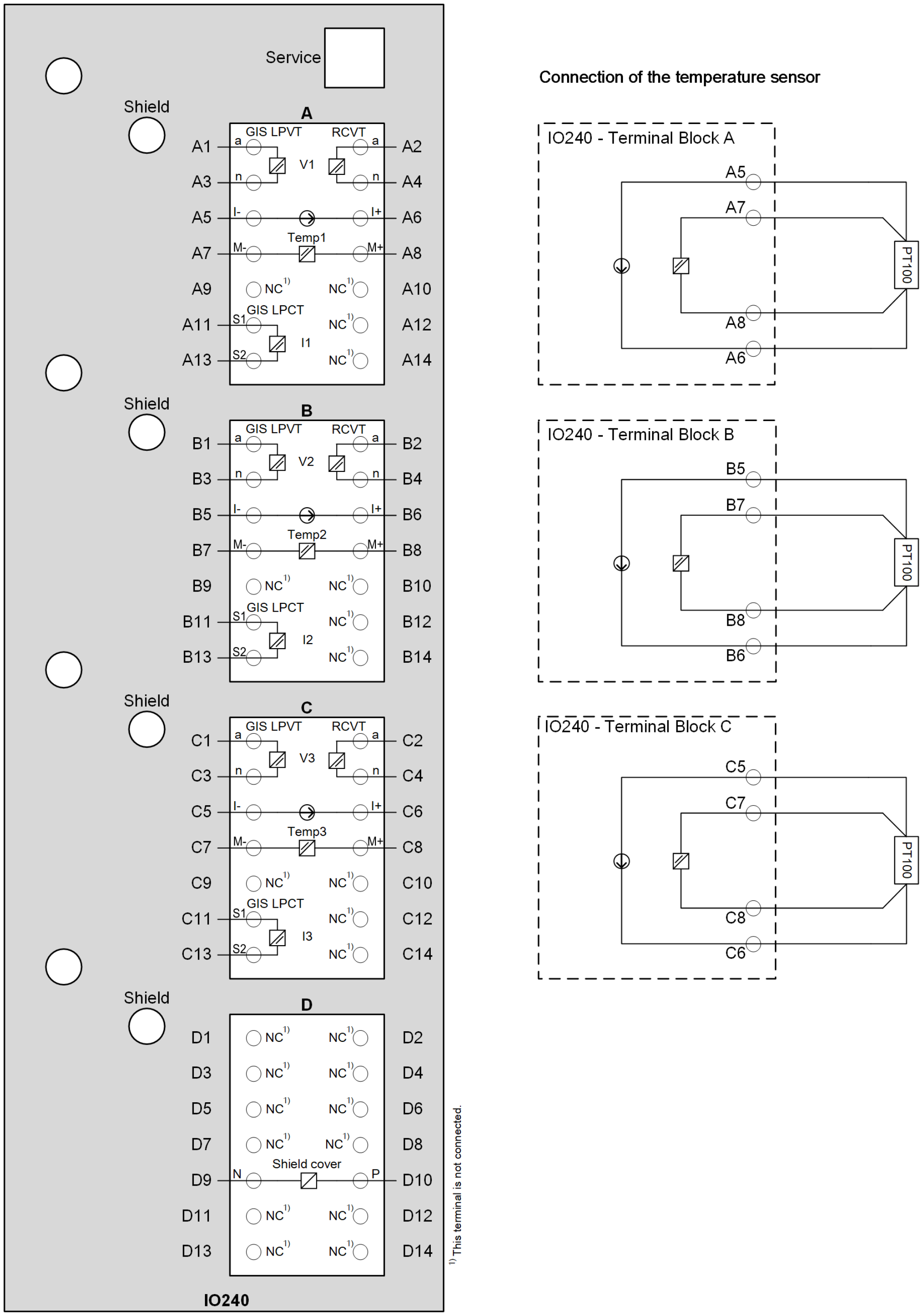
(1)	Current/Voltage/Temperature terminal xA
(2)	Current/Voltage/Temperature terminal xB
(3)	Current/Voltage/Temperature terminal xC
(4)	Shield-cover terminal xD

(5) Protective grounding terminal
(6) Screws for assembling the strain-relief plate
(7) LPIT cable shield

NOTE

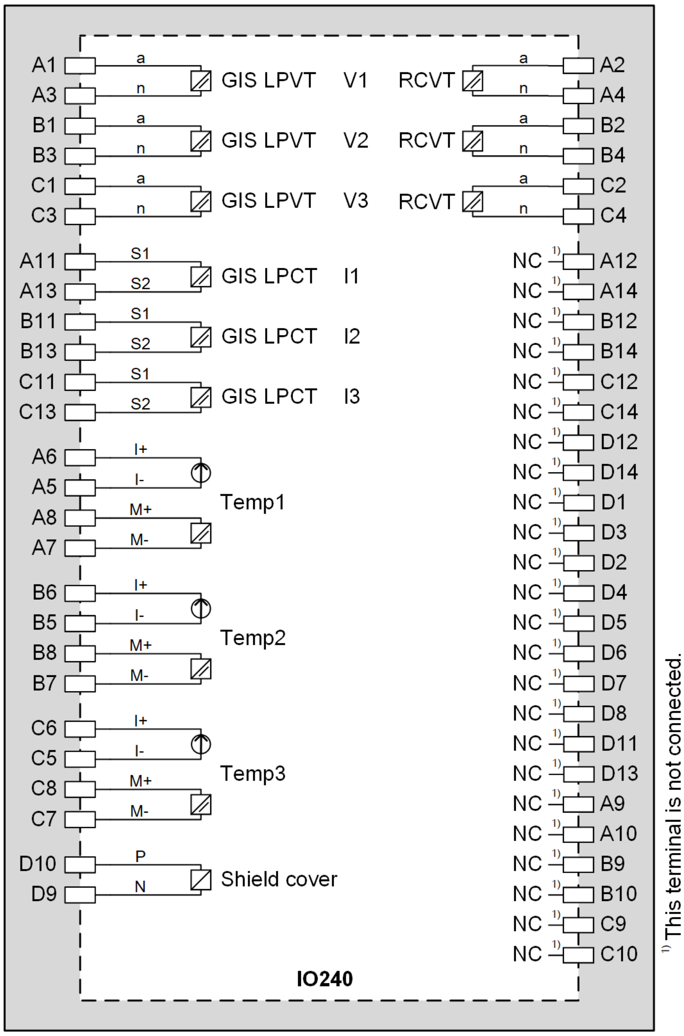
x corresponds to the slot in the 19-inch rack.

Terminal and Connection Diagram



[cd_io240x, 5, en_US]

Figure 3-80 IO240 – Terminal Diagram



[td_io240x, 5, en_US]

Figure 3-81 IO240 – Connection Diagram

NOTE

For the LPIT sensors of the GIS poles, you can set the relationship between the physical connection of LPIT sensors to the respective inputs of the LPIT module IO240 via the parameters `Primary Phase A`, `Primary Phase B`, and `Primary Phase C`.

NOTE

For RCVTs, physically connect primary phase A to the RCVT 1 terminals, primary phase B to the RCVT 2 terminals and primary phase C to the RCVT 3 terminals.

3.2.22.3 Connections of GIS-LPIT and RCVT Sensors

When connecting the Siemens Energy GIS-LPIT and RCVT sensors to the LPIT module IO240, proceed as follows:

✧ Use the delivered cable LEONI L45551-P42-B5 and confection the cable as explained in the user manual of the LPIT GIS sensor.

The L45551-P42-B5 cable has 4 twisted pairs: 1 pair for the low-power voltages, 1 pair for the low-power currents, and 2 pairs for the PT100 temperature sensor connection. Each conductor is terminated with a wire ferrule (length = 12 mm, wire gauge = 0.5 mm2). Each internal shield is connected with a cable ring-type lug (for M4 screw).

NOTE

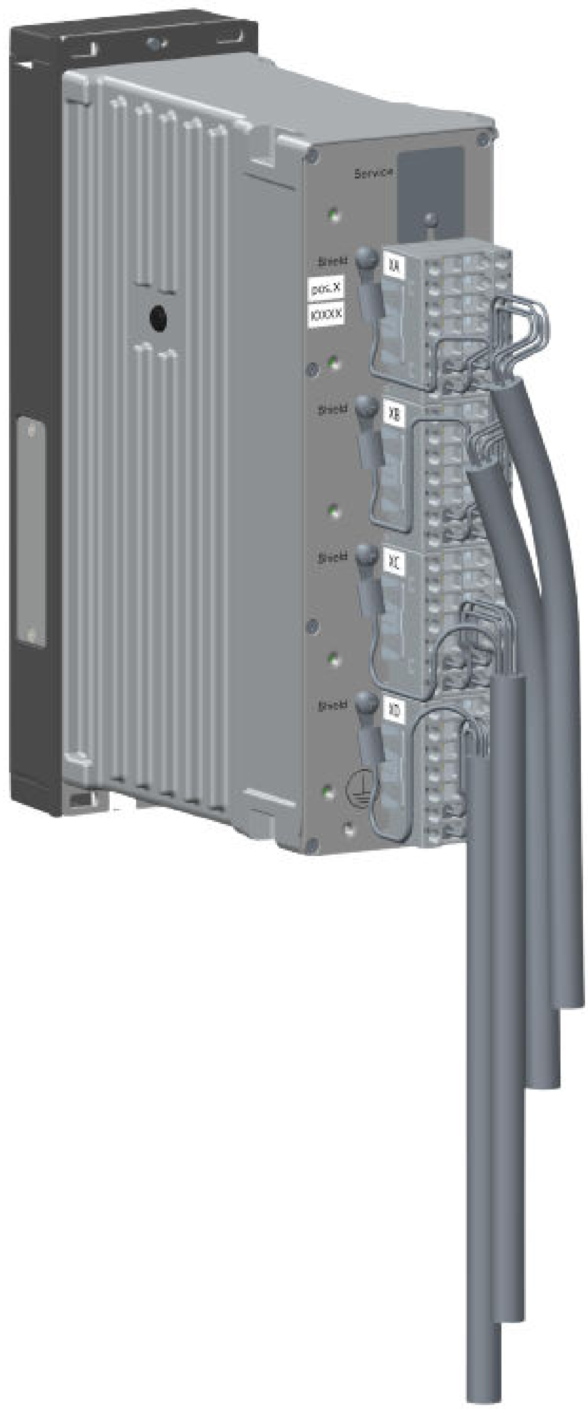
You can only use the LPIT Module IO240 with the LPIT Connection Box (C53207-A9443-B1-4).

You must use the cable L45551-P42-B5 from the LEONI Special Cables GmbH.

The maximum allowed cable length is 100 m.

✧ Connect the signal cables to the corresponding terminals, refer to *Figure 3-80*.

✧ Connect the ring-type lugs of the shield terminals with M4 screws (torque = 1.6 Nm) to the marked terminals (shield) at the rear plate of the LPIT module.



[sc_IO240 connection cables, 1, --_--]

Figure 3-82 Connection to Sensors with Cables

✧ Short-circuit the unused terminals individually, using the voltage-terminal cross-connectors (product code P1Z550), shown in *Figure 5-26*.

NOTE

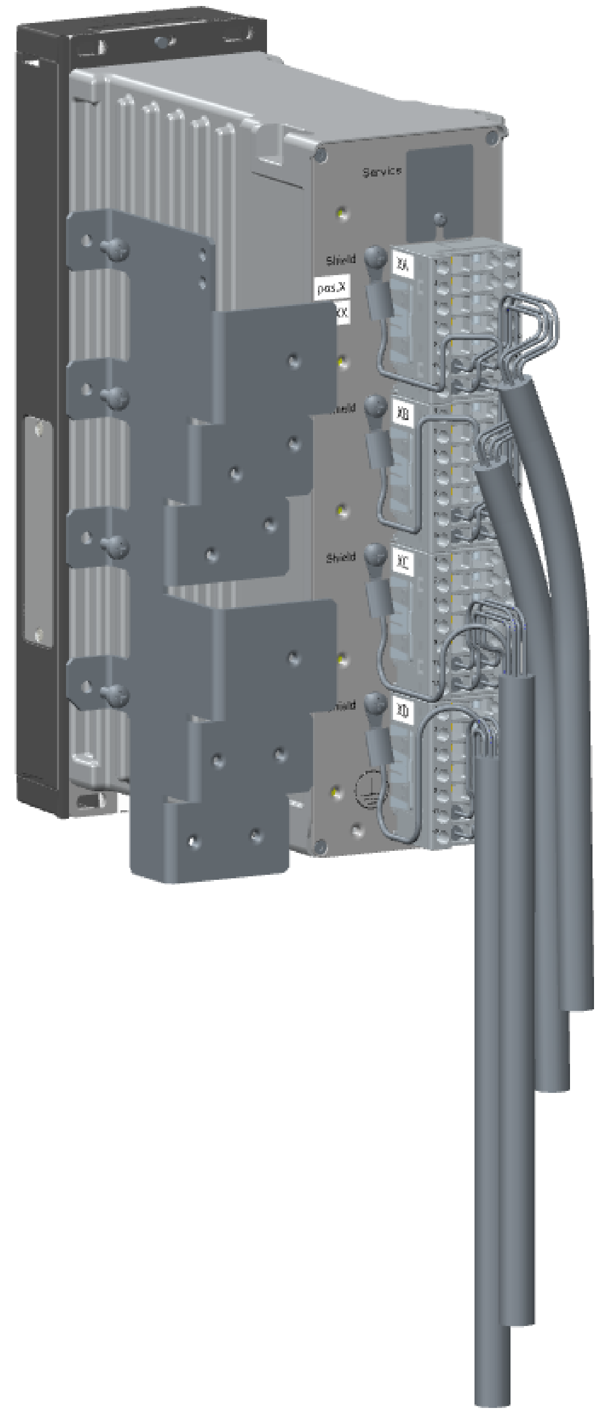
The following unused terminal pairs must be individually short-circuited, using the voltage terminal cross-connectors (product code P1Z550):

- A12 and A14
- B12 and B14
- C12 and C14
- D1 and D3
- D2 and D4
- D5 and D7
- D6 and D8
- D11 and D13
- D12 and D14

If RCVT is not used, the following more unused terminal pairs must be individually short-circuited, using the voltage terminal cross-connectors (product code P1Z550):

- A2 and A4
- B2 and B4
- C2 and C4

✧ Slide the strain-relief plate from the left toward the voltage terminals.



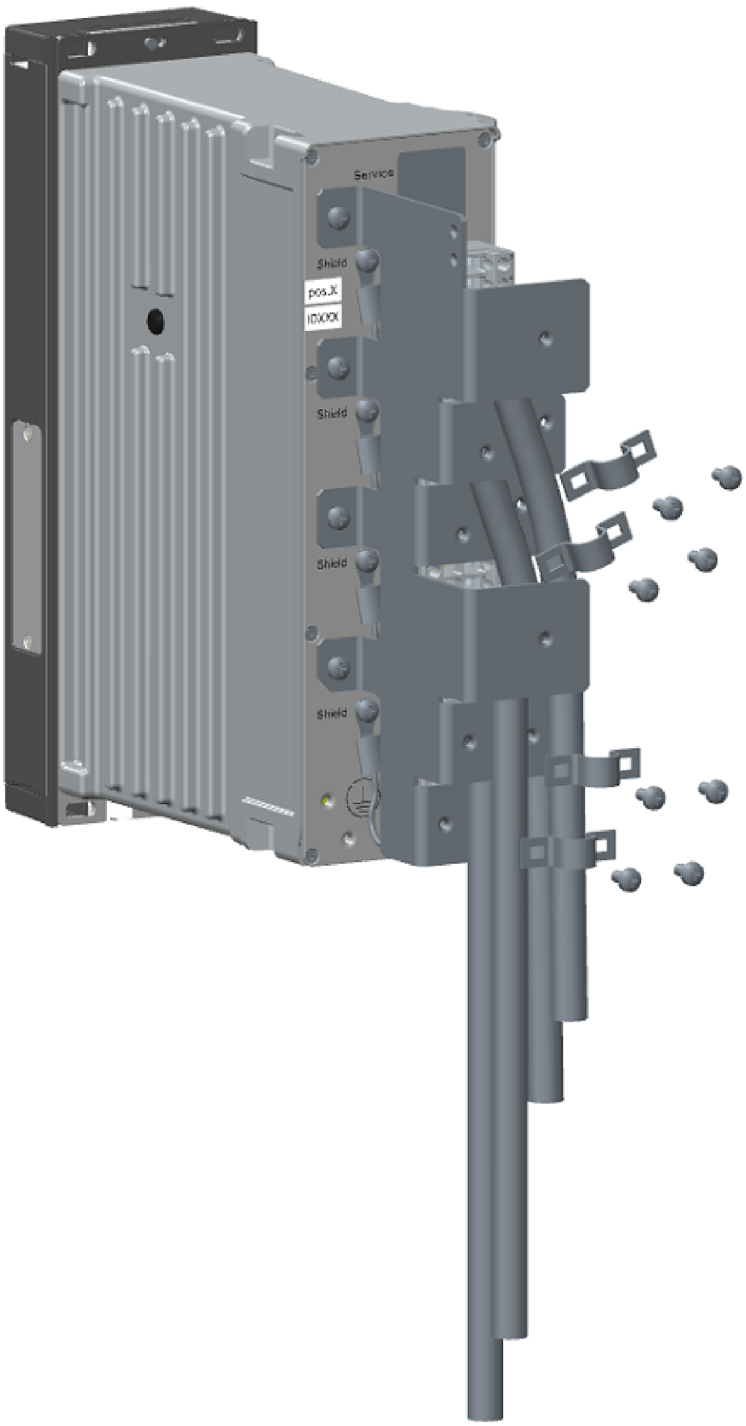
[sc_IO240 connection strain release, 1, --_--]

Figure 3-83 Strain-Relief Plate from the Left

✧ Place the 4 cables over the fixation surface.

✧ Fix the strain-relief plate to the rear plate of the LPIT module using 4 M4 screws (torque = 1.6 Nm).

✧ Mount the clamps for fixing the cables to the strain-relief plate using 8 M4 screws (torque = 1.6 Nm).



[sc_IO240 connection clamps, 1, --_--]

Figure 3-84 Clamps for Fixing the Cables

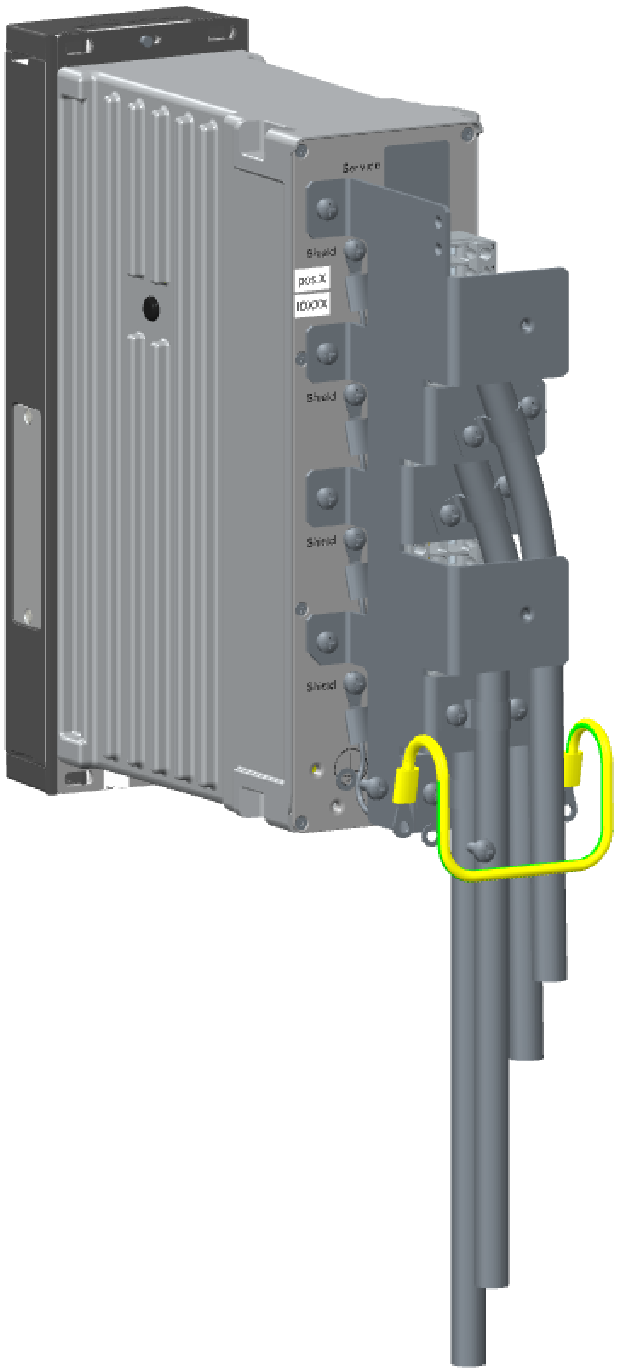
NOTICE

The insulation of the cables can be damaged if you are careless when mounting the clamps.

Noncompliance with the specified safety instructions means that material damage can occur.

✧ Be careful when mounting the clamps to protect the insulation of the cables.

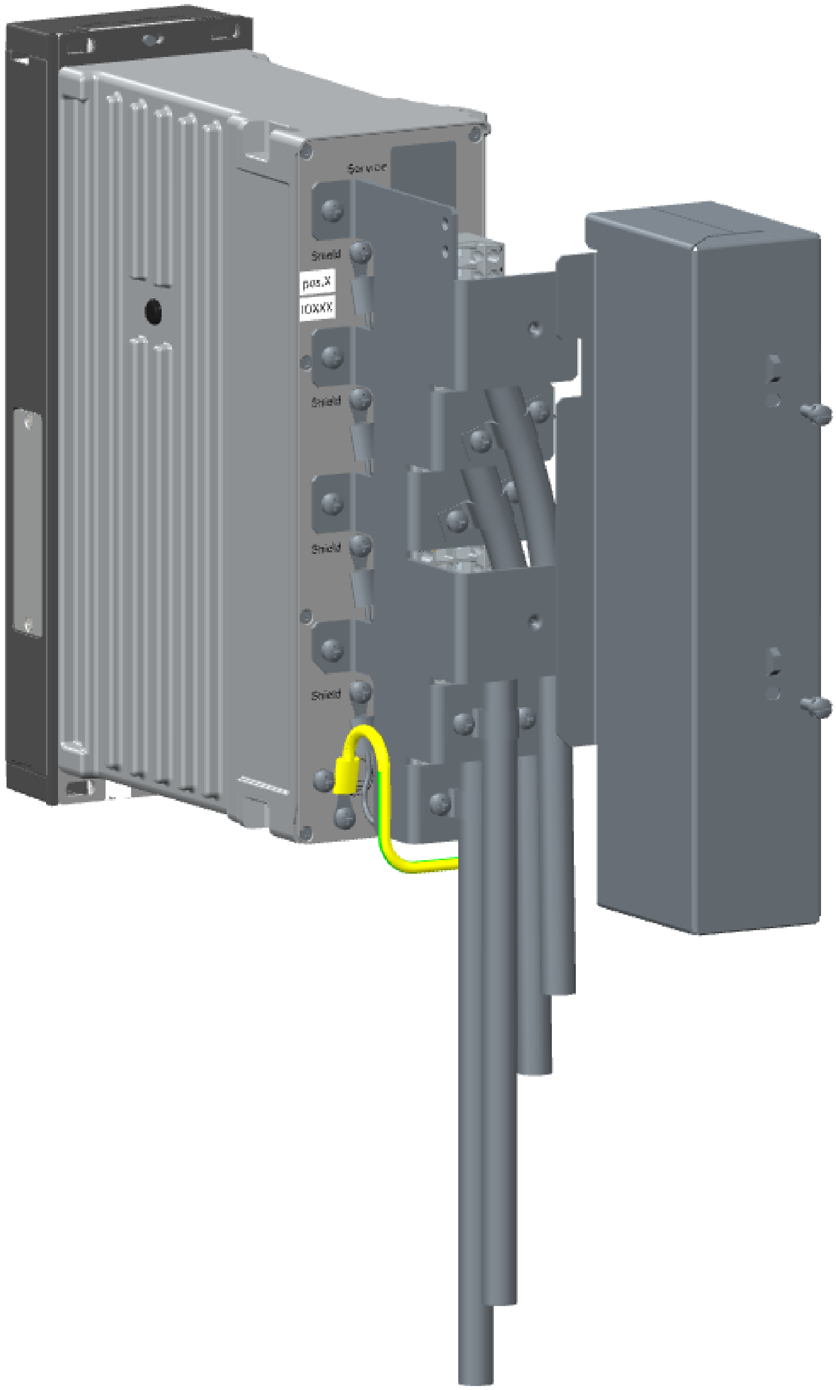
- ✧ Connect the LPIT module with the module or base unit on the right side of the LPIT module, using the provided PE cable. If there are additional IO modules, connect them using their PE cables to the upper PE screw of the LPIT module (torque = 1.6 Nm).



[sc_IO240 connection PE connection, 1, --_--]

Figure 3-85 Connection of PE

- ✧ Mount the shield cover with the supplied slotted capstan screws (torque = 1.2 Nm). To avoid unauthorized access to the terminal connections, the screw provides a hole and the cover provides a lug for applying a seal.



[sc_IO240 connection seal cage, 1, --_--]

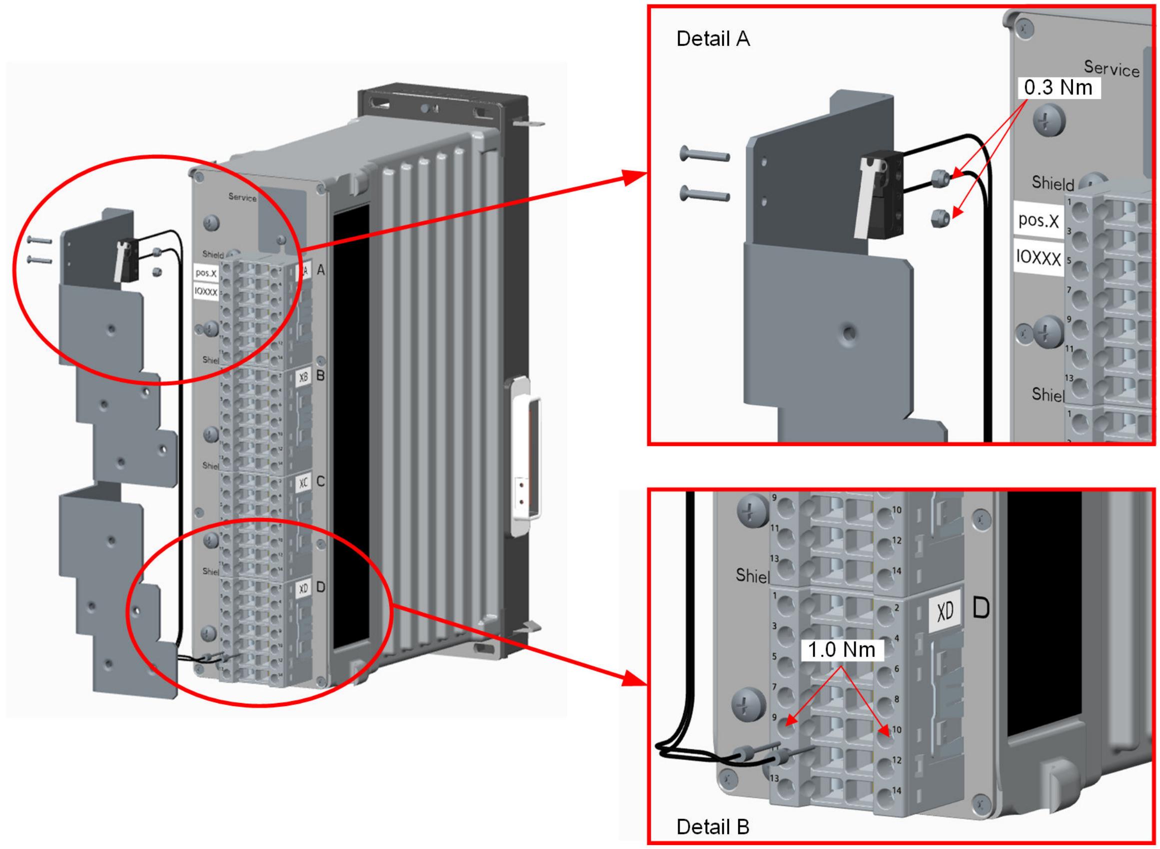
Figure 3-86 Mounting the Shield Cover

3.2.22.4 Installation of a Microswitch to the Strain-Relief Plate of the IO240 Module

To install a microswitch to the strain-relief plate of the IO240 module, proceed as follows:

✧ Assemble the microswitch to the strain-relief plate with the supplied screws and locking nuts (Detail A).
Use a Pozidriv PZ1 screwdriver and a 4-mm wrench with a torque of 0.3 Nm.

✧ Connect the cables to the terminals D9 and D10; any polarity can be applied (Detail B).
Use a Pozidriv PZ1 screwdriver with a maximum torque of 1.0 Nm.



[dw_micro-switch_installation, 2, en_US]

Figure 3-87 Installation of a Microswitch

NOTE

For more information on connecting the IO240 module to the LPIT sensors and mounting the shield cover, refer to the Supplementary Note C53000-M5050-C063.

3.2.23 LPIT Input Module IO245

3.2.23.1 Description

The following terminals for the connection of the TOCT (optical current transformer manufactured by Trench) and RCVT (resistive-capacitive voltage transformer) are on the LPIT input module IO245.

- 3 fiber-optic input groups for optical current measurement (measuring channels)
- 3 fiber-optic input groups for optical current measurement (protection channels)
- 3 fiber-optic connections for optical temperature measurement
- 3 RCVT voltage inputs (RC dividers)

The connections are distributed over:

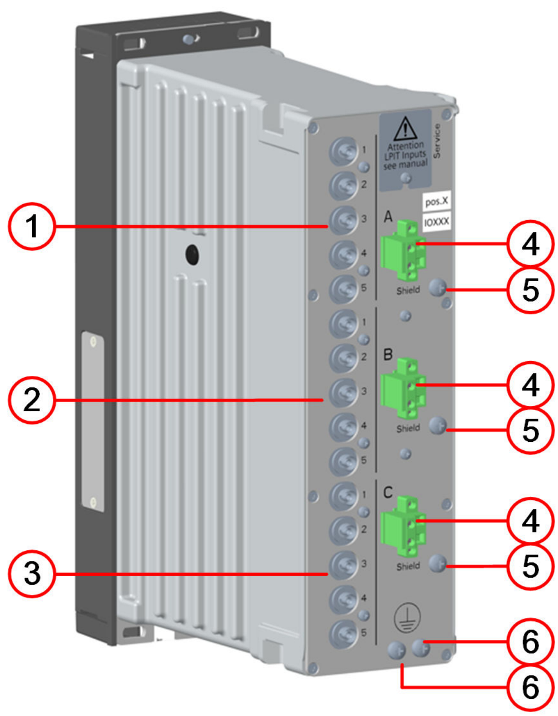
- 3 x 5 FC/APC fiber-optic connectors (FC = Ferrule Connector, APC = Angled Physical Contact)
- 3 x 2-pole voltage terminal

NOTE

Due to the higher power requirements of the modules IO218, IO240, and IO245, a maximum of 2 of these modules are permitted in each device row. If one of these modules is used in the 1/3 base module, then this also counts for the limit.

3.2.23.2 Terminals

Overview of Terminals

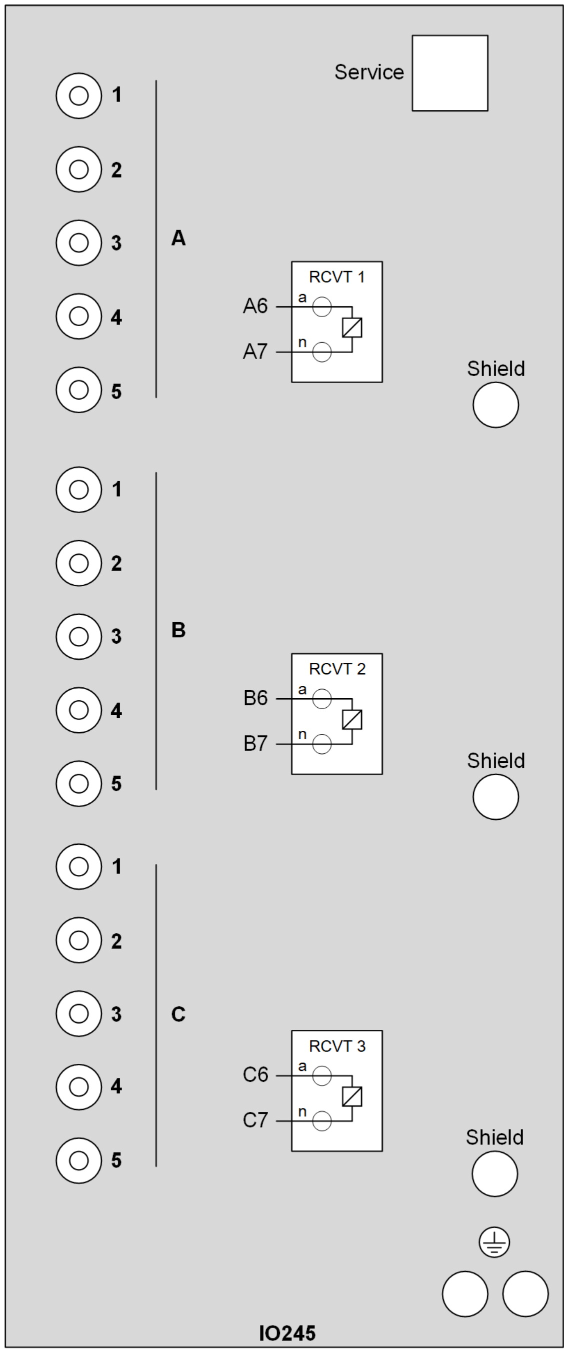


[le_IO245_overview, 2, --_--]

Figure 3-88 IO245 – Terminal Diagram

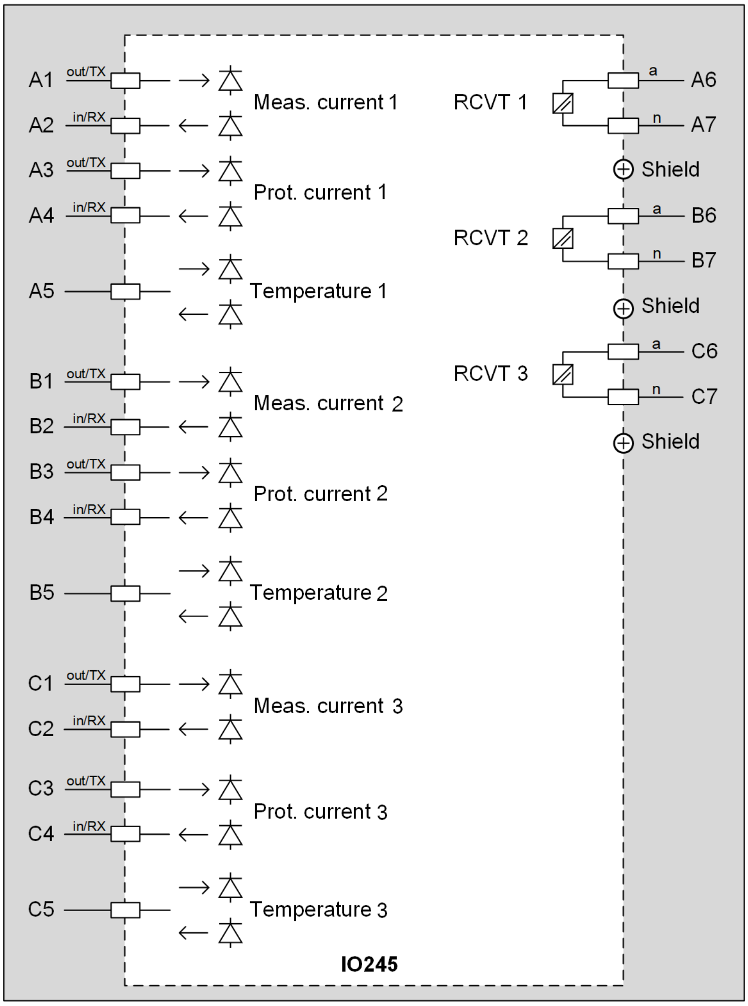
(1) Optical current and temperature terminals A
(2) Optical current and temperature terminals B
(3) Optical current and temperature terminals C
(4) RCVT voltage terminals
(5) RCVT voltage-input shield
(6) Protective grounding terminal

Terminal and Connection Diagram



[td_io245, 2, en_US]

Figure 3-89 IO245 – Terminal Diagram



[cd_io245, 2, en_US]

Figure 3-90 IO245 – Connection Diagram

NOTE

For TOCTs, you can set the relationship between the physical connection of the TOCTs to the respective TOCT inputs of the LPIT module IO245 via the parameters **`Primary Phase A`**, **`Primary Phase B`**, and **`Primary Phase C`**.

NOTE

For RCVTs, physically connect primary phase A to the RCVT 1 terminals, primary phase B to the RCVT 2 terminals and primary phase C to the RCVT 3 terminals.

NOTE

For more information on the commissioning of the LPIT module IO245, refer to the commissioning manual from Trench for the TOCT and RCVT sensors.

3.3 Power-Supply Module of Non-Modular Devices (7xx81, 7xx82)

3.3.1 Power-Supply Module PS101

3.3.1.1 Description

The PS101 power supply module is always permanently installed in the 1/3 module. The following can be found on the PS101 power supply module:

- 2 positions for plug-in modules (communication modules, measuring-transducer modules)
- Terminals for time synchronization and an integrated Ethernet interface
- A 14-pole voltage terminal (3 binary inputs, 3 binary outputs and connection for power supply)
- The battery for the CPU

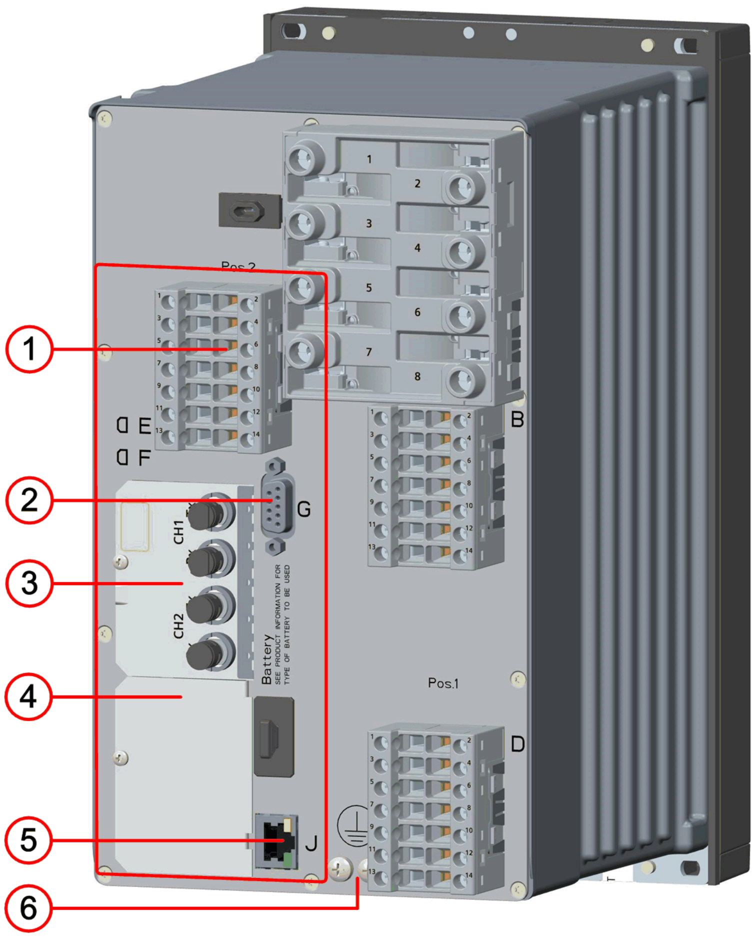
The following 3 variants are available for the rated voltage range:

- DC 24 V to 48 V (not for 7SX82)
- DC 60 V to 125 V
- DC 110 V to DC 250 V and AC 100 V to AC 230 V (50 Hz and 60 Hz)

3.3.1.2 Terminals

Overview of Terminals

The terminals assigned to the module are identified by the frame in the figure.

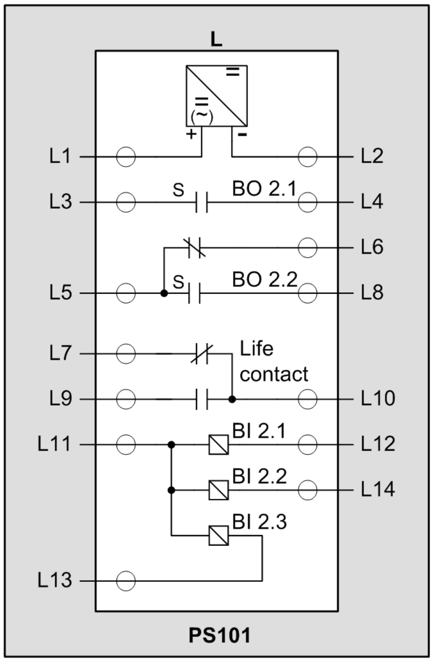


[le_ps101, 2, --_--]

Figure 3-91 PS101 – Terminals

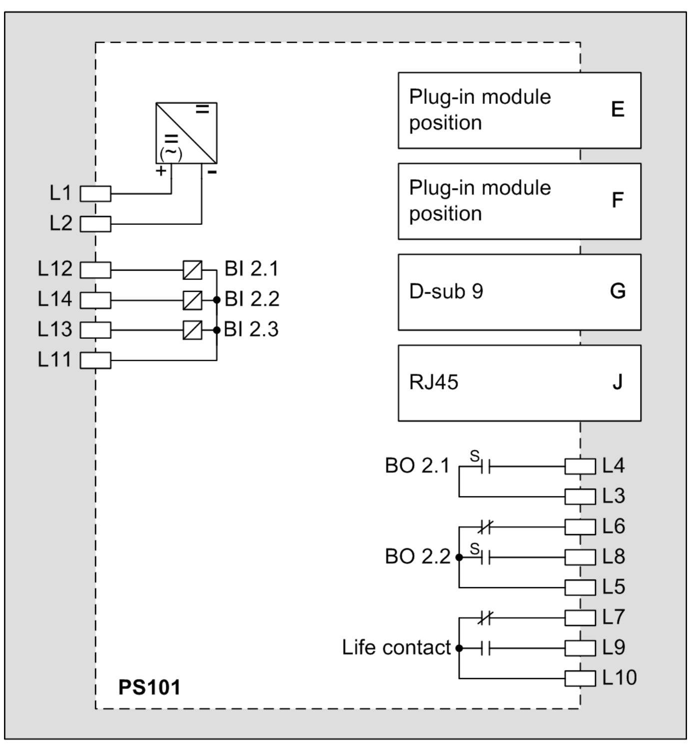
(1) Voltage terminal L
(2) Time synchronization G
(3) Plug-in module position E
(4) Plug-in module position F
(5) Integrated Ethernet interface J
(6) Protective grounding terminals

Terminal and Connection Diagram



[cdps101x-210513-01.tif, 1, en_US]

Figure 3-92 PS101 – Terminal Diagram



[tdps101x-210513-01.tif, 1, en_US]

Figure 3-93 PS101 – Connection Diagram

Time-Synchronization Terminal

The terminal for time synchronization is located on the D-sub 9 interface (position G). Time synchronization signals for DC 5 V, DC 12 V, and DC 24 V can be processed as an option.

For further information on connecting to the time synchronization, see chapter *6.6 Communication Interfaces* in the Technical Data.

Integrated Ethernet Interface (RJ45)

This terminal is used to load the device with DIGSI 5 using Ethernet. This terminal also enables straightforward IEC 61850 Ethernet communication (including GOOSE) or communication with another protocol via Ethernet, for example, for connecting an external RTD unit.

For further information on the integrated Ethernet interface, see chapter *6.6 Communication Interfaces* in the Technical Data.

3.4 Input and Output Modules of Non-Modular Devices (7xx81, 7xx82)

3.4.1 Function Description of the Input and Output Modules of the Non-Modular Devices

Module Designation	Function Description
IO101	• Input and output module • 4 current measuring inputs, 8 binary inputs, 6 binary outputs
IO102	• Input and output module • 4 current measuring inputs, 4 voltage measuring inputs, 8 binary inputs, 6 binary outputs
IO103	• Input and output module • 8 current measuring inputs, 4 binary inputs, 4 binary outputs
IO110	• Input and output module • 12 binary inputs, 7 binary outputs
IO111	• Input module • 12 temperature inputs
IO112	• Input and output module • 5 binary inputs, 2 binary outputs
IO113	• Input and output module • 7 binary inputs, 5 binary outputs
IO141	• Input and output module • 8 LPIT measuring inputs (4 x current sensors, 4 x voltage sensors), 6 binary inputs, 6 binary outputs

3.4.2 Input and Output Module IO101

3.4.2.1 Description

The terminals for the following are located on the input and output module IO101:

- 4 current transformers (3 transformers always as protection-class current transformers, the 4th optionally as protection-class or instrument transformer)
- 8 binary inputs
- 6 binary outputs, of which:
  - 4 standard make contacts (type S)
  - 2 standard change-over contacts (type S)

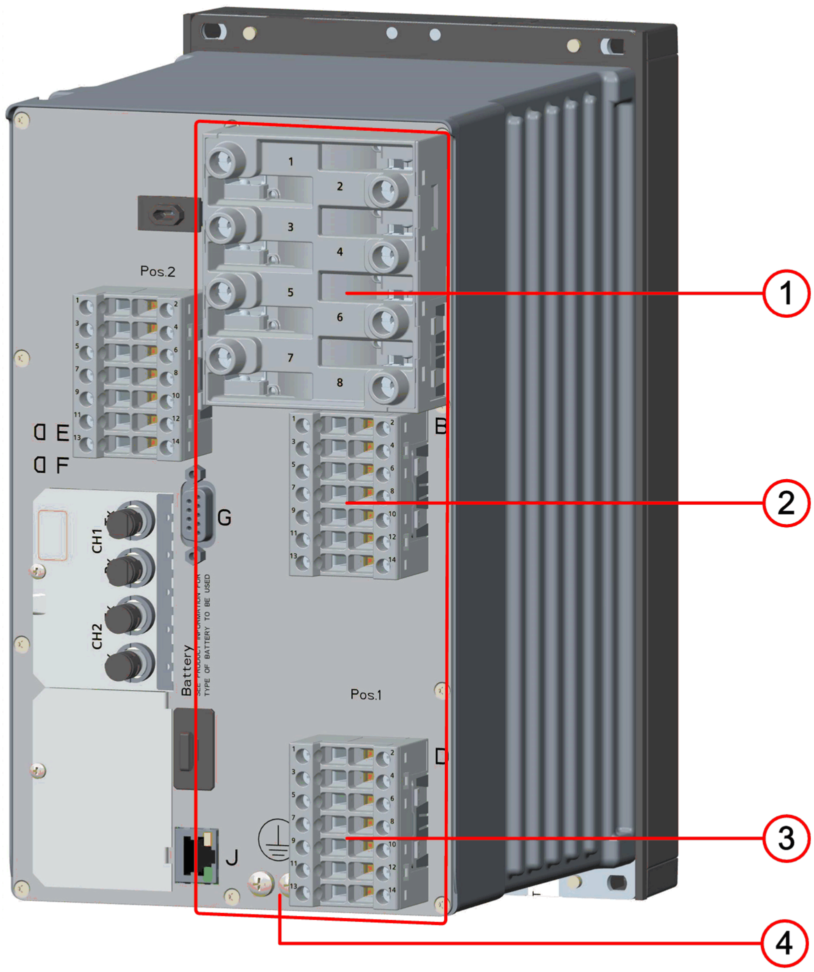
The connections are distributed over:

- 1 x 8-pole current terminal
- 2 x 14-pole voltage terminal

3.4.2.2 Terminals

Overview of Terminals

The terminals assigned to the module are identified by the frame in the figure.

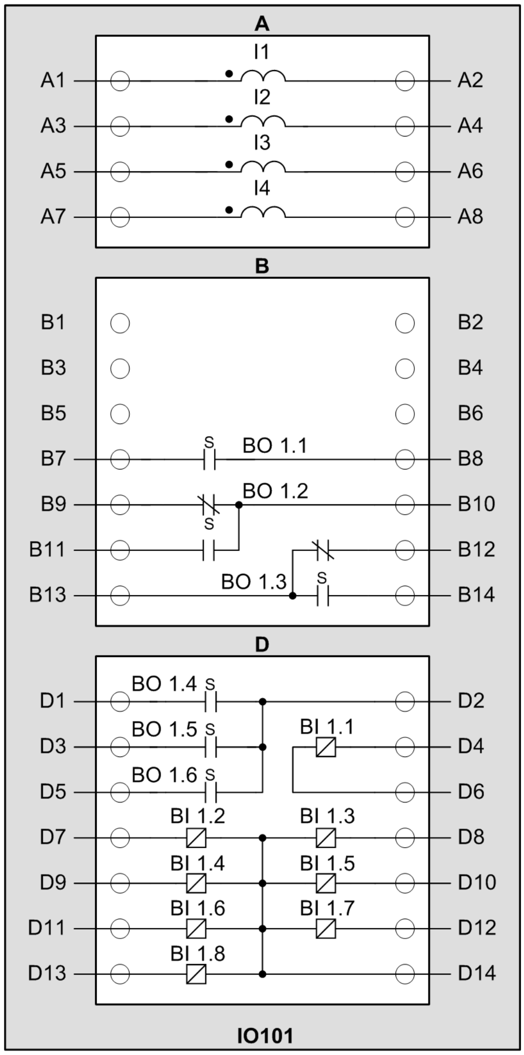


[le_io101, 2, --_--]

Figure 3-94 IO101 – Terminals

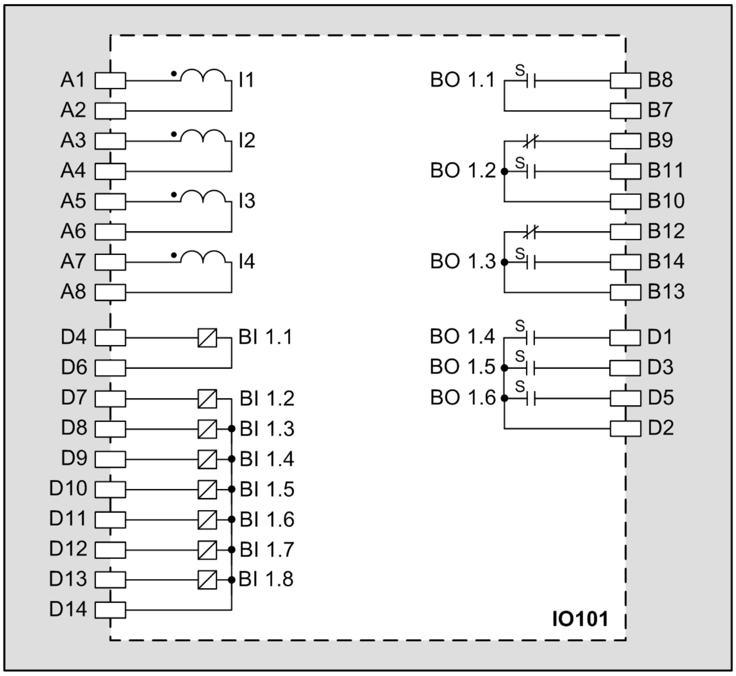
(1)	Current terminal A
(2)	Voltage terminal B
(3)	Voltage terminal D
(4)	Protective grounding terminals

Terminal and Connection Diagram



[cdio101x-220513-01.tif, 1, en_US]

Figure 3-95 IO101 – Terminal Diagram



[tdio101x-220513-01.tif, 1, en_US]

Figure 3-96 IO101 – Connection Diagram

3.4.3 Input and Output Module IO102

3.4.3.1 Description

The terminals for the following are located on the input and output module IO102:

- 4 current transformers (3 transformers always as protection-class current transformers, the 4th optionally as protection-class or instrument transformer)
- 4 voltage transformers
- 8 binary inputs
- 6 binary outputs, of which:
  - 4 standard make contacts (type S)
  - 2 standard change-over contacts (type S)

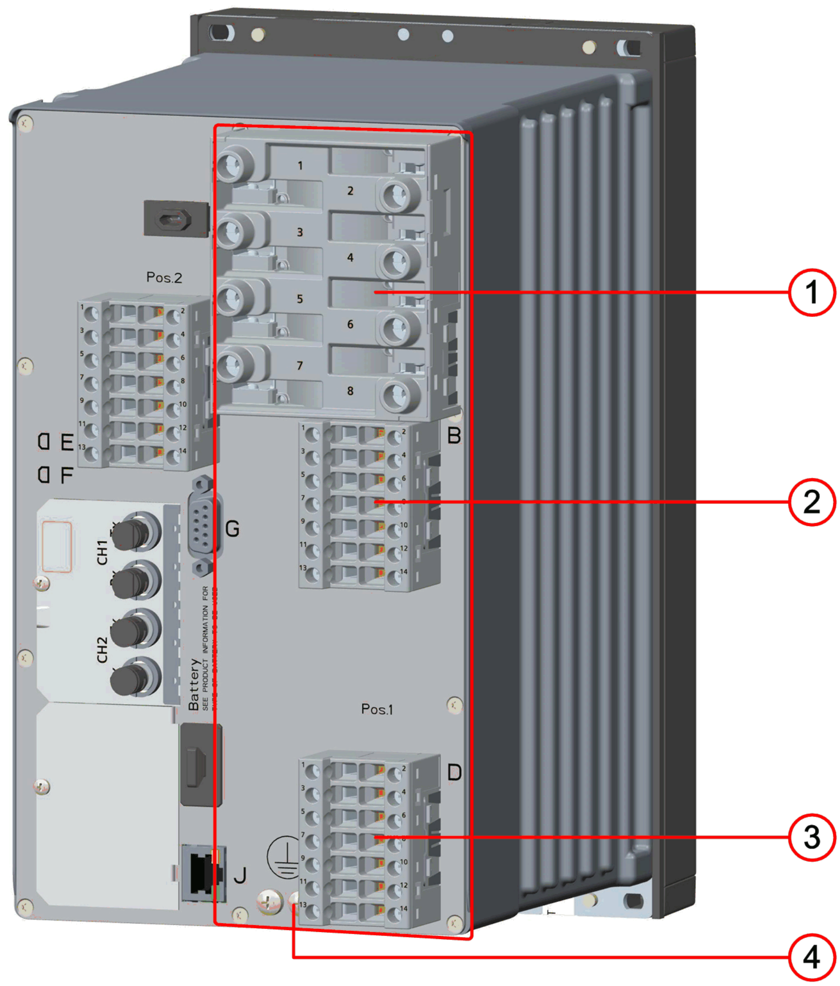
The connections are distributed over:

- 1 x 8-pole current terminal
- 2 x 14-pole voltage terminal

3.4.3.2 Terminals

Overview of Terminals

The terminals assigned to the module are identified by the frame in the figure.

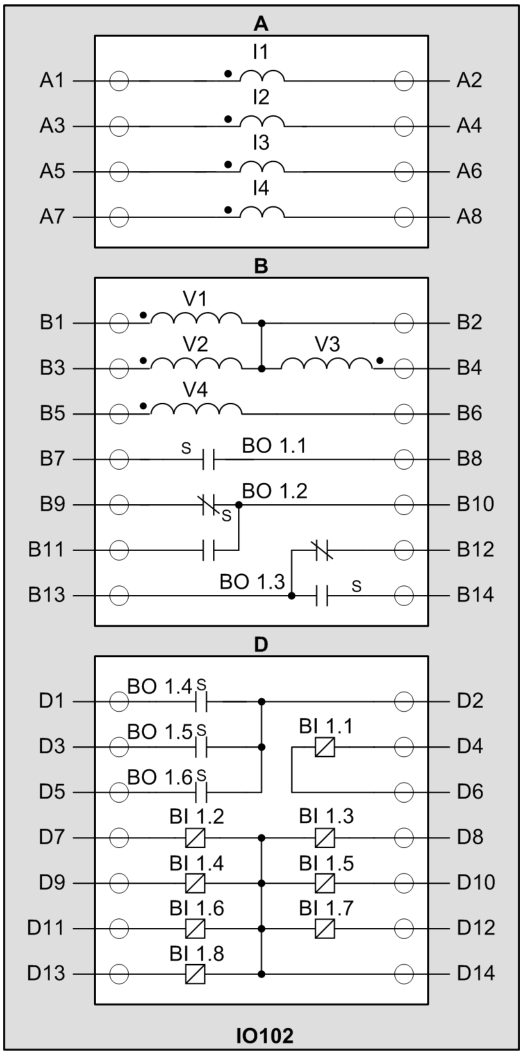


[le_io102, 2, --_--]

Figure 3-97 IO102 – Terminals

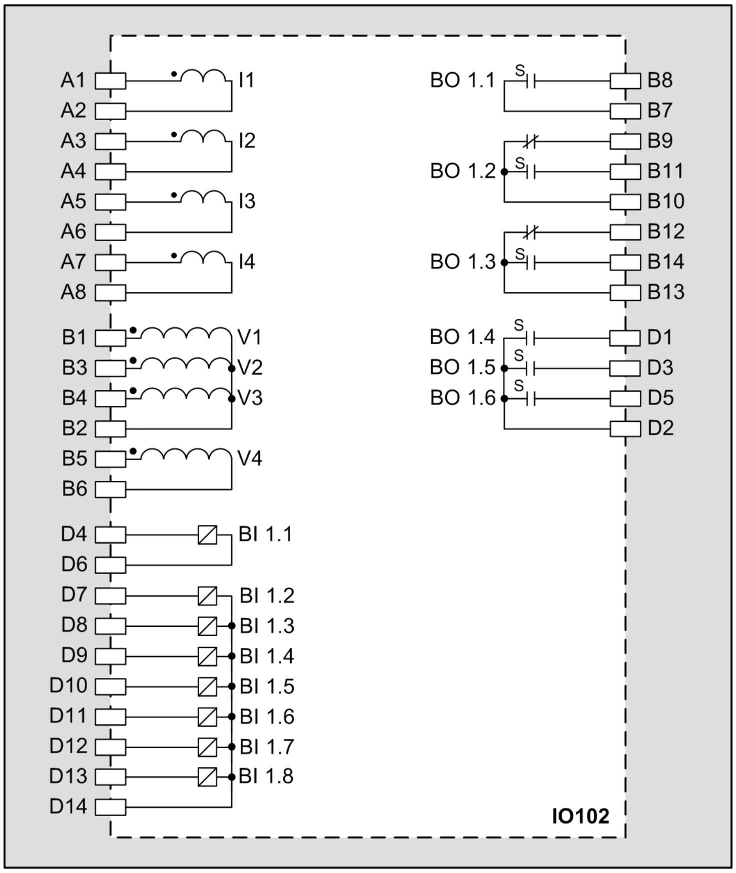
(1)	Current terminal A
(2)	Voltage terminal B
(3)	Voltage terminal D
(4)	Protective grounding terminals

Terminal and Connection Diagram



[cdio102x-220513-01.tif, 1, en_US]

Figure 3-98 IO102 – Terminal Diagram



[tdio102x-220513-01.tif, 1, en_US]

Figure 3-99 IO102 – Connection Diagram

3.4.4 Input and Output Module IO103

3.4.4.1 Description

The terminals for the following are located on the input and output module IO103:

- 8 current transformers (optionally as protection-class current transformers or instrument transformers)
- 4 binary inputs (2 binary inputs each with a common potential)
- 4 binary outputs with 4 standard make contacts (type S)

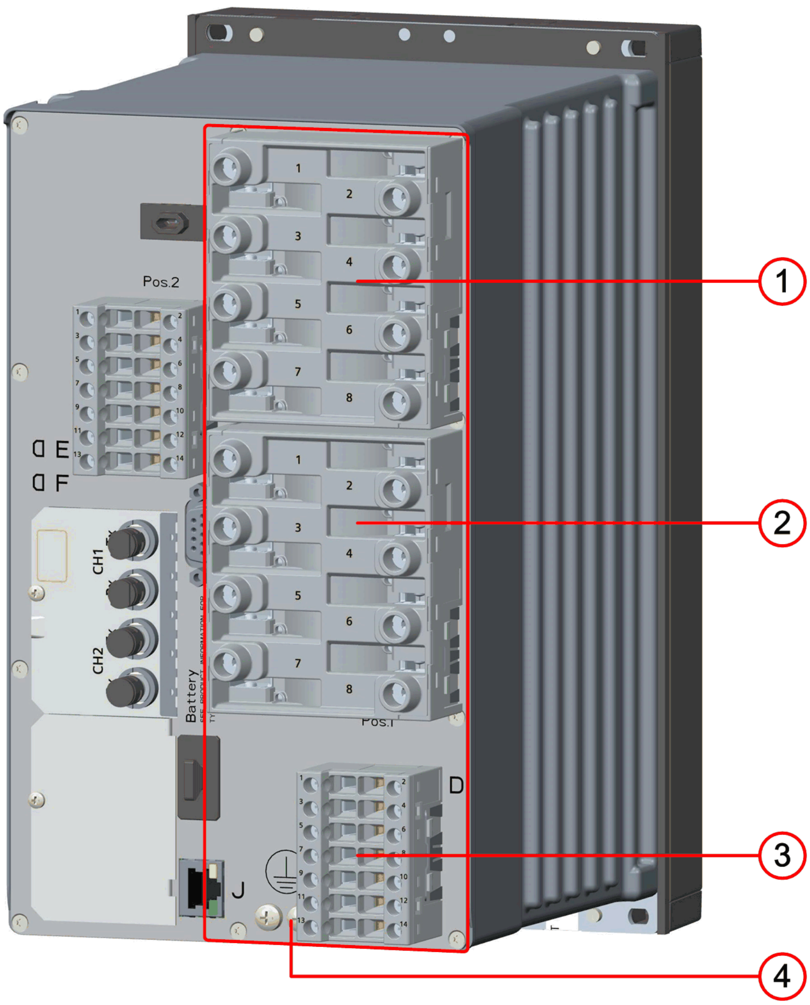
The connections are distributed over:

- 2 x 8-pole current terminal
- 1 x 14-pole voltage terminal

3.4.4.2 Terminals

Overview of Terminals

The terminals assigned to the module are identified by the frame in the figure.

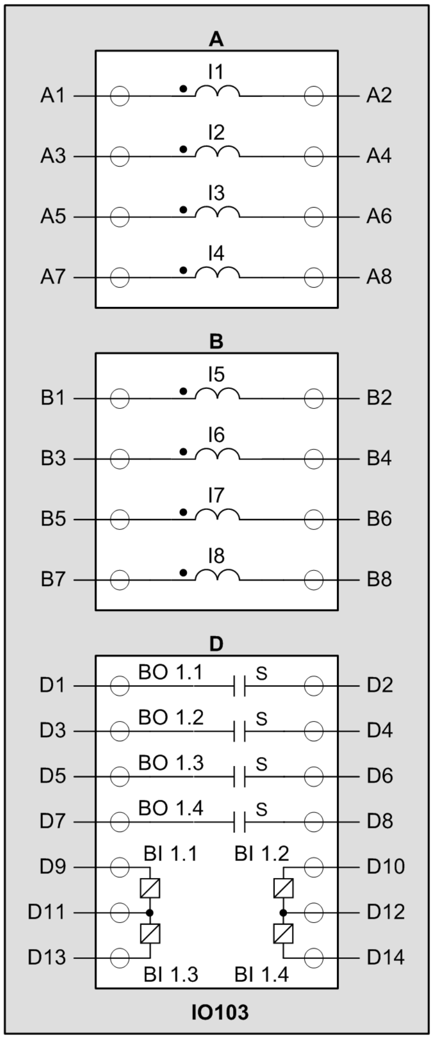


[le_io103, 2, --_--]

Figure 3-100 IO103 – Terminals

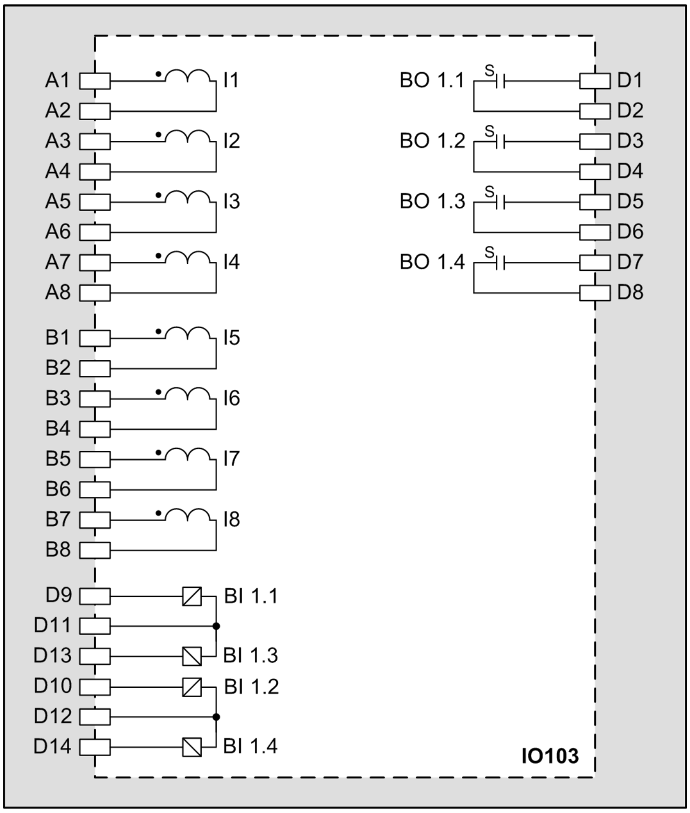
(1) Current terminal A
(2) Current terminal B
(3) Voltage terminal D
(4) Protective grounding terminals

Terminal and Connection Diagram



[cdio103x-131113-01, 3, en_US]

Figure 3-101 IO103 – Terminal Diagram



[tdio103x-01.vsd, 1, en_US]

Figure 3-102 IO103 – Connection Diagram

3.4.5 Input and Output Module IO110

3.4.5.1 Description

The terminals for the following are located on the input and output module IO110:

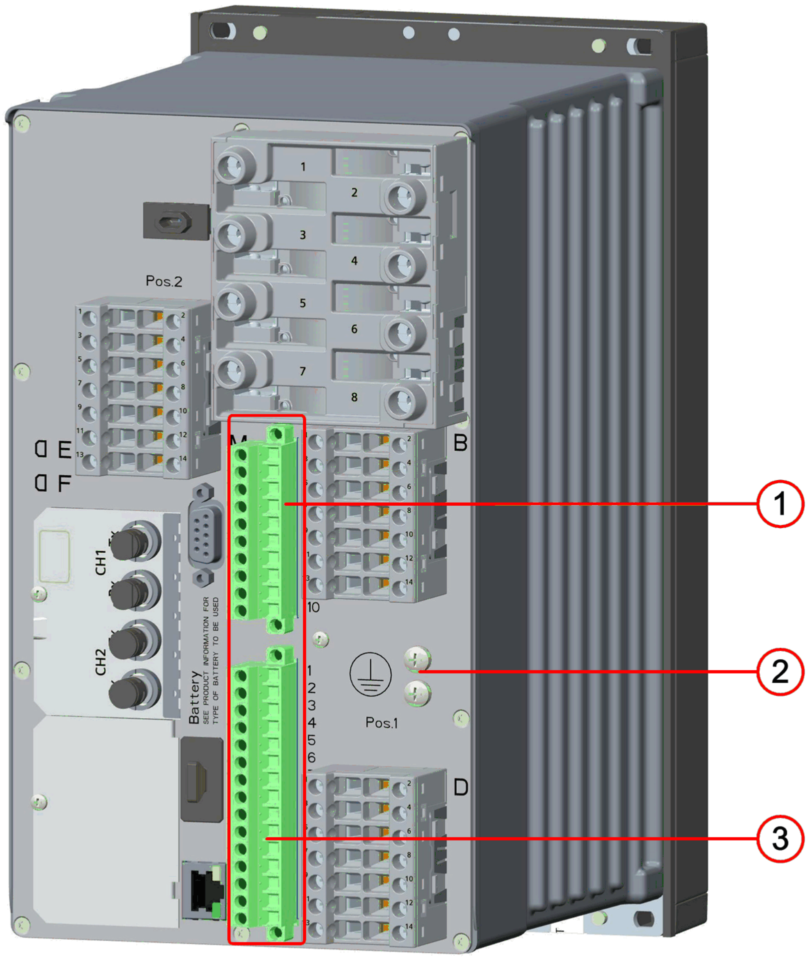
- 12 binary inputs
- 7 binary outputs, of which:
  - 7 standard make contacts (type S)

The connections are distributed over:

- 1 x 10-pole terminal
- 1 x 15-pole terminal

3.4.5.2 Terminals

Overview of Terminals

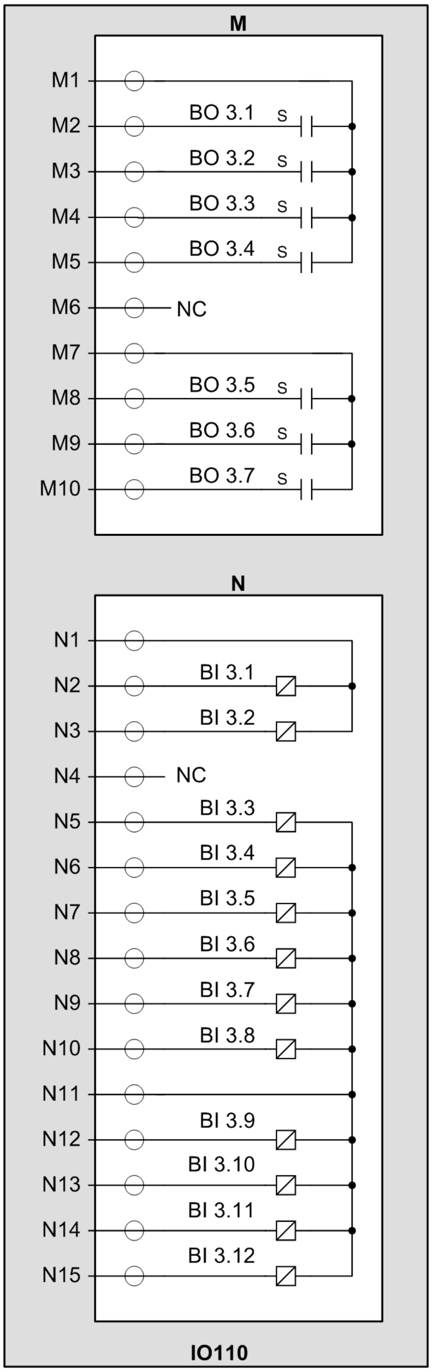


[le_io110, 3, --_--]

Figure 3-103 IO110 – Terminals

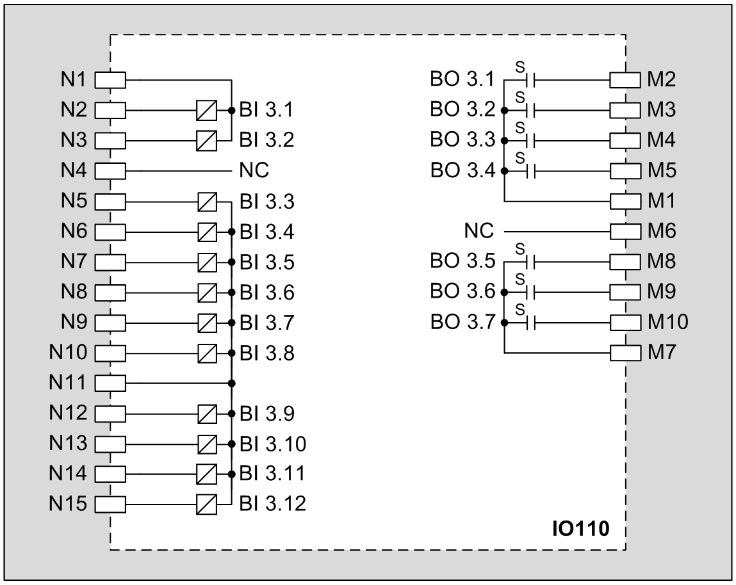
(1) Terminal M
(2) Protective grounding terminals
(3) Terminal N

Terminal and Connection Diagram



[cdio110x-220513-01.tif, 3, en_US]

Figure 3-104 IO110 – Terminal Diagram



[tdio110x-220513-01.tif, 1, en_US]

Figure 3-105 IO110 – Connection Diagram

3.4.6 Input and Output Module IO111

3.4.6.1 Description

The terminals for the following are located on the input and output module IO111:

- 12 temperature inputs

The connections are distributed over:

- 1 x 16-pole terminal
- 1 x 17-pole terminal

3.4.6.2 Terminals

Overview of Terminals

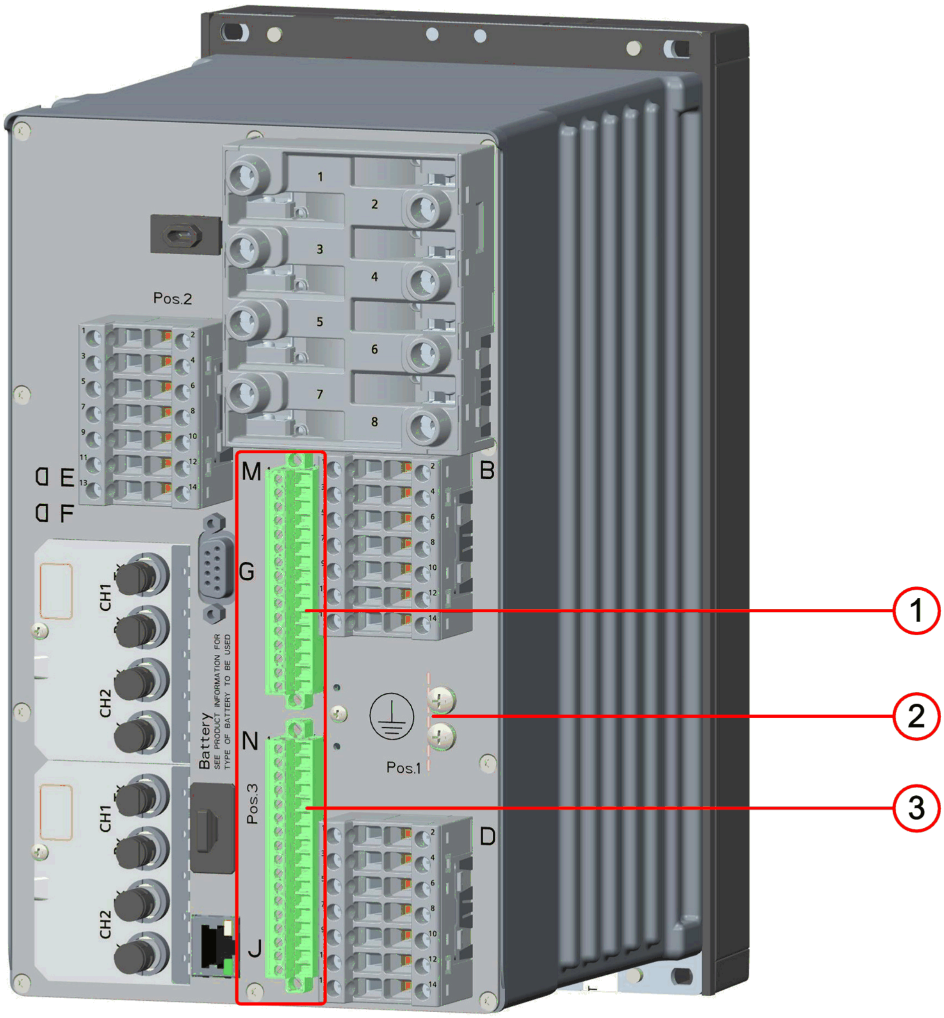
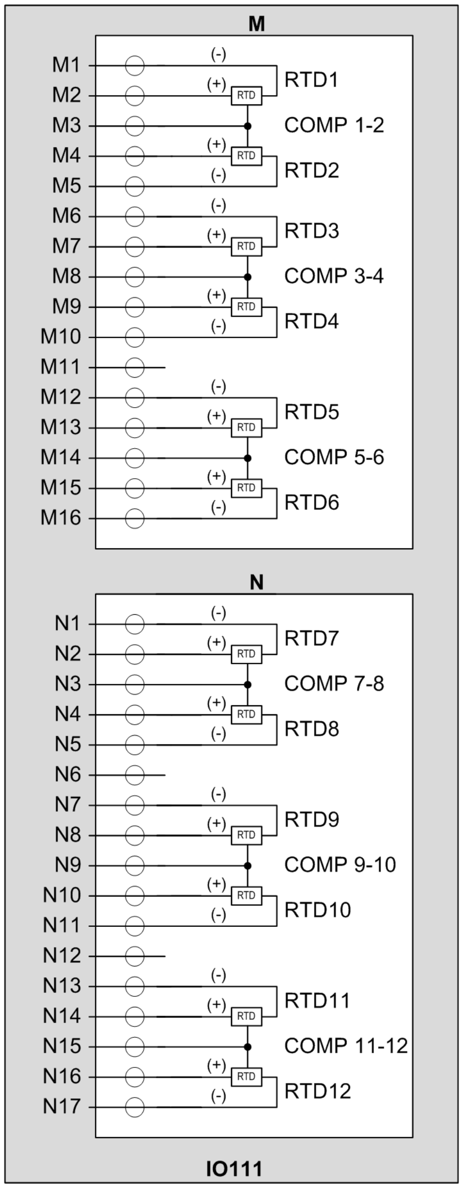


Figure 3-106 IO111 – Terminals

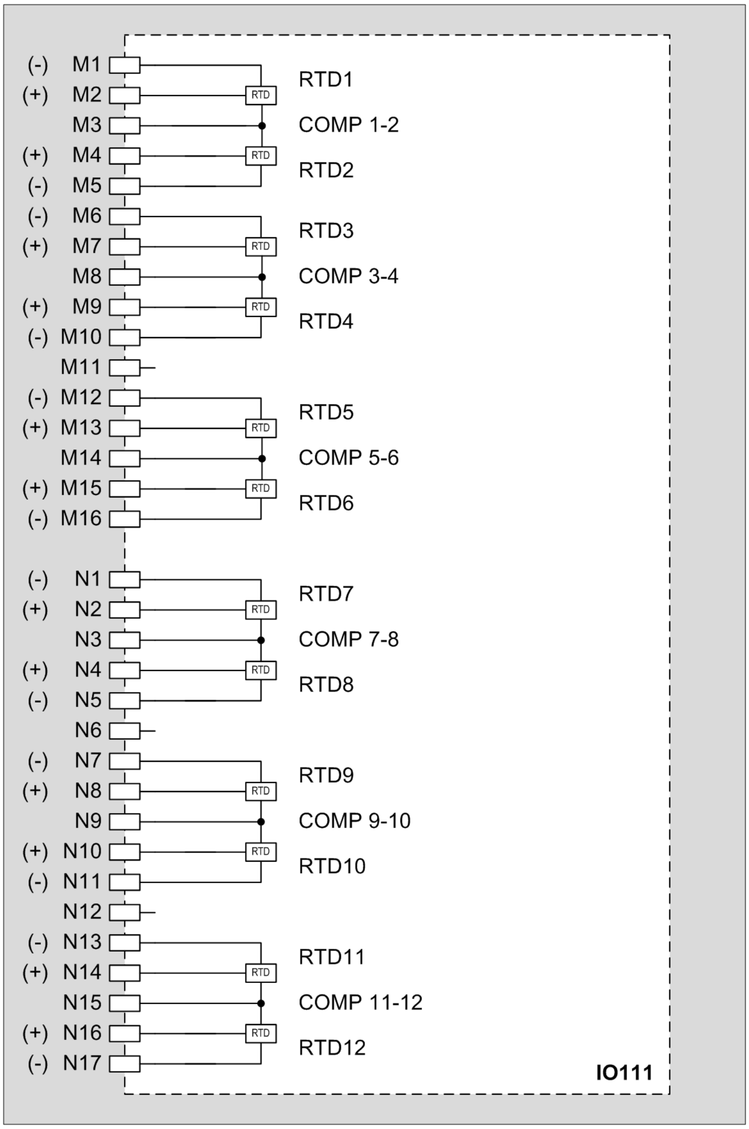
(1) Terminal M
(2) Protective grounding terminals
(3) Terminal N

Terminal and Connection Diagram



[cd_io111, 1, en_US]

Figure 3-107 IO111 – Terminal Diagram



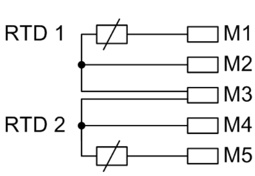
[td_io111, 1, en_US]

Figure 3-108 IO111 – Connection Diagram

3.4.6.3 Connections of Temperature Sensors and Cables

Connections of Temperature Sensors Directly to the Device

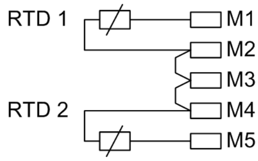
It is possible in principle to connect temperature sensors with 2-core or 3-core technology. To achieve the specified accuracy, Siemens recommends only using 3-core technology.



[dw_example_temp_sensor_3phase, 2, en_US]

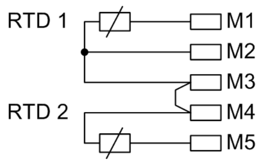
Figure 3-109 Example: Connecting Temperature Sensors RTD 1 (3-Core Terminal) and RTD 2 (3-Core Terminal) to Terminals M1 to M5

✧ For a connection with 2-core technology, you must connect a bridge, for example for RTD 2, between M3 and M4.



[dw_example_temp_sensor_2phase, 2, en_US]

Figure 3-110 Example: Connecting Temperature Sensors RTD 1 (2-Core Terminal) and RTD 2 (2-Core Terminal) to Terminals M1 to M5



[dw_temperature_sensor, 2, en_US]

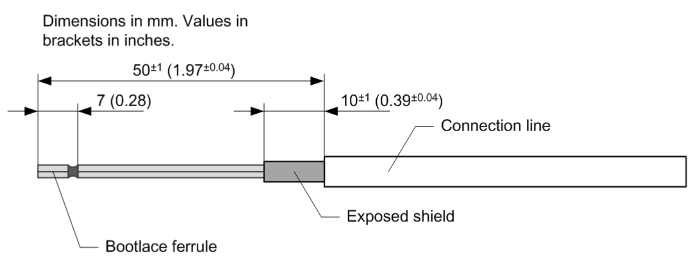
Figure 3-111 Example: Connecting Temperature Sensors RTD 1 (3-Core Terminal) and RTD 2 (2-Wire Terminal) to Terminals M1 to M5

Connecting the Lines

Connecting the Lines

✧ Use shielded lines with shielding braid (3-core AWG 24).

✧ Prepare the cable as shown in the following figure.
The dimensions in the drawing are designed so that the plug can still be plugged in with the shielding plate screwed on.

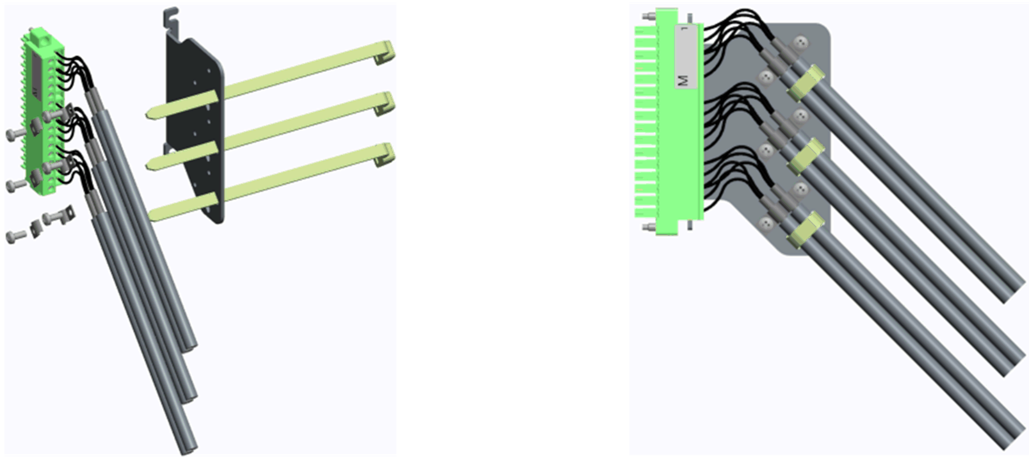


[dw_shielded_line, 1, en_US]

Figure 3-112 Preparing the Cable

✧ Connect the lines with bootlace ferrules.

✧ Use the included clamps and cable ties to make contact with the cable shield and provide strain relief on the cable.



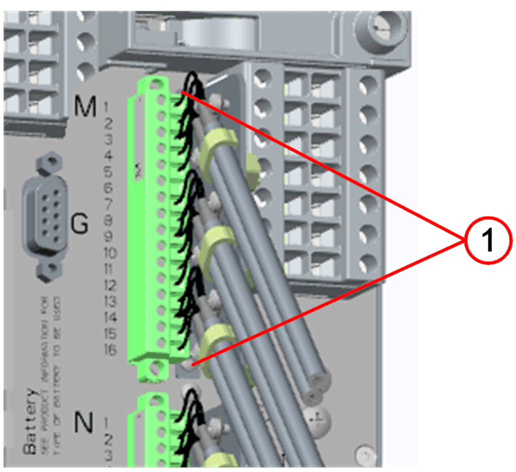
[sc_ shielding_plate _mounting-cutout, 1, --_--]

Figure 3-113 Using Clips and Cable Ties

✧ Loosen the 2 screws for fastening the shielding plates on the device next to the 16-pole or 17-pole plug so that there is somewhat more than 2 mm (0.08 in) space.

✧ Push the prepared shielding plate under the screw heads and tighten them.

✧ Plug in the plug and secure it with its 2 outer screws.



[le_ shielding_plate _screw fastening, 1, --_--]

Figure 3-114 Fastening with Screws

(1) Fastening screws for shielding plate

✧ Repeat the steps for the 2nd plug.

3.4.7 Input and Output Module IO112

3.4.7.1 Description

The terminals for the following are located on the input and output module IO112:

- 5 binary inputs
- 2 binary outputs, of which:
  - 2 standard-make contacts (type S)

The connections are distributed over:

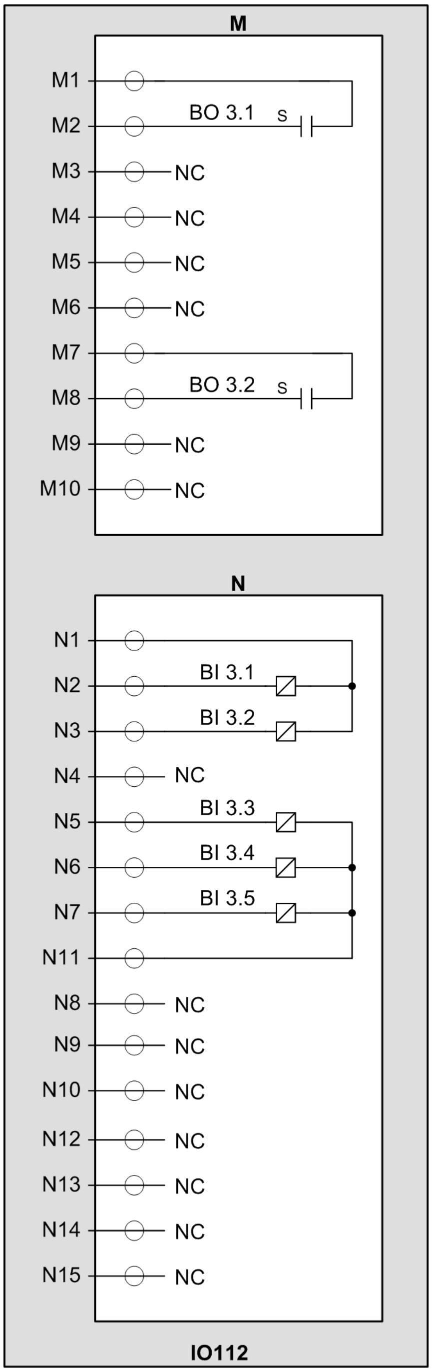
- 1 x 10-pole terminal
- 1 x 15-pole terminal

3.4.7.2 Terminals

Overview of Terminals

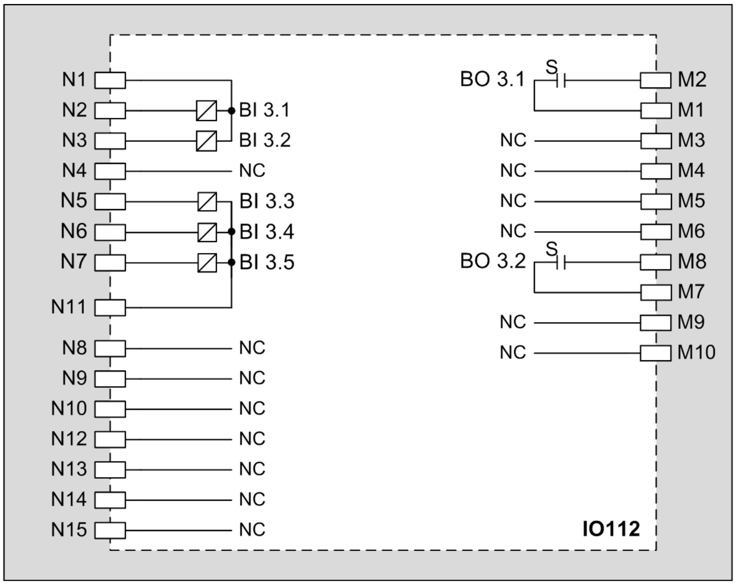
The overview of terminals is identical to the module IO110, see *Figure 3-103*.

Terminal and Connection Diagram



[cdio112, 1, en_US]

Figure 3-115 IO112 – Terminal Diagram



[tdio112x, 1, en_US]

Figure 3-116 IO112 – Connection Diagram

3.4.8 Input and Output Module IO113

3.4.8.1 Description

The terminals for the following are located on the input and output module IO113:

- 7 binary inputs
- 5 binary outputs, of which:
  - 5 standard make contacts (type S)

The connections are distributed over:

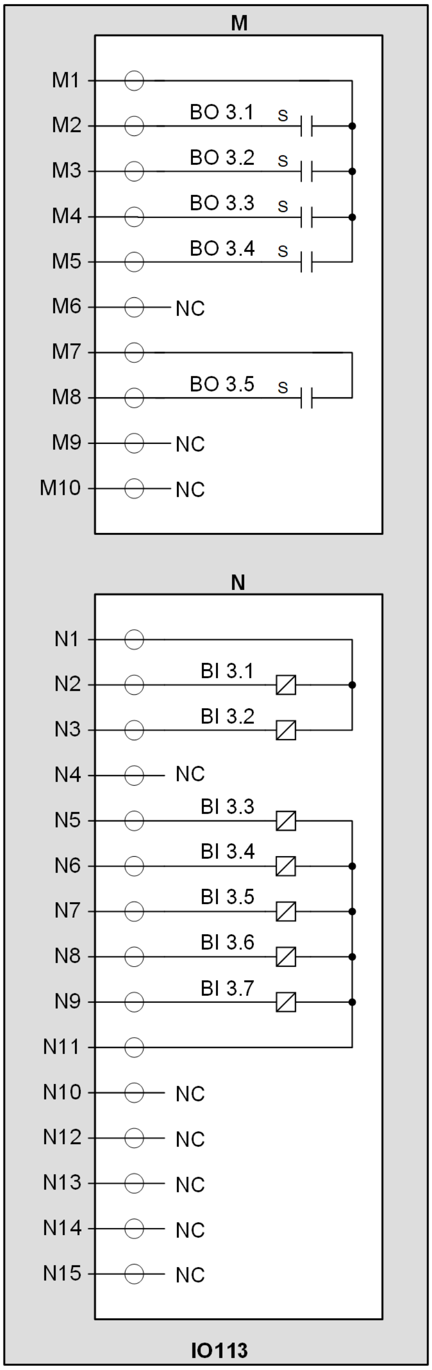
- 1 x 10-pole terminal
- 1 x 15-pole terminal

3.4.8.2 Terminals

Overview of Terminals

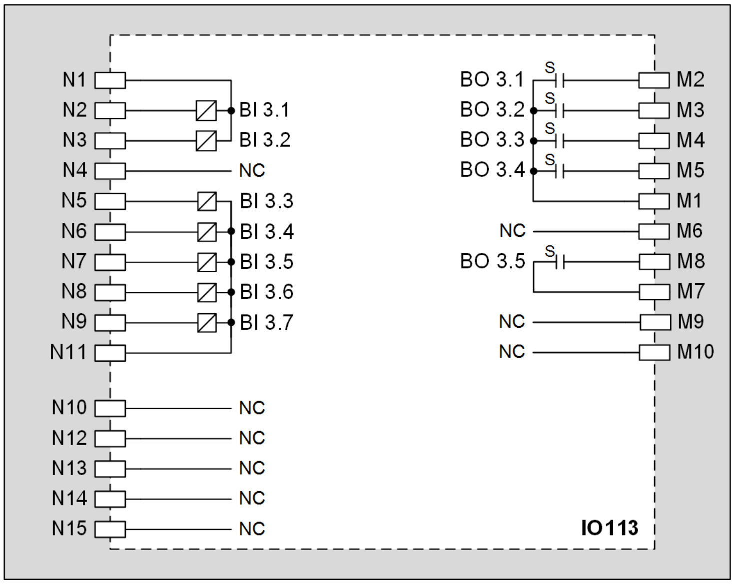
The overview of terminals is identical to the module IO110, see *Figure 3-103*.

Terminal and Connection Diagram



[cdio113, 1, en_US]

Figure 3-117 IO113 – Terminal Diagram



[tdio113x, 2, en_US]

Figure 3-118 IO113 – Connection Diagram

3.4.9 Input and Output Module IO141

3.4.9.1 Description

The terminals for the following are located on the IO141 input and output module:

- 8 universal inputs for measuring current and voltage values of low-power instrument transformers (4 inputs each for measuring current values and voltage values)
- 6 binary inputs
- 6 binary outputs, of which:
  - 4 standard make contacts (type S)
  - 2 standard change-over contacts (type S)

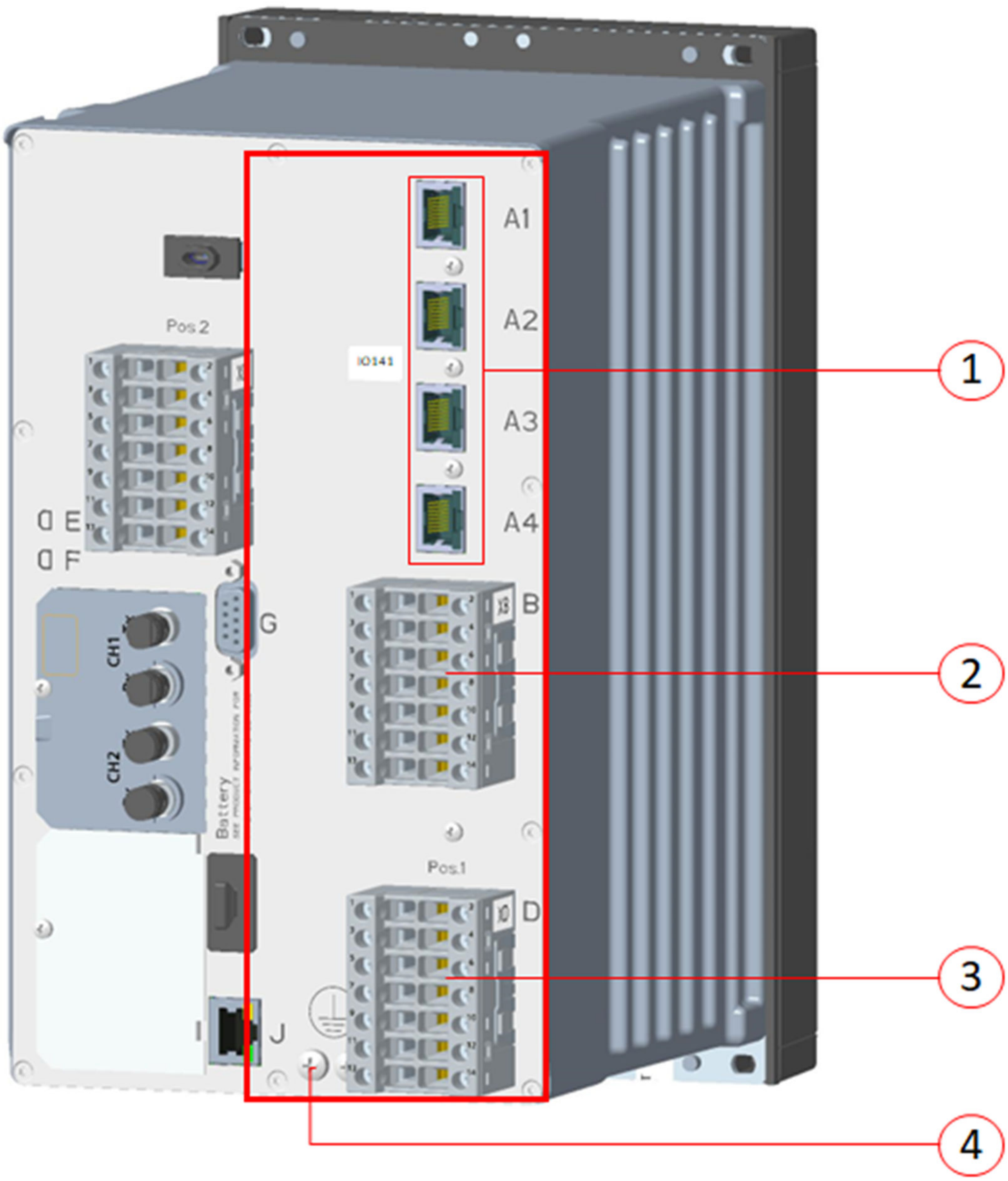
The connections are distributed over:

- 4 x 8-pole RJ45 socket
- 2 x 14-pole voltage terminal

3.4.9.2 Terminals

Overview of Terminals

The terminals assigned to the module are identified by the frame in the figure.

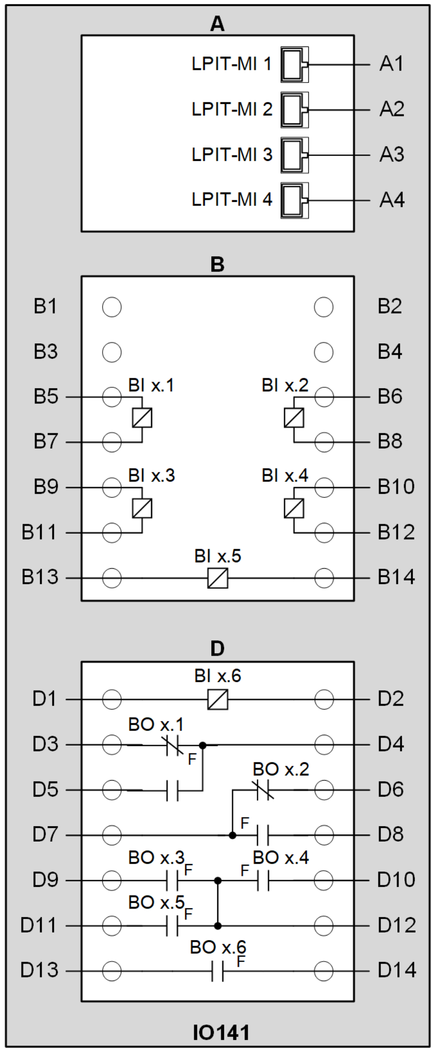


[le_io141, 1, --_--]

Figure 3-119 IO141 – Terminals

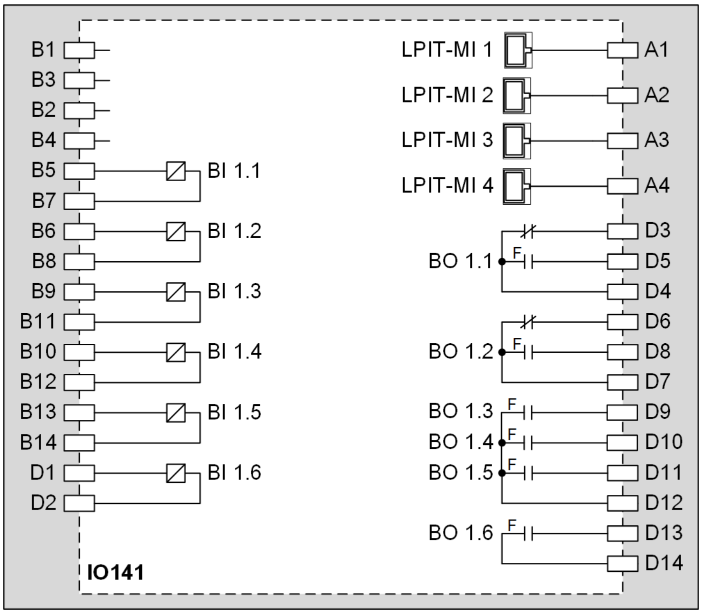
(1) LPIT measuring inputs A1–A4
(2) Voltage terminal B
(3) Voltage terminal D
(4) Protective grounding terminals

Terminal and Connection Diagram



[cd_io141, 2, en_US]

Figure 3-120 IO141 – Terminal Diagram



[td_io141, 2, en_US]

Figure 3-121 IO141 – Connection Diagram

4 Plug-In Modules

4.1 Function Description of the Plug-In Modules of the Modular and Non-Modular Devices

Plug-In Module Designation	Function Description
USART-xx-yEL	Serial communication module with electric transmission
USART-xx-yFO	Serial communication module with optical transmission for short distance
USART-xx-yLDFO	Serial communication module with optical transmission for long distance
ETH-xx-2EL	Ethernet module with electric transmission
ETH-xx-2FO	Ethernet module with optical transmission
ANAI-CA-4EL	Measuring-transducer module, measurement DC -20 mA to +20 mA
ANAI-CE-2EL	Measuring-transducer module, direct voltage measurement DC 0 V to +300 V
ARC-CD-3FO	Module for connecting optical sensors for detecting arcs
xx	**2 letters: Unique code for the module in the product code of the device**
y	**1 = 1 channel** **2 = 2 channels**

4.2 Communication Modules

4.2.1 Overview

SIPROTEC devices can be ordered with factory-installed communication modules. The communication modules can also be installed and replaced in the SIPROTEC devices afterwards. You do not have to open the device for this.

NOTE

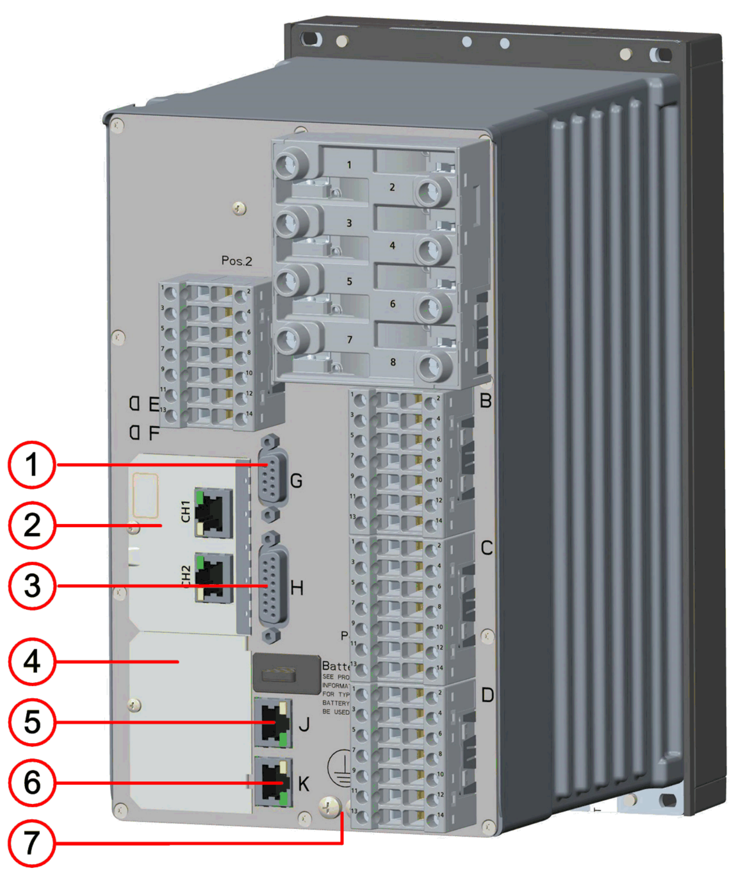
The communication modules available for reordering are not preconfigured. Use DIGSI 5 to carry out the functional adjustment to the required protocol application.

The communication modules can be installed in the base module or the 1/3 module and in the expansion module with the plug-in module assembly CB202. A maximum of 2 communication modules each can be installed. You can use only one CB202 in the device.

The plug-in module assembly CB202 is a printed circuit board assembly with an integrated power supply.

The plug-in module assembly CB202 communicates with the base module via a special connecting cable. This connecting cable (CAT 5 FTP patch cable) is always included in the scope of delivery of the plug-in module assembly CB202 or the devices containing the plug-in module assembly CB202 and needs not be ordered separately.

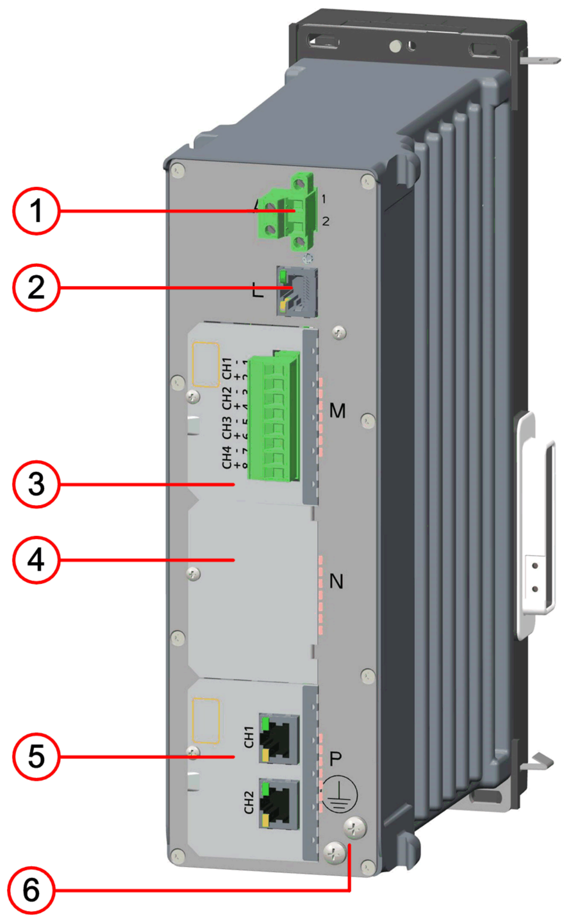
Ensure that you route the communication lines separately from network circuits.



[le_cm201p, 1, --_--]

Figure 4-1 Plug-In Module Positions and Communication Terminals in the Base Module, with Modular Devices

(1) Time synchronization G
(2) Plug-in module position E
(3) Terminal for detached on-site operation panel H
(4) Plug-in module position F
(5) Integrated Ethernet interface J
(6) Connection to expansion module with plug-in module assembly CB202
(7) Protective grounding terminals



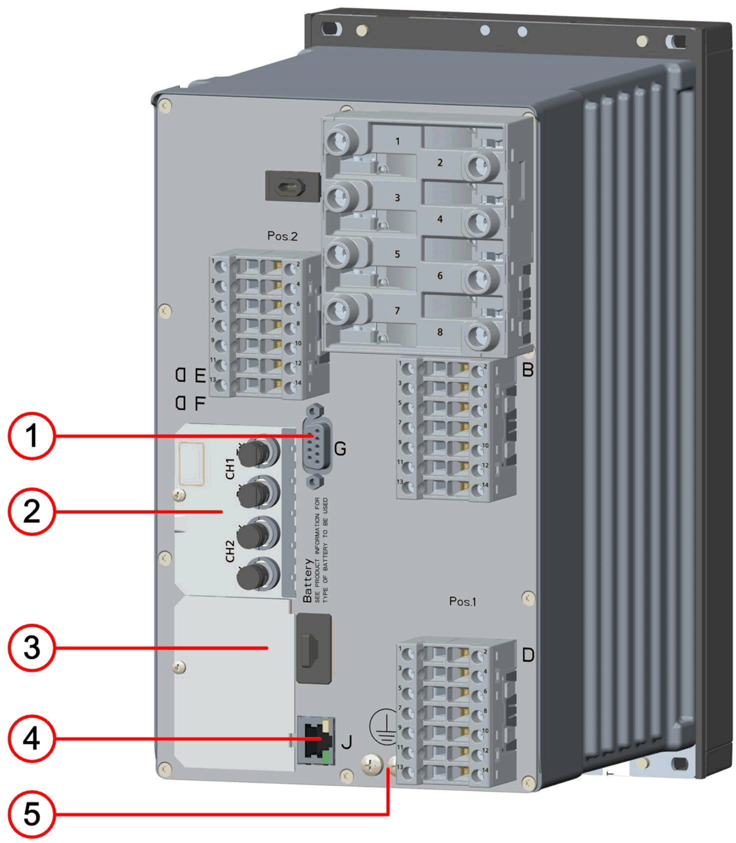
[le_lmnppo, 2, --_--]

Figure 4-2 Plug-In Module Positions and Communication Terminals in the Expansion Module with CB202

(1) 2-pole terminal to connect power supply
(2) COM link L (connection to interface K of the base unit)
(3) Plug-in module position M
(4) Plug-in module position N
(5) Plug-in module position P
(6) Protective grounding terminals

NOTE

You cannot insert any communication module at plug-in module position M. The plug-in module position M is intended for a measuring-transducer module only.



[le_slots and communication terminals, 2, --_--]

Figure 4-3 Plug-In Module Positions and Communication Terminals on the 1/3 Module, for Non-Modular Devices (7xx81, 7xx82)

(1) Time synchronization G

(2) Plug-in module position E

(3) Plug-in module position F (not applicable to 7xx81)

(4) Integrated Ethernet interface J

(5) Protective grounding terminals

The following communication modules can be used for SIPROTEC 5:

- Serial modules

  Application: Communication to the substation automation technology via substation-control protocols

  Protection interface (only optical serial modules) for interfacing to external communication converters for short direct connections.

  2 different communication protocols or 2 different applications can be operated on serial modules with 2 connections. The IEC 60870-5-103 protocol for the substation automation technology as well as a protection interface, for example, can be operated on a serial optical module for close range with 2 connections.

  Assign the protocol application to the corresponding channel of the communication module with DIGSI 5.

- Ethernet Modules
  Application: Ethernet-based communication to the substation automation technology via substation-control protocols (for example, IEC 61850 and DNP3)
  – Secure communication to DIGSI 5
  – Communication between the devices (IEC 61850-GOOSE)
  – Synchrophasor protocol (IEEE C37.118 - PMU)

  The modules can be operated with or without an integrated switch.
- Long-distance modules
  Application: Direct protection interface communication over long distances using multimode or single-mode optical fibers.

The designation of the modules corresponds to the following scheme, which is typically explained with the module USART-AB-1EL. The module designation consists of 3 blocks.

1st block	Type of module USART = Serial module for short or long distance ETH = Ethernet module
2nd block	Unique code for the module in the product code of the device The code consists of 2 letters.
3rd block	Number and physical design of the connections 1 = 1 connection (1 channel) 2 = 2 connections (2 channels) EL = Electrical connection FO = Fiber-optic connection LDFO = Long-distance transmission via optical fibers

4.2.2 Communication Applications of the Plug-in Modules

You can find information on communication applications for the plug-in modules in the following tables.

Plug-in Modules for the Communication

Table 4-1 Plug-in Modules for Applications with the Protection Interface and for Other Applications

Plug-in Module	USART-AB-1EL	USART-AC-2EL	Plug-In Module USART-AD-1FO	USART-AE-2FO	ETH-BA-2EL (rev. 1)	ETH-BA-2EL (rev. 2)	ETH-BB-2FO (rev. 1)	ETH-BB-2FO (rev. 2)	ETH-BD-2FO[2]	USART-AF-1LDFO	USART-AW-2LDFO	USART-AG-1LDFO	USART-AU-2LDFO	USART-AK-1LDFO	USART-AV-2LDFO	USART-AH-1LDFO[3]	USART-AJ-1LDFO[4]	USART-AX-2LDFO[5]	USART-AY-2LDFO[6]	ANAI-CA-4EL	ANAI-CE-2EL	ARC-CD-3FO
Physical Connector																						
1 x electrical serial RS485, RJ45	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2 x electrical serial RS485, RJ45	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1 x optical serial, 820 nm, ST connector, 2 km via 50/125 µm or 62.5/125 µm multimode optical fiber	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2 x optical serial, 820 nm, ST connector, 2 km via 50/125 µm multimode optical fiber	–	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2 x electrical Ethernet 100 Mbit/s, RJ45, 20 m	–	–	–	–	■	■	–	■ [7]	■ [7]	–	–	–	–	–	–	–	–	–	–	–	–	–
2 x optical Ethernet 100 Mbit/s, 1300 nm, LC connector, 24 km via 9/125 µm singlemode optical fiber	–	–	–	–	–	–	–	■ [7]	■ [7]	–	–	–	–	–	–	–	–	–	–	–	–	–
2 x optical Ethernet 100 Mbit/s, 1300 nm, LC connector, 2 km via 50/125 µm or 62.5/125 µm multi-mode optical fiber	–	–	–	–	–	–	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
1 x optical serial, 1300 nm, LC connector, 24 km via 9/125 µm singlemode optical fiber or 4 km via 50/125 µm multimode optical fiber	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–
2 x optical serial, 1300 nm, LC connector, 24 km via 9/125 µm singlemode optical fiber or 4 km via 50/125 µm multimode optical fiber	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–	–	–	–	–
1 x optical serial, 1300 nm, LC connector, 60 km via 9/125 µm singlemode optical fiber	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–	–	–	–
2 x optical serial, 1300 nm, LC connector, 60 km via 9/125 µm singlemode optical fiber	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–	–	–

2 For modular devices only (not for 7ST85 or 6MD89)
3 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
4 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side
5 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
6 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side
7 The **2 x electrical Ethernet and 2 x optical Ethernet over 24 km** function requires separate SFPs that are available on request as accessories, see *Table 7-1*.

Plug-in Module	USART-AB-1EL	USART-AC-2EL	Plug-In Module USART-AD-1FO	USART-AE-2FO	ETH-BA-2EL (rev. 1)	ETH-BA-2EL (rev. 2)	ETH-BB-2FO (rev. 1)	ETH-BB-2FO (rev. 2)	ETH-BD-2FO[2]	USART-AF-1LDFO	USART-AW-2LDFO	USART-AG-1LDFO	USART-AU-2LDFO	USART-AK-1LDFO	USART-AV-2LDFO	USART-AH-1LDFO[3]	USART-AJ-1LDFO[4]	USART-AX-2LDFO[5]	USART-AY-2LDFO[6]	ANAI-CA-4EL	ANAI-CE-2EL	ARC-CD-3FO
1 x optical serial, 1550 nm, LC connector, 100 km via 9/125 µm singlemode optical fiber	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–	–
2 x optical serial, 1550 nm, LC connector, 100 km via 9/125 µm singlemode optical fiber	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–
1 x optical serial, bi-directional via 1 common optical fiber, 1300 nm / 1550 nm (Tx/Rx), LC simplex plug, 40 km via 9/125 µm singlemode optical fiber[3]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–
1 x optical serial, bi-directional via 1 common optical fiber, 1550 nm/ 1300 nm (Tx/Rx), LC simplex plug, 40 km via 9/125 µm singlemode optical fiber[4]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–	–
2 x optical serial, bi-directional via 1 common optical fiber, 1300 nm/ 1550 nm (Tx/Rx), 2 x LC simplex plug, 40 km via 9/125 µm single-mode optical fiber[5]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–	–
2 x optical serial, bi-directional via 1 common optical fiber, 1550 nm/ 1300 nm (Tx/Rx), 2 x LC simplex plug, 40 km via 9/125 µm single-mode optical fiber[6]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–	–
8-pin screw-type terminal block	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	–
3 x optical (for point sensor)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■
Application																						
DIGSI 5 Protocol	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
IEC 61850-8-1 server You can find more information (whether GOOSE or MMS reporting) in the communication protocol manual, chapter *IEC 61850*.	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
IEC 61850-9-2 Merging Unit	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–
IEC 61850-9-2 Process bus client	–	–	–	–	–	–	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–
IEC 60870-5-103	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

2 For modular devices only (not for 7ST85 or 6MD89)
3 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
4 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side
5 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
6 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side

Plug-in Module	USART-AB-1EL	USART-AC-2EL	Plug-In Module USART-AD-1FO	USART-AE-2FO	ETH-BA-2EL (rev. 1)	ETH-BA-2EL (rev. 2)	ETH-BB-2FO (rev. 1)	ETH-BB-2FO (rev. 2)	ETH-BD-2FO[2]	USART-AF-1LDFO	USART-AW-2LDFO	USART-AG-1LDFO	USART-AU-2LDFO	USART-AK-1LDFO	USART-AV-2LDFO	USART-AH-1LDFO[3]	USART-AJ-1LDFO[4]	USART-AX-2LDFO[5]	USART-AY-2LDFO[6]	ANAI-CA-4EL	ANAI-CE-2EL	ARC-CD-3FO
IEC 60870-5-104	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
DNP3 serial	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DNP3 TCP	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
Modbus TCP	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
Modbus RTU	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Synchrophasor (IEEE C37.118 - PMU)	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
Protection Interface	–	–	■	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	–	–	–
Protection interface (IEEE C37.94)	–	–	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PROFINET IO	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
S2 redundancy and SOE for PROFINET IO	–	–	–	–	–	■	–	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
SUP serial (Slave Unit Protocol) for connecting external temperature gages or 20 mA measuring devices	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
SUP Ethernet (Slave Unit Protocol) for connecting external temperature gages or 20-mA measuring devices	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
Measuring transducer, 4 inputs, DC ±20 mA	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–	–
Measuring transducer, 1 input, DC 0 V to 300 V	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	–
Arc Protection	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■
Additional Ethernet protocols and services																						
DHCP, DCP (automatic IP configuration)	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
Line mode	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
PRP (Ethernet ring redundancy)	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
HSR (Ethernet ring redundancy)	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
RSTP (Ethernet ring redundancy)	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
SNTP (time synchronization over Ethernet)	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
SNMP V3 (network management protocol)	–	–	–	–	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–
IEEE 1588v2 (PTP protocol over Ethernet – ms accuracy)	–	–	–	–	■	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

2 For modular devices only (not for 7ST85 or 6MD89)
3 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
4 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side
5 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
6 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side

Plug-in Module	USART-AB-1EL	USART-AC-2EL	Plug-In Module USART-AD-1FO	USART-AE-2FO	ETH-BA-2EL (rev. 1)	ETH-BA-2EL (rev. 2)	ETH-BB-2FO (rev. 1)	ETH-BB-2FO (rev. 2)	ETH-BD-2FO[2]	USART-AF-1LDFO	USART-AW-2LDFO	USART-AG-1LDFO	USART-AU-2LDFO	USART-AK-1LDFO	USART-AV-2LDFO	USART-AH-1LDFO[3]	USART-AJ-1LDFO[4]	USART-AX-2LDFO[5]	USART-AY-2LDFO[6]	ANAI-CA-4EL	ANAI-CE-2EL	ARC-CD-3FO
IEEE 1588v2 (Precision Time Protocol via Ethernet – µs accuracy)[8]	–	–	–	–	–	■ [9]	–	■ [9]	■	–	–	–	–	–	–	–	–	–	–	–	–	–
IEEE 802.1Q (VLAN)	–	–	–	–	–	■	–	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–

NOTE

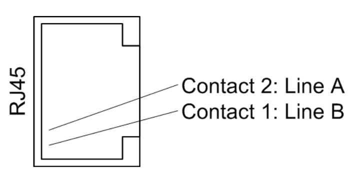
The USART and ETH plug-in module types may be used in slots E and F in the base module as well as in slots N and P in the CB202 expansion module. They are not intended for use in slot M in the CB202 expansion module.

The plug-in modules of types ANAI and ARC can be used in both slots in the base module (ports E and F), as well as in all slots in the expansion module CB202 (ports M, N and P).

4.2.3 Serial Modules for Short Distances

4.2.3.1 Unique Features of the Serial Electrical Modules

The serial electrical modules are equipped with RJ45 connections. These are not Ethernet connections. The serial signals of the RS485 interface are routed to the RJ45 connections (see following figure).



[dw_rj45pb, 1, en_US]

Figure 4-4 RJ45 Terminals for the Serial Signals of the RS485 Interface

Cabling Examples of Devices with Serial Electrical Modules

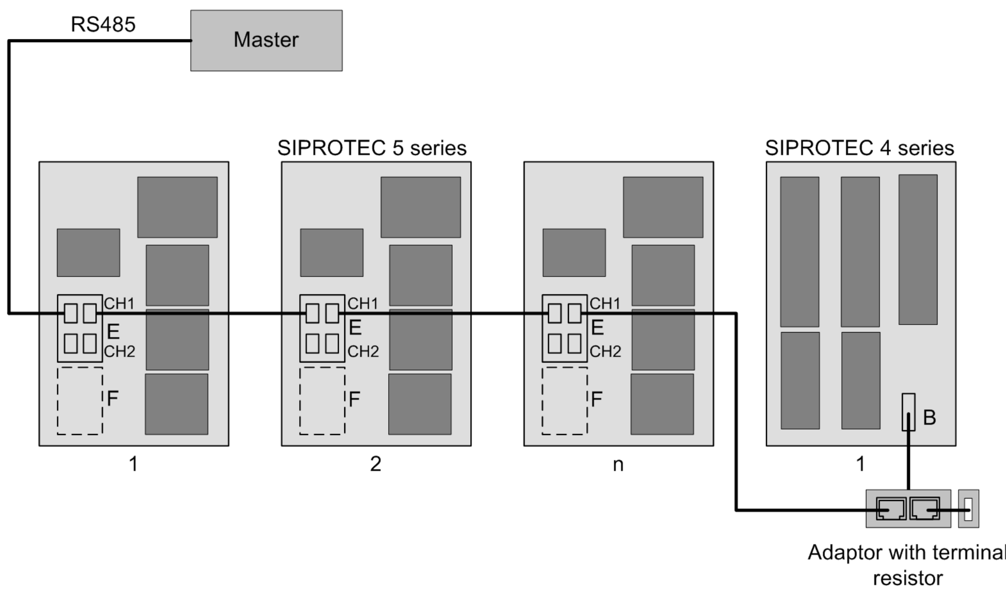
Serial electrical RS485 connections of devices in the SIPROTEC 5 series can be cabled with low-cost Ethernet patch cables. Special bus cables and adaptors are not needed. Pay attention to the following note if you include devices from the SIPROTEC 4 series in the connection.

2 For modular devices only (not for 7ST85 or 6MD89)
3 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
4 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side
5 Only pairs with USART-AJ-1LDFO or USART-AY-2LDFO on the opposite side
6 Only pairs with USART-AH-1LDFO or USART-AX-2LDFO on the opposite side
8 SFP accuracy is 1 ms with optional RJ45
9 The grandmaster functionality is not supported.

NOTE

The RS485 interface in devices of the SIPROTEC 4 series is a D-Sub 9 connection with a connected load resistor.

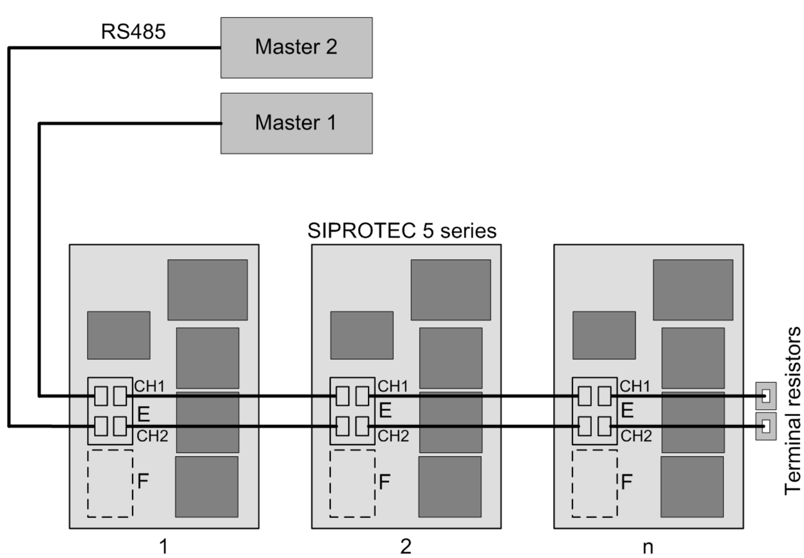
If you connect devices from the SIPROTEC 5 series with devices from the SIPROTEC 4 series, then use an Y adaptor with the order designation 7XV5103-2BA00. Complete the connection on the last device with a load resistor. For the SIPROTEC 5 device, use a load resistor with the order designation RS485 terminator 7XV5103-5BA00.



[dw_serma1, 1, en_US]

Figure 4-5 Communication with a Single Master Using an RS485 Bus

The preceding figure shows the cabling using the new RJ45 sockets in a simplified format. The serial RS485 bus can be extended by simply connecting Ethernet patch cables from device to device.



[dw_serma2, 1, en_US]

Figure 4-6 Redundant Communication with 2 Masters Using RS485 Bus (for Example, Redundant IEC 60870-5-103 Protocol)

The preceding figure shows the use of both connections on one module for connecting the devices to 2 independent masters following the same principle as with a single master.

Reorder

When reordering serial communication modules, specify the product code for the physical version of the module. The order configurator (IPC configurator) shows you which applications are capable of running on the module:

- Serial
- 1-channel or 2-channel
- Electrical or optical

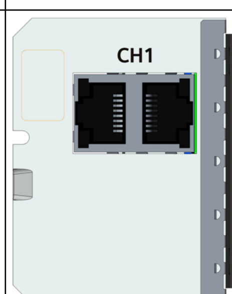
Serial Optical Fiber Communication Modules

For the connector polish types of the ST and LC connector types for multimode and singlemode optical fiber connections, Siemens recommends:

- Flat fiber connector (Flat)
- PC fiber connector (Physical Contact)
- UPC fiber connector (Ultra Physical Contact)

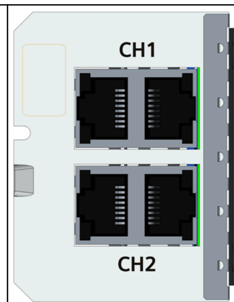
For wide-range transmission optical fiber applications, the specified wavelength of the optical fiber cable must match that of the wide-range transmission module (1310 nm or 1550 nm). Operation with other wavelengths than specified may result in higher attenuation and thus lower achievable distances.

4.2.3.2 USART-AB-1EL

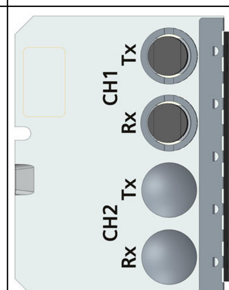
Description	Serial asynchronous communication module with one electrical interface
Product code	P1Z79
Figure	
Connector type	2 x RJ45
Baud rate	1.2 kbit/s to 115.2 kbit/s
Protocol	IEC 60870-5-103 DNP3 Modbus RTU SUP serial

4.2.3.3 USART-AC-2EL

Description	Serial asynchronous communication module with 2 independent electrical interfaces
Product code	P1Z437

Figure	
Connector type	4 x RJ45
Baud rate	1.2 kbit/s to 115.2 kbit/s
For 1 or 2 protocols or applications (1 application per connector)	IEC 60870-5-103 DNP3 Modbus RTU SUP serial

4.2.3.4 USART-AD-1FO

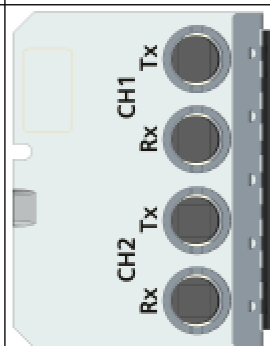
Description	Serial asynchronous or synchronous communication module with 1 independent optical interface
Product code	P1Z62
Figure	
Connector type	2 x ST
Wavelength	λ = 820 nm
Baud rate	Asynchronous: 1.2 kbit/s to 115.2 kbit/s Synchronous: 64 kbit/s to 2 Mbit/s
For 1 protocol or application	IEC 60870-5-103 DNP3 Modbus RTU SUP serial Protection interface communication
Max. range	2.5 km when using an optical fiber 50 μm/125 μm or 62.5 μm/125 μm

Transmit Power	Minimum	Typical	Maximum
50 μm/125 μm, NA[10] = 0.2	-19.8 dBm	-15.8 dBm	-12.8 dBm
62.5 μm/125 μm, NA[10] = 0.275	-16.0 dBm	-12.0 dBm	-9.0 dBm

10 Numerical Aperture (NA = sin θ [launch angle])

Receiver sensitivity	Maximum +1 dBm Minimum -32 dBm
Optical budget	Minimum 9.0 dB for 50 µm/125 µm, NA[10] = 0.2 Minimum 13.0 dB for 62.5 µm/125 µm, NA[10] = 0.275
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 µm/125 µm and 50 µm/125 µm optical fibers

4.2.3.5 USART-AE-2FO

Description	Serial asynchronous or synchronous communication module with 2 independent optical interfaces
Product code	P1Z48
Figure	
Connector type	4 x ST
Wavelength	λ = 820 nm
Baud rate	Asynchronous: Both connections 1.2 kbit/s to 115.2 kbit/s Synchronous: Both connections 64 kbit/s to 2 Mbit/s Asynchronous/Synchronous: 1 connector 1.2 kbit/s to 115.2 kbit/s and 1 connector 64 kbit/s to 2 Mbit/s
For 1 or 2 protocols or applications (1 application per optical connector)	IEC 60870-5-103 DNP3 Modbus RTU SUP serial Protection interface communication
Max. range	2.5 km when using an optical fiber 50 µm/125 µm or 62.5 µm/125 µm

Transmit Power	Minimum	Typical	Maximum
50 µm/125 µm, NA[11] = 0.2	-19.8 dBm	-15.8 dBm	-12.8 dBm
62.5 µm/125 µm, NA[11] = 0.275	-16.0 dBm	-12.0 dBm	-9.0 dBm

Receiver sensitivity	Maximum +1 dBm Minimum -32 dBm
Optical budget	Minimum 9.0 dB for 50 µm/125 µm, NA[11] = 0.2 Minimum 13.0 dB for 62.5 µm/125 µm, NA[11] = 0.275
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 µm/125 µm and 50 µm/125 µm optical fibers

11 Numerical Aperture (NA = sin θ [launch angle])

4.2.4 Serial Modules for Long Distances

4.2.4.1 Application

The optical protection-interface modules are used for wide-range transmission over multimode or singlemode optical fibers. In the case of the protection interface, these serve the purpose of point-to-point transmission between 2 devices. One possible application is the transmission of differential protection data. For example, if you wish to transmit only binary data and measured values, you can equip all SIPROTEC devices with these protection interfaces.

The attainable distance in multimode optical fibers is limited by 2 factors.

- Bandwidth-distance product

  Typical for 62.5 μm/125 μm optical fibers: 400 MHz x km to 800 MHz x km

  Typical for 50 μm/125 μm optical fibers: 400 MHz x km to 1200 MHz x km

  Due to the maximum bit rate of the interface of 2 Mbit/s, the specified modal bandwidth for multimode optical fibers is not relevant for determining the maximum range. The modal bandwidth is not relevant for singlemode optical fibers.

- Fiber attenuation

  For light with a wavelength of λ = 1300 nm, the typical attenuation of a 50 μm/125 μm or 62.5 μm/125 μm optical fiber is from 0.9 dB/km to 1 dB/km. 1.5 dB/km are added for splices, aging, and as a reserve. An attenuation of 2.5 dB/km is used for calculation of the distance.

  Siemens recommends that the attenuation of the optical path is measured from end to end in dB. The optical budget specified for the modules used must be sufficient for this. A safety margin for aging and future repairs must be included.

  In the case of singlemode optical fibers, for example, 9 μm/125 μm, the attenuation is approx. 0.4 dB/km for λ = 1300 nm and approx. 0.22 dB/km for λ = 1550 nm. In the technical data, reference data is specified for the range in km. This data acts as a reference and corresponds to approximate attenuation and includes a reserve of 5 dB to 7 dB for splices and connectors.

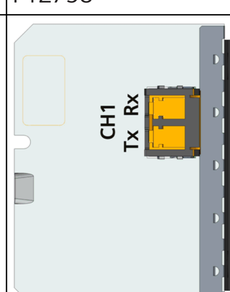
Serial Optical Fiber Communication Modules

For the connector polish types of the ST and LC connector types for multimode and singlemode optical fiber connections, Siemens recommends:

- Flat fiber connector (Flat)
- PC fiber connector (Physical Contact)
- UPC fiber connector (Ultra Physical Contact)

For wide-range transmission optical fiber applications, the specified wavelength of the optical fiber cable must match that of the wide-range transmission module (1310 nm or 1550 nm). Operation with other wavelengths than specified may result in higher attenuation and thus lower achievable distances.

4.2.4.2 USART-AF-1LDFO

Description	Protection-interface module for synchronous operation with an optical interface
Product code	P1Z758
Figure	

Connector type	1 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. distance	24 km for singlemode optical fibers or 4 km with multimode optical fiber

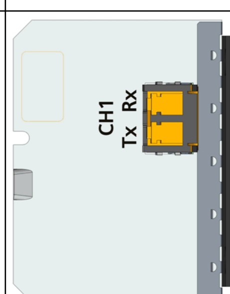
Distance 4 km	
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 μm/125 μm and 50 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in multimode optical fiber	-15.0 dBm_{avg}	-8.0 dBm_{avg}
Receiver sensitivity	-8.0 dBm_{avg}	-31.0 dBm_{avg}
Optical budget	16.0 dB	–

Distance 24 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in singlemode optical fiber	-15.0 dBm_{avg}	-8.0 dBm_{avg}
Receiver sensitivity	-8.0 dBm_{avg}	-31.0 dBm_{avg}
Optical budget	16.0 dB	–

4.2.4.3 USART-AG-1LDFO

Description	Protection-interface module for synchronous operation with an optical interface
Product code	P1Z468
Figure	
Connector type	1 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	60 km for singlemode optical fibers or 8 km with multimode optical fiber

Distance 8 km	
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 μm/125 μm and 50 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in multimode optical fiber	-5.0 dBm_{avg}	0 dBm_{avg}
Receiver sensitivity	0 dBm_{avg}	-34.0 dBm_{avg}
Optical budget	29.0 dB	–

Distance 60 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 µm/125 µm optical fibers

	Minimum	Maximum
Transmitter power coupled in singlemode optical fiber	-5.0 dBm_{avg}	0 dBm_{avg}
Receiver sensitivity	0 dBm_{avg}	-34.0 dBm_{avg}
Optical budget	29.0 dB	–

4.2.4.4 USART-AH-1LDFO

NOTE

Use the protection-interface module USART-AH-1LDFO paired with USART-AJ-1LDFO or USART-AY-2LDFO only.

Description	Protection-interface module for synchronous operation with an optical interface In particular, a bidirectional data exchange through a single optical fiber is possible with the USART-AJ-1LDFO module.
Product code	P1Z765
Figure	
Connector type	1 x simplex LC
Wavelength	Tx λ = 1310 nm Rx λ = 1550 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	40 km for singlemode optical fibers

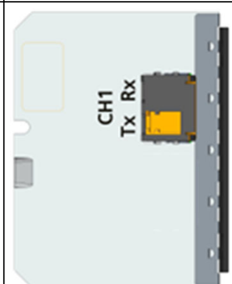
Range 40 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 µm/125 µm optical fibers

	Minimum	Maximum
Transmitter power coupled in the singlemode optical fiber	-8.0 dBm_{avg}	-3.0 dBm_{avg}
Receiver sensitivity	-3.0 dBm_{avg}	-33.0 dBm_{avg}
Optical budget	25.0 dB	–

4.2.4.5 USART-AJ-1LDFO

NOTE

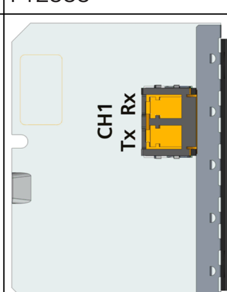
Use the protection-interface module USART-AJ-1LDFO paired with USART-AH-1LDFO or USART-AX-2LDFO only.

Description	Protection-interface module for synchronous operation with 1 optical interface In particular, a bidirectional data exchange through a single optical fiber is possible with the USART-AH-1LDFO module.
Product code	P1Z1007
Figure	
Connector type	1 x simplex LC
Wavelength	Tx λ = 1550 nm Rx λ = 1310 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	40 km for singlemode optical fibers

Range 40 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in singlemode optical fiber	-8.0 dBm_{avg}	-3.0 dBm_{avg}
Receiver sensitivity	-3.0 dBm_{avg}	-33.0 dBm_{avg}
Optical budget	25.0 dB	–

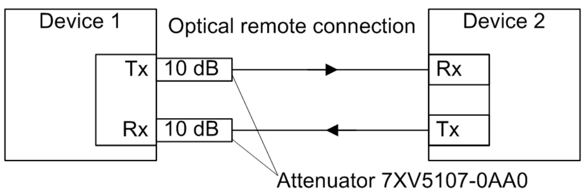
4.2.4.6 USART-AK-1LDFO

Description	Protection-interface module for synchronous operation with an optical interface
Product code	P1Z888
Figure	
Connector type	1 x duplex LC
Wavelength	λ = 1550 nm

Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	100 km for singlemode optical fibers

Distance 100 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 µm/125 µm optical fibers

	Minimum	**Maximum**
Transmitter power coupled in the singlemode optical fiber	-5.0 dBm_{avg}	-0.0 dBm_{avg}
Receiver sensitivity	-10.0 dBm_{avg}	-34.0 dBm_{avg}
Optical budget	29.0 dB	–



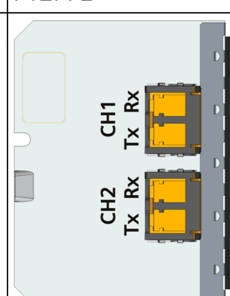
[dw_attenuator, 2, en_US]

Figure 4-7 Optical Remote Connection with Attenuators

NOTE

If you use the protection-interface module USART-AK-1LDFO for distances under 30 km, then connect 2 attenuators 7XV5107-0AA00. To continue using the duplex LC plugs, attach both attenuators to one end of the remote connection (see *Figure 4-7*).

4.2.4.7 USART-AW-2LDFO

Description	Protection-interface module for synchronous operation with 2 optical interfaces
Product code	P1Z772
Figure	
Connector type	2 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	24 km for singlemode optical fibers or 4 km with multimode optical fiber

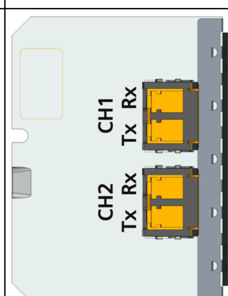
Distance 4 km	
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 µm/125 µm and 50 µm/125 µm optical fibers

	Minimum	Maximum
Transmitter power coupled in multimode optical fiber	-15.0 dBm_{avg}	-8.0 dBm_{avg}
Receiver sensitivity	-8.0 dBm_{avg}	-31.0 dBm_{avg}
Optical budget	16.0 dB	–

Distance 24 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in the singlemode optical fiber	-15.0 dBm_{avg}	-8.0 dBm_{avg}
Receiver sensitivity	-8.0 dBm_{avg}	-31.0 dBm_{avg}
Optical budget	16.0 dB	–

4.2.4.8 USART-AU-2LDFO

Description	Protection-interface module for synchronous or asynchronous operation with 2 optical interfaces
Product code	P1Z239
Figure	
Connector type	2 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	60 km for singlemode optical fibers or 8 km with multimode optical fiber

Distance 8 km	
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 μm/125 μm and 50 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in multimode optical fiber	-5.0 dBm_{avg}	0.0 dBm_{avg}
Receiver sensitivity	0 dBm_{avg}	-34.0 dBm_{avg}
Optical budget	29.0 dB	–

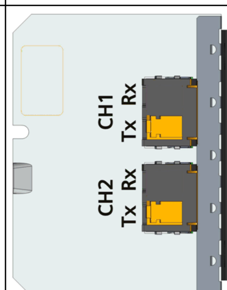
Distance 60 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in multimode optical fiber	-5.0 dBm_{avg}	0.0 dBm_{avg}
Receiver sensitivity	0 dBm_{avg}	-34.0 dBm_{avg}
Optical budget	29.0 dB	–

4.2.4.9 USART-AX-2LDFO

NOTE

Use the protection-interface module USART-AX-2LDFO paired with USART-AY-2LDFO or USART-AJ-1LDFO only.

Description	Protection-interface module for synchronous or asynchronous operation with 2 optical interfaces In particular, a bidirectional data exchange through a single optical fiber is possible with the USART-AY-2LDFO module.
Product code	P1Z802
Figure	
Connector type	2 x simplex LC
Wavelength	Tx λ = 1300 nm Rx λ = 1550 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	40 km for singlemode optical fibers

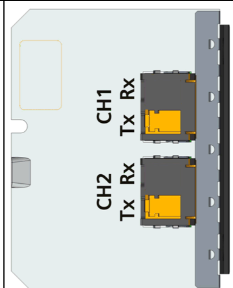
Range 40 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 μm/125 μm optical fibers

	Minimum	Maximum
Transmitter power coupled in the singlemode optical fiber	-8.0 dBm_{avg}	-3.0 dBm_{avg}
Receiver sensitivity	-3.0 dBm_{avg}	-33.0 dBm_{avg}
Optical budget	25.0 dB	–

4.2.4.10 USART-AY-2LDFO

NOTE

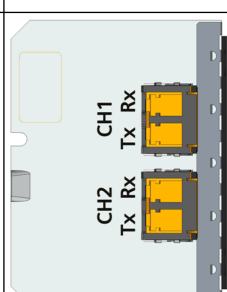
Use the protection-interface module USART-AY-2LDFO paired with USART-AX-2LDFO or USART-AH-1LDFO only.

Description	Protection-interface module for synchronous or asynchronous operation with 2 optical interfaces In particular, a bidirectional data exchange through a single optical fiber is possible with the USART-AX-2LDFO module.
Product code	P1Z789
Figure	
Connector type	2 x simplex LC
Wavelength	Tx λ = 1550 nm Rx λ = 1310 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	40 km for singlemode optical fibers

Range 40 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 µm/125 µm optical fibers

	Minimum	Maximum
Transmitter power coupled in the singlemode optical fiber	-8.0 dBm_{avg}	-3.0 dBm_{avg}
Receiver sensitivity	-3.0 dBm_{avg}	-33.0 dBm_{avg}
Optical budget	25.0 dB	–

4.2.4.11 USART-AV-2LDFO

Description	Protection-interface module for synchronous or asynchronous operation with 2 optical interfaces
Product code	P1Z741
Figure	
Connector type	2 x duplex LC
Wavelength	λ = 1550 nm
Baud rate	2 Mbit/s for the protection-interface communication
Protocol	Protection-interface communication
Max. line length	100 km for singlemode optical fibers

Distance 100 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 µm/125 µm optical fibers

	Minimum	Maximum
Transmitter power coupled in the singlemode optical fiber	-5.0 dBm_{avg}	-0.0 dBm_{avg}
Receiver sensitivity	-10.0 dBm_{avg}	-34.0 dBm_{avg}
Optical budget	29.0 dB	–

NOTE

If you use the protection-interface module USART-AV-2LDFO for distances under 30 km, then connect 2 attenuators 7XV5107-0AA00. To continue using the duplex LC plugs, attach both attenuators to one end of the remote connection (see *Figure 4-7*).

4.2.5 Ethernet Modules

4.2.5.1 Operation of Ethernet Modules

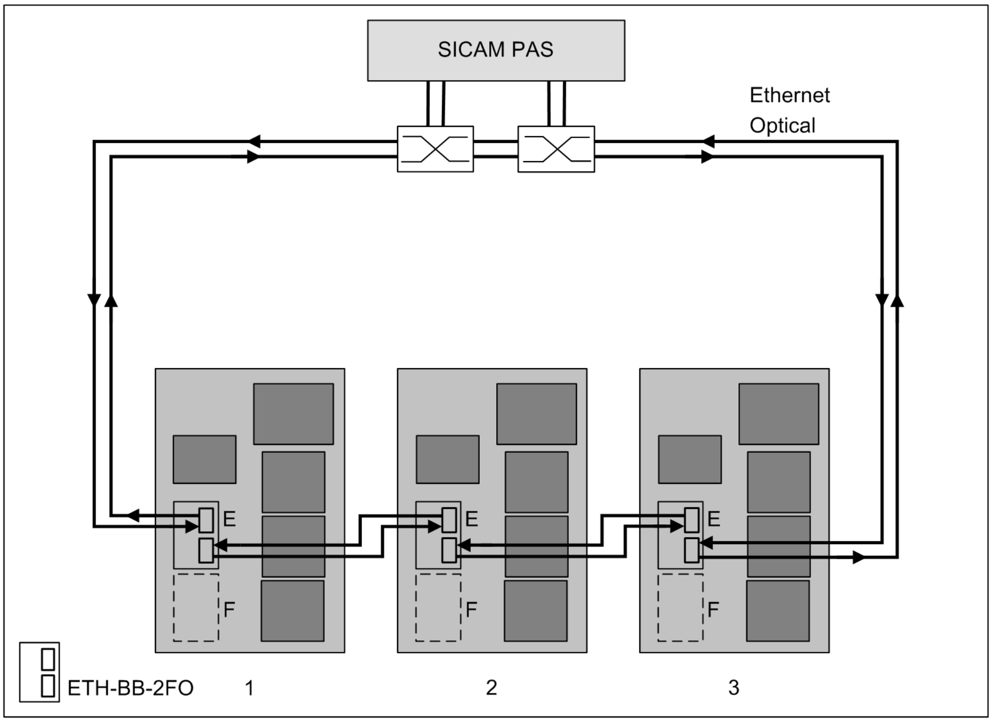
The Ethernet modules of the SIPROTEC 5 series can be operated optionally with or without integrated switch function. This applies for the electrical as well as the optical module. This function can be selected via the parameterization. It is not necessary to make any indication in the order. The optical Ethernet modules are compatible with the EN100 modules of the SIPROTEC 4 series. If the RSTP protocol or the HSR protocol is active, the optical modules of the SIPROTEC 4 series and the SIPROTEC 5 series can be operated in a ring.

When using SIPROTEC 4 devices with module firmware ≤ V4.06 and SIPROTEC 5 devices, the maximum allowable number of participants is 30 devices. When using SIPROTEC 4 devices with module firmware ≥ V4.07 and SIPROTEC 5 devices, the maximum allowable number of participants is 40 devices. When using SIPROTEC 5 devices, the maximum allowable number of participants is 40 devices.

Figure 4-8 shows operation of the Ethernet modules with integrated switch function. All devices of a station are shown which are connected to one another by means of optical fibers. The devices form optical rings. In addition, 2 switches are used on the substation controller for the SICAM PAS. The 2 switches take the requirements for the redundancy into account.

Additional participants with electrical interfaces can also be connected to the SICAM PAS (for example, the DIGSI 5 control PC). An external switch is sufficient. Optical communication modules are primarily used for this topology, as there can be substantial distances between the devices.

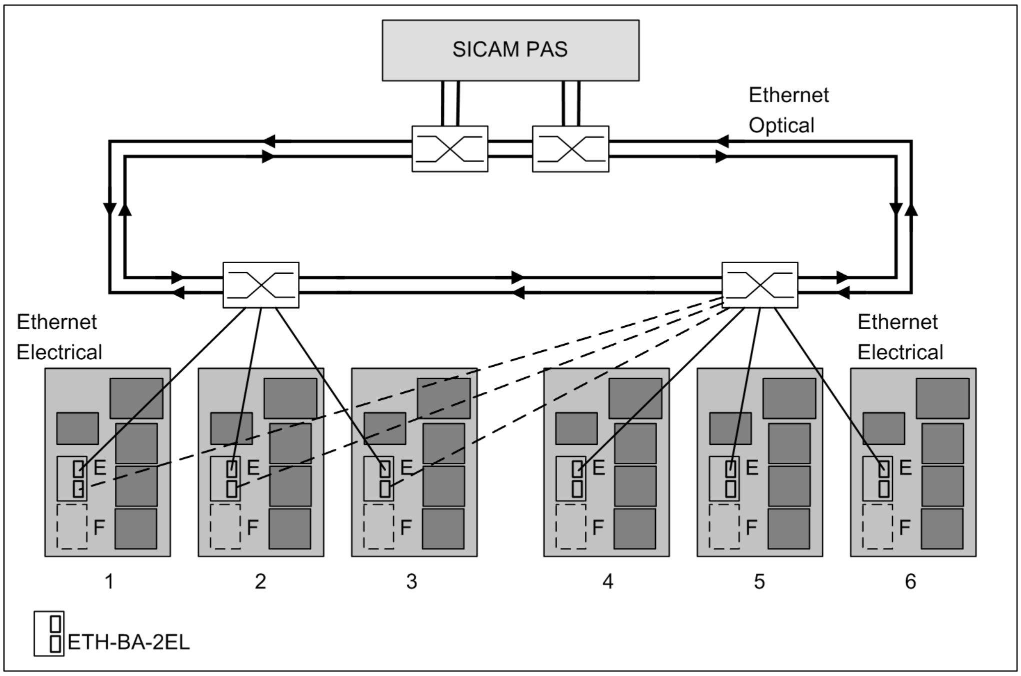
If the Ethernet modules are installed in expansion modules with a CB202 PCB assembly, the power supply can be provided with an independent battery. The integrated switch can maintain its function when the device is switched off. The data are transmitted in optical and electric rings. This prevents opening of the ring. The ring continues to operate when 1 or more devices are switched off.



[dw_eth1sw, 2, en_US]

Figure 4-8 Operation of Ethernet Modules with an Integrated Switch Function

Figure 4-9 shows the operating mode without integrated switch function. Optionally, the 2nd connection can be connected to the 2nd switch. This connection is shown with a dashed line in *Figure 4-9*. The IP communication is established using the 1st connection here. If this connection fails, the system changes over to the 2nd connection within a few milliseconds. The IP connection is retained practically without interruption using the 2nd switch. This hot-standby connection redundancy increases the availability in such configurations, as shown in the following figure. The information on failure of the protection connection is transmitted to the substation automation technology.



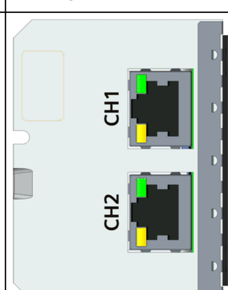
[dw_ethsw3, 2, en_US]

Figure 4-9 Operation of Ethernet Modules Without Integrated Switch Function with Single or Redundant Connection to the Switch

4.2.5.2 ETH-BA-2EL (Rev. 1)

NOTE

You can identify the revision number of the module by the product code and the name plate.

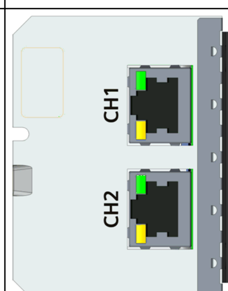
Description	Communication module for the transmission of Ethernet protocols via 2 electrical interfaces
Product code	P1Z4022
Figure	
Connector type	2 x RJ45
Baud rate	100 Mbit/s

Protocol	DIGSI 5 protocol (secure Web service protocol) IEC 61850 (MMS and GOOSE) DNP3 Modbus TCP IEC 60870-5-104 PROFINET IO IEEE 1588v2/PTP Synchrophasor protocol (IEEE C37.118 - PMU) You can switch other network services like SNMP, RSTP, PRP, HSR, SNTP and SUP Ethernet on and off.
Max. line length	20 m with Ethernet patch cable CAT 6 S/FTP, F/FTP or SF/FTP
Interface design	Corresponds to IEEE 802.3, 100Base-TX

4.2.5.3 ETH-BA-2EL (Rev. 2)

NOTE

You can identify the revision number of the module by the product code and the name plate.

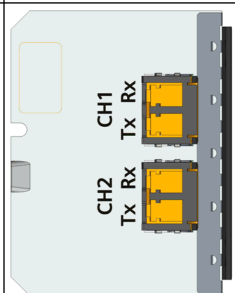
Description	Communication module for the transmission of Ethernet protocols via 2 electrical interfaces, can be used for ultrafast GOOSE
Product code	P1Z55
Figure	
Connector type	2 x RJ45
Baud rate	100 Mbit/s
Protocol	DIGSI 5 protocol (secure Web service protocol) IEC 61850 (MMS and GOOSE) DNP3 Modbus TCP IEC 60870-5-104 PROFINET IO S2 redundancy and SOE for PROFINET IO Synchrophasor protocol (IEEE C37.118 - PMU) You can enable and disable other network services such as SNMP, RSTP, PRP, HSR, SNTP, SUP Ethernet and IEEE 1588v2/PTP[12]
Max. line length	20 m with Ethernet patch cable CAT 6 S/FTP, F/FTP or SF/FTP
Interface design	Corresponds to IEEE 802.3, 100Base-TX

12 The grandmaster functionality is not supported.

4.2.5.4 ETH-BB-2FO (Rev. 1)

NOTE

You can identify the revision number of the module by the product code and the name plate.

Description	Communication module for the transmission of Ethernet protocols via 2 optical interfaces
Product code	P1Z4008
Figure	
Connector type	2 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	100 Mbit/s
Protocol	DIGSI 5 protocol (secure Web service protocol) IEC 61850 (MMS and GOOSE) DNP3 Modbus TCP IEC 60870-5-104 PROFINET IO IEEE 1588v2/PTP Synchrophasor protocol (IEEE C37.118 - PMU) You can switch other network services like SNMP, RSTP, PRP, HSR, SNTP and SUP Ethernet on and off.
Max. line length	2.5 km when using a 50 μm/125 μm or 62.5 μm/125 μm optical fiber

Transmitter Power	Minimum	Typical	Maximum
50 μm/125 μm, NA[13] = 0.2	-24.0 dBm	-21.0 dBm	-17.0 dBm
62.5 μm/125 μm, NA[13] = 0.275	-20.0 dBm	-17.0 dBm	-14.0 dBm

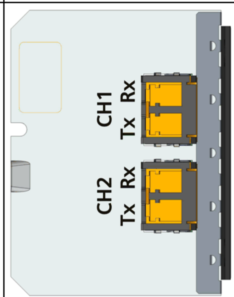
Receiver sensitivity	Maximum -12.0 dBm Minimum -31.0 dBm
Optical budget	Minimum 7.0 dB for 50 μm/125 μm, NA[13] = 0.2 Minimum 11.0 dB for 62.5 μm/125 μm, NA[13] = 0.275
Interface design	Corresponds to IEEE 802.3, 100Base-FX
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 μm/125 μm and 50 μm/125 μm optical fibers

4.2.5.5 ETH-BB-2FO (Rev. 2)

NOTE

You can identify the revision number of the module by the product code and the name plate.

13 Numerical Aperture (NA = sin θ [launch angle])

Description	Communication module for the transmission of Ethernet protocols via 2 optical interfaces, can be used for ultrafast GOOSE
Product code	P1Z390
Figure	
Connector type	2 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	100 Mbit/s
Protocol	DIGSI 5 protocol (secure Web service protocol) IEC 61850 (MMS and GOOSE) DNP3 Modbus TCP IEC 60870-5-104 PROFINET IO S2 redundancy and SOE for PROFINET IO Synchrophasor protocol (IEEE C37.118 - PMU) You can enable and disable other network services such as SNMP, RSTP, PRP, HSR, SNTP, SUP Ethernet and IEEE 1588v2/PTP[14]
Max. line length	2.5 km when using a 50 µm/125 µm or 62.5 µm/125 µm optical fiber

Transmitter Power	Minimum	Typical	Maximum
50 µm/125 µm, NA[15] = 0.2	-24.0 dBm	-21.0 dBm	-17.0 dBm
62.5 µm/125 µm, NA[15] = 0.275	-20.0 dBm	-17.0 dBm	-14.0 dBm

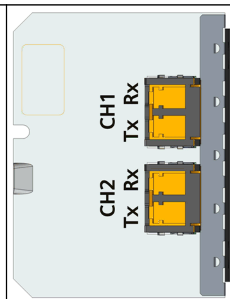
Receiver sensitivity	Maximum -12.0 dBm Minimum -31.0 dBm
Optical budget	Minimum 7.0 dB for 50 µm/125 µm, NA[15] = 0.2 Minimum 11.0 dB for 62.5 µm/125 µm, NA[15] = 0.275
Interface design	Corresponds to IEEE 802.3, 100Base-FX
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 µm/125 µm and 50 µm/125 µm optical fibers

4.2.5.6 ETH-BD-2FO

Description	Communication module for the transmission of Ethernet protocols via 2 optical interfaces, suitable for Process-bus client, Merging Unit, and ultrafast GOOSE
Product code	P1Z3034

14 The grandmaster functionality is not supported.

15 Numerical Aperture (NA = sin θ [launch angle])

Figure	
Connector type	2 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	100 Mbit/s
Protocol	DIGSI 5 protocol (secure Web service protocol) IEC 61850 (MMS and GOOSE) IEC 61850-8-1 (9-2 Client and 9-2 Merging Unit) IEC 60870-5-104 DNP3 Modbus TCP PROFINET IO S2 redundancy and SOE for PROFINET IO Synchrophasor protocol (IEEE C37.118 – PMU) You can switch other network services such as HSR, SNMP, RSTP, PRP, SNTP, SUP, and IEEE 1588v2/PTP on and off.
Max. line length	2.5 km for 50 μm/125 μm or 62.5 μm/125 μm optical fibers

Transmitter Power	Minimum	Typical	Maximum
50 μm/125 μm, NA[16] = 0.2	-24.0 dBm	-21.0 dBm	-17.0 dBm
62.5 μm/125 μm, NA[16] = 0.275	-20.0 dBm	-17.0 dBm	-14.0 dBm

Receiver sensitivity	Maximum -12.0 dBm Minimum -31.0 dBm
Optical budget	Minimum 7.0 dB for 50 μm/125 μm, NA[16] = 0.2 Minimum 11.0 dB for 62.5 μm/125 μm, NA[16] = 0.275
Interface design	Corresponds to IEEE 802.3, 100Base-FX
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 μm/125 μm and 50 μm/125 μm optical fibers

To adapt the interface to longer transmission distances, for a transmission distance of up to 2 km, the modules ETH-BD-2FO and ETH-BB-2EL (revision 2) offer the option to exchange the SFPs (Small Form-Factor Pluggable) supplied as standard for 24 km Single Mode SFPs (order number P1Z3210).

SFP with Optical Interface for 24 Km, Single Mode

Description	SFP for distances up to 24 km when using singlemode optical fibers
Product code	P1Z3210
Connector type	Duplex LC
Wavelength	λ = 1300 nm
Baud rate	100 Mbit/s
Protocol	See information for the modules ETH-BD-2FO, ETH-BA-2EL (revision 2) and ETH-BB-2EL (revision 2).
Max. line length	24 km for 9 μm/125 μm optical fibers

16 Numerical Aperture (NA = sin θ [launch angle])

Distance 24 km	
Laser class 1 as per EN 60825-1/-2	With the use of 9 μm/125 μm optical fibers

Transmitter Power	Minimum	Maximum
Transmitter power coupled in singlemode optical fibers	-15 dBm	-8 dBm
Receiver sensitivity	-8 dBm	-31dBm
Optical budget	16 dB	–

SFP (Small Form-Factor Pluggable) with Electrical Interface

Description	SFP with RJ45 connector, for Ethernet protocols via an electrical interface
Product code	P1Z3201
Connector type	RJ45
Baud rate	100 Mbit/s
Protocol	See information for *4.2.5.6 ETH-BD-2FO*
Max. line length	20 m with Ethernet patch cable CAT 6 S/FTP, F/FTP, or SF/FTP
Interface design	Corresponds to IEEE 802.3, 100BaseTX

Removing SFP Pluggable Transceivers

CAUTION

Risk of burns due to high temperatures of the SFP pluggable transceivers

Noncompliance with the safety notes may result in medium or light injuries.

- ✧ The SFP pluggable transceivers can be disconnected and plugged in while in operation. Siemens recommends switching off the device.
- ✧ Allow the SFP pluggable transceiver to cool as much as possible.

- ✧ Remove the connecting cables or the dust protection cap that was plugged on in the delivery state from the SFP pluggable transceiver.
- ✧ In order to release the interlocking, open the bracket on the SFP pluggable transceiver.
- ✧ Pull on the bracket in order to pull the SFP pluggable transceiver out of the slot. The removal must be possible with free movement and without great exertion of force.
- ✧ Provide the SFP pluggable transceiver with the dust protection cap so that the optics are protected from contamination.

Mounting SFP Pluggable Transceivers

- ✧ Check whether the bracket on the SFP pluggable transceiver is closed.
  The bracket must be closed.
- ✧ Insert the pluggable transceiver into the slot until it audibly locks in place.
  The SFP pluggable transceiver is securely fixed in the slot.

NOTE

Check for secure positioning of the transceiver in the slot and whether it is locked in place in order to avoid unintentional removal by pulling on the connection line.

4.3 Measuring-Transducer Modules

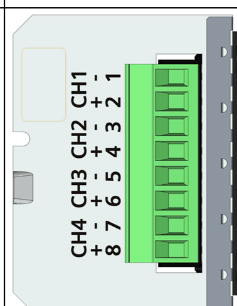
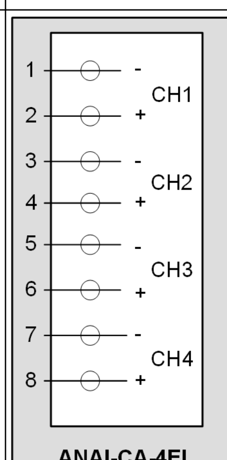
4.3.1 Overview

You can install the measuring-transducer modules in base modules or 1/3 modules (plug-in module positions E and F) and in expansion modules with a CB202 plug-in module assembly (plug-in module position M, N, or P).

4.3.2 ANAI-CA-4EL

The ports CH1 to CH4 of the measuring-transducer modules are Protective Extra Low Voltage circuits (PELV circuits). For the connection to the measuring-transducer modules, the following conditions apply:

- PELV circuits may be connected only to PELV circuits.
- Ensure that the lines of PELV circuits are routed separately from the supply circuits.
- Use shielded lines.

Product code	P1Z1137
Figure	
Terminal diagram	
Connector type	8-pin terminal spring
Input channels	4 differential current inputs
Measuring range	-20 mA DC to +20 mA DC
Tolerance	0.5 % of measuring range
Maximum measuring range	-25.6 mA DC to +25.6 mA DC
Input impedance	140 Ω
Permissible potential difference between channels	DC 20 V
Permissible overload	DC 100 mA continuously

4.3.3 ANAI-CE-2EL

Channel 2 (CH2) of the measuring-transducer module can be used to monitor a direct voltage of 0 VDC to +300 VDC. Channel 1 (CH1) of the plug-in module has no function and cannot be used. For the connection to the measuring-transducer modules, the following conditions apply:

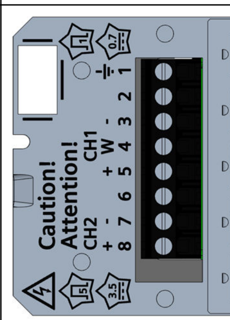
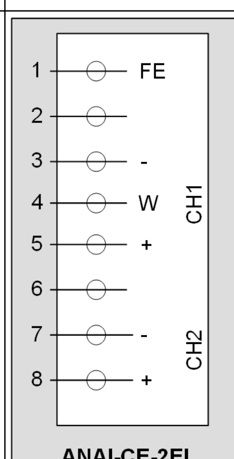
- Channel 2 (CH2) is an input with HLV (Hazardous Live Voltage)
- For CH2, use a core cross section of 1.0 mm² to 2.5 mm² (AWG 18-14).
- Leave the terminal inserted even if the plug-in module is not being used in the device.

DANGER

Dangerous voltage when working on the plug-in module.

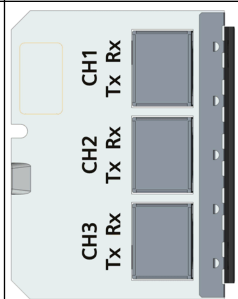
Disregarding the measures may lead to death or severe injuries.

✧ When working on (installation/removal) the modules or terminals, make sure that no voltage is applied.

Product Code	P1Z3704
Figure	
Terminal Diagram	
Connector type	8-pin terminal spring
Input channels	1 direct voltage input, Channel 2 (CH2)
Measuring range	0 VDC to +300 VDC
Tolerance	0.2% of measuring range or 500 mV
Input impedance	260 kΩ
Max. permissible voltage against ground on the measuring inputs	DC 300 V

4.3.4 ARC-CD-3FO

With the module, you can detect an arc in the air-insulated system part of the switchgear by way of an optical arc sensor.

Product code	P1Z1966
Figure	
Connector type	AVAGO AFBR-4526Z
Number of sensor connections	3 point or line sensors (combinations are possible)
Fiber type	Polymer Optical Fiber (POF) 1 mm
Receiver	
Maximum	-10 dBm ± 2 dBm
Minimum	-40 dBm ± 2 dBm
Spectrum	400 nm to 1100 nm
Attenuation	In the case of polymer optical fibers, you can expect a path attenuation of 0.2 dB/m. Additional attenuation comes from the plug and sensor head.
Optical budget [17]	Minimal 25 dB
Analog sampling rate	16 kHz
ADC type	10-bit successive approximation
Transmitter	
Type	LED
Wavelength	λ = 650 nm
Transmitter power	Minimum 0 dBm Maximum 2 dBm
Numerical aperture	0.5 [18]
Signal rate connection test	1 pulse per second
Pulse duration connection test	11 µs

NOTE

Laser class 1 is maintained in compliance with EN 60825-1 and EN 60825-2 when using 1 mm polymer optical fibers.

17 All values in combination with sensors approved by Siemens.

18 Numerical aperture (NA = sin θ (launch angle))

5 Working on the Device

5.1 First Steps

5.1.1 Electrical Inspection

Device Protection

DANGER

Danger when connecting the SIPROTEC 5 device

Noncompliance with the safety notes will result in death, severe injury, or considerable material damage.

- ✧ The device must be situated in the operating area for at least 2 hours before you connect it to the power supply for the first time. This prevents condensed water from forming in the device.
- ✧ If the device has been in storage for more than 2 years, connect it to an auxiliary voltage for 1 to 2 days. This will cause the electrolytic capacitors to form on the printed circuit board assemblies again.

- ✧ Perform the electrical inspection.

Activating the Battery

NOTE

The battery is covered by a protective film, which also prevents premature discharge.

The battery compartment is located on the rear of the base module. You do not have to take the battery out of the battery compartment in order to remove the protective film.

NOTE

Use only insulated tools to open and close the battery cover and to remove and insert the battery.

Activate the battery for SIPROTEC 5 devices as follows:

- ✧ Pull out the battery compartment including the battery.
- ✧ Remove the protective film from the battery by simply pulling on the film tab.
- ✧ Push the battery compartment including the battery back in again.

Grounding a Device

All SIPROTEC 5 devices, are protection class I equipment and must be connected to the system ground prior to commissioning.

- ✧ Ground each module with solid low-impedance system grounding (cross-section ≥ 4.0 mm^2 (≥ 0.0062 in^2), grounding area ≥ M4, torque: at least 1.2 Nm).
- ✧ In order to ensure the electromagnetic compatibility (EMC) of the device, connect the protective grounding terminals of the modules to each other in series connection. Use the double protective grounding terminals of the individual modules for this purpose.
- ✧ Connect the protective conductor of the protection device (connected modules) to the protective grounding terminal of the installation (for example control cabinet) with a single connection to the base module of the protection device.

Connecting a Device

- ✧ Connect all cables and lines. Use the connection diagrams in the Hardware Manual and Device Manual.

✧ Tighten the terminal screws to the prescribed torques (refer to *Tightening Torques for Terminal Screws, Page 272*).

Grounding an On-Site Operation Panel

✧ Join several on-site operation panels to one another with firm contact.

Siemens recommends the use of contact washers on painted metal mounting walls. If the mounting wall is not metallic, place a metal layer, for example a layer of sheet metal, between the mounting wall and the on-site operation panels. Then connect this sheet-metal layer to the system grounding.

Safety Notes

DANGER

Danger during electrical inspection

Noncompliance with the safety notes will result in death, severe injury, or considerable material damage.

✧ Comply with all given safety notes when carrying out the electrical inspection.

✧ Note that hazardous voltages are present when you perform the electrical inspection.

✧ During the electrical inspection, check that the device becomes ready for operation once it has been connected to the power supply.

Performing the Electrical Inspection

✧ Connect the power supply.

✧ Activate the power supply.

After (initial) activation, there is no Device Configuration File (DCF) in the device and the device is in fallback mode. The green and red LEDs light in fallback mode.

✧ Once you have loaded the DCF file into the SIPROTEC 5 device, the green **RUN** LED lights up continuously and the device is ready for operation.

✧ If the device does not assume the normal operating state (process mode), switch off the power supply. Disconnect the wiring and the grounding.

✧ Pack this device and return it to the manufacturer, stating the defect. Use transport packaging that meets the requirements of standard ISO 2248.

5.2 Expanding Modular Devices

5.2.1 Flush-Mounting Devices

5.2.1.1 Basic Rules for Expanding

NOTE

Prepare the following tools for the device expansion:

- Phillips screwdriver size PZ1 and PZ2
- Screwdriver DIN 4 x 0.8
- During assembly, use the prescribed torques (refer to *6.13 Design Data*).

Comply with the following basic rules when extending devices:

✧ Always fit the base module on the left in the 1st device row.

✧ Always fit the expansion modules from left to right.

✧ Always fit the expansion module with the key switches as the 1st module next to the base module.

✧ Always fit the expansion modules without LEDs last.

✧ Always install a power supply module PS203 on the left as the first unit in the 2nd device row.

✧ Note that the PS203 must always have the same rated voltage as the base module.

✧ In the 2nd device row, mount only input and output modules without light-emitting diodes

✧ Always mount the redundant PS204 power supply module at the position furthest to the right in the corresponding row when you're looking at it from the front. If a CB202 printed circuit board assembly is present in the row, the CB202 printed circuit board assembly must always be mounted to the right of the PS204 printed circuit board assembly (at the outermost position). You will find an example of this in Chapter *3.1.4.2 Positioning Specifications*.

✧ Note that the PS204 printed circuit board assembly must always have the same rated voltage as the base module.

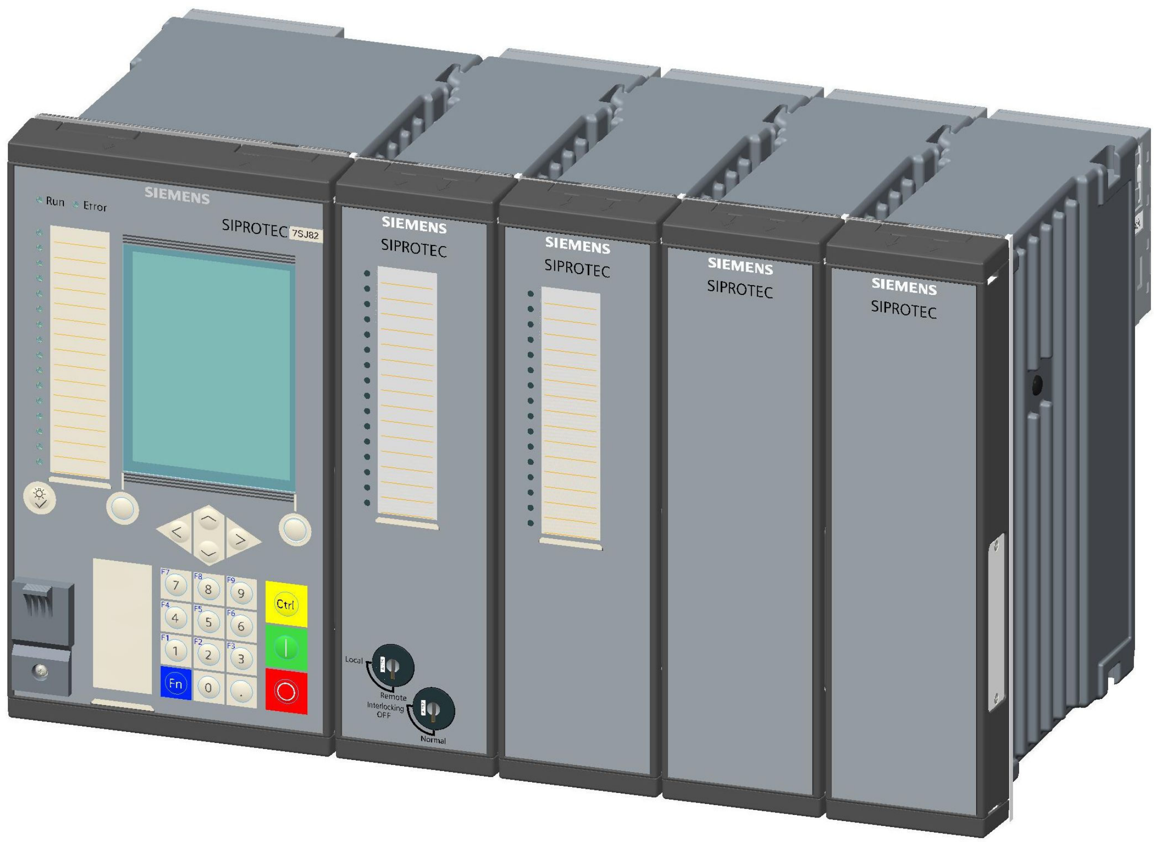


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Figure 5-1 Device Row of a Flush-Mounting Device

5.2.1.2 Expanding 1st Device Row

Preparation

NOTE

Reordered modules are not contained in the original device configuration. Use DIGSI to perform the corresponding extension in the **Hardware and Protocols** Editor.

Carry out the steps described in this chapter if you wish to expand an installed device later on with expansion modules.

- ✧ Shut down the device.
- ✧ Use the screwdriver to carefully bend the left and right spring clips on the rear plate terminals outwards.
- ✧ Completely detach the wired current and voltage terminal blocks from the device.
- ✧ Remove all communication lines.
- ✧ Remove the plastic screw covers.
- ✧ Remove the device.
- ✧ Expand the cut-out in the control cabinet.
- ✧ Then continue with assembly.

Assembling the Devices

- ✧ Remove the bus cover from the extreme right-hand module of the device to be expanded.

- Remove the plastic screw covers from the expansion module.
- Remove the right sealing strips from the base device.
- Place the expansion module on the right next to the device. Insert the 2 hinged angle clips of the expansion module in the cut-outs of the device.
- Slip ring the expansion module in the direction of the device so that the bottom snap-in spring engages.
- Bolt the 2 on-site operation panels of the module to one another through the contact tab.
- Check that the bus connection is screwed on at the extreme right of the expansion module.

Installation and Commissioning

- Reinstall the device.
- Reinstall the plastic screw covers.
- Refasten the terminal blocks and the necessary communication lines.
- Connect the current and voltage blocks of the expansion module.
- Connect any available plug-in modules.
- Use the supplied grounding cable to connect the expansion module with the device and reconnect the device to service ground.
- Extend the device configuration in DIGSI and load this configuration to the device.
- Resume operation of the device.

5.2.1.3 Expanding Devices with 2nd Device Row

Preparation

NOTE

Reordered modules are not contained in the original device configuration. Use DIGSI to perform the corresponding extension in the **Hardware and Protocols** Editor.

Carry out the steps described in this chapter if you want to expand an installed device later on with a 2nd device row.

- Shut down the device in the 1st device row.
- Use the screwdriver to carefully bend the left and right spring clips on the rear plate terminals outwards.
- Completely detach the wired current and voltage terminal blocks from the device.
- Remove all communication lines.
- Remove the plastic screw covers.
- Remove the device from the 1st device row.
- Remove the device bus cover from the extreme right-hand expansion module of the device to be expanded.
- Screw the sealing plate and the adaptor bracket according to *Figure 5-4* on the outer right expansion module of the 1st device row. The sealing plate, adaptor angle, and screws are included with the supply of the power-supply module PS203.
- Attach the cable holder for the connecting cable of the 2nd device row to the back side of the angle rail.
- Clip the connecting cable into the cable holder.

NOTE

Observe the direction of the connecting cable.
Note that the available cable end for the connection of the 2nd device row must be longer than the cable end for the connection of the 1st device row.

✧ Insert the cable in the rubber seals, and introduce the seals in the slot of the angle rail (see *Figure 5-3*)

Assembling the Devices

✧ Install the angle rail.

✧ Install the 1st device row above the angle rail.

✧ Install the 2nd device row below the angle rail.

✧ Screw the 2 handle moulds of the connecting cable to the 1st and 2nd device row.

NOTE

Make sure that the handle moulds are not rotated during assembly so as not to damage the contact surfaces of the plugs.

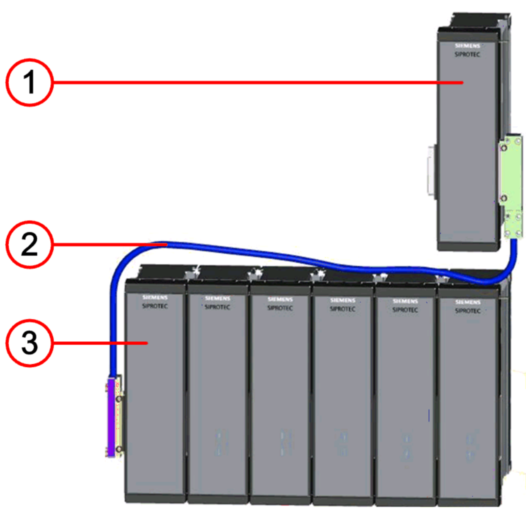

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Figure 5-2 Expansion with 2nd Device Row

(1) Extreme right expansion module of the 1st device row
(2) Connecting cable
(3) 2nd device row

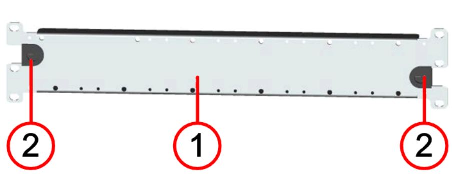

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Figure 5-3 Angle Rail

(1) Angle rail
(2) 2 Rubber seals

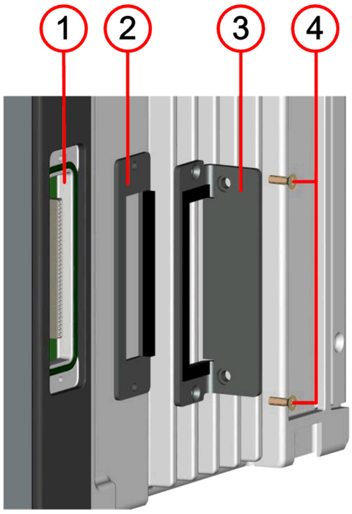

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Figure 5-4 Sealing Plate and Adaptor Bracket for the Expansion Module of the 1st Device Row

(1) Device bus of the outermost right expansion module of the 1st device row
(2) Sealing plate
(3) Adaptor angle
(4) 2 mounting screws

Installation and Commissioning

- ✧ Reinstall the plastic screw covers.
- ✧ Refasten the terminal blocks and the necessary communication lines.
- ✧ Connect the current and voltage blocks of the expansion module.
- ✧ Connect any available plug-in modules.
- ✧ Use the supplied grounding cable to connect the expansion module with the device and reconnect the device to service ground.
- ✧ Extend the device configuration in DIGSI and load this configuration to the device.
- ✧ Resume operation of the device.

5.2.2 Surface-Mounted Devices with Integrated On-Site Operation Panel

5.2.2.1 Basic Rules for Expanding

NOTE

Prepare the following tools for the device expansion:

- Phillips screwdriver size PZ1 and PZ2
- Screwdriver DIN 4 x 0.8
- During assembly, use the prescribed torques (refer to *6.13 Design Data*).

Comply with the following basic rules when extending devices:

- Always fit the base module on the right in the 1st device row.
- Always fit the expansion modules from right to left.
- Always fit the on-site operation panel of the base module on the left.

- Always fit the on-site operation panels of the expansion modules from left to right.
- Always fit the on-site operation panel of the expansion module with the key switches in the 1st place next to the on-site operation panel of the base module.
- Always fit the on-site operation panels without LEDs last.
- Join the on-site operation panels to one another with 2 mounting brackets.
- Always install a power-supply module PS203 on the right as the first unit in the 2nd device row.
- Note that the PS203 must always have the same rated voltage as the base module.
- Always mount the redundant PS204 power supply module at the position furthest to the right in the corresponding row when you're looking at it from the front. If a CB202 printed circuit board assembly is present in the row, the CB202 printed circuit board assembly must always be mounted to the right of the PS204 printed circuit board assembly (at the outermost position). You will find an example of this in Chapter *3.1.4.2 Positioning Specifications*.
- Note that the PS204 printed circuit board assembly must always have the same rated voltage as the base module.
- In the 2nd device row, you do not need any on-site operation panels, mounting brackets, or distance frames.

NOTE

When expanding a device in the 1st device row, order 2 mounting brackets that match the width of the expanded device.

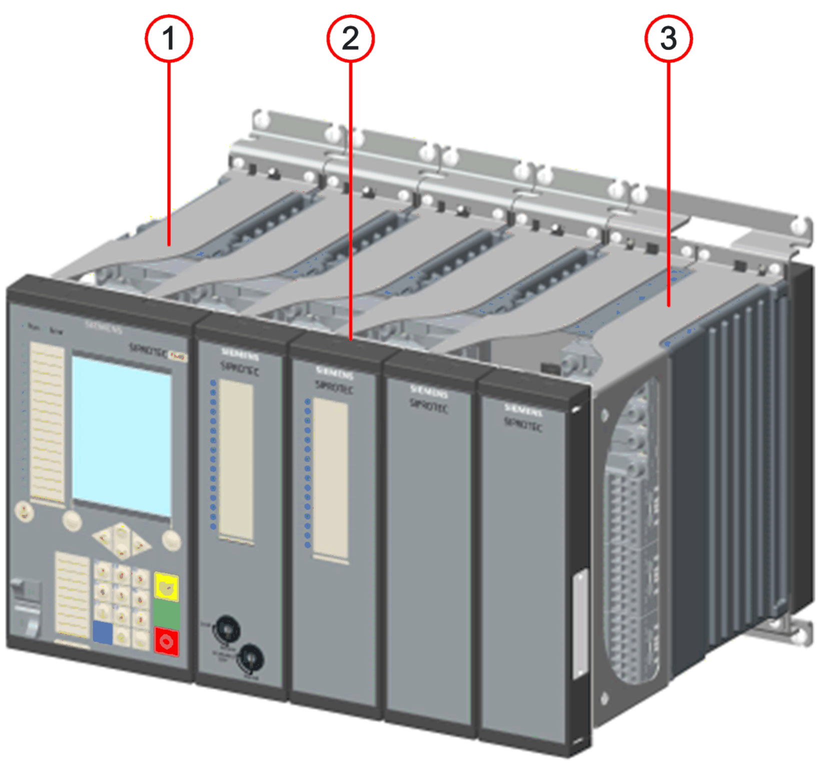

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Figure 5-5 Device Row

(1) Distance frame
(2) Mounting bracket
(3) Distance frame on base module rotated by 180°

5.2.2.2 Expanding 1st Device Row

Preparation

NOTE

Reordered modules are not contained in the original device configuration. Use DIGSI to perform the corresponding extension in the **Hardware and Protocols** Editor.

Carry out the steps described in this chapter if you wish to expand an installed device later on with expansion modules.

- ✧ Shut down the device.
- ✧ Detach all on-site operation panels from the distance frames.
- ✧ Remove the mounting brackets.

NOTE

If the device is an expanded device, then detach the 2 mounting brackets. You must replace these mounting brackets with 2 new mounting brackets that match the width of the device.

- ✧ Use a screwdriver to carefully bend the left and right spring clips on the terminals outwards.
- ✧ Completely detach the wired current and voltage terminal blocks from the device.
- ✧ Remove all communication lines.
- ✧ Remove the device completely.

Assembling the On-Site Operation Panel into One Block

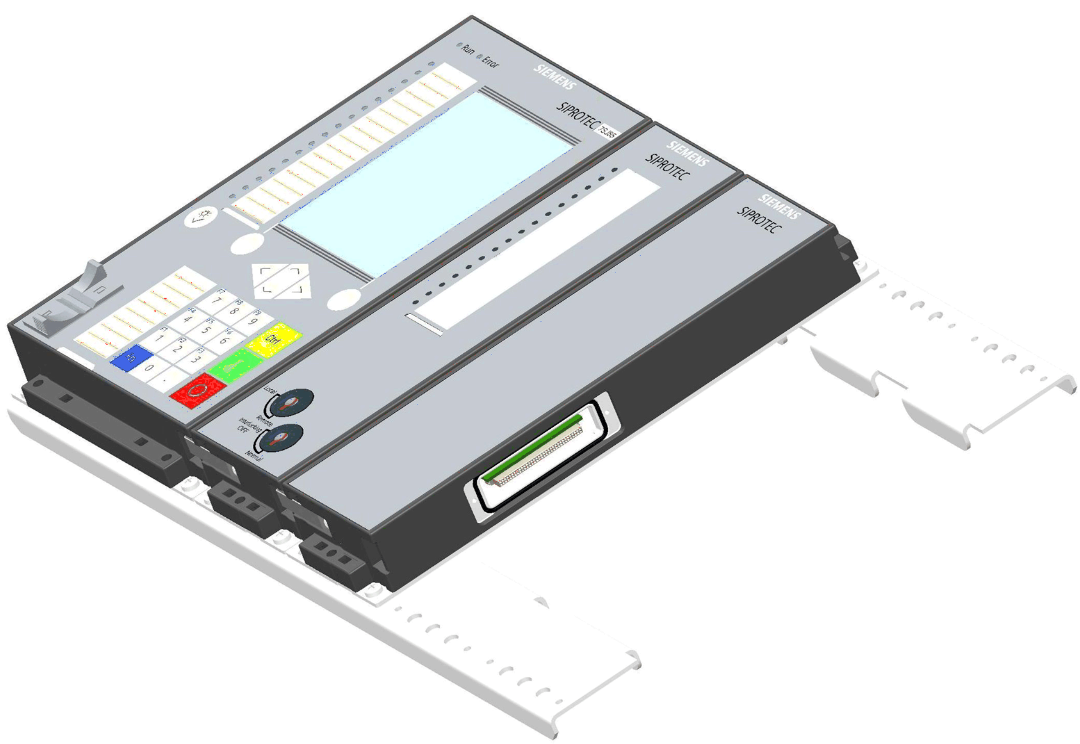

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Figure 5-6 On-Site Operation Panel Fitted on Mounting Bracket

- ✧ Place the 2 mounting brackets intended for expansion in parallel to one another on a flat surface.

- ✧ Bolt the 1st (left-hand) on-site operation panel to the 2 mounting brackets. Do not firmly tighten the screws.
- ✧ Place the 2nd on-site operation panel on the right of the 1st one and screw these panels onto the 2 mounting brackets. Do not firmly tighten the screws. Make sure that the snap-in spring is engaged!
- ✧ Bolt the 2 operation panels to one another through the contact tab. Do not firmly tighten the screws.
- ✧ Repeat the last 2 steps for the remaining operation panels. Leave all screws loose.

Assembling the Devices

- ✧ Remove the distance frame from the expansion module.
- ✧ Remove the bus cover from the extreme left-hand module.
- ✧ Remove the plastic screw covers from the extreme left-hand module and from the expansion module.
- ✧ Place the expansion module on the left next to the device. Insert the 2 hinged angle clips of the expansion module in the cut-outs of the device.
- ✧ Swivel the expansion module in the direction of the device so that the bottom snap-in spring engages.
- ✧ Bolt the contact tab to the 2 modules.

Installation and Commissioning

- ✧ Install the distance frame intended for expansion.
- ✧ Wire and, if required, fasten the current and voltage terminal blocks.
- ✧ Fit the device back onto the wall without fastened on-site operation panels.
- ✧ Use the supplied grounding cable to connect the expansion module with the device and reconnect the device to service ground.
- ✧ Fasten the connecting cable for the on-site operation panel on the extreme left-hand operation panel of those on-site operation panels assembled beforehand into a block.
- ✧ Place the block of assembled operation panels on the distance frames of the device. In doing so, guide the connecting cable for the on-site operation panel through the cut-outs of the distance frame to the terminal of the base module.
- ✧ Fasten the connecting cable for the on-site operation panel to the base module.
- ✧ Bolt the operation panels to the distance frames and firmly tighten the screws.
- ✧ Tighten all loose screws on the contact tabs and on the mounting brackets.
- ✧ Reinstall all plastic screw covers.
- ✧ Extend the device configuration in DIGSI and load it to the device.
- ✧ Resume operation of the device.

5.2.2.3 Expanding Devices with 2nd Device Row

Preparation

NOTE

Reordered modules are not contained in the original device configuration. Use DIGSI to perform the corresponding extension in the **Hardware and Protocols** Editor.

Carry out the steps described in this chapter if you wish to expand an installed device later on with expansion modules.

- ✧ Shut down the device in the 1st device row.

NOTE

The next 6 steps are only necessary if the 1st device row is not accessible.
If the left side of the 1st device row is accessible, then the complete device can remain on the wall.

- ✧ Detach all on-site operation panels from the distance frames.
- ✧ Remove the mounting brackets.
- ✧ Use the screwdriver to carefully bend the left and right spring clips on the rear plate terminals outwards.
- ✧ Completely detach the wired current and voltage terminal blocks from the device.
- ✧ Remove all communication lines.
- ✧ Completely remove the device from the 1st device row.
- ✧ Remove the device bus cover from the extreme left-hand expansion module of the device to be expanded.
- ✧ Bolt the sealing plate and the adaptor bracket according to *Figure 5-8* on the outer left expansion module of the 1st device row. The sealing plate, adaptor bracket, and screws are included with the delivery of the power-supply module PS203.

Assembling the Devices

- ✧ Install the 1st device row.

NOTE

The distance between the 1st and the 2nd device row must be not more than 80 mm (3.15 in).

- ✧ Install the 2nd device row.
- ✧ Unscrew the captive screws from the handle mold.
- ✧ Install the handle mold.
- ✧ Install the screws for the handle mold from the view of the adaptor bracket. Thus, later accessibility is ensured without having to remove the entire device.

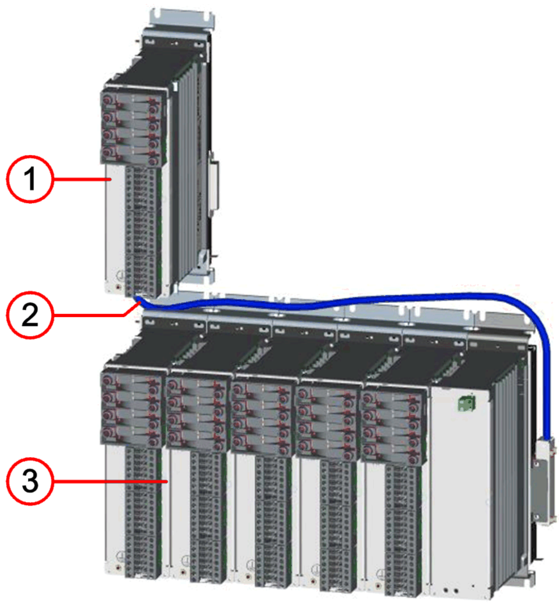

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Figure 5-7 Expansion with 2nd Device Row (View of the Installation Level without Showing the On-Site Operation Panel)

(1) Extreme right expansion module of the 1st device row
(2) Connecting cables
(3) 2nd device row

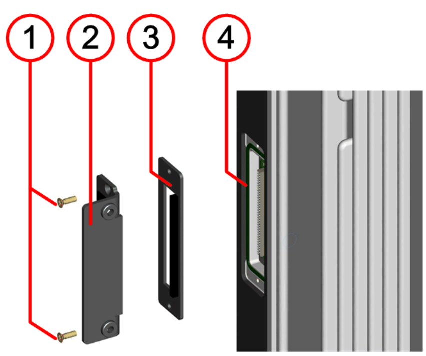

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Figure 5-8 Sealing Plate and Adaptor Bracket for the Expansion Module of the 1st Device Row

(1) 2 fastening screws
(2) Adaptor angle
(3) Sealing plate
(4) Device bus of the outermost left expansion module of the 1st device row

Installation and Commissioning

- Reinstall the plastic screw covers.
- Refasten the terminal blocks and the necessary communication lines.
- Connect the current and voltage blocks of the expansion module.
- Connect any available plug-in modules.
- Use the supplied grounding cable to connect the expansion module with the device and reconnect the device to service ground.

✧ Extend the device configuration in DIGSI and load it to the device.

✧ Resume operation of the device.

5.2.3 Surface-Mounted Devices with Detached On-Site Operation Panel

5.2.3.1 Basic Rules for Expanding

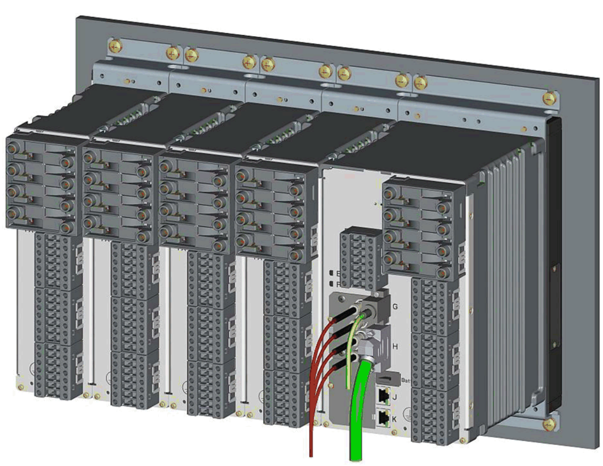
NOTE

Prepare the following tools for the device expansion:

- Phillips screwdriver size PZ1 and PZ2
- Screwdriver DIN 4 x 0.8
- During assembly, use the prescribed torques (refer to *6.13 Design Data*).

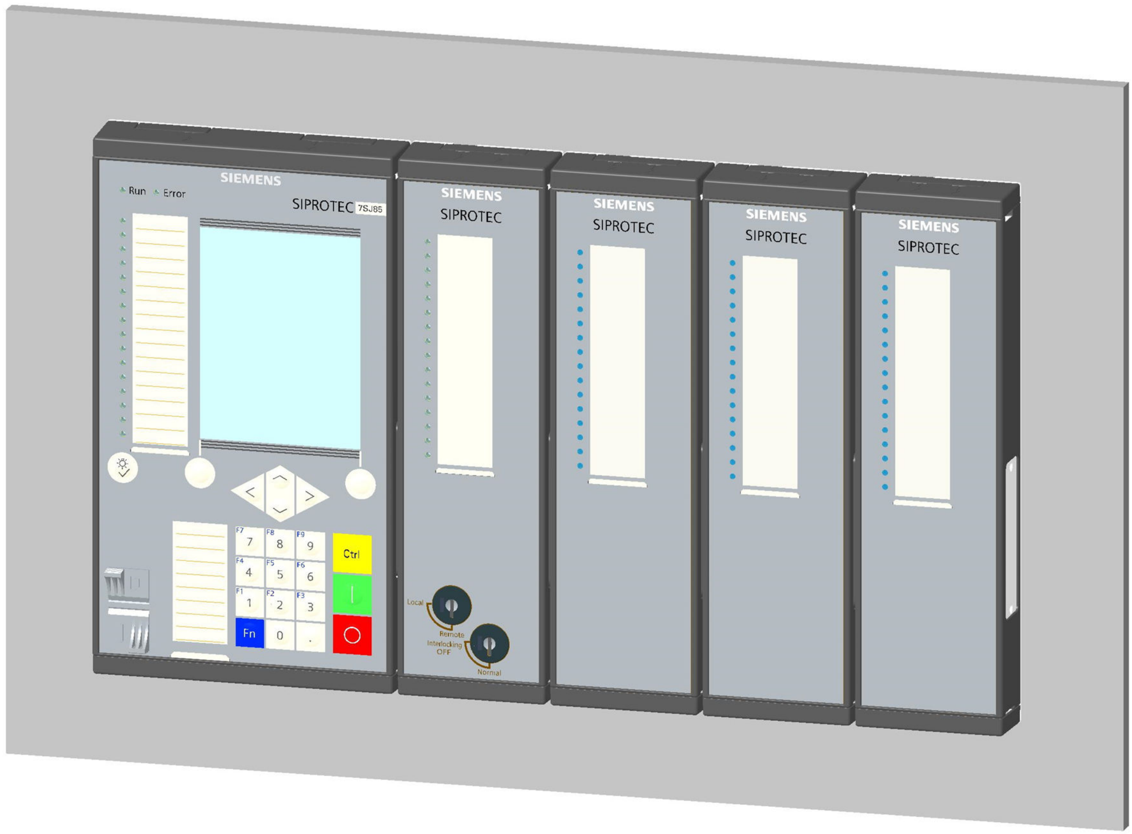
Comply with the following basic rules when extending devices:

- Always fit the base module on the right in the 1st device row.
- Always fit the expansion modules from right to left.
- Always fit the on-site operation panel of the base module on the left.
- Always fit the on-site operation panels of the expansion modules from left to right.
- Always install a power-supply module PS203 on the right as the first unit in the 2nd device row.
- Note that the PS203 must always have the same rated voltage as the base module.
- Always mount the redundant PS204 power supply module at the position furthest to the left in the corresponding row when you're looking at it from the front. If a CB202 printed circuit board assembly is present in the row, the CB202 printed circuit board assembly must always be mounted to the left of the PS204 printed circuit board assembly (at the outermost position). You will find an example of this in Chapter *3.1.4.2 Positioning Specifications*.
- Note that the PS204 printed circuit board assembly must always have the same rated voltage as the base module.
- The distance between the device and the on-site operation panel is limited to not more than 5 m by the length of the connecting cable.



[dwauizei-040211-01.tif, 1, --_--]

Figure 5-9 Device Row



[dw_abosop-040211-01, 1, --_--]

Figure 5-10 Detached on-site operation panel

5.2.3.2 Expanding 1st Device Row

Preparation

NOTE

Reordered modules are not contained in the original device configuration. Use DIGSI to perform the corresponding extension in the **Hardware and Protocols** Editor.

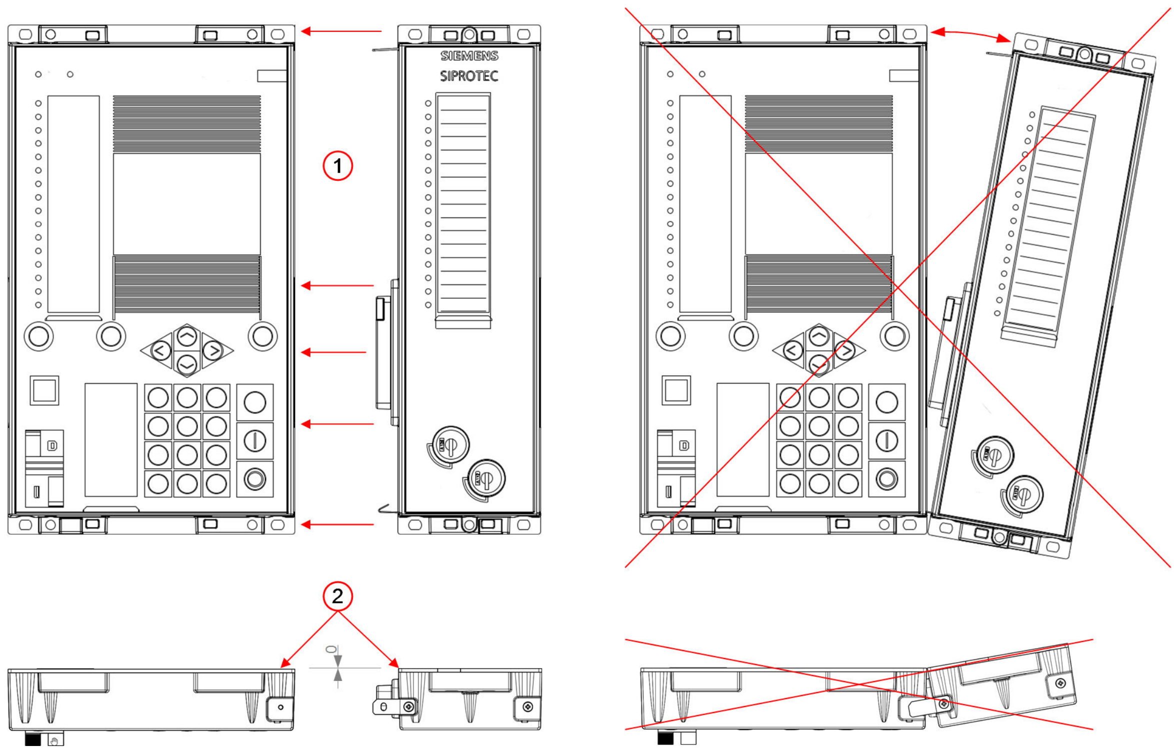
Carry out the steps described in this chapter if you wish to expand an installed device later on with expansion modules.

- ✧ Shut down the device.
- ✧ Use a screwdriver to carefully bend the left and right spring clips outwards.
- ✧ Completely detach the wired current and voltage terminal blocks from the device.
- ✧ Remove all communication lines.
- ✧ If you want to extend the device, then detach it completely.
- ✧ If you want to extend the on-site operation panel, then remove the on-site operation panel from the installation space.

NOTE

The device and the on-site operation panel can be extended independently of one another. Therefore, you need only detach those components that are to be extended.

Please note the handling guidelines shown in the following figure when connecting the on-site operation panels.



[dw_osops, 1, --_--]

Figure 5-11 Connecting the On-site Operation Panel

(1) Vertical end faces remain parallel during the assembly process.

(2) Rear panels of the on-site operation panel during assembly on the same level.

Installing the Devices (with View to the Installation Plane)

- Remove the bus cover from the extreme left-hand module of the device to be extended.
- Remove the plastic screw covers from the extreme right-hand module and from the expansion module.
- Place the expansion module on the left next to the device. Insert the two hinged angle clips of the expansion module in the cut-out of the device.
- Swivel the expansion module in the direction of the device so that the bottom snap-in spring engages.
- Bolt the on-site operation panels of the two modules to one another through the contact tab.
- Check that the bus connection is screwed on at the extreme left of the expansion module.

Installation and Commissioning

- Reinstall the plastic screw covers.
- Use the supplied grounding cable to connect the expansion module with the device and reconnect the device to service ground.
- Fit the device back onto the wall.

- ✧ Extend the on-site operation panel with the on-site operation panel of the expansion modules. Make sure that the bus connection is plugged in reliably and that the snap-in springs have engaged.
- ✧ Bolt the on-site operation panels to one another through the contact tab.
- ✧ Check that the bus connection on the expansion module on the extreme right is covered.
- ✧ Connect all communication lines again.
- ✧ Expand the device configuration with DIGSI and load it into the device.
- ✧ Resume operation of the device.

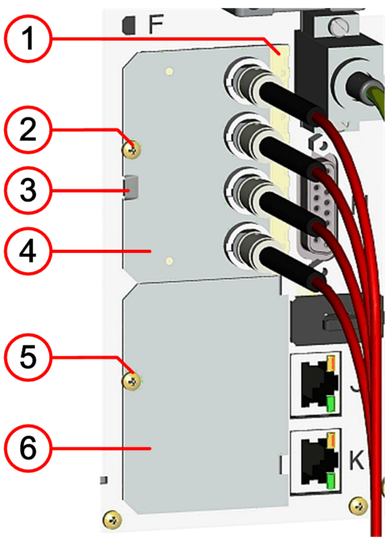
Expanding Devices with 2nd Device Rows

- ✧ When expanding a surface-mounting device with a 2nd device row, follow the instructions in Chapter *5.2.2.3 Expanding Devices with 2nd Device Row*.

5.3 Plug-In Modules

5.3.1 Fasteners

The fasteners of the plug-in modules are shown in the following figure regarding the example of an installed module and an empty, covered slot.



[le_fixing_elements, 1, --_--]

Figure 5-12 Fasteners

(1) EMC spring contact
(2) Fastening screw
(3) Cut-out for prying out the modules
(4) Plug-in module
(5) Fastening screw
(6) Cover plate

5.3.2 Installation

NOTE

Reordered modules are not contained in the original device configuration. Use DIGSI to perform the corresponding extension in the **Hardware and Protocols** Editor.

Preparing Installation

DANGER

Danger due to live voltage when installing the plug-in modules.

Noncompliance with the safety notes will result in death or severe injuries.

✧ Install plug-in modules on the electrically deactivated device only.

CAUTION

Exercise caution with laser beams of the optical plug-in modules.

Noncompliance with the safety notes can result in medium-severe or slight injuries.

✧ Do not look directly into the optical fiber terminals of the active optical plug-in modules, not even with optical devices. The laser beams can damage the eyes.

✧ De-energize the device.

NOTE

When using optical communication modules, Laser class 1 is maintained in compliance with EN 60825-1 and EN 60825-2 when using optical fibers ≤ 62.5 µm/125 µm.

When using the ARC-CD-3FO module, Laser class 1 is maintained in compliance with EN 60825-1 and EN 60825-2 when using 1 mm plastic optical fibers.

✧ In the case of a surface-mounted device with integrated on-site operation panel, remove the entire on-site operation panel.

✧ Undo the fastening screw and remove the cover plate from the plug-in module position.

Installing the Plug-In Module

✧ Push in the plug-in module on the inner guide as far as it will go.

✧ Ensure that the EMC contact spring is seated correctly.

✧ Bolt down the plug-in module on the assembly frame to a torque of 0.4 Nm.

✧ Connect the lines to the terminals.

✧ Then check for secure attachment of the plugs.

✧ If necessary, fit the on-site operation panel again.

Completing Installation

✧ Resume operation of the device.

5.3.3 Removing

Accessories

NOTE

Seal an unused plug-in module position with a cover plate.

✧ Order the **module cover plate** set of parts to cover the unused plug-in module position.

Preparing Removal

DANGER

Risk of live voltage when removing the plug-in modules.

Noncompliance with the safety notes will result death or severe injuries.

✧ Remove plug-in modules on the electrically deactivated device only.

CAUTION

Exercise caution with laser beams of the optical plug-in modules.

Noncompliance with the safety notes can result in medium-severe or slight injuries.

✧ Do not look directly into the optical fiber terminals of the active optical plug-in modules, not even with optical devices. The laser beams can damage the eyes.

✧ De-energize the device.

NOTE

Laser class 1 is adhered to in compliance with EN 60825-1 and EN 60825-2, in the case of
≤ 62.5 μm/125 μm optical fibers.

✧ In the case of a surface mounting device with integrated on-site operation panel, remove the on-site operation panel before the base module.

Removing the Plug-In Module

✧ Remove all connecting lines.

✧ Undo the fastening screw with which the plug-in module is fixed on the device.

✧ Insert a screwdriver (DIN 4 x 0.8) in the cut-out underneath the oblong hole.

✧ Carefully pull out the plug-in module.

Fastening the Cover Plate

✧ Fasten the cover plate with the fixing screw to a torque of 0.4 Nm. The fixing screw is included in the set of parts.

Completing Removal

✧ In the case of a surface mounting device with integrated local operation panel, fit the on-site operation panel of the base module again.

✧ Resume operation of the device.

5.3.4 Replacement

Preparing for Replacement

DANGER

Danger due to live voltage when replacing the plug-in modules.

Noncompliance with the safety notes will result in death or severe injuries.

- ✧ Install plug-in modules on the electrically deactivated device only.

CAUTION

Exercise caution with laser beams of the optical plug-in modules.

Noncompliance with the safety notes can result in slight to medium injuries.

- ✧ Do not look directly into the optical fiber terminals of the active optical plug-in modules, not even with optical devices. The laser beams can damage the eyes.

- ✧ De-energize the device.

NOTE

Laser class 1 is adhered to in compliance with EN 60825-1 and EN 60825-2, in the case of ≤ 62.5 μm/125 μm optical fibers.
When using the ARC-CD-3FO module, Laser class 1 is maintained in compliance with EN 60825-1 and EN 60825-2 when using 1-mm plastic optical fiber.

- ✧ In the case of a surface-mounted device with integrated on-site operation panel, remove the on-site operation panel before the base module.
- ✧ Remove all connecting lines.
- ✧ Undo the fastening screw with which the plug-in module is fixed on the device.
- ✧ Insert a screwdriver (DIN 4 x 0.8) in the cut-out underneath the elongated hole in the mounting frame and disengage the plug-in module.
- ✧ Carefully pull out the plug-in module.

Fastening the Plug-In Module

- ✧ Push in the new plug-in module on the inner guide of the plug-in module position until it moves no further.
- ✧ Bolt down the plug-in module on the mounting frame to a torque of 0.4 Nm.
- ✧ Connect the lines to the terminals.
- ✧ Then check for secure attachment of the plugs.
- ✧ If necessary, fit the on-site operation panel again.

Completing Replacement

- ✧ Place the device is service again and perform a firmware update of the communication modules.

NOTE

If you have not cabled the optical fiber plug-in modules, then seal the terminals with protective covers. This prevents soiling of the terminals.

5.4 Arc Sensors for Module: ARC-CD-3FO

5.4.1 Point Sensor

5.4.1.1 Description

The point sensor detects arcs in the control cabinets of the air-insulated system part.

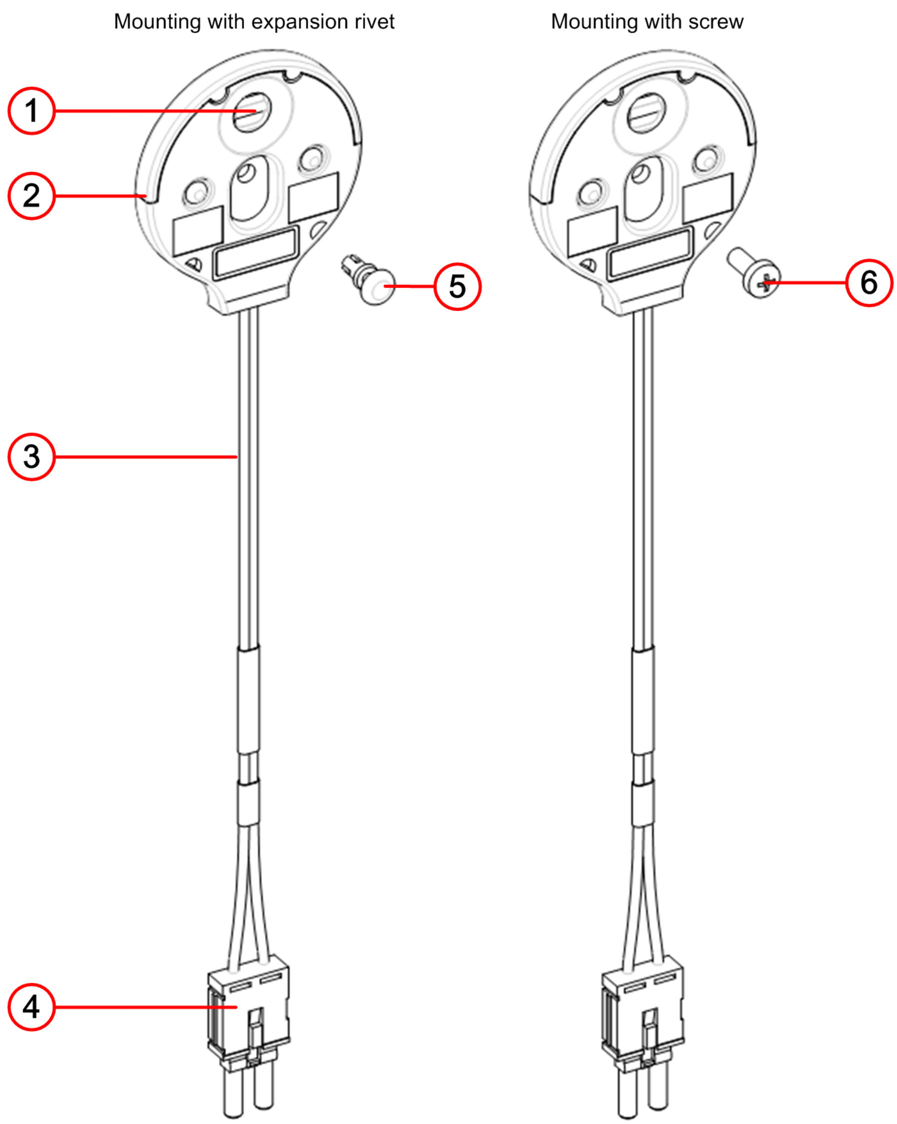
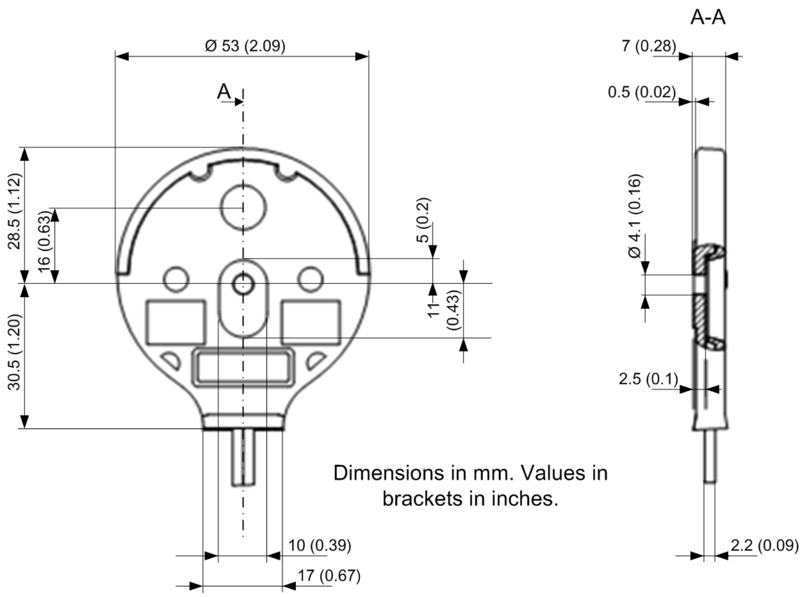


Figure 5-13 Point Sensor for the Arc-Protection Module: ARC-CD-3FO

(1) Optically active zone
(2) Sensor head
(3) Supply line
(4) Plug to the arc-protection module: ARC-CD-3FO
(5) Expansion rivet, 4x7
(6) Screw, M4



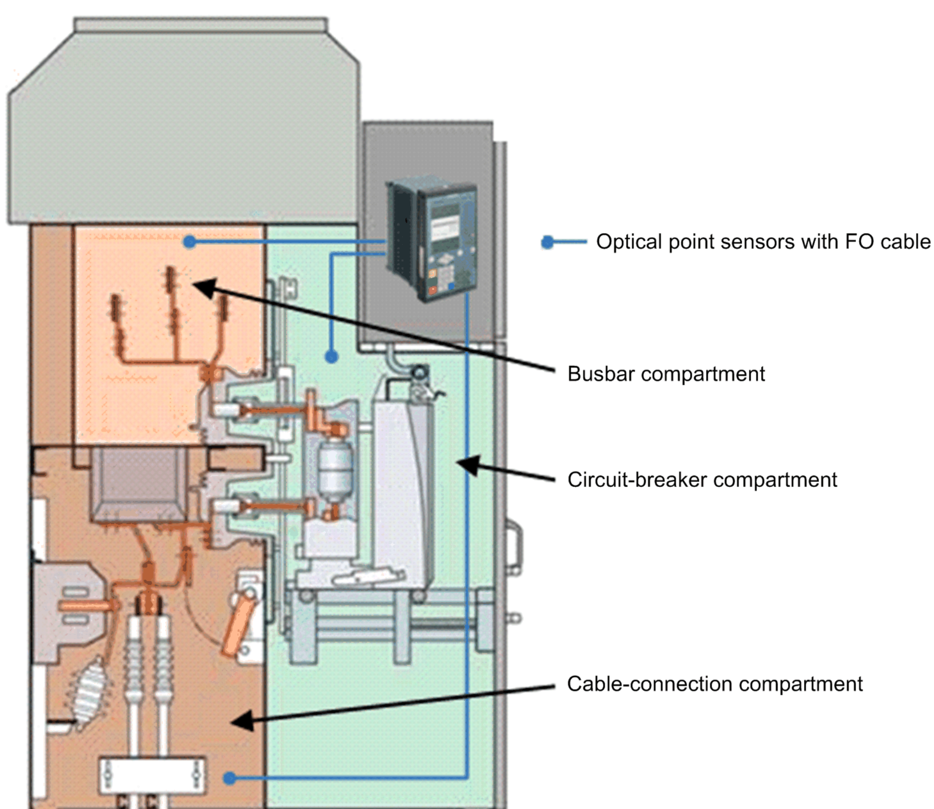
[dw_point_sensor_dimensions, 1, en_US]

Figure 5-14 Dimensional Drawing of the Point Sensor

The sensitivity of the point sensors with line lengths up to 4 m typically begins at 10 kLux.

5.4.1.2 Installation

The point sensors are mounted in the different compartments of a control cabinet, see the following figure. The point sensor detects light in an angle of ± 60°.



[dw_position_sensor, 2, en_US]

Figure 5-15 Mounting Position of the Optical Arc Sensors in the Control Cabinet

NOTE

Install the arc sensors in the control cabinet in such a way that the relevant sections are not hidden behind other system components!

NOTE

The ambient temperature for the arc sensor may be between -40 °C and 85 °C.

Preparing Installation

CAUTION

Exercise caution with laser beams of the optical plug-in modules.

Noncompliance with the safety notes can result in slight to medium injuries.

✧ Do not look directly into the fiber optic terminals of the active optical plug-in modules, not even with optical devices. The laser beams can damage the eyes.

✧ De-energize the device.

NOTE

Laser class 1 is maintained in compliance with EN 60825-1 and EN 60825-2 when using 1 mm polymer optical fibers.

✧ You need 1 hole in the control cabinet for fastening.

Mounting the Point Sensor

✧ With a wall thickness of 1.5 mm to 2.5 mm, fasten the point sensor using an expansion rivet. This expansion rivet is included in the scope of delivery.
Hole diameter = 4.1 mm to 4.2 mm

✧ Insert the expansion rivet through the hole in the point sensor and through the hole in the wall. Press the head of the expansion rivet firmly into the base body.

✧ As an alternative, you can also fasten the point sensor using a screw (M4). Tighten the screw with a torque of 0.2 Nm.

✧ Siemens recommends fastening the line to the wall below the point sensor. The line must not be bent or stressed in any other way.
R = 50 mm (minimum bending radius)
Maximum continuous tensile force = 1 N

NOTE

Order the point sensor with a suitable line length. If the line is too long, it must not be shortened! It must be rolled up with a minimum diameter of 0.3 m because of the optical attenuation.
Obey the general recommendations of the manufacturers of optical lines.

✧ Remove the dust caps from the plug and connect the line to the plug-in module.

NOTE

The contact surfaces of the plug must be clean.

✧ Then check for secure attachment of the plug.

Completing Installation

✧ Resume operation of the device.

NOTE

In order to warrant safe functioning, the affected sensor must be substituted after detection of an arc.

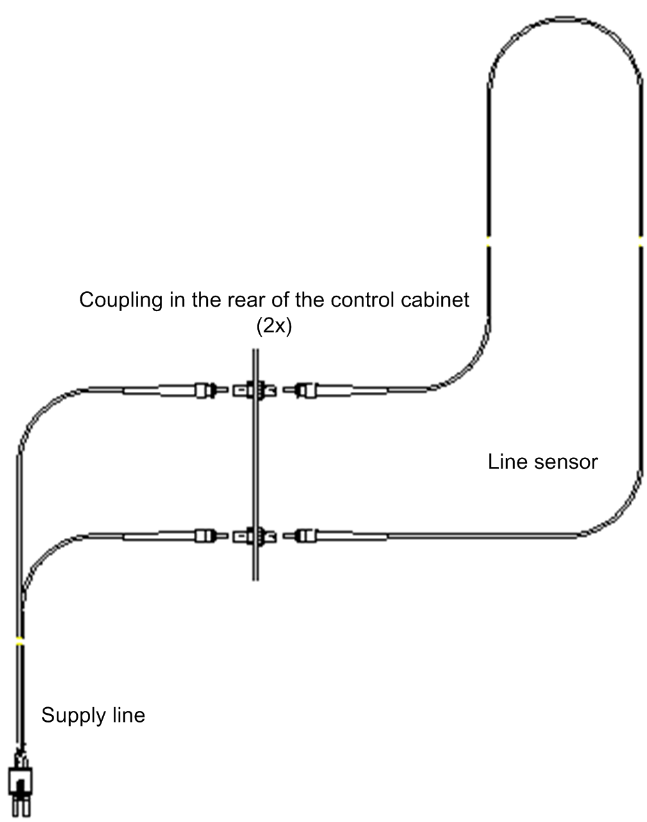
NOTE

Hereby, Siemens declares that until now, UL has neither investigated whether the device can detect an arc-protection fault, neither if in case of an arc-protection fault, the safety of personnel and system is guaranteed.

5.4.2 Line Sensor

5.4.2.1 Description

The line sensor detects arcs in the control cabinets of the air-insulated system part.



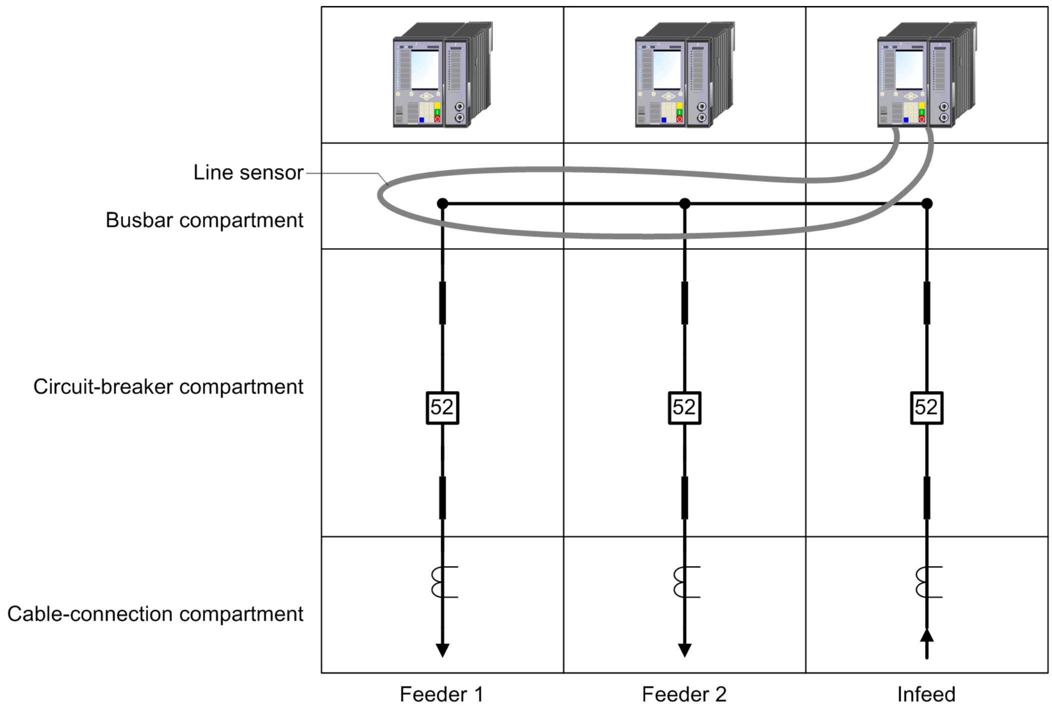
[dw_line_sensor_mounting, 1, en_US]

Figure 5-16 Line Sensor for the Arc-Protection Module ARC-CD-3FO

5.4.2.2 Installation

Depending on the application, the line sensor can be, for example, laid along the busbar. Additional point sensors are installed in order to identify the arcs in the circuit-breaker compartment and in the cable connection compartment.

In addition to the busbar compartment, the line sensor can also be passed through the circuit-breaker compartment and the cable connection compartment of the feeders, depending on the routing options in the control cabinet.



[dw_line sensor, 1, en_US]

Figure 5-17 Laying a Line Sensor Along the Busbar

NOTE

Install the arc sensors in the control cabinet in such a way that the relevant sections are not hidden behind other system components!

NOTE

The ambient temperature for the arc sensor may be between -40 °C and 85 °C.

Preparing Installation

CAUTION

Exercise caution with laser beams of the optical plug-in modules.

Noncompliance with the safety notes can result in slight to medium injuries.

✧ Do not look directly into the fiber-optic terminals of the active optical plug-in modules, not even with optical devices. The laser beams can damage the eyes.

✧ De-energize the device.

NOTE

Laser class 1 is maintained in compliance with EN 60825-1 and EN 60825-2 when using 1 mm polymer optical fibers.

- ✧ You need 2 holes (10.0 mm in diameter) in the control cabinet for fastening. Siemens recommends a distance of approx. 10 cm.

Mounting the Line Sensor

- ✧ Fasten both busbar-coupler pieces in both the holes in the control-cabinet wall.
  The busbar-coupler pieces (including nut and lock washer) are contained in the scope of delivery for the sensor.
- ✧ Connect one end of the line sensor to a busbar-coupler piece and route the sensor fiber along the section to be protected, for example, the busbar.
- ✧ Make sure that the piece of fiber exposed to the arc has a minimum size of 0.5 m and that the distance from the potential arc source is a maximum of 0.25 m.
  If these boundary conditions cannot be satisfied, please contact our Customer Support for further questions.
- ✧ Fasten the sensor fiber with, for example, cable fasteners.
  Ensure that the fiber is not damaged or broken when fastening.
- ✧ The sensor fiber is non-conductive. However, ensure that the sensor fiber is laid in such way as to avoid contact with hot or energized parts.
- ✧ Make sure that the sensor and the line are not damaged by sharp edges.
- ✧ Sensor areas that should not react to light can be covered up.
- ✧ Pass the sensor fiber back again and connect it with the 2nd busbar coupler piece.
- ✧ The line must not be bent or stressed in any other way.
  R = 50 mm (minimum bending radius)
  Maximum continuous tensile force = 1 N
- ✧ Fasten the supply line with the busbar-coupler piece to the side of the protection device.
- ✧ Remove the dust caps from the plug and connect the supply line to the plug-in module.

NOTE

Order the line sensor and the supply line with a suitable line length. If the line is too long, it must not be shortened! It must be rolled up with a minimum diameter of 0.3 m because of the optical attenuation.

Obey the general recommendations of the manufacturers of optical lines.

NOTE

The contact surfaces of the plug must be clean.

Completing Installation

- ✧ Resume operation of the device.

NOTE

In order to warrant safe functioning, the affected sensor must be substituted after detection of an arc.

NOTE

Hereby, Siemens declares that until now, UL has neither investigated whether the device can detect an arc-protection fault, neither if in case of an arc-protection fault, the safety of personnel and system is guaranteed.

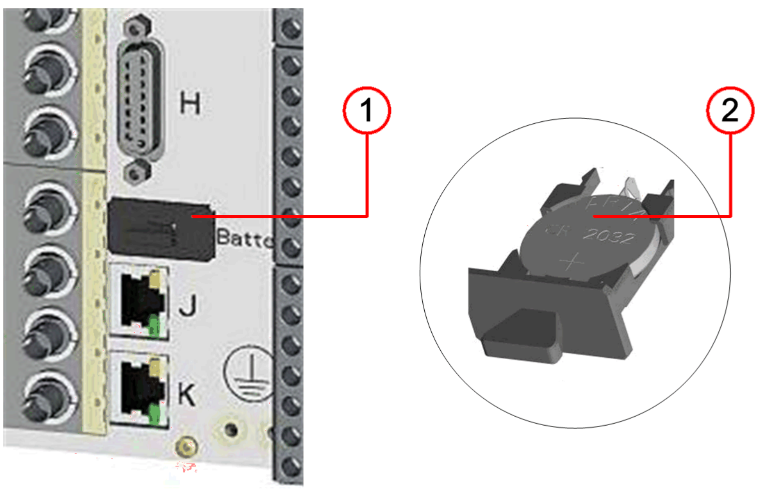
5.5 Battery

5.5.1 Description

The battery lies in an externally accessible battery compartment. The battery compartment is located on the rear of the base module. You need not open the device when replacing the battery.

If the auxiliary voltage fails, the battery ensures continued operation of the internal clock and storage of certain data (statistical values, values of thermal models) for at least 6 months. Parameterization, logs, and fault records are always stored in a fail-safe way in a non-volatile memory.

The device cyclically checks the charge of the battery. The **`Battery fault`** indication is issued if the actual voltage falls below the minimum.

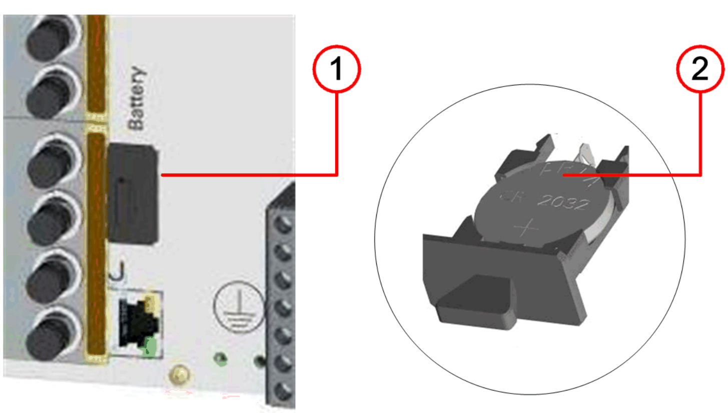


[dwbatpos-040211-01.tif, 2, --_--]

Figure 5-18 Position of the Battery Compartment in the Modular Device

(1) Battery compartment

(2) Battery



[dwbatpo1-240613-01.tif, 2, --_--]

Figure 5-19 Position of the Battery Compartment in the Non-Modular Device (7xx81, 7xx82)

(1) Battery compartment

(2) Battery

5.5.2 Replacing the Battery

Safety Notes

NOTICE

Exercise caution when replacing the battery.

Noncompliance with the specified measures can result in material damage.

✧ Replace the battery only with the type specified in the Technical Data.

NOTICE

Exercise caution when disposing of the battery. The battery contains lithium. Lithium batteries are subject to the statutory regulations governing the disposal of batteries.

Noncompliance with the specified measures can result in material damage.

✧ Dispose of the battery in compliance with national and international regulations. Hand in the battery at an approved collection point, or dispose of it in the collection bins provided for the purpose.

Error Message on the Device

The `Battery fault` message is displayed on the device.

✧ Replace the battery.

Replacing the Battery

✧ Pull out the battery compartment.

✧ Remove the battery.

✧ Place the new battery in the battery compartment so that the positive pole points upwards.

✧ Push the battery compartment back in again.

✧ Check whether the `Battery fault` indication is displayed.

✧ The `Battery fault` indication is reset within 24 hours or after switching the device on and off again.

You have replaced the battery successfully if the message is no longer displayed.

NOTE

If you replace the battery without a power supply connected or if you disconnect the device from the power supply when changing the battery, all battery-backed data will be lost.

5.5.3 Environmental Protection Hints

Disposal of Old Equipment and Batteries (Applicable only for European Union and Countries with a Recycling System)

The disposal of our products and possible recycling of their components after decommissioning has to be carried out by an accredited recycling company, or the products/components must be taken to applicable collection points. Such disposal activities must comply with all local laws, guidelines and environmental specifications of the country in which the disposal is done. For the European Union the sustainable disposal of electronic scrap is defined in the respective regulation for "waste electrical and electronic equipment" (WEEE).

The crossed-out wheelie bin on the products, packaging and/or accompanying documents means that used electrical and electronic products and batteries must not be mixed with normal household waste.

According to national legislation, penalties may be charged for incorrect disposal of such waste.

By disposing of these products correctly you will help to save valuable resources and prevent any potential negative effects on human health and the environment.

NOTE

Our products and batteries must not be disposed of as household waste. For disposing batteries it is necessary to observe the local national/international directives.

Disposal of Mobile Storage Devices (e.g. USB Sticks and Memory Cards)

When disposing of/transferring mobile storage devices, using the **format** or **delete** functions only changes the file management information and does not completely delete the data from your mobile storage device. When disposing of or transferring a mobile storage device, Siemens strongly recommends physically destroying it or completely deleting data from the mobile storage device by using a commercially available computer data erasing software.

REACH/RoHS Declaration

You can find our current **REACH/RoHS** declarations at:

https://www.siemens.com/global/en/home/products/energy/ecotransparency/ecotransparency-downloads.html

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NOTE

You can find more information about activities and programs to protect the climate at the EcoTransparency website:

https://www.siemens.com/global/en/home/products/energy/ecotransparency.html

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5.6 SDHC Memory Card

The SDHC memory card (Secure Digital High Capacity) is used to store records from the 7KE85 fault recorder.

[dw_SDHC, 1, --_--]

Figure 5-20 SDHC Memory Card

NOTE

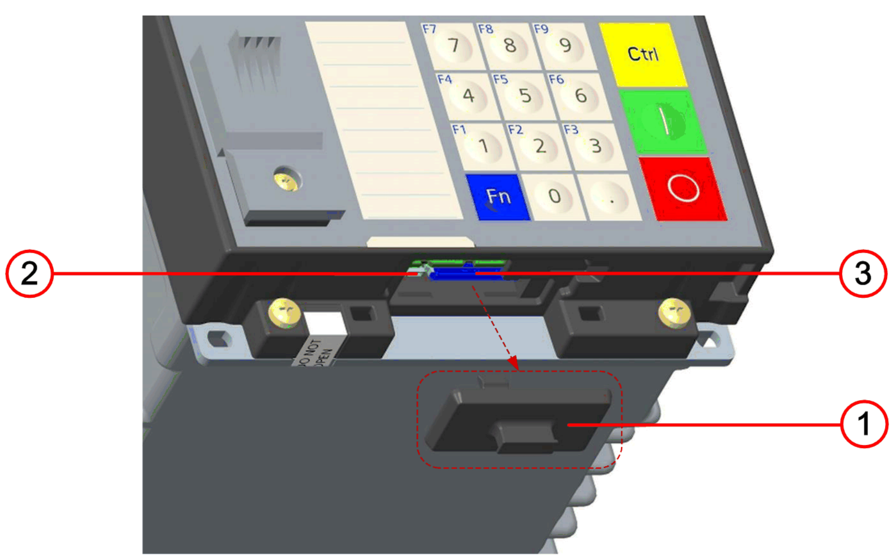
Reading the data of the SDHC memory card with a PC is not intended.
Avoid too frequent insertion cycles!

NOTE

Use only the original SDHC memory card (ACCESAR) approved by Siemens for the 7KE85 fault recorder.

Replacing the SDHC Memory Card

- ✧ De-energize the device.
- ✧ Remove the sealing cap.
- ✧ Unlock the card by pressing the turquoise eject lever.



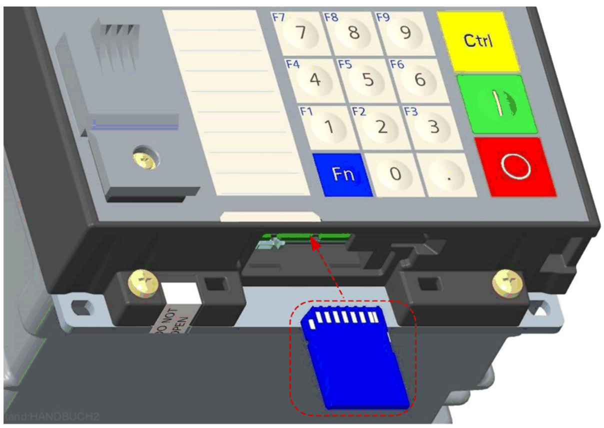
[le_Remove_cap_and_SDHC, 1, --_--]

Figure 5-21 Removing the Sealing Cap and SDHC Memory Card

(1) Push the holder, push the sealing cap to the back and remove it
(2) Unlock the eject lever
(3) Remove the SDHC memory card

✧ Unpack the new SDHC memory card.
Do not touch the contacts of the SDHC memory card with your fingers.

✧ Insert the new SDHC memory card.
When inserting, make sure that the SDHC memory card is properly aligned: The side with the contacts must be facing up, the side with the sticker facing down.



[dw_insert_SDHC, 1, --_--]

Figure 5-22 Inserting the SDHC Memory Card into the Device

CAUTION

Exercise caution when removing the SDHC memory card from a defective device.
If you want to remove the SDHC memory card from a defective device and to insert the card into another healthy device and if the data must be kept, note the following:

Noncompliance with the specified measures can result in loss of data.

✧ To avoid a reformatting of the SDHC memory card, you must first import the parameters of the defective device to another device.

✧ You can insert the SDHC memory card in the other device and use it only then.

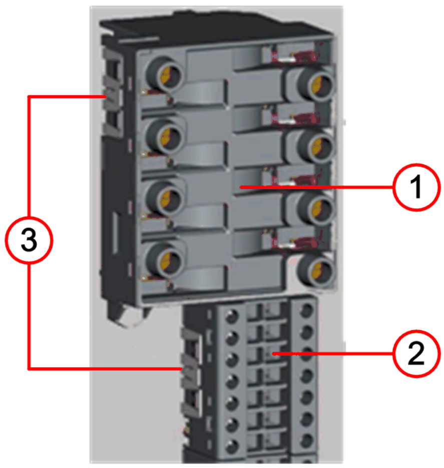
✧ The recordings on the SDHC memory card from the defective device can still be read in the other device.

✧ Insert the sealing cap back again.

✧ Resume operation of the device.

5.7 Installing Current and Voltage Terminals

5.7.1 Description



[dwklepos-030211-01.tif, 1, --_--]

Figure 5-23 Current and Voltage Terminals with Spring Clips

(1) Current-terminal block
(2) Voltage-terminal block
(3) Spring clips

The spring clips fix the terminal block in place.

[sc_klepos-020414-01, 1, --_--]

Figure 5-24 Voltage Terminal with Screw Connection

[dw_terminal position IO111, 1, --_--]

Figure 5-25 Voltage Terminal with Screw Connection – IO111

Current-Terminal Block of the Modular Devices

The following transformers can optionally be installed in a current-terminal block for modular devices:

- 4 protection-class current transformers
- 3 protection-class current transformers and 1 instrument transformer
- 4 instrument transformers

Protection-class current transformers on modular devices are transformers with a rated current of 1 A or 5 A and a device-dependent measuring range of 20 x rated current or 100 x rated current.

NOTE

You can read the type of the current transformer used on the side of the terminal block, for example 3xI 1xIE. The reference number is located on the connector interface and can only be read when removed.

- C73334A 1A1***7 *** = 4 protection-class current transformers
- C73334A 1A1***8 *** = 3 protection-class current transformers and 1 instrument transformer
- C73334A 1A1***9 *** = 4 instrument transformers

Current-Terminal Block for Non-Modular Devices (7xx81, 7xx82)

The following transformers can be installed optionally in a current-terminal block for non-modular devices:

- 4 protection-class current transformers
- 3 protection-class current transformers and 1 instrument transformer

Protection-class current transformers on non-modular devices are transformers with a rated current of 1 A or 5 A and a measuring range of 50 x rated current.

Instrument transformers are transformers with a rated current of 1 A or 5 A and a measuring range of 1.6 x rated current. Instrument transformers are also referred to as sensitive protection-class current transformers or sensitive ground-current transformers.

NOTE

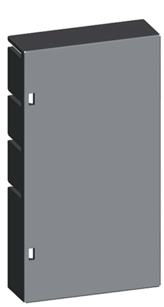
You can read the type of the current transformer used on the side of the terminal block, for example 3xI 1xIE. The reference number is located on the connector interface and can only be read when removed.

- C73334A 1A18**5 *** = 4 protection-class current transformers
- C73334A 1A18**6 *** = 3 protection-class current transformers and 1 instrument transformer

Use the cross connector for voltage terminals shown on the right in the following figure for connecting binary inputs and relay outputs to a common potential.

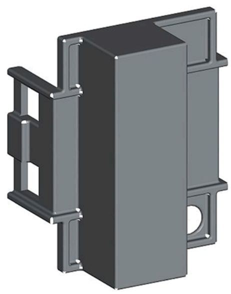
[dwquerve-030211-01.tif, 1, --_--]

Figure 5-26 Cross Connector for Current (Left) and Voltage Terminals (Right)



[dwkappst-030211-01.tif, 1, --_--]

Figure 5-27 Covering Cap for Current-Terminal Block



[dwkappsp-030211-01.tif, 1, --_--]

Figure 5-28 Covering Cap for Voltage-Terminal Block

Cover caps for sealing the connector interface of the terminal block can be ordered as accessories.

Terminal Designations

The current terminals have different designations in DIGSI, the configurator, and the device. The following table provides an overview of the different terminal designations and order numbers of the terminals.

Terminal	Configurator	DIGSI	Display on the Device	Terminal Labeling	Ordering No. (Short Designation)
Modular Device 50/60 Hz					
4 protection-class current transformers	TypeA-Curr.term., 4x prot.tion	Current 4x protection	TBC4PROTA	C73334A 1A18**7***	P1Z512[19]
3 protection-class current transformers and 1 instrument transformer	TypeA-Curr.term., 3xprot. 1xsens.	Current 3x prot., 1x sensitive	TBC3PROTA1M	C73334A 1A18**8***	P1Z529[19]
4 instrument transformers	TypeA-Curr.term., 4x measurem	Current 4x sensitive	TBC4M	C73334A 1A18**9***	P1Z536[19]
Modular Device 50/60/16.7 Hz					
4 protection-class current transformers	TypeA-Curr.term., 4x prot.	Current 4x protection	TBC4PROTA	C73334A 1A17**7***	P1Z512
3 protection-class current transformers and 1 instrument transformer	TypeA-Curr.term., 3xprot. 1xsens.	Current 3x prot., 1x sensitive	TBC3PROTA1M	C73334A 1A17**8***	P1Z529
4 instrument transformers	TypeA-Curr.term., 4x measurem	Current 4x sensitive	TBC4M	C73334A 1A17**9***	P1Z536
Non-Modular Device					
4 protection-class current transformers	TypeB-Curr.term., 4x prot.	Current 4x protection	TBC4PROTB	C73334A 1A18**5***	P1Z1869
3 protection-class current transformers and 1 instrument transformer	TypeB-Curr.term., 3xprot. 1xsens.	Current 3x prot., 1x sensitive	TBC3PROTB1M	C73334A 1A18**6***	P1Z1647

[19] The equivalent 50/60/16.7-Hz terminal is used as a reorderable single part.

5.7.2 Connections of Current Terminals

Fasteners

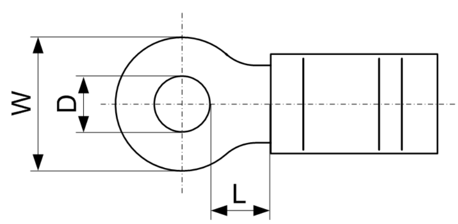
The fasteners for the transformer connection are part of the current terminal (housing side). They are made of a stress-crack and corrosion-free alloy. The head shape of the clamping screw allows the use of a DIN 5.5 x 1.0 screwdriver or a PZ2 screwdriver. Siemens recommends a PZ2 screwdriver.

Connection Elements and Conductor Cross-Sections

The following connection types are possible:

- Stranded-wire conductor with ring-type lug
- Stranded-wire conductor with bootlace ferrule
- Solid conductor

Siemens recommends the use of ring-type lugs with the dimensions shown in the following figure. Use copper cables only.



[dwringka-030211-01.tif, 1, en_US]

Figure 5-29 Ring-Type Lug

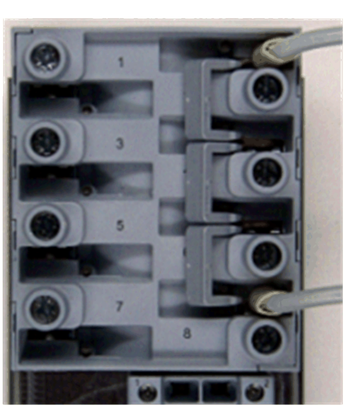
D (for bolt)	5.0 mm (0.2 in)
W	9.5 mm (0.37 in)
L	7.1 mm to 7.7 mm (0.28 in to 0.3 in)

In order to maintain the insulation route, you must use insulated cable lugs or you must insulate the crimping zone (for example, by using heat-shrink tube insulation)

Siemens recommends ring-type lugs of the PIDG series made by Tyco Electronics.

Use copper conductors only, at least certified for a temperature of +105 °C. Use prepared solid conductors intended for single or multi-wiring connection, maximum 2 wires per pole, and for usage of ferrules, crimped-on pressure wire connectors (ring-type and pin-type).

2 terminal lugs can be installed for each connection.



[dwklest1-030211-01.tif, 1, --_--]

Figure 5-30 Example of a Current Terminal with Connection of Cross Connectors and Single Cables

[dwklest2-030211-01.tif, 1, --_--]

Figure 5-31 Example of a Current Terminal with Connection of 2 Single Cables

You can connect solid conductors as well as stranded-wire conductors with ring-type lug or bootlace ferrule. For each connection, you can install up to 2 single cables of the same type and the same cross-section.

Bridges can be used as an alternative for horizontally arranged clamping points. If bridges are used, only ring-type lugs may be used.

The following cable cross-sections can be used for the connection of single cables:

Cable cross-section	AWG (**A**merican **W**ire **G**auge) 14-10 (2.0 mm^2 to 4.0 mm^2 (0.0031 in^2 to 0.0062 in^2))
Ferrule with plastic shroud	L = 10 mm (0.39 in) or L = 12 mm (0.47 in)
Stripped length	15 mm (0.59 in)
For use without ferrule	Use solid copper cables only.

NOTE

Always guide the solid conductor or stranded-wire conductor with bootlace from the left- or right-hand side ferrule into the terminal. Making contact from the center is not permitted.

Mechanical Requirements

The fasteners and their associated components are designed for the following mechanical requirements:

Permissible tightening torque at clamping screw	2.7 Nm For solid conductors, the max. permissible tightening torque is 2 Nm.
Permissible tensile force for each connected conductor	80 N following IEC 60947-1 (VDE 660, part 100)

5.7.3 Connections of Voltage Terminals

5.7.3.1 Connections of Voltage Terminals with Spring Clips

Fasteners

The fasteners for the voltage connection are part of the voltage terminal (housing side). They are made of a stress-crack and corrosion-free alloy. The head shape of the clamping screw allows the use of a DIN 4.0 x 0.8 screwdriver or a PZ1 Phillips screwdriver. Siemens recommends a PZ1 Phillips screwdriver.

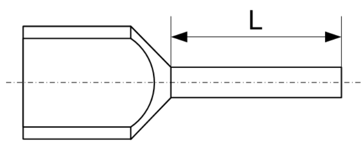
Connection Elements and Conductor Cross-Sections

The single cable connection type is available for the connection. You can connect solid conductors as well as stranded-wire conductors with and without bootlace ferrule as single cables. Siemens recommends using twin bootlace ferrules of series PN 966 144 made by Tyco Electronics for the connection of 2 single cables.

The following cable cross-sections can be used for the connection of single cables:

Cable cross-section	AWG (**A**merican **W**ire **G**auge) 20-14 (0.5 mm^2 to 2.5 mm^2 (0.0008 in^2 to 0.0039 in^2)) solid or bare stranded wire with or without UL listed boot-lace ferrule Use AWG 14 (2,5 mm^2 (0.0039 in^2)) for currents from 5 A to 10 A. Use copper conductors only, at least certified for a temperature of +105 °C (221 °F).
Bootlace ferrule with plastic shroud	L = 12 mm (0.47 in)
Stripped length (for use without bootlace ferrule)	12 mm (0.47 in), only copper lines may be used.

Single cables and bridges can be connected together for horizontally arranged clamping points. Note that adjacent bridges are installed reciprocally.



[dw_bootlace_ferrule, 1, en_US]

Figure 5-32 Twin Bootlace Ferrules

Mechanical Requirements

The fasteners and their associated components are designed for the following mechanical requirements:

Permissible tightening torque at clamping screw	1.0 Nm
Permissible tensile force for each connected conductor	50 N following IEC 60947-1 (VDE 660, part 100)

5.7.3.2 Connections of Voltage Terminals with Screw Connection

For connection of the following modules, Phoenix terminals are used (see *Figure 5-25*):

- Power supply module PS203
- Plug-in module assembly with integrated power supply CB202
- Input module IO230, IO231, IO232, IO233
- Input and output module IO110, IO112, and IO113
- ANAI-CA-4EL measuring-transducer modules
- Temperature measurement module IO111

Connection Elements and Conductor Cross-Sections

The following cross-sections can be used for the connection of single cables:

Cable cross-section	AWG (**A**merican **W**ire **G**auge) 22-12 (0.5 mm^2 to 2.5 mm^2 solid (0.0008 in^2 to 0.0039 in^2)) or bare stranded wire or with UL listed bootlace ferrules Approved for at least a temperature of +105 °C (221 °F)
Bootlace ferrule with plastic shroud	L = 8 mm to 10 mm
Stripped length (for use without bootlace ferrule)	10 mm (0.39 in), only copper lines may be used.

Mechanical Requirements

The fasteners and their associated components are designed for the following mechanical requirements:

Permissible tightening torque at clamping screw	0.6 Nm

5.7.3.3 Connections of Voltage Terminal with Screw Connection for IO111

For the connection of the module IO111, Phoenix terminals are used (see *Figure 5-25*).

Connection Elements and Conductor Cross-Sections

The following cable cross-sections can be used for the connection of single cables:

Cable cross-section	AWG (**A**merican **W**ire **G**auge) 30-16 (0.14 mm^2 to 1.5 mm^2 (0.0002 in^2 to 0,0023 in^2) solid or bare stranded wire with or without UL listed bootlace ferrules At least approved for a temperature of +105 °C (221 °F)
Bootlace ferrule with plastic shroud	L = 9 mm (0,35 in)
Stripped length (for use without bootlace ferrule)	9 mm (0.35 in), only copper lines may be used.

Mechanical Requirements

The fasteners and their associated components are designed for the following mechanical requirements:

Permissible tightening torque at clamping screw	0.22 Nm to 0.26 Nm

5.7.3.4 Connections of Voltage Terminals with Screw Connection for ANAI-CE-2EL

Weidmüller terminals are used for connecting the ANAI-CE-2EL plug-in module

Connection Elements and Conductor Cross-sections

The following cross-sections can be used for the connection of single lines:

Cable cross-section	AWG (**A**merican **W**ire **G**auge) 18-14 (1.0 mm^2 to 2.5 mm^2) solid or AWG 18-16 (1.0 mm^2 to 1.5 mm^2) stranded wire with UL listed bootlace ferrules Approved for at least a temperature of +105 °C
Bootlace ferrule with plastic shroud	L = 12 mm
Stripped length (for use without bootlace ferrule)	13 mm, only copper leads may be used.

Mechanical Requirements

The fasteners and their associated components are designed for the following mechanical requirements:

Permissible tightening torque at clamping screw	0.4 Nm to 0.5 Nm

5.7.4 Installation and Removal

✧ Switch off the device before starting work.

Assembly tool

✧ Use a screwdriver (DIN 4 x 0.8).

Removal

✧ Use a screwdriver to carefully bend the left and right spring clips outwards.

- ✧ Carefully pull out the terminal block.
- ✧ Seal the contacts with a cover cap (see *Figure 5-27* and *Figure 5-28*).

Installation

- ✧ Pull the cover cap off the terminal.
- ✧ Carefully insert the terminal block into the spring clips.
- ✧ Both spring clips must engage clearly audibly.

6 Technical Data

6.1 Analog Inputs

Current Inputs

All current, voltage, and power data are specified as RMS values.			
Rated frequency f_{rated}	50 Hz, 60 Hz 16.7 Hz (for rail protection devices only)		
Protection-class current transformers	Rated current I_{rated}	Measuring range of the modular devices	Measuring range of the non-modular devices
	5 A 1 A	0 A to 500 A 0 A to 100 A	0 A to 250 A 0 A to 50 A
Instrument transformers	5 A 1 A	0 A to 8 A 0 A to 1.6 A	0 A to 8 A 0 A to 1.6 A
Burden for rated current	Approx. 0.1 VA		
Thermal rating (protection and instrument transformers)	20 A continuously		
	25 A for 3 min		
	30 A for 2 min		
	150 A for 10 s		
	500 A for 1 s		
Dynamic load-carrying capacity	1250 A one half wave		

GIS Low-Power Current Input (via Module IO240)

All current, voltage, and power data are specified as RMS values.		
Rated frequency f_{rated}	50 Hz, 60 Hz	
GIS-LPCT input	Primary rated current I_{rated}	Measuring range
	Kr · GIS-LPCT secondary rated value Kr = Transformation ratio of the GIS-LPCT (DIGSI setting) Refer to the GIS manual for the GIS-LPCT secondary rated value.	K_{pcr} = 50 (protection channel) K_{pcr} = 1.6 (measuring channel)
Power consumption per current circuit at rated current	Max. 40 mVA Burden = 9.5 kΩ	
Thermal rating	Max. input voltage = 20 V	
Accuracy	Class 5TPE (protection channel) Class 0.2S (measuring channel)	

Optical Current Input (via Module IO245)

All current, voltage, and power data are specified as RMS values.			
Rated frequency f_{rated}	50 Hz, 60 Hz		
Rated current I_{rated}	Depending on the TOCT design		
Measuring range	Measuring channel	Protection channel	
	$1.6 \cdot I_{rated}$	$100 \cdot I_{rated}$	
Accuracy	Measuring channel	Protection channel	
	0.5, 0.2, 0.2S	< 10 kA	> 10 kA
		Comparable to measuring channel	5TPE

Voltage Input

All current, voltage, and power data are specified as RMS values.		
Rated frequency f_{rated}	50 Hz, 60 Hz 16.7 Hz (for rail devices only)	
Input and output modules	IO102, IO202, IO208, IO211, IO214	IO215
Measuring range	0 V to 200 V	0 V to 7.07 V
Burden	< 0.1 VA	< 0.01 VA
Thermal rating	230 V continuously	20 V continuously

GIS Low-Power Voltage Input (via Module IO240)

All current, voltage, and power data are specified as RMS values.		
Rated frequency f_{rated}	50 Hz, 60 Hz	
GIS-LPVT input	Primary rated voltage V_{rated}	Measuring range
	Kr · GIS-LPVT secondary rated value Kr = Transformation ratio of the GIS-LPVT (DIGSI setting) Refer to the GIS manual for the GIS-LPVT secondary rated value.	$K_{pcr} = 2$
Power consumption per current circuit at rated current	Max. 1 mVA Burden = 50 Ω	
Thermal rating	Max. input current = 4.4 mA	
Accuracy	Class 0.1	

RCVT Voltage Input (via Module IO240 or IO245)

All current, voltage, and power data are specified as RMS values.		
Rated frequency f_{rated}	50 Hz, 60 Hz	
RCVT input	Primary rated voltage V_{rated}	Measuring range
	100/√3 V L-N	$2 \cdot V_{rated}$
Burden	2 MΩ/50 pF	
Thermal rating	200 V L-N	
Accuracy	Class 0.1	

NOTE

For more information on the technical data of the current and voltage transformers, refer to the *Technical Data* in the *SIPROTEC 5 device manuals*.

Measuring-Transducer Inputs (via Module ANAI-CA-4EL)

Insulation class	PELV (Protective Extra Low Voltage) (according to IEC 60255-27)
Connector type	8-pin terminal spring
Input channels	4 differential current inputs
Measuring range	DC -20 mA to +20 mA
Tolerance	0.5 % of the measuring range
Maximum measuring range	DC -25.6 mA to +25.6 mA
Input impedance	140 Ω
ADC type	16-Bit Delta-Sigma

Permissible potential difference between channels	DC 20 V
Galvanic separation from ground/ housing	AC 500 V, DC 700 V
Permissible overload	DC 100 mA continuously
Sampling rate	5 Hz

Fast Measuring Transducer Inputs, Voltage (via Module ANAI-CE-2EL, Channel 2, and IO218)

Insulation class	HLV (Hazardous Live Voltage) (in accordance with IEC 60255-27)
Input channels	1 DC voltage input, ANAI-CE-2EL, channel 2 (CH2) 3 DC voltage inputs, IO218
Measuring range	DC 0 V to + 300 V
Tolerance	0.2 % of measuring range
Input impedance	260 kΩ
Galvanic separation against ground/housing	DC 4.6 kV
Max. permissible voltage against ground on the measuring inputs	DC 300 V
Sampling rate	16 kHz

Inputs for Optical Sensors for Arc Protection (via Module ARC-CD-3FO)

Connector type	AVAGO AFBR-4526Z
Number of transceivers	3
Fiber type	Plastic Optical Fiber (POF) 1 mm
Receiver	
Maximum	-10 dBm ± 2 dBm
Minimum	-40 dBm ± 2 dBm
Spectrum	400 nm to 1100 nm
Attenuation	In the case of plastic optical fibers, you can expect a path attenuation of 0.2 dB/m. Additional attenuation comes from the plug and sensor head.
Optical budget[20]	Minimal 25 dB
Analog sampling rate	16 kHz
ADC type	10-bit successive approximation
Transmitter	
Type	LED
Wavelength	λ = 650 nm
Transmitter power	Minimum 0 dBm Maximum 2 dBm
Numerical aperture	0.5 [21]
Signal rate connection test	1 pulse per second
Pulse duration connection test	11 µs

20 All values in combination with sensors approved by Siemens.

21 Numerical aperture (NA = sin θ (launch angle))

Fast Measuring Transducer Inputs, Voltage/Current (via IO210, IO212)

NOTE

Current and voltage must not be connected at the same time to one measuring transducer input. Instead, only connect either current or voltage. For EMC reasons, do not connect a line to an unused input (current or voltage).

Use shielded cables.

Table 6-1 Fast Measuring Transducer Inputs, Voltage

Differential voltage input channels	IO210: 4[22] IO212: 8[23]
Measuring range	DC -10 V to +10 V
Fault	< 0.5 % of measuring range
Input impedance	48 kΩ
Max. permissible voltage with respect to ground on the measuring inputs	300 V
Permissible overload	DC 20 V continuously DC 60 V continuously (IO210 MU3 terminal point C9)

Table 6-2 Fast Measuring Transducer Inputs, Current

Differential current input channels	IO210: 4[24] IO212: 8[25]
Measuring range	DC -20 mA to +20 mA
Fault	< 0.5 % of measuring range
Input impedance, current	12 Ω
Permissible potential difference between channels	DC 3.5 kV
Galvanic separation with respect to ground/housing	DC 3.5 kV
Permissible current overload	DC 100 mA continuously

Table 6-3 Combined Data for Fast Measuring Transducer Voltage/Current Inputs

Conversion principle	Delta-sigma (16 bit)
Insulation test voltage between the channels	DC 3.5 kV
Insulation test voltage with respect to ground/housing	DC 3.5 kV
Measured value repetition	62.5 μs
Insulation class IO210	ELV (Extra Low Voltage) (as per IEC 60255-27)
Insulation class IO212	SELV (as per IEC 60255-27)

[22] The IO210 has 4 fast measuring transducer inputs. They can be used either as a voltage or current input.
[23] The IO212 has 8 fast measuring transducer inputs. They can be used either as a voltage or current input.
[24] The IO210 has 4 fast measuring transducer inputs. They can be used either as a voltage or current input.
[25] The IO212 has 8 fast measuring transducer inputs. They can be used either as a voltage or current input.

Table 6-4 Measuring Transducer Inputs, Current (via Module IO218)

Insulation class	PELV (Protective Extra Low Voltage) (acc. to IEC 60255-27)
Input channels	7 current inputs with common ground (MUx inputs and RTD not galvanically separated)
Measuring range	DC 0 mA to +20 mA
Tolerance	0.5 % of measuring range (MU1 to MU3) Typ. 1.0 % (max. 2.6 %) of measuring range (MU4 to MU7)
Maximum measuring range	DC 0 mA to +24.5 mA
Input impedance	12 Ω
ADC type	12-bit SAR
Permissible potential difference between channels	DC 20 V
Galvanic separation against ground/housing	AC 500 V, DC 700 V
Permissible overload	DC 100 mA continuously
Sampling rate	16 kHz (MU1 to MU3) 5 Hz (MU4 to MU7)

NOTE

For more information on the measuring accuracy of the analog inputs, refer to the *Technical Data* in the *SIPROTEC 5 device manuals*.

Temperature Inputs

Settings	Value	Note
Insulation class	PELV (Protective Extra Low Voltage) (acc. to IEC 60255-27)	With IO218: RTD and MUx inputs not galvanically separated.
Measurement mode	• Pt 100 Ω • Ni 100 Ω • Ni 120 Ω 3-wire connection, shielded cables	–
Temperature measuring range	-65 °C to +710 °C	For PT100
	-50 °C to +250 °C	For NI100
	-50 °C to +250 °C	For NI120

Temperature Inputs (via Module IO240)

Settings	Value
Sensor Type	PT100 (Class F 0.3 EN 60751) 4-wire shielded cable connection
Measurement range	-50 °C to +180 °C
Accuracy	±1 °C

Optical Temperature Input (via Module IO245)

Setting	Value
Sensor type	Optical GaAs (Gallium Arsenide) sensor Single cable with multi-mode fiber optic (OM1)
Measuring range	-50 °C to +150 °C
Accuracy	±2 °C

LPIT Digital Input (via Module IO240)

Shield Cover Input	
Sensor type	Dry contact input
Measurement type	Output voltage of 1 mA current injection @ max. DC 5 V

Insulation of LPIT Digital Input (via Module IO245)

Insulation (All Inputs)	
Configuration	The LPVT inputs are isolated from PE and the operator according to the requirements of IEC 61869-1 (AC 3 kV, 50 Hz, 1 min) and IEC 60255-27 for a rated voltage of 300 V despite the low-level signaling voltages. All channels are protected with differential-mode and common-mode voltage-limiting devices.
Test levels (type test)	AC 3250 V, 50 Hz, 1 min 6000 V 1.2/50 µs peak impulse

6.2 Supply Voltage

<table>
<tr><th colspan="4">Integrated Power Supply</th></tr>
<tr><td colspan="4">For modular devices, the following modules contain a power supply:
PS201 – Power supply of the base module and of the 1st device row
PS203 – Power supply of the 2nd device row
PS204 – Redundant power supply
CB202 – Plug-in module assembly with integrated power supply, for example, to accommodate communication modules</td></tr>
<tr><td>Permissible voltage ranges
(PS201, PS203, PS204, CB202)</td><td>DC 19 V to DC 60 V</td><td colspan="2">DC 48 V to DC 300 V
AC 80 V to AC 265 V, 50 Hz/60 Hz</td></tr>
<tr><td>Auxiliary rated voltage V_H
(PS201, PS203, PS204, CB202)</td><td>DC 24 V/DC 48 V</td><td colspan="2">DC 60 V/DC 110 V/DC 125 V/DC 220 V/
DC 250 V or
AC 100 V/AC 115 V/AC 230 V, 50 Hz/60 Hz</td></tr>
<tr><td>Permissible voltage ranges (PS101)
Only for non-modular devices</td><td>DC 19 V to DC 60 V</td><td>DC 48 V to 150 V</td><td>DC 88 V to DC 300 V
AC 80 V to AC 265 V, 50 Hz/60 Hz</td></tr>
<tr><td>Auxiliary rated voltage V_H
(PS101)
Only for non-modular devices</td><td>DC 24 V/DC 48 V</td><td>DC 60 V/DC 110 V/
DC 125 V</td><td>DC 110 V/ DC 125 V/
DC 220 V/DC 250 V
or
AC 100 V/AC 115 V/
AC 230 V, 50 Hz/60 Hz</td></tr>
<tr><td>Superimposed alternating voltage, peak-to-peak, IEC 60255-11,
IEC 61000-4-17</td><td colspan="3">≤ 15 % of the DC auxiliary rated voltage (applies only to direct voltage)</td></tr>
<tr><td>Inrush current</td><td colspan="3">≤ 18 A</td></tr>
<tr><td>Recommended external protection</td><td colspan="3">Miniature circuit breaker 6 A, characteristic C according to IEC 60898</td></tr>
<tr><td colspan="4">Internal fuse</td></tr>
<tr><td>–</td><td>DC 24 V to DC 48 V</td><td>DC 60 V to DC 125 V</td><td>DC 24 V to DC 48 V
AC 100 V to AC 230 V</td></tr>
<tr><td>PS101
Only for non-modular devices</td><td>4 A inert, AC 250 V, DC 150 V,
UL recognized
SIBA type 179200 or Schurter type SPT 5x20</td><td colspan="2">2 A time-lag, AC 250 V, DC 300 V, UL recognized
SIBA type 179200 or Schurter type SPT 5x20</td></tr>
<tr><td>PS201, PS203, CB202
(to device version xA)</td><td>4 A inert, AC 250 V, DC 150 V,
UL recognized
SIBA type 179200 or Schurter type SPT 5x20</td><td colspan="2">2 A time-lag, AC 250 V, DC 300 V, UL recognized
SIBA type 179200 or Schurter type SPT 5x20</td></tr>
<tr><td>PS201, PS203, PS204
(Device version xB and higher)</td><td>4 A inert, AC 250 V, DC 150 V,
UL recognized
SIBA type 179200 or Schurter type SPT 5x20</td><td colspan="2">3.15 A time-lag, AC 250 V, DC 300 V, UL recognized
SIBA type 179200 or Schurter type SPT 5x20</td></tr>
</table>

Integrated Power Supply			
Power consumption (life relay active)			
–	DC	AC 230 V/50 Hz	AC 115 V/50 Hz
1/3 module, non-modular Without plug-in modules	7 W	16 VA, 7 W	12.5 VA, 7 W
1/3 base module, modular Without plug-in modules	13 W	55 VA, 13 W	40 VA, 13 W
1/6 expansion module	3 W	6 VA, 3 W	6 VA, 3 W
1/6 plug-in module assembly without plug-in modules (modules CB202)	3.5 W	14 VA, 3.5 W	7 VA, 3.5 W
Plug-in module for base module or plug-in module assembly (for example, communication module)	< 5 W	< 6 VA, < 5 W	< 6 VA, < 5 W
Stored-energy time for auxiliary voltage outage or short circuit, modular devices IEC 61000-4-11 IEC 61000-4-29		For V ≥ DC 24 V ≥ 50 ms For V ≥ DC 110 V ≥ 50 ms For V ≥ AC 115 V ≥ 50 ms	
Stored-energy time for auxiliary voltage outage or short circuit, non-modular devices IEC 61000-4-11 IEC 61000-4-29		For V ≥ DC 24 V ≥ 20 ms For V ≥ DC 60 V ≥ 50 ms For V ≥ AC 115 V ≥ 200 ms	

Power Supply for External Measuring Transducers (via Module IO218)

Insulation class	PELV (Protective Extra Low Voltage) (acc. to IEC 60255-27)
Output voltage	DC 24 V, common ground with MU inputs
Tolerance	10 %
Output current	Max. 210 mA, sustained short-circuit protection
Continuous power	Max. 5 W (at temperatures > 55 °C max. 2.5 W)

6.3 Binary Inputs

Standard Binary Input

Rated voltage range	DC 24 V to 250 V The binary inputs of SIPROTEC 5 are bipolar, with the exception of the binary inputs on the modules IO230, IO231, IO232, and IO233.	
Current consumption, picked up	Approx. DC 0.6 mA to 2.5 mA (independent of the control voltage)	
Max. power consumption	0.6 W	
Pickup time	Approx. 3 ms	
Dropout time[26]	Capacitive load (supply-line capacitance)	Dropout time
	< 5 nF	< 4 ms
	< 10 nF	< 6 ms
	< 50 nF	< 10 ms
	< 220 nF	< 35 ms
Control voltage for all modules with binary inputs, except module IO233	Adapt the binary-input threshold to be set in the device to the control voltage.	
	Range 1 for 24 V, 48 V, and 60 V control voltage	$V_{low} \leq$ DC 10 V $V_{high} \geq$ DC 19 V
	Range 2 for 110 V and 125 V control voltage	$V_{low} \leq$ DC 44 V $V_{high} \geq$ DC 88 V
	Range 3 for 220 V and 250 V control voltage	$V_{low} \leq$ DC 88 V $V_{high} \geq$ DC 176 V
Control voltage for binary inputs of the IO233 module	Range for 125 V control voltage	$V_{low} \leq$ DC 85 V $V_{high} \geq$ DC 105 V
Maximum admissible voltage	DC 300 V	
The binary inputs contain interference suppression capacitors. To ensure EMC immunity, use the marked terminals shown in the terminal diagrams/connection diagrams to connect 2 or more binary inputs to the a common potential.		

Special Binary Input with Maximized Robustness against Electrical Disturbances and Failures (IO216)

Rated voltage range	DC 220 V The special binary inputs of the SIPROTEC 5 with maximized robustness against electrical disturbances and failures are bipolar and available only on the module IO216.
Input impedance	50 kΩ to 60 kΩ
Rejection pulse charge	> 200 μC
Current consumption, excited	Approx. DC 1.2 mA to 2.0 mA (additionally to the current consumption of the input impedance)
Power consumption, max.	1.5 W at DC 242 V
Pickup time	Approx. 3 ms

26 Pay attention to the specified dropout times for time-critical applications with active-low signals. If necessary, provide for active discharge of the binary input (for example, a resistor in parallel with the binary input or using a change-over contact).

Dropout time[27]	Capacitive load (supply-line capacitance)	Dropout time
	< 5 nF	< 3 ms
	< 10 nF	< 4 ms
	< 50 nF	< 5 ms
	< 220 nF	< 10 ms
Control voltage for the module IO216	Range for 220 V control voltage	
	Threshold pickup	158 V to 170 V
	Threshold dropout	132 V to 154 V
Maximum permitted voltage	DC 300 V	
The binary inputs contain interference suppression capacitors. To ensure EMC immunity, use the terminals shown in the terminal diagrams/connection diagrams to connect the binary inputs to the common potential.		

27 For time-critical applications with low-active signals, consider the specified dropout times. If necessary, provide for active discharge of the binary input (for example, a resistor in parallel to the binary input or using a change-over contact).

6.4 Relay Outputs

Standard Relay (Type S)

Rated voltage (AC and DC)	250 V
Rated current (continuous) and total permissible current for contacts connected to common potential	5 A
Permissible current per contact (switching on and holding)	30 A for 1 s (make contact only)
Short-time current across closed contact	250 A for 30 ms
Breaking capacity	Max. 30 W (L/R = 40 ms) Max. 360 VA (power factor ≥ 0.35, 50 Hz to 60 Hz)
Switching time OOT (**O**utput **O**perating **T**ime) Additional delay of the output medium used	Make time: typical: 8 ms; maximum: 10 ms Break time: typical: 2 ms; maximum: 5 ms
Max. rated data of the output contacts in accordance with UL certification	DC 24 V, 5 A, general purpose DC 48 V, 0.8 A, general purpose DC 240 V, 0.1 A, general purpose AC 240 V, 5 A, general purpose AC 120 V, 1/6 hp AC 250 V, 1/2 hp B300 R300
Interference suppression capacitors across the contacts	4.7 nF, ± 20 %, AC 250 V
Safety/monitoring	2-channel activation

Fast Relay (Type F)

Rated voltage (AC and DC)	250 V
Rated current (continuous) and total permissible current for contacts connected to common potential	5 A
Permissible current per contact (switching on and holding)	30 A for 1 s (make contact only)
Short-time current across closed contact	250 A for 30 ms
Breaking capacity	Max. 30 W (L/R = 40 ms) Max. 360 VA (power factor ≥ 0.35, 50 Hz to 60 Hz)
Switching time OOT (**O**utput **O**perating **T**ime) Additional delay of the output medium used	Make time: typical: 4 ms; maximum: 5 ms Break time: typical: 2 ms; maximum: 5 ms
Max. rated data of the output contacts in accordance with UL certification	AC 120 V, 5 A, general purpose AC 250 V, 5 A, general purpose AC 250 V, 1/2 hp B300 R300
Interference suppression capacitors across the contacts	4.7 nF, ± 20 %, AC 250 V
Safety/monitoring	2-channel activation with cyclic testing (make contact only)

High-Speed Relay with Semiconductor Acceleration (Type HS)

Rated voltage	AC 200 V, DC 250 V
Rated current (continuous)	5 A (in accordance with UL approval) 10 A (not UL approved; AWG 14 / 2.5 mm^{2}copper conductors necessary)
Permissible current per contact (switching on and holding)	30 A for 1 s
Short-time current across closed contact	250 A for 30 ms
Breaking capacity	Max. 2500 W (L/R = 40 ms)
Switching time OOT (**O**utput **O**perating **T**ime) Additional delay of the output medium used	Make time: typical: 0.2 ms; maximum: 0.2 ms Break time: typical: 9 ms; maximum: 9 ms
Max. rated data of the output contacts in accordance with UL certification	B150 Q300
Interference suppression capacitors across the contacts	4.7 nF, ± 20 %, AC 250 V
Safety/monitoring	2-channel activation

Power Relay (for Direct Control of Motor Switches)

Rated voltage (AC and DC)	250 V
Rated current (continuous) and total permissible current for contacts connected to common potential	5 A
Switching power for permanent and periodic operation In order to prevent any damage, the external protection circuit must switch off the motor in case the rotor is blocked.	250 V/4.0 A 220 V/4.5 A 110 V/5.0 A 60 V/5.0 A 48 V/5.0 A 24 V/5.0 A
Turn on switching power for 30 s, recovery time until switching on again is 15 minutes. For short-term switching operations, an impulse/pause ratio of 3 % must be considered. In order to prevent any damage, the external protection circuit must switch off the motor in case the rotor is blocked.	100 V/9.0 A 60 V/10.0 A 48 V/10.0 A 24 V/10.0 A
Permissible current per contact (switching on and holding)	30 A for 1 s
Short-time current across closed contact	250 A for 30 ms
Switching time OOT (**O**utput **O**perating **T**ime) Additional delay of the output medium used	≤ 16 ms
Max. rated data of the output contacts in accordance with UL certification	DC 300 V, 4.5 A – 30 s ON, 15 min OFF DC 250 V, 1 hp Motor – 30 s ON, 15 min OFF DC 110 V, 3/4 hp Motor – 30 s ON, 15 min OFF DC 60 V, 10 A, 1/2 hp Motor – 30 s ON, 15 min OFF DC 48 V, 10 A, 1/3 hp Motor – 30 s ON, 15 min OFF DC 24 V, 10 A, 1/6 hp Motor – 30 s ON, 15 min OFF
Interference suppression capacitors across the contacts	4.7 nF, ± 20 %, AC 250 V
Safety/monitoring	2-channel activation
The power relays operate in interlocked mode, that is, only one relay of each switching pair picks up at a time thereby avoiding a power-supply short circuit.	

6.5 Light-Emitting Diodes in the On-Site Operation Panel

Base Module

Status	Color	Quantity
RUN	Green	1
ERROR	Red	1
Routable (adjustable with DIGSI 5) Only the defined color can be used in operation.	2-colored: red or green	16

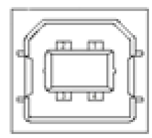
Expansion Module

Status	Color	Quantity
Routable	Red	16 optional

6.6 Communication Interfaces

User Interface, Front Side

You can find a USB connection of type B for the connection to a laptop computer or to a PC on the front side of the device. A protection cover protects this USB connection against pollution and humidity.

USB	User interface
Connection	USB type B 
Insulation class	PELV (Protective Extra Low Voltage) (according to IEC 60255-27)

Time-Synchronization Interface (Port G)

The terminal for time synchronization is located on the D-sub 9 interface (position G). Time synchronization signals for DC 5 V, DC 12 V, and DC 24 V can be processed as an option.

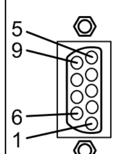
Time Synchronization	External synchronization sources, for example, DCF77 IRIG B signal
Connection	Rear D-sub 9 
Rated signal voltages	DC 5 V, DC 12 V, or DC 24 V (optional)
Test voltage	AC 500 V at 50 Hz
Insulation class	SELV (according to IEC 60255-27)
Max. line length	10 m (0.39 in)

Table 6-5 Time-Synchronization Connection

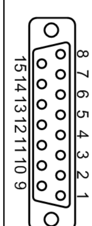
Pin	Signal	Signal Description
1	P24-TSIG	DC 24 V input
2	P5-TSIG	DC 5 V input
3	M-TSIG	Return line Pxx-TSIG
4	M-TSYNC [28]	Return line for P-TSYNC
5	Screen	Shield potential
6	–	–
7	P12-TSIG	DC 12 V input
8	P-TSYNC[28]	DC 24 V input
9	Screen	Shield potential

[28] Only for the PPS signal (GPS)

Signal Levels/ Burdens	Signal Rated Input Voltage, DC		
	5 V	**12 V**	**24 V**
V_{Imax}	6.0 V	15.8 V	31.0 V
V_{IHigh}	≥4.7 V	≥6.6 V	≥12.5 V
V_{ILow}	≤1.0 V at I_{ILow} = 0.25 mA	≤1.4 V at I_{ILow} = 0.25 mA	≤1.9 V at I_{ILow} = 0.25 mA
I_{IHigh}	4.5 mA to 9.4 mA	4.5 mA to 9.3 mA	4.5 mA to 8.7 mA
R_I	890 Ω at V_I = 4 V	1930 Ω at V_I = 8.7 V	3780 Ω at V_I = 17 V
	640 Ω at V_I = 6 V	1700 Ω at V_I = 15.8 V	3560 Ω at V_I = 31 V

On-Site Operation Panel for Surface-Mounting Housing (Port H) (Available only for Modular Devices)

The terminal for the on-site operation panel of surface-mounted devices is located on the D-sub 15 interface (position H). The on-site operation panel of surface-mounted devices with integrated or detached on-site operation panel is connected to this interface.

User interface	Detached on-site operation panel
Connection	On the rear side D-sub 15 
Insulation class	PELV (according to IEC 60255-27)

Integrated Ethernet Interface (Port J)

This terminal is used to load the device with DIGSI 5 using Ethernet. This terminal also enables IEC 61850 Ethernet communication or communication with another protocol via Ethernet, for example, for connecting an external RTD unit.

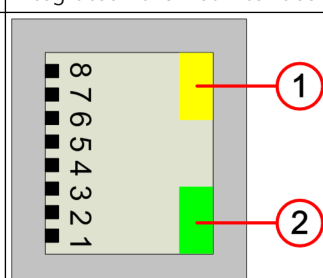
Interface	Integrated Ethernet interface
Connection	 (1) LED 1: Yellow (2) LED 2: Green
Connector type	1 x RJ45
Baud rate	100 Mbit/s
Max. line length	20 m with Ethernet patch cable CAT 6 S/FTP, F/FTP, or SF/FTP
Insulation class	SELV (acc. to IEC 60255-27)
Interface design	Corresponds to IEEE 802.3, 100Base-TX

Table 6-6 Connection

Pin	Signal	Signal Description
1	ETH_TX_P	Transmit Data +
2	ETH_TX_N	Transmit Data -
3	ETH_RX_P	Receive Data +
4	–	–
5	–	–
6	ETH_RX_N	Receive Data -
7	–	–
8	–	–
	Screen	Shield potential

LEDs of the RJ45 Terminals – Integrated Ethernet Interface (Port J)

The light-emitting diodes (LEDs) signal the operating state of the communication link. The operating states are explained in the following table:

Integrated Ethernet Interface (RJ45)	Signal	Color	Operating Status
LED 1	ETH_LED1_N	Yellow	Continuously lit: 100 Mbit Not lit: 10 Mbit
LED 2	ETH_LED0_N	Green	Flashing: Telegram reception Continuously lit: No communication

Ethernet COM Link (Port K) (Available only for Modular Devices)

The Ethernet connection to the CB202 module (plug-in module assembly with integrated power supply) is realized using the RJ45 interface.

The RJ45 interface can only be used for the connection of the CB202 plug-in module assembly. This terminal is left unused when If no CB202 plug-in module assembly is in use.

The light-emitting diodes (LEDs) signal the operating state of the communication connection.

Table 6-7 Operating states

COM Link (RJ45)	Signal	Color	Operating State
LED 1	CL2_LED0_N	Yellow	Flashes when a communication module is inserted in plug-in module position P.
LED 2	CL3_LED0_N	Green	Flashes when a communication module is inserted in plug-in module position N.

Table 6-8 Connection

Pin	Signal	Comment
	Siemens-specific assignment	Connection using a special cable Is part of the device delivery

Insulation class	SELV (as per IEC 60255-27)

Plug-In Modules

The technical data concerning plug-in modules can be found in *4 Plug-In Modules*.

6.7 Electrical Tests

Standards

IEC 60255 (product standard)
IEEE Std C37.90
UL 508
Additional standards are listed for the individual tests.

Installation Requirements

Overvoltage category	III
Degree of pollution	2
Protection class	1

Voltage-Immunity and Safety Tests

Standards	IEC 60255-27
Voltage test (routine test), current measurement inputs, voltage measurement inputs, relay outputs	AC 2.5 kV 50 Hz
Voltage test (routine test), auxiliary voltage, binary inputs	DC 3.5 kV
Voltage test (routine test), only isolated communication and time-synchronization interfaces and analog inputs (module position E, F, M, N, and P)	DC 700 V
Surge immunity test (type testing), all circuits except communication and time-synchronization interfaces and analog inputs, class III	5 kV (peak value) 1.2 μs/50 μs 0.5 J 3 positive and 3 negative impulses at intervals of 1 s
Insulation resistance	> 100 MΩ @ DC 500 V
Resistor of protective-equipotential-bonding	< 0.1 Ω @ DC 12 V, 30 A after 1 min.

Voltage Immunity of the Fast Measuring-Transducer Input

Insulation (all Inputs)	
Test levels (type test)	Voltage immunity: DC 4.6 kV, 1 min 7.2 kV, 1.2/50 μs peak impulse

Insulation of LPIT Digital Input (via Module IO240)

Insulation (All Inputs)	
Configuration	Each phase group (current, voltage, and temperature) is insulated from each other, to PE and to the operator according to the requirements of IEC 61869-1 (AC 3 kV, 50 Hz, 1 min) and IEC 60255-27 for a rated voltage of 300 V despite the low-level signal voltages. All channels are protected with differential-mode and common-mode voltage-limiting devices.
Test levels (type test)	AC 3250 V, 50 Hz, 1 min 6000 V 1.2/50 μs peak impulse

EMC Immunity Tests (Type Tests, Test under Mounting Conditions)

Standards	IEC 60255-1 and -26 (product standards) EN 61000-6-2 (generic standard)	
Electrostatic discharge test IEC 61000-4-2	Contact discharge: • Front panel, modular and non-modular devices: 8 kV • Rear panel, modular devices: 8 kV • Rear panel, non-modular devices: 6 kV Air discharge: 15 kV Both polarities 150 pF Ri = 330 Ω	
Radiated electromagnetic field immunity Frequency sweep IEC 61000-4-3	20 V/m, 80 MHz to 1 GHz 10 V/m, 1 GHz to 6 GHz 80 % AM 1 kHz	
Radiated electromagnetic field immunity Spot frequencies IEC 61000-4-3	20 V/m, 80 MHz/160 MHz/380 MHz/450 MHz/900 MHz 10 V/1.85 GHz/2.15 GHz 80 % AM 1 kHz Dwell time ≥ 10 s	
Electrical fast transient/burst immunity IEC 61000-4-4	4 kV 5 ns/50 ns 5 kHz Burst length 15 ms Repetition rate 300 ms Both polarities Ri = 50 Ω Test duration ≥ 1 min	
High-energy surge voltages IEC 61000-4-5	Pulse: 1.2 µs/50 µs	
	Auxiliary voltage	Common mode: 4 kV, 12 Ω, 9 µF Differential mode: 2 kV, 2 Ω, 18 µF (device version xB and higher) Differential mode: 1 kV, 2 Ω, 18 µF (to device version xA) and non-modular devices
	Measuring inputs, binary inputs, and relay outputs	Common mode: 4 kV, 42 Ω, 0.5 µF Differential mode: 2 kV, 42 Ω, 0.5 µF or varistor
Conducted RF, amplitude-modulated IEC 61000-4-6		10 V, 150 kHz to 80 MHz, 80 % AM, 1 kHz
Conducted RF, amplitude-modulated IEC 61000-4-6 Spot frequencies		27 MHz/68 MHz at 10 V, dwell time ≥ 10 s 80 % AM, 1 kHz
Power frequency magnetic field immunity test IEC 61000-4-8	100 A/m (continuous) 1000 A/m for 3 s	

Pulsed magnetic field IEC 61000-4-9	1000 A/m, 8 μs/20 μs
Standard for Surge Withstand Capability (SWC) IEEE Std C37.90.1	2.5 kV (peak value) 1 MHz τ = 15 μs 400 impulses per s Test duration ≥ 10 s Ri = 200 Ω Common mode and differential mode test
Standard for Fast Transient Surge Withstand Capability IEEE Std C37.90.1[29]	4 kV 5 ns/50 ns 5 kHz Burst length 15 ms Repetition rate 300 ms Both polarities Ri = 50 Ω Test duration 60 s Common mode and differential mode test
Standard for Withstand Capability or Relay Systems to Radiated Electromagnetic Interference from Transceivers (Keying test) IEEE Std C37.90.2	20 V/m 80 MHz to 1 GHz Pulse modulation (not valid for IO216)
Damped oscillatory wave immunity test IEC 61000-4-18	100 kHz, 1 MHz, 2.5 kV (peak value) 3 MHz, 10 MHz, 30 MHz, 2.5 kV (peak value) Test duration ≥ 60 s
Power-frequency disturbance variables at binary inputs IEC 61000-4-16	Zone A 150 V (differential mode) 300 V (common mode)

EMC Electromagnetic Emission Tests (Type Tests, Test under Mounting Conditions)

Standards		IEC 60255-26 (product standard) IEC 61000-6-4 (generic standard)
Conducted emission on auxiliary-voltage lines CISPR 22		150 kHz to 30 MHz limit class A
Radiated emission	CISPR 11	30 MHz to 1 000 MHz limit class A
	CISPR 22	1 GHz to 6 GHz limit class A
Loading effect in electricity-supply systems, harmonics Harmonic current emissions		Does not apply! (see EN 61000-3-2, section 7, power consumption < 75 W)
Loading effect in electricity-supply systems, voltage fluctuations Flicker		Does not apply! (see EN 61000-3-3, section 6, no significant voltage fluctuations)

29 If a module ETH-BD-2FO is installed on a PS201 in the top slot (plug-in module position E in *Figure 2-8*), the immunity for this module is currently restricted to 3.5 kV.

6.8 Mechanical Tests

Vibration and Shock Stress in Stationary Use

Standards	IEC 60255-21 and IEC 60068
Vibration Test (sinusoidal) IEC 60255-21-1, class 2[30] and IEC 60068-2-6	Sinusoidal 10 Hz to 60 Hz: ± 0.075 mm amplitude 60 Hz to 150 Hz; 10 m/s^2 acceleration Frequency sweep 1 octave/min 20 cycles in 3 axes perpendicular to one another
Shock Test IEC 60255-21-2, class 1	Semi-sinusoidal Acceleration 50 m/s^2 Duration 11 ms 3 shocks each in both directions of the 3 axes
Seismic Tests IEC 60255-21-3, class 2 and IEC 60068-3-3	Sinusoidal 3 Hz [31] to 35 Hz: Frequency sweep 1 octave/min 1 cycle in 3 axes perpendicular to one another 3 Hz to 8 Hz: ± 7.5 mm amplitude (horizontal axes) 3 Hz to 8 Hz: ± 3.5 mm amplitude (vertical axis) 8 Hz to 35 Hz: 20 m/s^2 acceleration (horizontal axes) 8 Hz to 35 Hz: 10 m/s^2 acceleration (vertical axis)

Vibration and Shock Stress During Transport

Standards	IEC 60255-21 and IEC 60068
Vibration Test (sinusoidal) IEC 60255-21-1, class 2[32] and IEC 60068-2-6	Sinusoidal 5 Hz to 8 Hz: ± 7.5 mm amplitude 8 Hz to 150 Hz: 20 m/s^2 acceleration Frequency sweep 1 octave/min 20 cycles in 3 axes perpendicular to one another
Shock Test IEC 60255-21-2, class 1 and IEC 60068-2-27	Semi-sinusoidal Acceleration 150 m/s^2 Duration 11 ms 3 shocks each in both directions of the 3 axes
Continuous shock IEC 60255-21-2, class 1 and IEC 60068-2-27	Semi-sinusoidal Acceleration 100 m/s^2 Duration 16 ms 1000 shocks each in both directions of the 3 axes

30 The non-modular devices in the assembly frame meet class 1.

31 For technical reasons, the frequency range is raised from 1 Hz to 3 Hz at the lower limit.

32 The non-modular devices in the assembly frame meet class 1.

6.9 Environmental Conditions

Temperatures

Type test, in operation (in compliance with IEC 60068-2-1 and IEC 60068-2-2, test Ad for 16 h and test Bd for 16 h)	-40 °C to +85 °C
Temporarily permissible during operation (tested for 96 h)	-25 °C to +70 °C Load conditions for the non-modular devices: With temperatures above 55 °C, no more than 50 % of the binary inputs and relay outputs per printed circuit board assembly are allowed to be continuously active. Readability of the display may be impaired below -10 °C and above +55 °C.
Recommended for uninterrupted duty (in compliance with IEC 60255-1)	-10 °C to +55 °C
Temperatures for continuous storage	-25 °C to +55 °C
Type test, transport and storage for 16 h	-40 °C to +85 °C

Heat-related constraints for the binary inputs on the input module IO216 (modular devices)		
Switching thresholds	Up to 55 °C	Up to 70 °C
Operating voltage: 220 V	All 16 binary inputs usable for uninterrupted duty	10 binary inputs usable for uninterrupted duty

Heat-related constraints for the binary inputs on the input module IO230 (modular devices)			
Switching thresholds	Up to 40 °C	Up to 55 °C	Up to 70 °C
Range 1 for 24 V, 48 V, and 60 V operating voltage	All 48 binary inputs usable for uninterrupted duty	All 48 binary inputs usable for uninterrupted duty	All 48 binary inputs usable for uninterrupted duty
Range 2 for 110 V and 125 V operating voltage	All 48 binary inputs usable for uninterrupted duty	All 48 binary inputs usable for uninterrupted duty	36 binary inputs usable for uninterrupted duty (max. 3 in each group of 4 at the same time)
Range 3 for 220 V and 250 V operating voltage	36 binary inputs usable for uninterrupted duty (max. 3 in each group of 4 at the same time)	24 binary inputs usable for uninterrupted duty (max. 2 in each group of 4 at the same time)	12 binary inputs usable for uninterrupted duty (max. 1 in each group of 4 at the same time)

NOTE

At an ambient temperature of 55 °C to 70 °C, a maximum of 36 relays per row can be switched on simultaneously.

Heat-related constraints for the binary inputs on the IO231 and IO232 input modules (modular devices)			
Switching thresholds	Up to 40 °C	Up to 55 °C	Up to 70 °C
Range 1 for 24 V, 48 V, and 60 V operating voltage	All 24 binary inputs usable for uninterrupted duty	All 24 binary inputs usable for uninterrupted duty	All 24 binary inputs usable for uninterrupted duty

Range 2 for 110 V and 125 V operating voltage	All 24 binary inputs usable for uninterrupted duty	All 24 binary inputs usable for uninterrupted duty	18 binary inputs usable for uninterrupted duty (max. 3 in each group of 4 at the same time)
Range 3 for 220 V and 250 V operating voltage	18 binary inputs usable for uninterrupted duty (max. 3 in each group of 4 at the same time)	12 binary inputs usable for uninterrupted duty (max. 2 in each group of 4 at the same time)	6 binary inputs usable for uninterrupted duty (max. 1 in each group of 4 at the same time)

Heat-related constraints for the binary inputs on the input module IO233 (modular devices)			
Switching thresholds	Up to 40 °C	Up to 55 °C	Up to 70 °C
Range 2 for 110 V and 125 V operating voltage	All 48 binary inputs usable for uninterrupted duty	All 48 binary inputs usable for uninterrupted duty	36 binary inputs usable for uninterrupted duty (max. 3 in each group of 4 at the same time)

Humidity

Permissible humidity stress (according to IEC 60068-2-30)	≤ 75 % relative humidity on the annual average Up to 93 % relative humidity on 56 days a year Transient condensation is permissible.
	Arrange the devices so that they are not exposed to direct sunlight or extreme temperature changes. This will prevent condensation in the device.
Constant humid heat, 56 days	40 °C, 93 % relative humidity
Humid heat, cyclical	12 h + 12 h cycles 25 °C/55 °C/95 % relative humidity

Other Environmental Information

Maximum operating altitude above sea level	2000 m (6561.68 ft)
Minimum permissible atmospheric pressure	783.8 hPa

Corrosion Tests

Corrosion test SO2 (IEC 60068-2-42)	25 ppm
Corrosion test H2S (IEC 60068-2-43)	10 ppm
Mixed gas corrosion test (IEC 60068-2-60 and ISA 71.04 G3)	SO2 300 ppb, SO2 1250 ppb, H2S 100, CL2 20 ppb
Humidity, cyclic (IEC 60068-2-30 and LR test specification Section 14)	25 °C (93 %), 55 °C (97 %) for 6 cycles of 24 hours each
Dust and sand test Lc	Arizona dust for 24 hours
Salt mist (IEC 60068-2-52)	Method 1 (40 °C, 90 % to 95 %) for 28 days

6.10 Operating Conditions

The protection device is designed for flush mounting in conventional relay rooms and systems such that electromagnetic compatibility (EMC) is ensured with proper flush mounting.

Siemens additionally recommends:

- Use contactors and relays that work within the same cabinet or the same relay panel with digital protection equipment, only with suitable quenching equipment.
- With switchgear rated at 100 kV or higher, provide external connecting lines with shielding grounded at both ends that is capable of carrying current. No special measures are necessary in medium-voltage systems.
- Removing or plugging in individual modules under live voltage is prohibited. Some components are electrostatically sensitive in the removed state. Pay attention to the ESD specifications (**E**lectrostatically **S**ensitive **D**evices). There is no danger for the components when they are installed.

6.11 Reference Conditions and Influencing Variables

Reference Conditions

Measurand current I	I_{rated} ± 1 %
Measurand voltage V	V_{rated} ± 1 %
Frequency f	f_{rated} ± 1 %
Sine waveform, total harmonic distortion	≤ 5 %
Ambient temperature T_V	23 °C ± 1 °C (73.4 °F ± 2 °F)
Auxiliary voltage V_{Aux}	$V_{Aux,rated}$ ± 1 %
Warmup time	≥ 15 min
External fields/external influences	None

Variables Influencing Pickup and Dropout Thresholds (Protection)

Auxiliary voltage: 0.8 $V_{Aux,rated}$ up to 1.2 $V_{Aux,rated}$	≤ 0.2 %
Ambient temperature: -10 °C to 55 °C	≤ 0.5 %/10 K
Frequency: 45 Hz to 65 Hz	≤ 1 %
Harmonics • Up to 10 % of 3rd harmonics • Up to 10 % of 5th harmonics	 ≤ 1 % ≤ 1 %
Warmup	≤ 0.3 %
Transient excess pickup in fundamental component measurement method for τ > 100 ms (with complete unbalance)	≤ 5 %
EMC interference	≤ 5 %

Variables Influencing the Measured Values (Fault Recorders)

Auxiliary voltage: 0.8 $V_{Aux,rated}$ up to 1.2 $V_{Aux,rated}$	≤ 0.2 %
Ambient temperature: -10 °C to 55 °C	≤ 0.5 %/10 K
Frequency: 45 Hz to 65 Hz	≤ 1 %
Harmonics • Up to 10 % of 3rd harmonics • Up to 10 % of 5th harmonics	 ≤ 1 % ≤ 1 %
Warmup	≤ 0.3 %
Transient excess pickup in fundamental component measurement method for τ > 100 ms (with complete unbalance)	≤ 5 %
EMC interference [33]	≤ 1.5 %

[33] Use shielded cables for the current and voltage measuring inputs on the fault recorder.

6.12 Approvals

UL-Listed/UL-Approved

Base module and 1/3 base module	IND. CONT. EQ. 69CA
Expansion module	IND. CONT. EQ. 69CA

6.13 Design Data

Masses

	Device Size Weight of the Modular Devices				
Type of construction	1/3	1/2	2/3	5/6	1/1
Flush-mounting device	4.4 kg	7.2 kg	9.9 kg	12.7 kg	15.5 kg
Surface-mounted device with integrated on-site operation panel	7.4 kg	11.7 kg	15.9 kg	20.2 kg	24.5 kg
Surface-mounted device with detached on-site operation panel	4.7 kg	7.8 kg	10.8 kg	13.9 kg	17.0 kg

Devices with IO240 weigh 0.9 kg more.

	Size	Weight
Detached on-site operation panel	1/3	1.9 kg
Detached on-site operation panel	1/6	1.1 kg

	Device Size Weight of the Non-Modular Devices 7xx81, 7xx82
Type of construction	1/3
Flush-mounting device	3.6 kg
Bracket for non-modular surface-mounting version	1.9 kg

Dimensions of the Base and Expansion Modules

Type of Construction		Max. Total Width x Max. Total Height x Max. Total Depth[34], Each Rounded up to the Next Full mm (in Inches)
Flush-mounting device	Base module	150 mm x 266 mm x 231 mm (5.91 x 10.47 x 9.09)
	Base module with IO240	150 mm x 266 mm x 277 mm (5.91 x 10.47 x 10.91)
	Base module with IO111	150 mm x 266 mm x 243 mm (5.91 x 10.47 x 9.57)
	Expansion module	75 mm x 266 mm x 231 mm (2.95 x 10.47 x 9.09)
	Expansion module with IO240, IO218	75 mm x 266 mm x 277 mm (2.95 x 10.47 x 10.91)
	Expansion module with IO111	75 mm x 266 mm x 243 mm (2.95 x 10.47 x 9.57)
Surface-mounted device with integrated on-site operation panel	Base module	150 mm x 315 mm x 341 mm (5.91 x 12.4 x 13.43)
	Expansion module	75 mm x 315 mm x 341 mm (2.95 x 12.4 x 13.43)

34 Including current terminal, excluding USB port cover

Type of Construction		Max. Total Width x Max. Total Height x Max. Total Depth[34], Each Rounded up to the Next Full mm (in Inches)
Surface-mounted device with detached on-site operation panel	Base module	150 mm x 315 mm x 231 mm (5.91 x 12.4 x 9.09)
	Base module with IO240	150 mm x 315 mm x 277 mm (5.91 x 12.4 x 10.91)
	Base module with IO111	150 mm x 315 mm x 243 mm (5.91 x 12.4 x 9.57)
	Expansion module	75 mm x 315 mm x 231 mm (2.95 x 12.4 x 9.09)
	Expansion module with IO240, IO218	75 mm x 315 mm x 277 mm (2.95 x 12.4 x 10.91)
	Expansion module with IO111	75 mm x 315 mm x 243 mm (2.95 x 12.4 x 9.57)

Dimensions of the Device Rows

Type of Construction	Max. Total Width x Max. Total Height x Max. Total Depth[35], Rounded to full mm (in Inches)				
Device width	1/3	1/2	2/3	5/6	1/1
Flush-mounting device	150 mm x 266 mm x 231 mm (5.91 x 10.47 x 9.09)	225 mm x 266 mm x 231 mm (8.86 x 10.47 x 9.09)	300 mm x 266 mm x 231 mm (11.81 x 10.47 x 9.09)	375 mm x 266 mm x 231 mm (14.76 x 10.47 x 9.09)	450 mm x 266 mm x 231 mm (17.72 x 10.47 x 9.09)
Flush-mounting device with IO240, IO218	150 mm x 266 mm x 277 mm (5.91 x 10.47 x 10.91)	225 mm x 266 mm x 277 mm (8.86 x 10.47 x 10.91)	300 mm x 266 mm x 277 mm (11.81 x 10.47 x 10.91)	375 mm x 266 mm x 277 mm (14.76 x 10.47 x 10.91)	450 mm x 266 mm x 277 mm (17.72 x 10.47 x 10.91)
Flush-mounting device with IO111	150 mm x 266 mm x 243 mm (5.91 x 10.47 x 9.57)	225 mm x 266 mm x 243 mm (8.86 x 10.47 x 9.57)	300 mm x 266 mm x 243 mm (11.81 x 10.47 x 9.57)	375 mm x 266 mm x 243 mm (14.76 x 10.47 x 9.57)	450 mm x 266 mm x 243 mm (17.72 x 10.47 x 9.57)
Surface-mounted device with integrated on-site operation panel	150 mm x 315 mm x 341 mm (5.91 x 12.4 x 13.43)	225 mm x 315 mm x 343 mm[36] (8.86 x 12.4 x 13.43)	300 mm x 315 mm x 343 mm[36] (11.81 x 12.4 x 13.43)	375 mm x 315 mm x 343 mm[36] (14.76 x 12.4 x 13.43)	450 mm x 315 mm x 343 mm[36] (17.72 x 12.4 x 13.43)
Surface-mounted device with detached on-site operation panel	150 mm x 315 mm x 231 mm (5.91 x 12.4 x 9.09)	225 mm x 315 mm x 231 mm (8.86 x 12.4 x 9.09)	300 mm x 315 mm x 231 mm (11.81 x 12.4 x 9.09)	375 mm x 315 mm x 231 mm (14.76 x 12.4 x 9.09)	450 mm x 315 mm x 231 mm (17.72 x 12.4 x 9.09)

34 Including current terminal, excluding USB port cover
35 Including current terminal, excluding USB port cover
36 Including connecting rail

Type of Construction	Max. Total Width x Max. Total Height x Max. Total Depth[35], Rounded to full mm (in Inches)				
Surface-mounted device with detached on-site operation panel with IO240, IO218	150 mm x 315 mm x 277 mm (5.91 x 12.4 x 10.91)	225 mm x 315 mm x 277 mm (8.86 x 12.4 x 10.91)	300 mm x 315 mm x 277 mm (11.81 x 12.4 x 10.91)	375 mm x 315 mm x 277 mm (14.76 x 12.4 x 10.91)	450 mm x 315 mm x 277 mm (17.72 x 12.4 x 10.91)
Surface-mounted device with detached on-site operation panel with IO111	150 mm x 315 mm x 243 mm (5.91 x 12.4 x 9.57)	225 mm x 315 mm x 243 mm (8.86 x 12.4 x 9.57)	300 mm x 315 mm x 243 mm (11.81 x 12.4 x 9.57)	375 mm x 315 mm x 243 mm (14.76 x 12.4 x 9.57)	450 mm x 315 mm x 243 mm (17.72 x 12.4 x 9.57)

Plug-In Module Dimensions

Type of Construction	Max. Width x Max. Height x Max. Depth (in Inches)
USART-Ax-xEL, ETH-Bx-xEL	61 mm x 45 mm x 121 mm (2.4 x 1.77 x 4.76)
USART-Ax-xFO, ETH-Bx-xFO (without protective cover)	61 mm x 45 mm x 133 mm (2.4 x 1.77 x 5.24)
ANAI-CA-4EL, ANAI-CE-2EL	61 mm x 45 mm x 120 mm (2.4 x 1.77 x 4.72)
ARC-CD-3FO	61 mm x 45 mm x 121 mm (2.4 x 1.77 x 4.76)

Minimum Bending Radii of the Connecting Cables Between the On-Site Operation Panel and the Base Module

Fiber-optic cable	R = 50 mm Pay attention to the length of the cable protection sleeve, which you must also include in calculations.
D-Sub cable	R = 50 mm (minimum bending radius)

Degree of Protection According to IEC 60529

For equipment in the surface-mounting housing	IP54[37] for front
For equipment in the flush-mounting housing	IP54[37] for front
For operator protection (back side)	IP2x for current terminal (installed) IP2x for voltage terminal (installed)
Degree of pollution, IEC 60255-27	2
Maximum operating altitude above sea level	2000 m (6561.68 ft)

UL Note

Type 1 if mounted into a door or front cover of an enclosure. When expanding the device with the 2nd device row, then they must be mounted completely inside an enclosure.

35 Including current terminal, excluding USB port cover

37 The supplied plug-in strips must be used for expansion modules with LEDs.

Tightening Torques for Terminal Screws

Type of Line	Current Terminal (also refer to *Figure 5-23*)	Voltage Terminal with Spring-Loaded Terminals (also refer to *Figure 5-23*)	Voltage Terminal with Screw Connection (also refer to *Figure 5-24*)
Stranded wires with ring-type lug	2.7 Nm	No ring-type lug	No ring-type lug
Stranded wires with boot-lace ferrules or pin-type lugs	2.7 Nm	1.0 Nm	0.6 Nm
Solid conductor, bare (2 mm^2)	2.0 Nm	1.0 Nm	–
Blank stranded wire	Not permitted	1 Nm	0.6 Nm

NOTE

For current and voltage terminals, the maximum speed of the tool must not exceed 640 rpm.

NOTE

Use copper cables only.

Torques for Other Screw Types

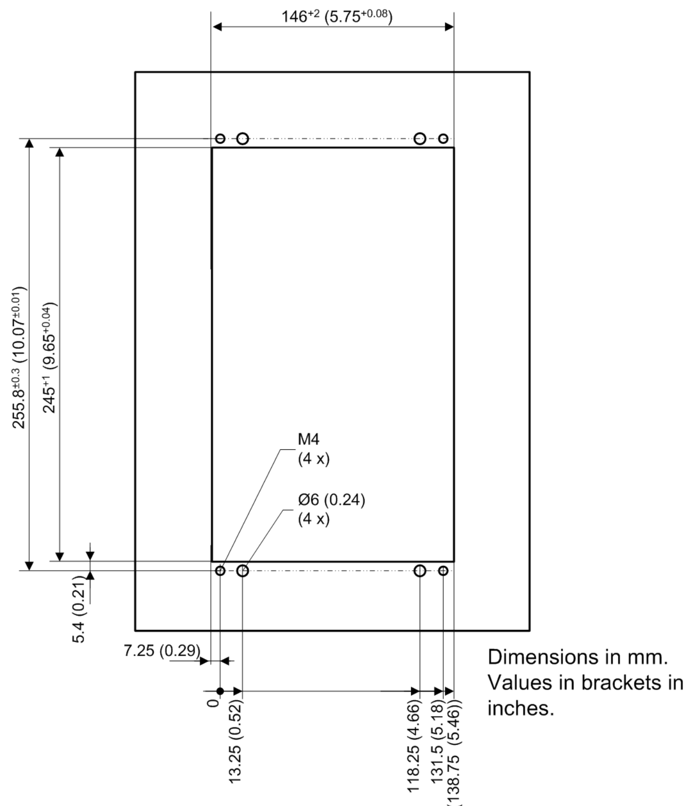
Screw Type	Torque
M4 x 20	1.2 Nm
M4 x 8	1.2 Nm
M2.5 x 6	0.39 Nm
Countersunk screw, M2.5 x 6	0.39 Nm
Countersunk screw, M2.5 x 8	0.39 Nm
Collar screw, M4 x 20	0.7 Nm

6.14 Assembly Dimensions

NOTE

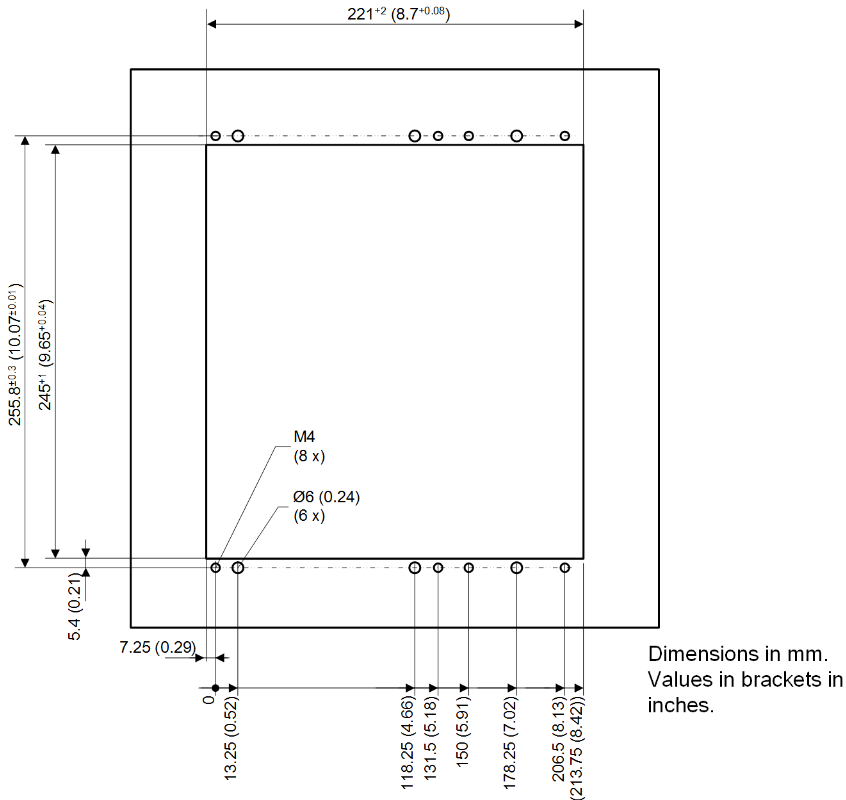
You must mount the devices vertically.

Flush-Mounting Device



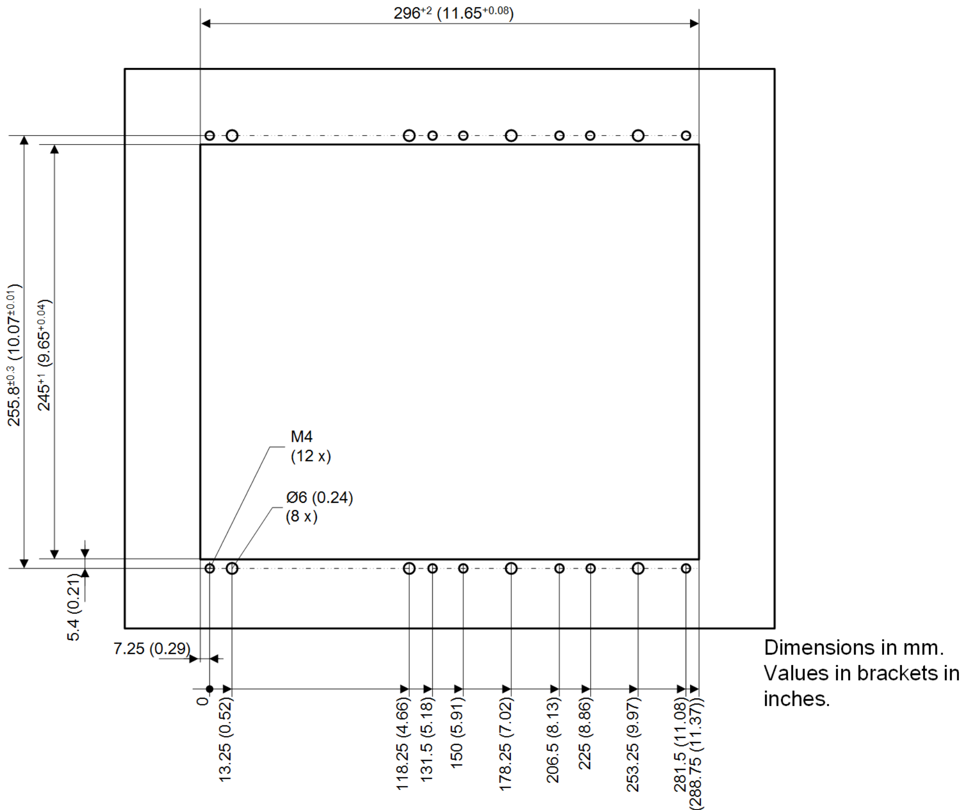
[dw_z1_1-3, 2, en_US]

Figure 6-1 Cut-out Widths and Drilling Pattern - 1/3 Device, 1st Device Row



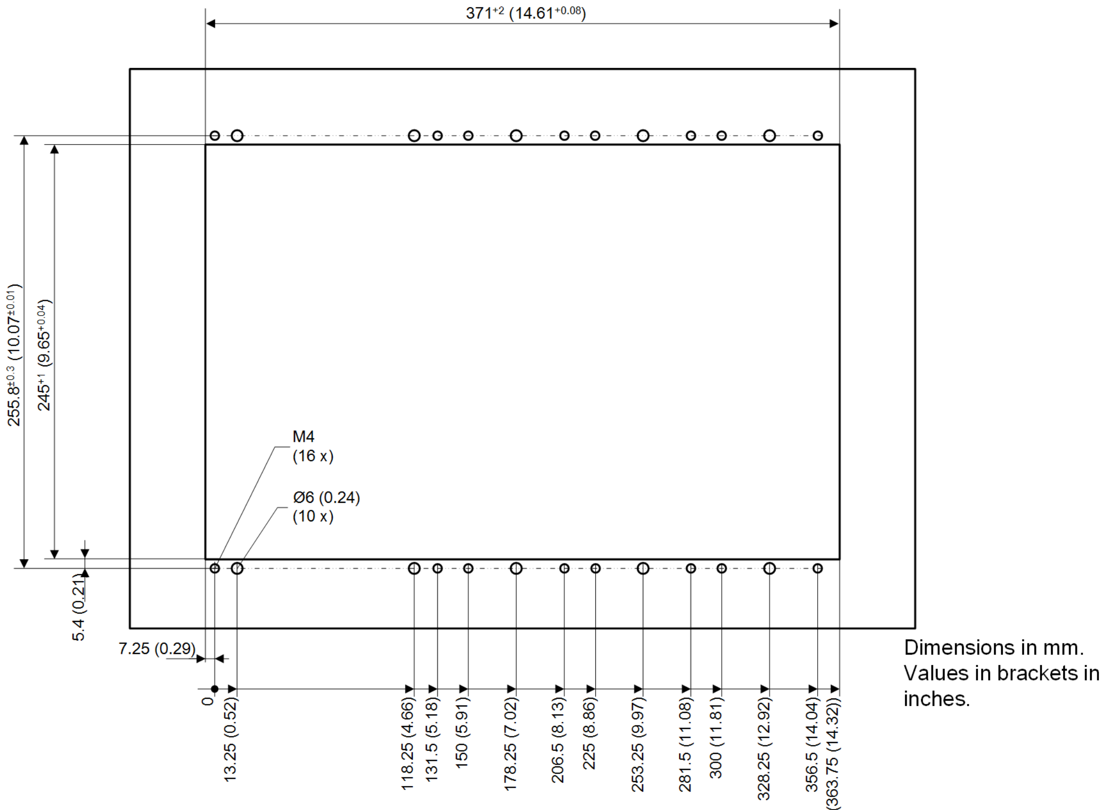
[dw_z1_1-2, 3, en_US]

Figure 6-2 Cut-out Widths and Drilling Pattern - 1/2 Device, 1st Device Row



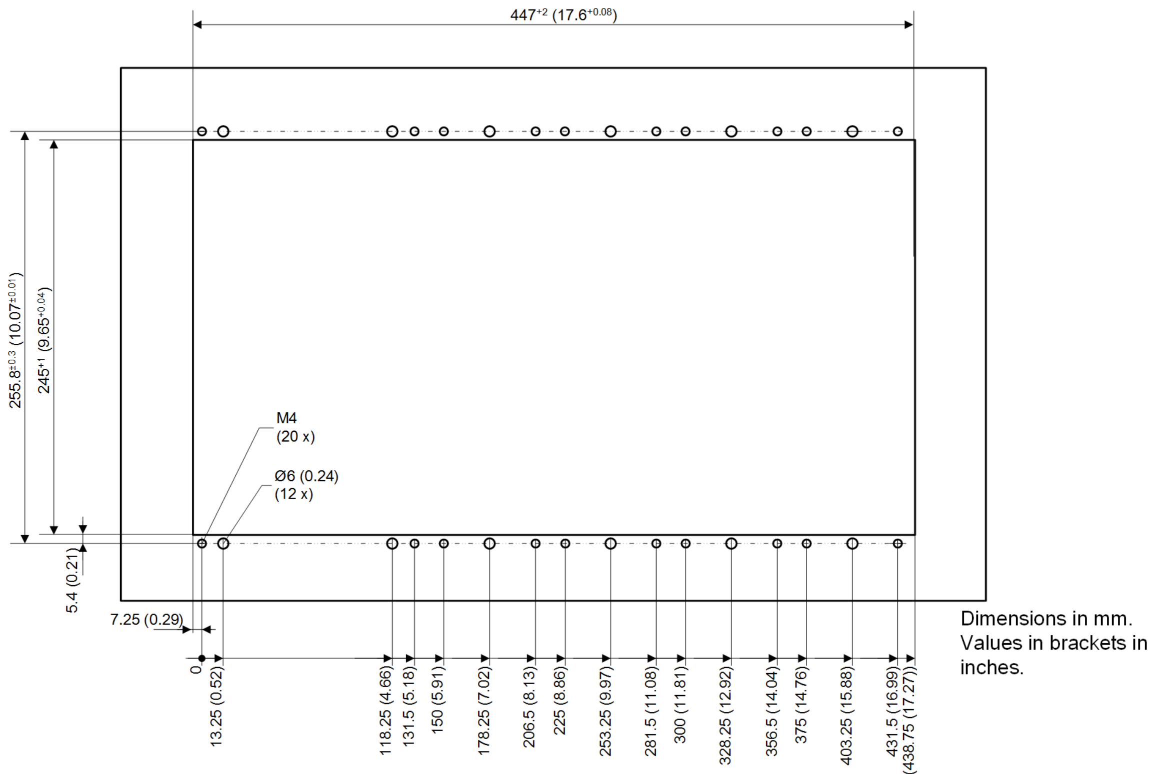
[dw_z1_2-3, 3, en_US]

Figure 6-3 Cut-out Widths and Drilling Pattern - 2/3 Device, 1st Device Row



[dw_z1_5-6, 3, en_US]

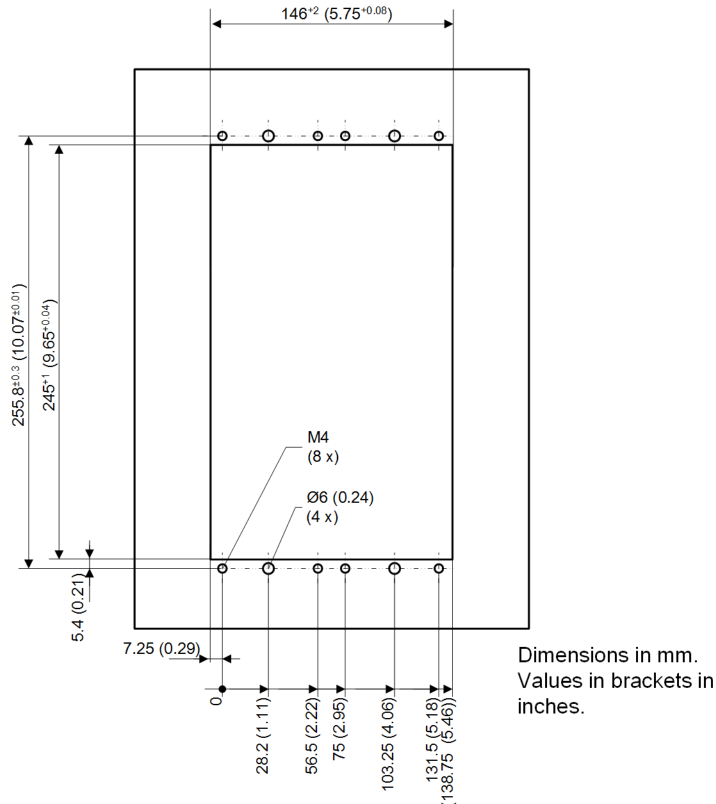
Figure 6-4 Cut-out Widths and Drilling Pattern - 5/6 Device, 1st Device Row



[dw_z1_1-1, 4, en_US]

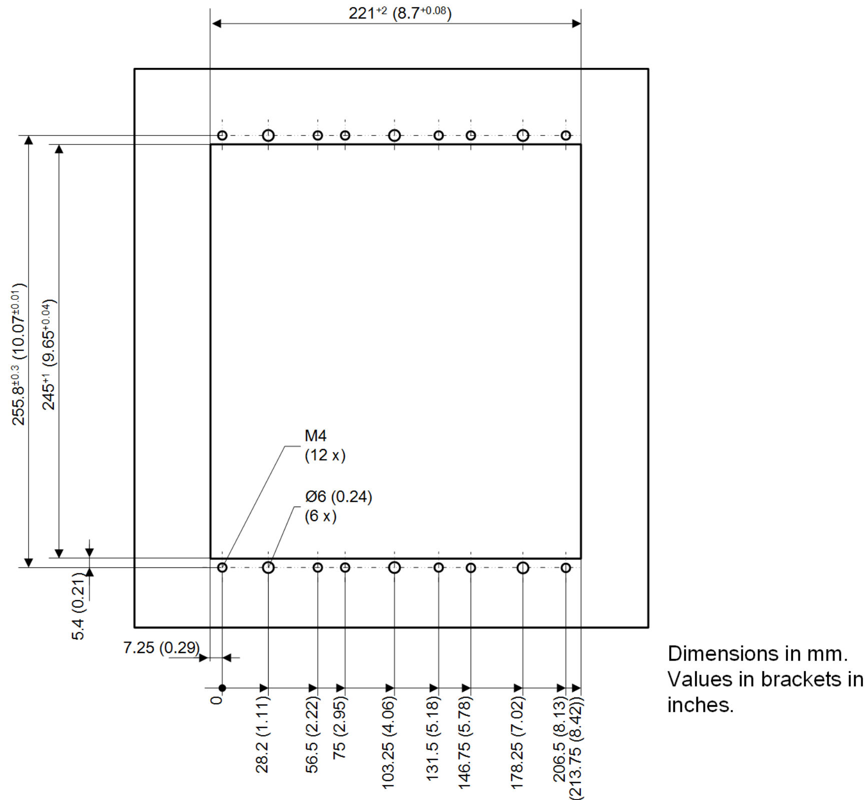
Figure 6-5 Cut-out Widths and Drilling Pattern - 1/1 Device, 1st Device Row

All holes in the area of the specific device cut-out width (see *Table 6-9*) must comply with the dimensions in the corresponding figures.



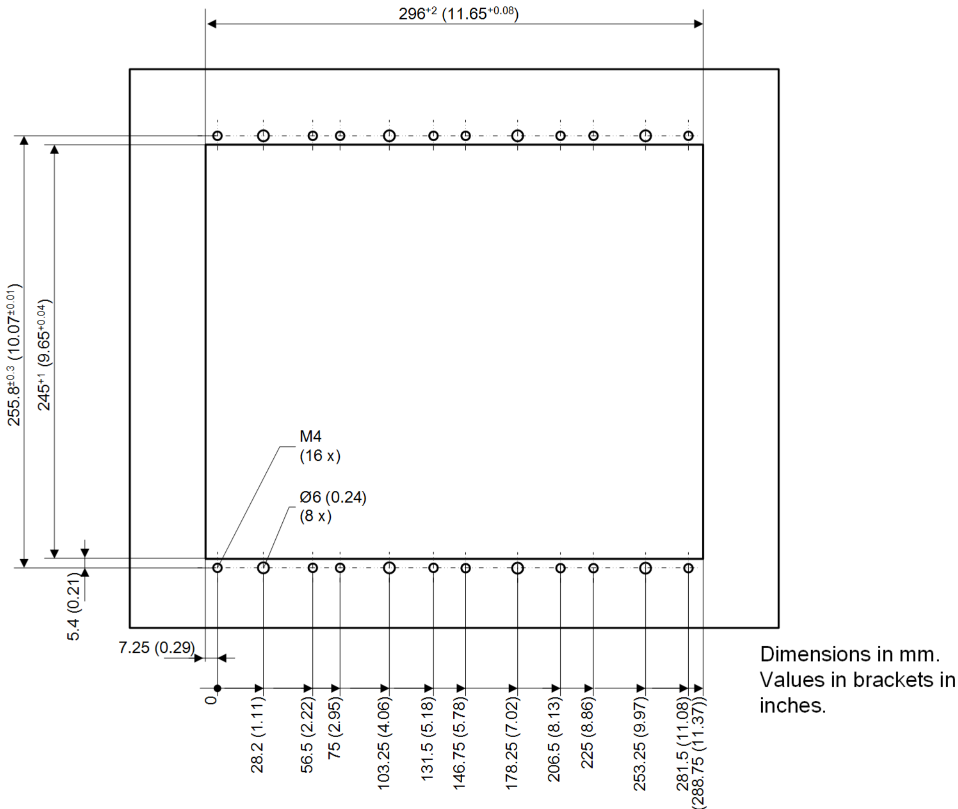
[dw_z2_2-6, 3, en_US]

Figure 6-6 Cut-out Widths and Drilling Pattern - 1/3 Device, 2nd Device Row



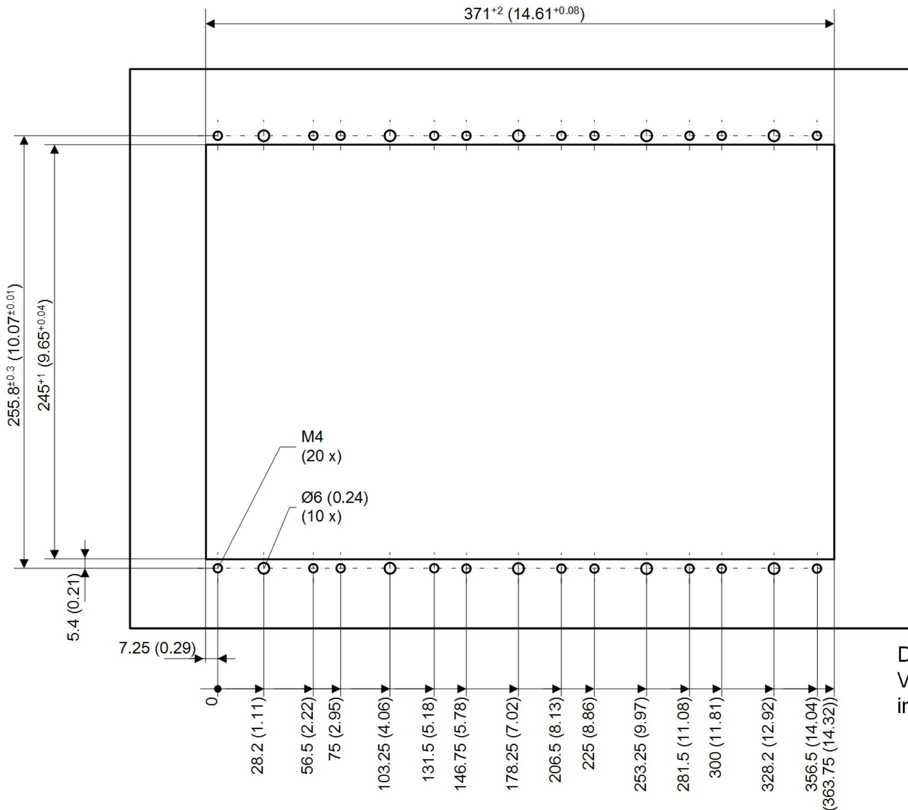
[dw_z2_3-6, 3, en_US]

Figure 6-7 Cut-out Widths and Drilling Pattern - 1/2 Device, 2nd Device Row



[dw_z2_4-6, 3, en_US]

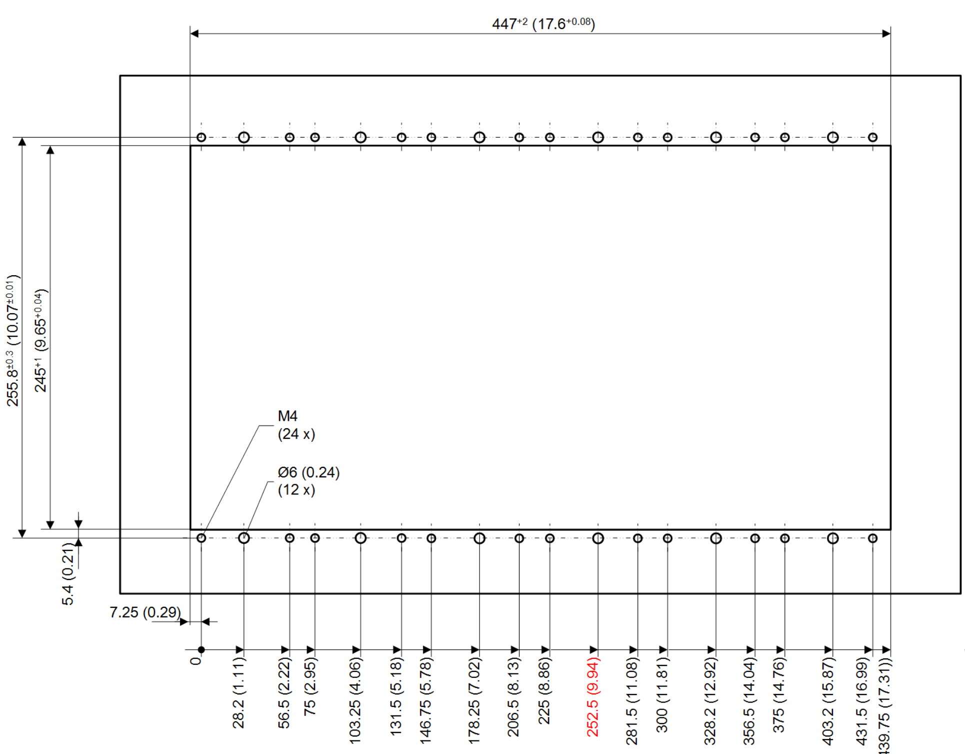
Figure 6-8 Cut-out Widths and Drilling Pattern - 2/3 Device, 2nd Device Row



Dimensions in mm. Values in brackets in inches.

[dw_z2_5-6, 3, en_US]

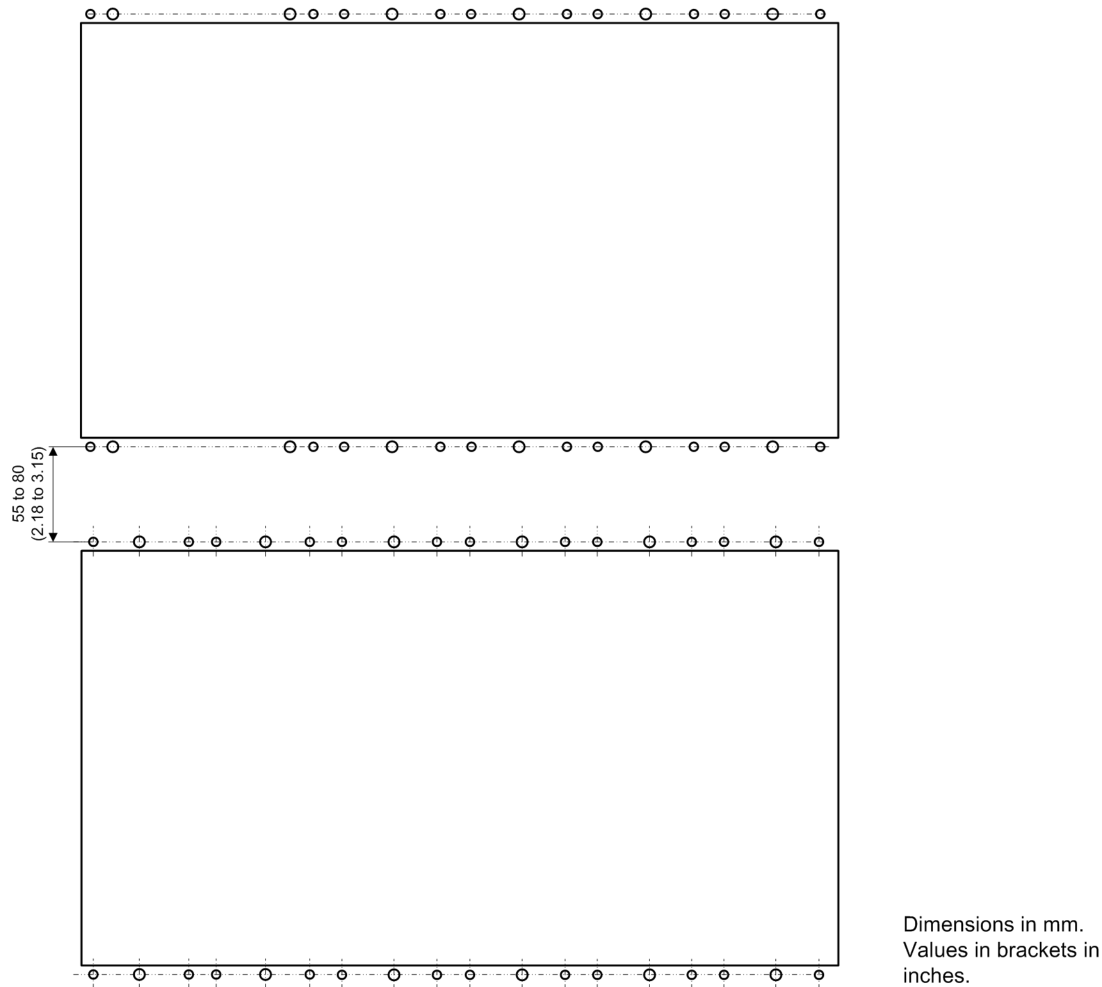
Figure 6-9 Cut-out Widths and Drilling Pattern - 5/6 Device, 2nd Device Row



Dimensions in mm. Values in brackets in inches.

[dw_z2_6-6, 4, en_US]

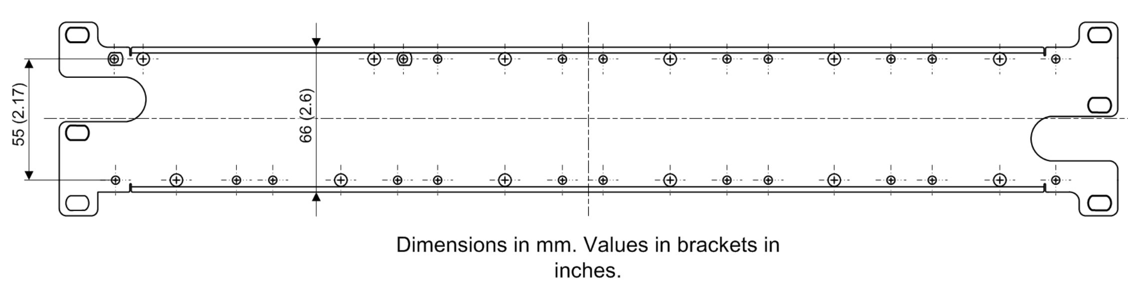
Figure 6-10 Cut-out Widths and Drilling Pattern - 1/1 Device, 2nd Device Row



[dw_first and second device row, 1, en_US]

Figure 6-11 Drilling Pattern - 1/1 Device, 1st and 2nd Device Row

Siemens recommends a hole spacing of at least 55 mm (2.17 in) between the 1st and 2nd device rows. The maximum spacing may be about 80 mm (3.15 in) due to the length of the connecting cable. The length of the cable is 890 mm (35.04 in) from the center of the plug to the center of the connector.



[dw_angle rail, 1, en_US]

Figure 6-12 Angle Rail for Connecting the 1st and 2nd Device Row

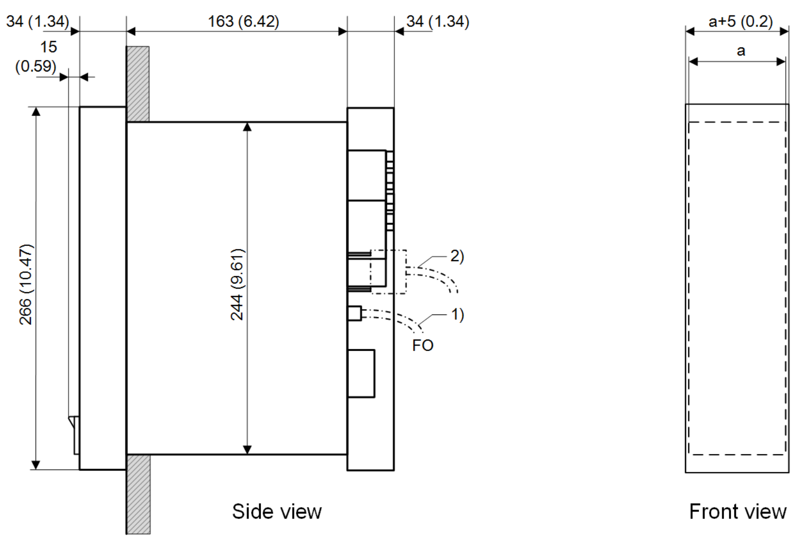
Table 6-9 Cut-Out Widths

	Width of the Mounting Opening
1/3 device (base module)	146^{+2} mm ($5.75^{+0.08}$)
1/2 device (base module with one expansion module)	221^{+2} mm ($8.7^{+0.08}$)
2/3 device (base module with 2 expansion modules)	296^{+2} mm ($11.65^{+0.08}$)

	Width of the Mounting Opening
5/6 device (base module with 3 expansion modules)	371^{+2} mm ($14.61^{+0.08}$)
1/1 device (base module with 4 expansion modules)	447^{+2} mm ($17.6^{+0.08}$)

Table 6-10 Variable Housing Widths

	Dimension a Housing Widths in mm (in Inches) (Total Width = Housing Width + 5 mm (0.2 in))
1/3 device	145 (5.71)
1/2 device	220 (8.66)
2/3 device	295 (11.61)
5/6 device	370 (14.57)
1/1 device	445 (17.52)



Maximum dimensions, roundet to integer mm values (in brackets in inches)

Attention!

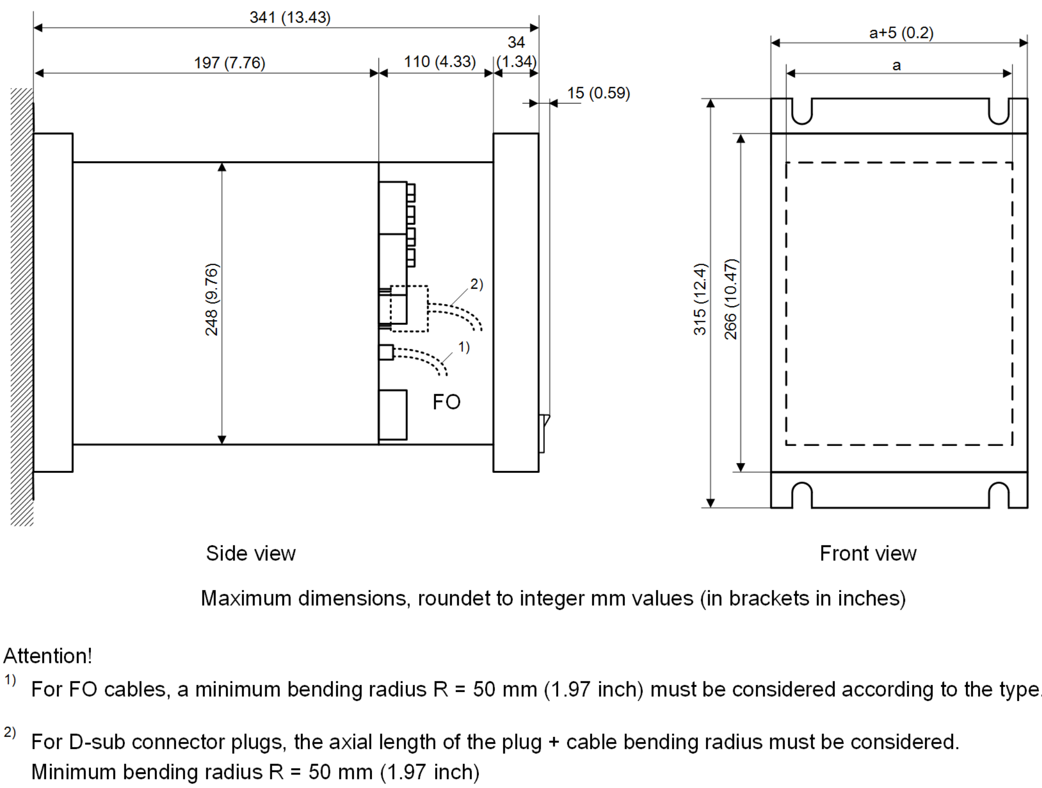
1) For FO cables, a minimum bending radius R = 50 mm (1.97 inch) must be considered according to the type.

2) For RJ45 connector plugs, the axial length of the plug + cable bending radius must be considered.
Minimum bending radius R = 50 mm (1.97 inch)

[dw_surface_mounting_in_SIP5Comp, 4, en_US]

Figure 6-13 Flush-Mounting Devices, Dimensions from the Side and Front Views

Surface-Mounted Devices with Integrated On-Site Operation Panel (Modular Device)

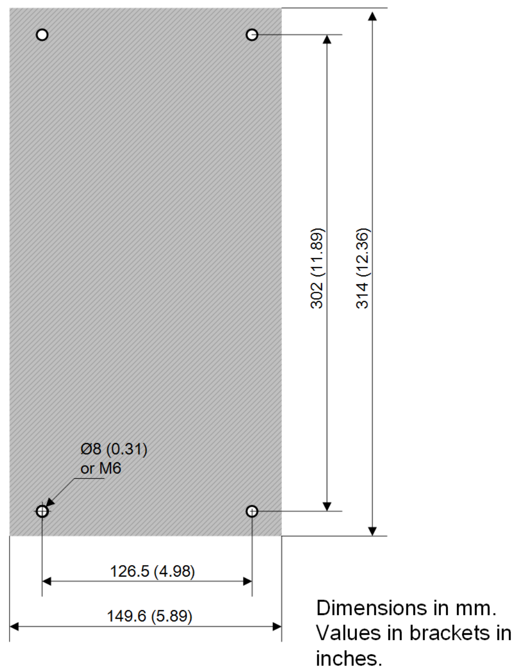


[dwosopin-070211-01.tif, 4, en_US]

Figure 6-14 1/3 Surface-Mounted Device with Integrated On-Site Operation Panel; Dimensions in the Side and Front Views

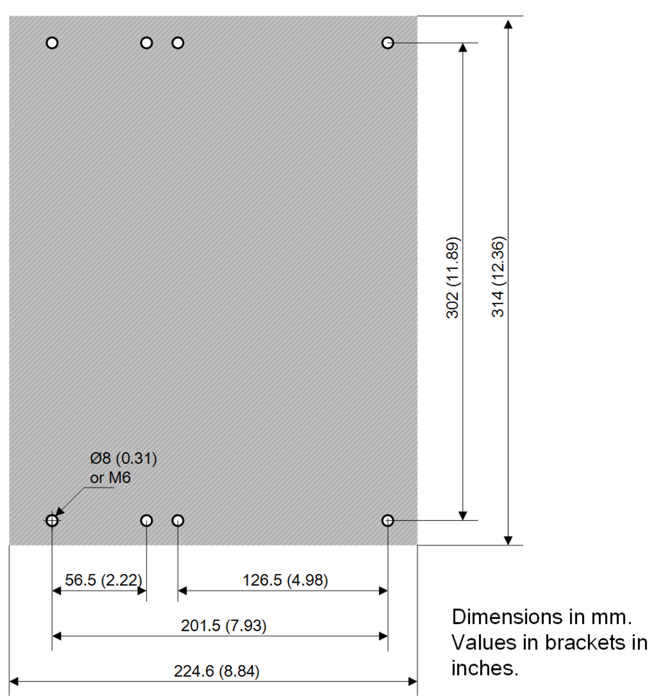
NOTE

When mounting the surface-mounted devices, ensure that the holes are dimensioned for a screw size M6.



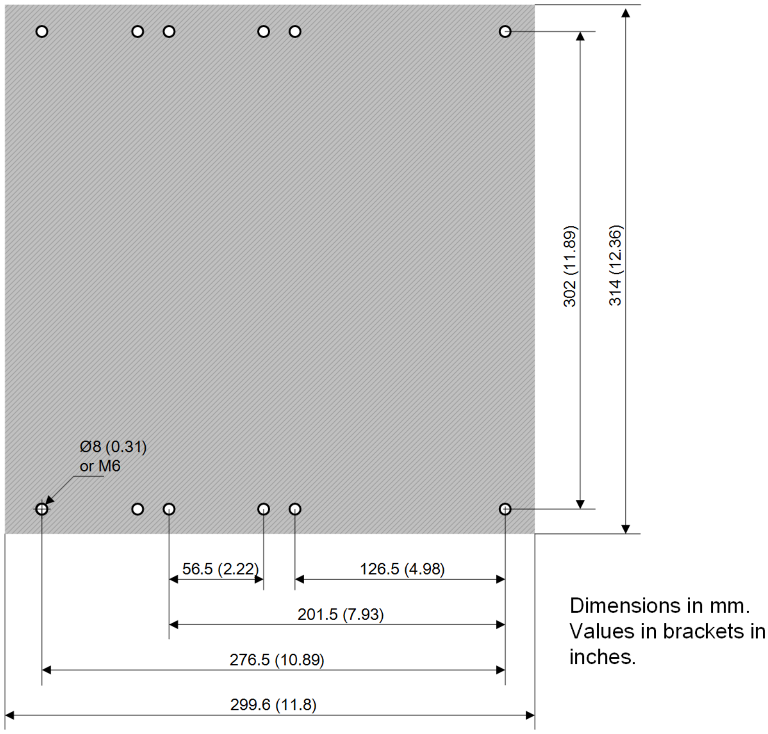
[dwbohrge-1_3.vsd, 3, en_US]

Figure 6-15 Drilling Pattern of a 1/3 Surface-Mounted Device – 1st Device Row



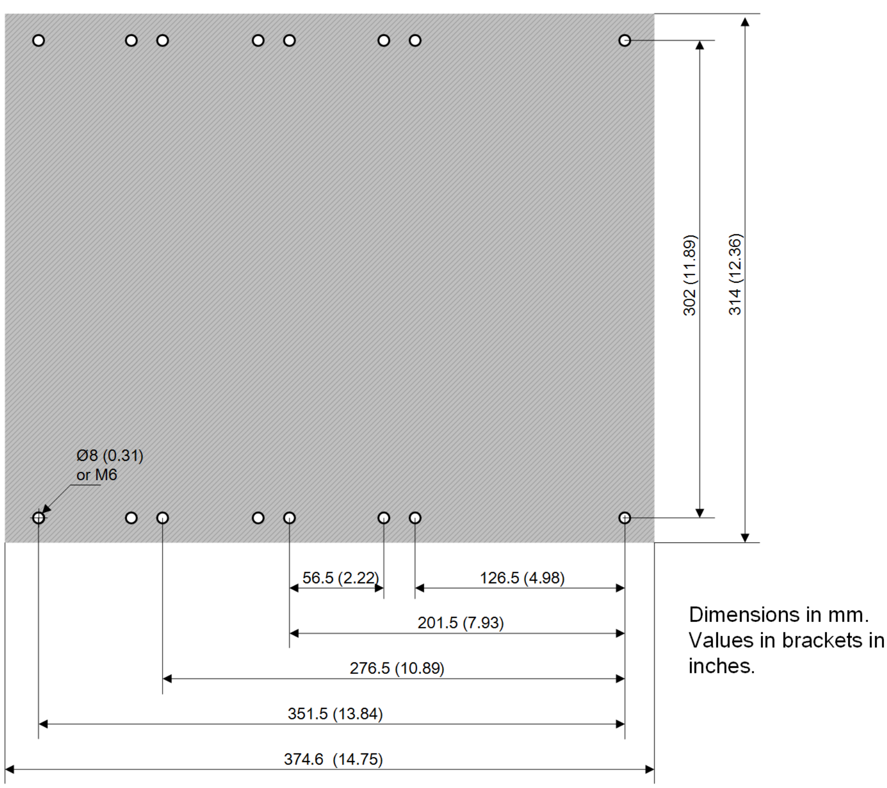
[dwbohrge-1_2.vsd, 3, en_US]

Figure 6-16 Drilling Pattern of a 1/2 Surface-Mounted Device – 1st Device Row



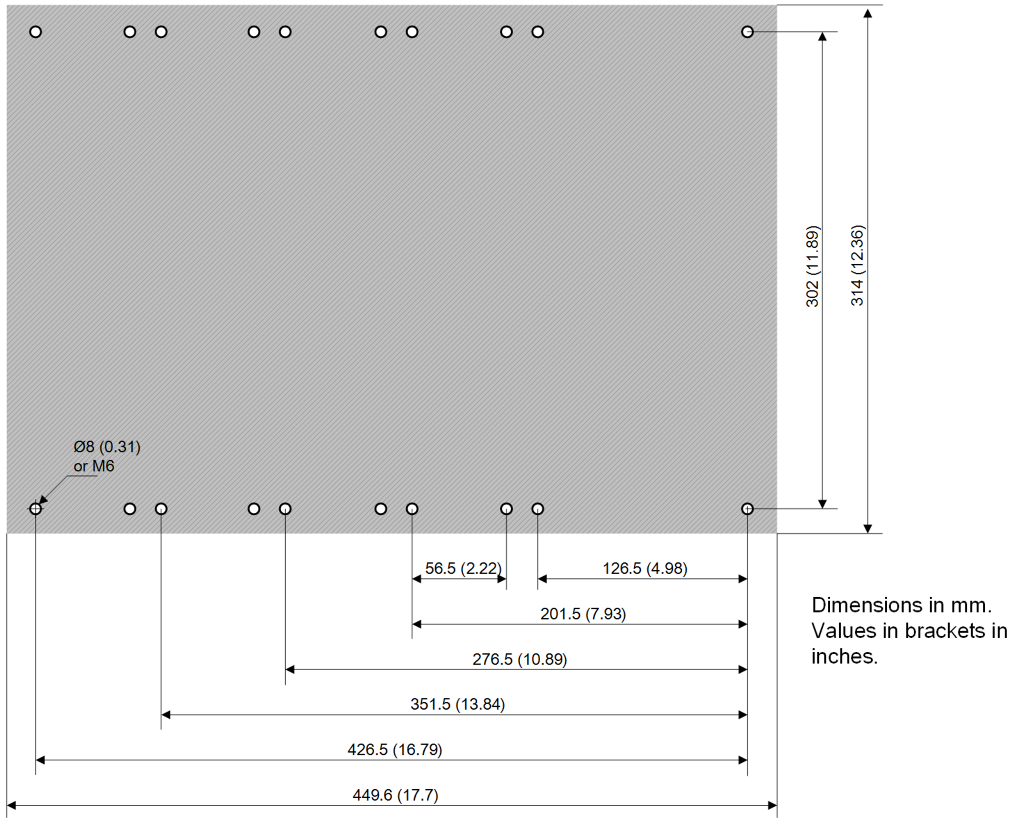
[dwbohrge-2_3.vsd, 3, en_US]

Figure 6-17 Drilling Pattern of a 2/3 Surface-Mounted Device – 1st Device Row



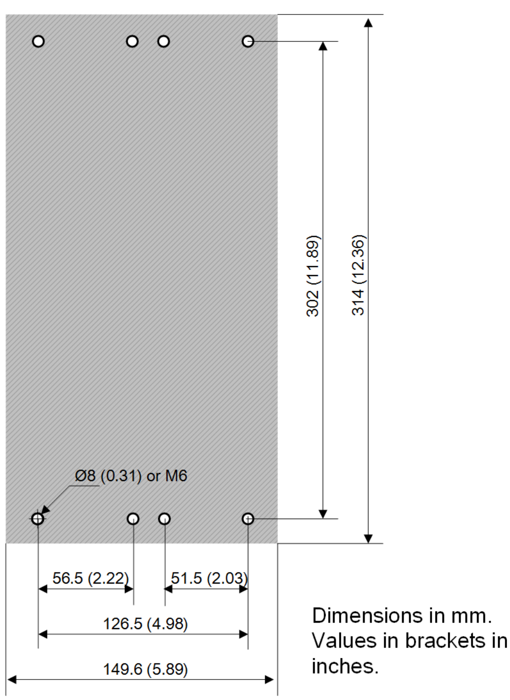
[dwbohrge-5_6.vsd, 3, en_US]

Figure 6-18 Drilling Pattern of a 5/6 Surface-Mounted Device – 1st Device Row



[dwbohrge-070211-01.tif, 4, en_US]

Figure 6-19 Drilling Pattern of a 1/1 Surface-Mounted Device – 1st Device Row



[dw_z2_bohr_1-3.vsd, 3, en_US]

Figure 6-20 Drilling Pattern of a 1/3 Surface-Mounted Device – 2nd Device Row

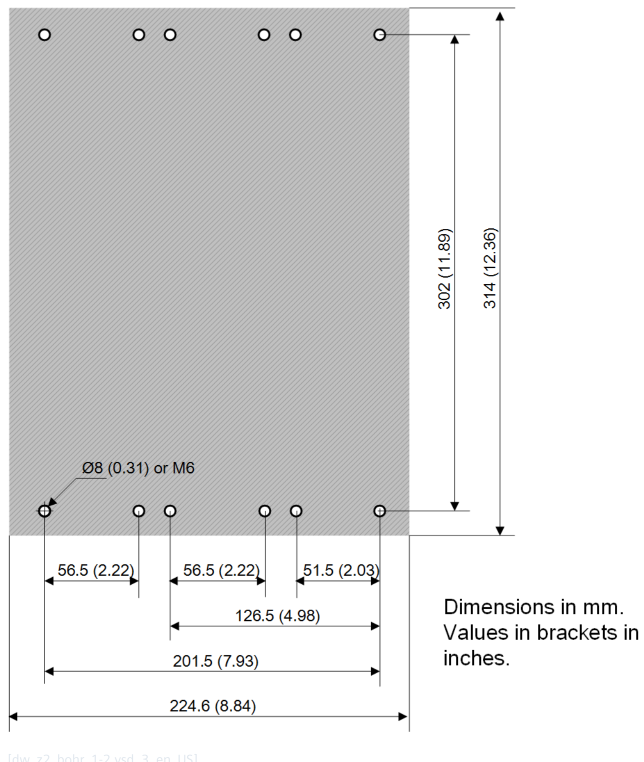


Figure 6-21 Drilling Pattern of a 1/2 Surface-Mounted Device – 2nd Device Row

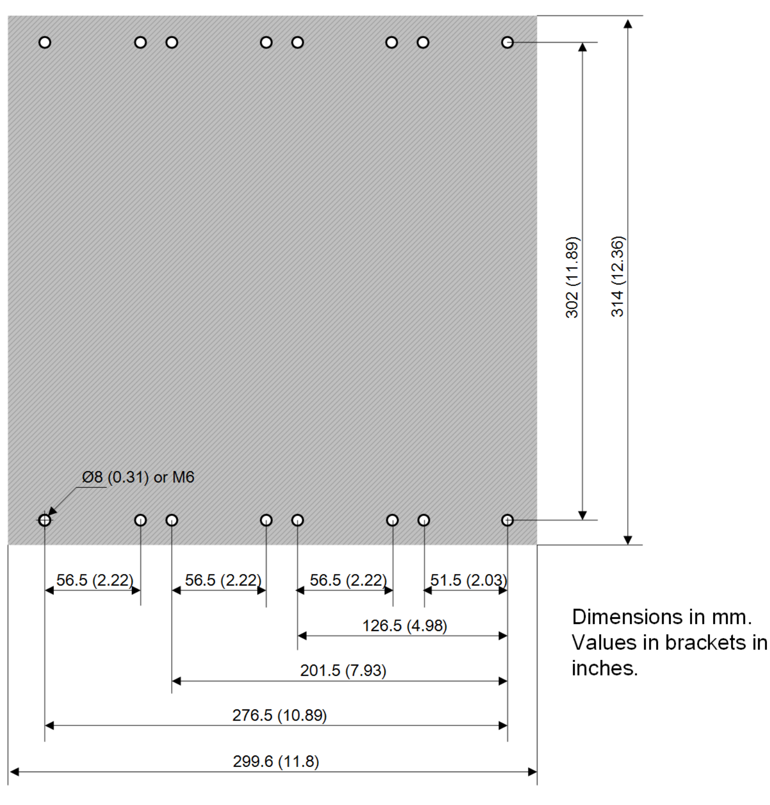
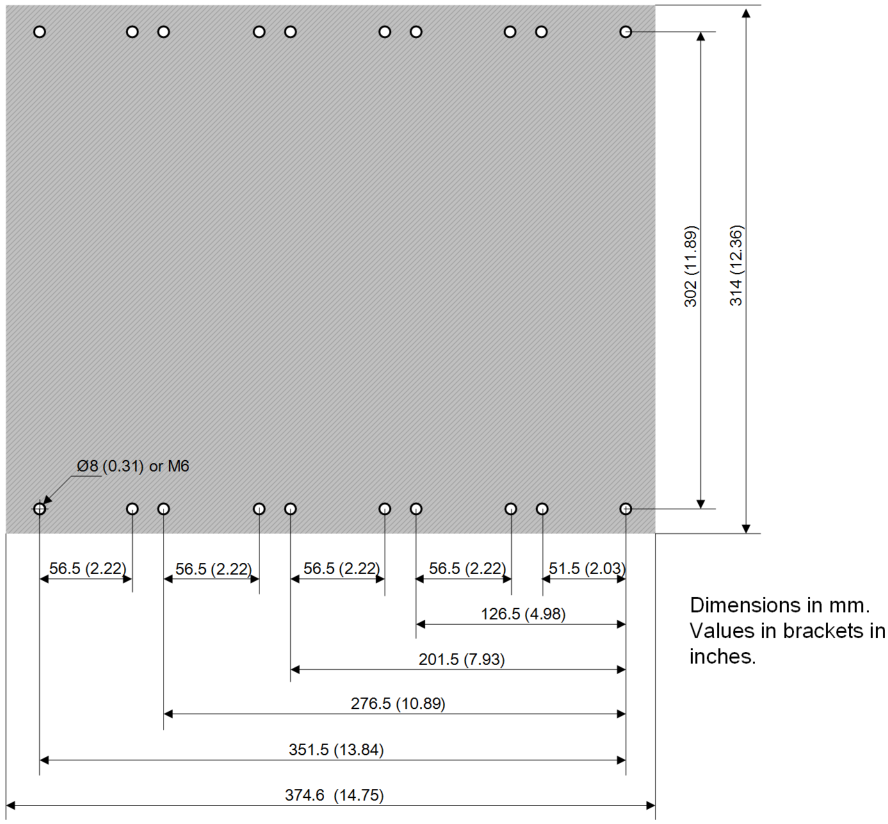
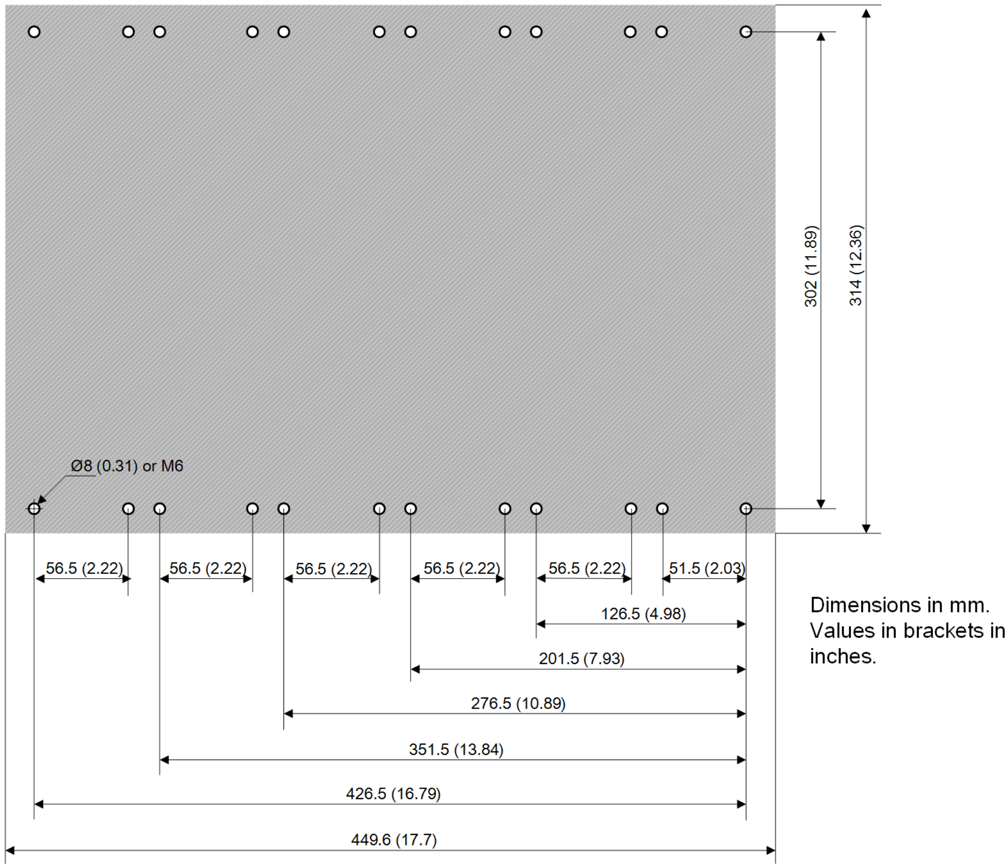


Figure 6-22 Drilling Pattern of a 2/3 Surface-Mounted Device – 2nd Device Row



[dw_z2_bohr_5-6.vsd, 3, en_US]

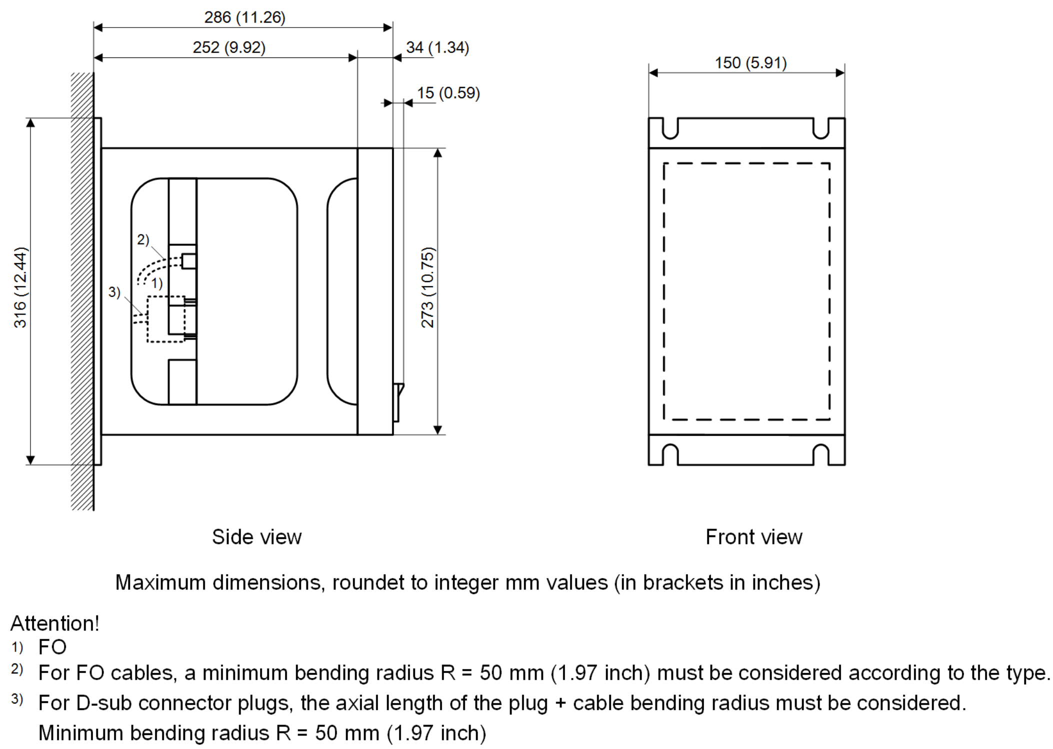
Figure 6-23 Drilling Pattern of a 5/6 Surface-Mounted Device – 2nd Device Row



[dw_z2_bohr_1-1.vsd, 3, en_US]

Figure 6-24 Drilling Pattern of a 1/1 Surface-Mounted Device – 2nd Device Row

Surface-Mounted Devices with Integrated On-Site Operation Panel (Non-Modular Device)



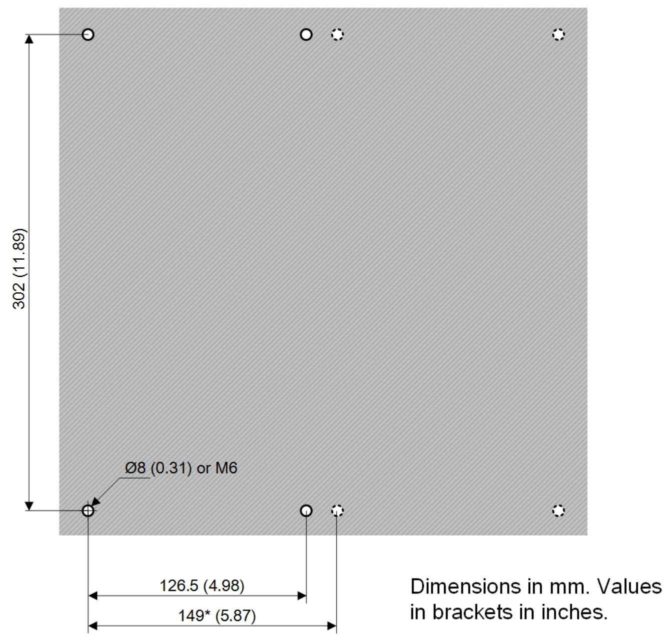
[dw_console side view, 4, en_US]

Figure 6-25 Non-Modular Surface-Mounted Device with Integrated On-Site Operation Panel, Dimensions in the Side and Front Views

Surface-Mounted Devices with Integrated On-Site Operation Panel (Non-Modular Device)

NOTE

When mounting the surface-mounted devices, ensure that the holes are dimensioned for a screw size M6.



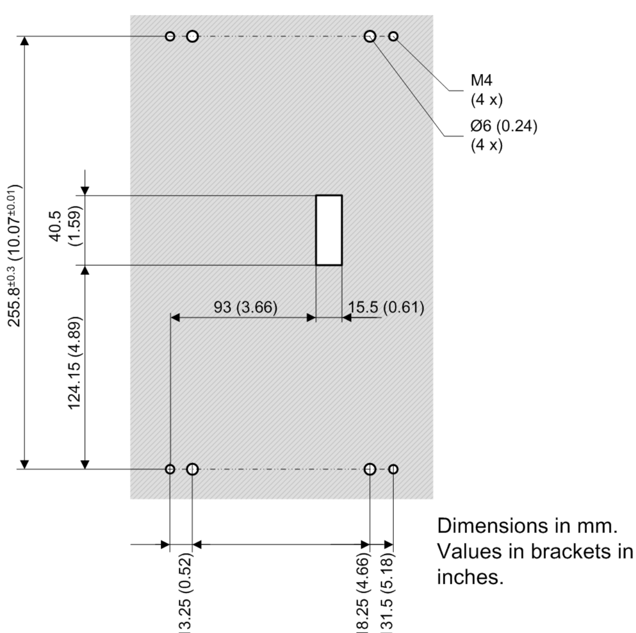
[dw_drilling non modular surface mounting with several consoles, 2, en_US]

Figure 6-26 Drilling Pattern for a Non-Modular Surface-Mounted Device – Several Consoles

* The 149 mm applies in the case that several mounted consoles should be mounted next to each other.

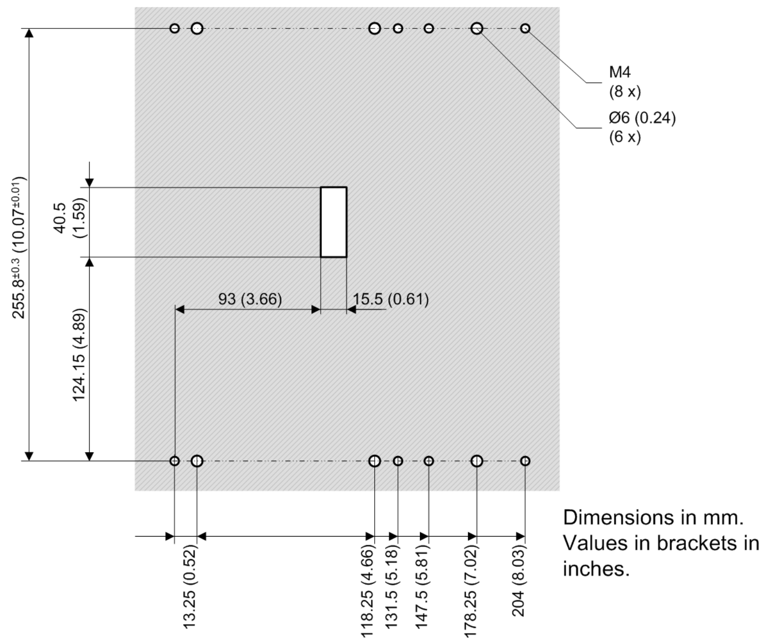
Surface-Mounted Devices with Detached On-Site Operation Panel

You will find more information on the drilling patterns for the devices in section *Surface-Mounted Devices with Integrated On-Site Operation Panel (Modular Device) , Page 284*.



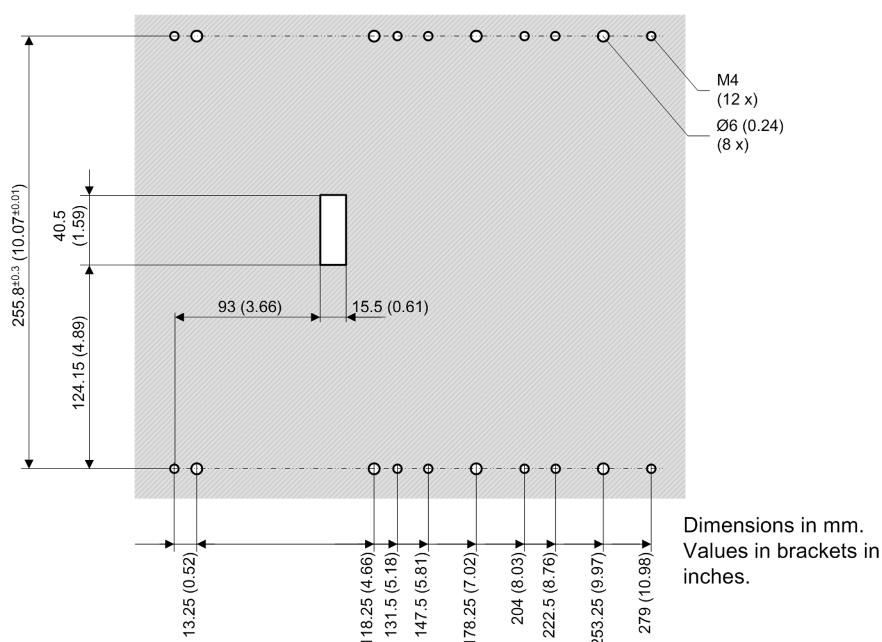
[dw_z1_osop_1-3, 1, en_US]

Figure 6-27 On-Site Operation Panel Drilling Pattern of the 1/3 Device



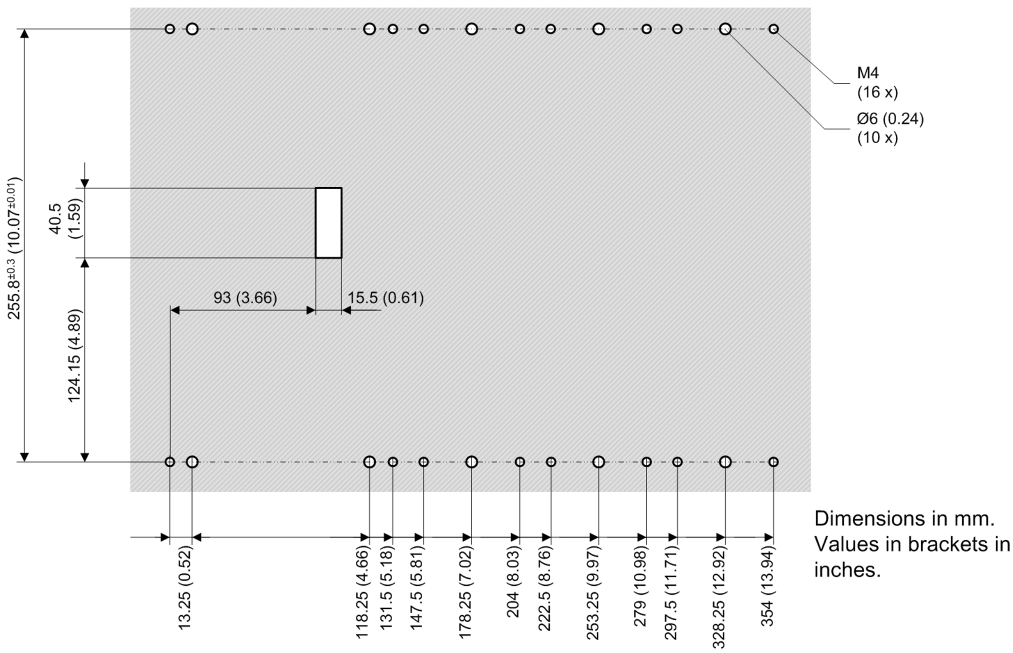
[dw_z1_osop_1-2, 1, en_US]

Figure 6-28 On-Site Operation Panel Drilling Pattern of the 1/2 Device



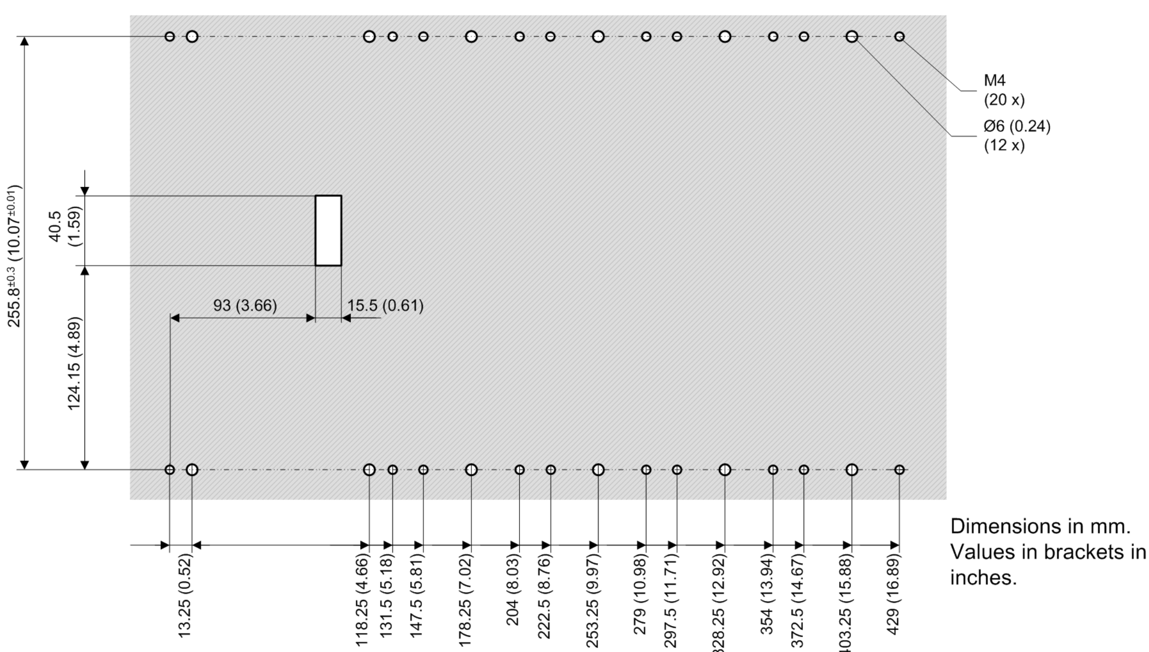
[dw_z1_osop_2-3, 1, en_US]

Figure 6-29 On-Site Operation Panel Drilling Pattern of the 2/3 Device



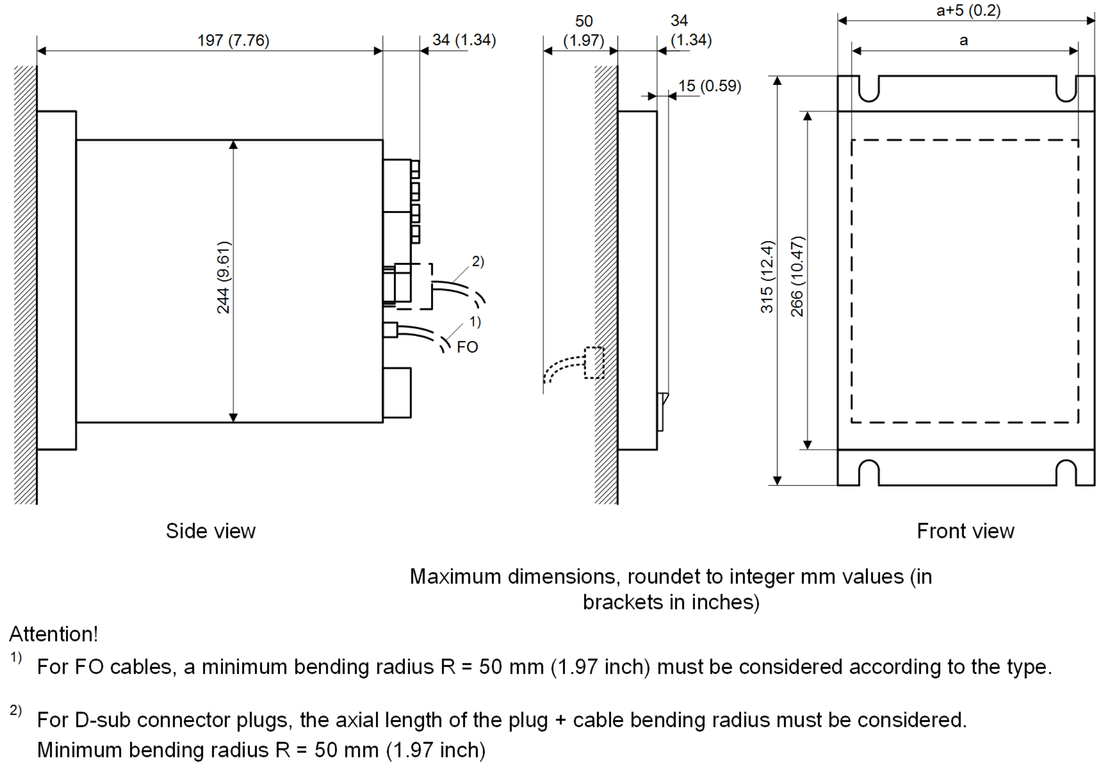
[dw_z1_osop_5-6, 1, en_US]

Figure 6-30 On-Site Operation Panel Drilling Pattern of the 5/6 Device



[dw_z1_osop_1-1, 1, en_US]

Figure 6-31 On-Site Operation Panel Drilling Pattern of the 1/1 Device



[dwosopab-070211-01.tif, 4, en_US]

Figure 6-32 Surface-Mounted Device with Detached On-Site Operation Panel, Dimensions in the Side and Front Views

Refer to *Table 6-10*. for the variable dimension a.

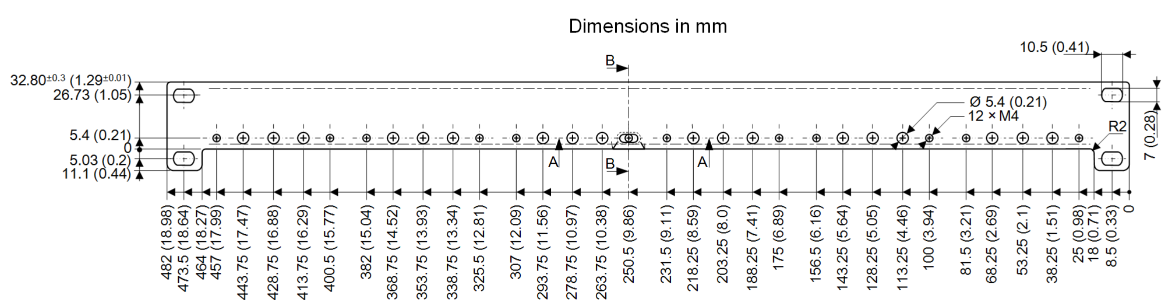
The drilling patterns correspond to the figures *Figure 6-15* to *Figure 6-24*.

The cable length for the detached operation panel is up to 5 m (196.85 in).

NOTE

Cables with a length of 5 m (196.85 in) are only specified for PCs and laptop computers using USB 2.0. These cables are not specified for PCs and laptop computers with USB ports using USB 3.0 and above.

Cables with a length of 2.5 m (98.43 in) are specified for USB 2.0 and from USB 3.0.

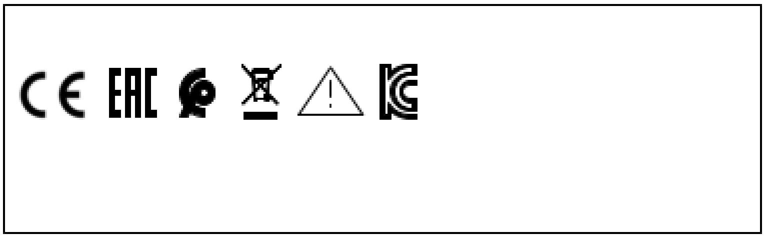


[dw_angel-bracket_without_relief-cutouts, 1, en_US]

Figure 6-33 Angle Rail with Assembly Dimensions

6.15 Conformity Label, Modular and Non-Modular Devices

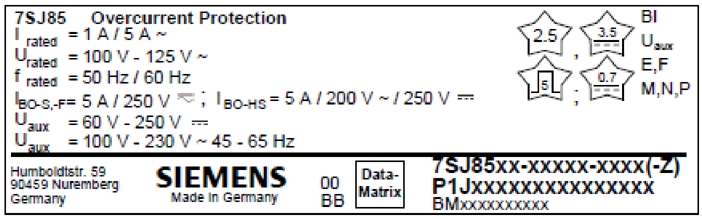
In the following table, the conformity label of a modular or non-modular device is explained as an example. The conformity label is located on the device.

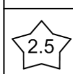
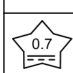
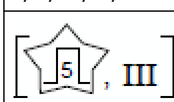


CE	European CE marking
EAC	Directive for the Eurasian Economic Union
	Binding conformity mark for electronics and electrical products in Morocco
	Directive 2002/96/EC for electrical and electronic equipment
⚠	Pay attention to the overall documentation for the device (Product information, Device manual, Hardware manual, Operating manual, and Communication protocols manuals)
KC	South Korea KC, certification for electrical and electronic products

6.16 Modular Device Name Plate

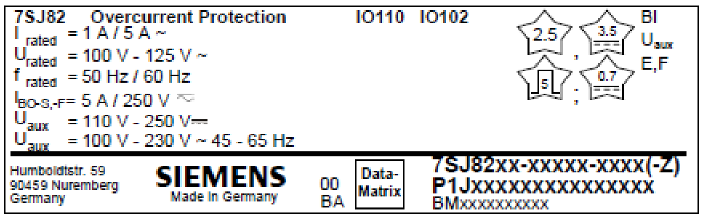
In the following table, the name plate of a modular device is explained as an example. The name plate is located on the device.

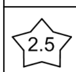
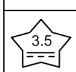
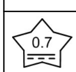
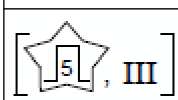


7SJ85	Device type or, in the case of expansion modules, designation of the module
Overcurrent Protection	Product group
I_{rated}, V_{rated}, f_{rated}	Rated values (specified when current and/or voltage transformers are placed on the module)
I_{load}	This value is specified when relays are placed on the module.
$I_{BO\text{-}S,\ \text{-}F}$	Binary output - standard or fast
V_{aux}	Values for the power supply
	QR code
AA	The device hardware supports the operation of a redundant power supply module. The letter combinations have the following meaning: • xA: Power supply not capable of redundancy • xB: Power supply capable of redundancy
IOxxx	Module used
	Insulation test of the voltage inputs, current inputs, and binary outputs with AC 2.5 kV
	Insulation test of the power supply (V_{AUX}) and binary inputs (BI) with DC 3.5 kV
	Insulation testing of all sealed-off interfaces with DC 700 V
E, F, M, N, P	Designation of the ports into which the plug-in modules are plugged.
	5 kV surge immunity test [type test] in compliance with Class III
P1JXXXXXXXXXX	Technical Numbering System (TNS), maximum 18 digits
BMXXXXXXXXXX	Serial number

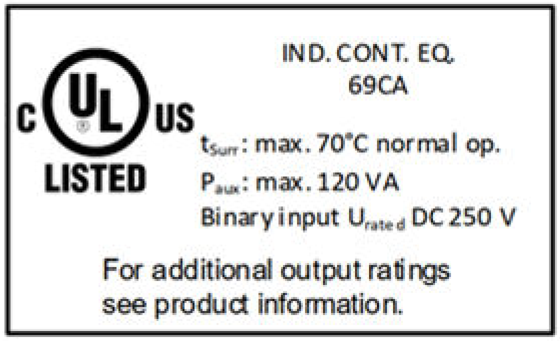
6.17 Name Plate of Non-Modular Devices (7xx81, 7xx82)

In the following table, the name plate of a non-modular device is explained as an example. The name plate is located on the device.



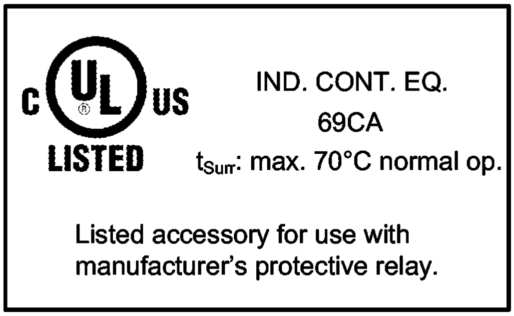
7SJ82	Device type
Overcurrent Protection	Product group
IO110 IO102	Designation of the I/O module
I_{rated}, V_{rated}, f_{rated}	Rated values (specified when current and/or voltage transformers are placed on the module)
$I_{BO\text{-}S,\ \text{-}F}$	Binary Output - standard or fast
V_{aux}	Values for the power supply
P1JXXXXXXXXXX	Technical Numbering System (TNS), maximum 18 digits
BMXXXXXXXXXX	Serial number
	QR code
	Insulation test of the voltage inputs, current inputs, and binary outputs with AC 2.5 kV
	Insulation test of the power supply (V_{AUX}) and binary inputs (BI) with DC 3.5 kV
	Insulation testing of all sealed-off interfaces with DC 700 V
E, F	Designation of the ports into which the plug-in modules are plugged.
	5 kV surge immunity test [type test] in compliance with Class III

6.18 Name Plate, UL Approval, Base Module and 1/3 Base Module



c UL US LISTED	UL approved for Canada and the USA
IND. CONT. EQ.	Industrial controller
69CA	Approval number
t_{Surr}: max. 70 °C normal op.	The ambient temperature must not exceed 70 °C or 158 °F during normal operation.
P_{aux}: max. 120 VA	Maximum power consumption of the device
For additional output ratings see product information	For additional output ratings see Product information.

6.19 Name Plate, UL Approval, Expansion Module



c UL US LISTED	UL approved for Canada and the USA
IND. CONT. EQ.	Industrial controller
69CA	Approval number
t_{Surr}: max. 70 °C normal op.	The ambient temperature must not exceed 70 °C or 158 °F during normal operation.
Listed accessory for use with manufacturer´s protection relay.	Approved accessory for use with a protection device from Siemens

6.20 Battery

Type	CR2032 Button cell Lithium
Voltage	3 V
Capacity	230 mAh
Average service life of the battery, unpowered after removal of protective film	At least 6 months
Service life of the battery in the activated state with protective film removed	10 years

Use button cells from manufacturers like Varta, Panasonic, or Duracell.

NOTE

After the **Battery fault** indication, you must replace the battery within 2 weeks. If ignored, data loss may occur.

6.21 SDHC Memory Card

NOTE

You can use only Siemens SDHC memory cards.

Capacity	16 GB[38]
Performance class	≥ Class 10
Temperature range	-40 °C to +85 °C
Flash type	SLC

Dimensions

	Width x Height x Depth (in Inches)
SDHC memory card	24 mm x 32 mm x 2.1 mm (0.94 x 1.26 x 0.08)

38 Usable capacity: Approx. 15 GB

6.22 Display Resolution

LCD Graphic display (Liquid Crystal Display)	240 x 320 pixels

7 Ordering Information

7.1 Ordering Spare Parts and Accessories

7.1.1 Order Configurator and Order Options

Order Configurator

The order configurator assists you in the selection of SIPROTEC 5 products. The order configurator is a Web application that can be used with any browser. The order configurator can be used to configure complete devices or individual components, such as communication modules, expansion modules, or other accessories. At the end of the configuration process, the product code and a detailed presentation of the configuration result are provided. The product code unambiguously describes the selected product and also serves as an order number.

Ordering Options

The following ordering options are possible for SIPROTEC 5 products:

- Device
- Single part
- DIGSI 5
- Functional enhancement

NOTE

To order single parts in the order configurator, use the **Single part** link.

Individual parts are:

- Expansion module
- Plug-in module
- Sensors for arc protection
- Operation panel
- Terminal
- Accessories

7.1.2 Ordering Spare Parts and Accessories

NOTE

To order terminals, terminal accessories, and mechanical accessories in the order configurator, use the **Single part** link.

Table 7-1 Spare Parts, Accessories

Description	Article per Packaging Unit	Order no. (Short Designa-tion)	Part Number (for Identification only)	Component Type
Voltage terminal, terminal block, 14-pole	8	P1Z499	C73334A 1A 81 *	Terminal
Voltage terminal (power supply) Terminal block, 2-pole[1]	2	P1Z505	–	Terminal
Type A current terminal, 4 x protection for modular devices	1	P1Z512	C73334A 1A177 * / C73334A 1A187 * [2]	Terminal

Description	Article per Packaging Unit	Order no. (Short Designation)	Part Number (for Identification only)	Component Type
Type A current terminal, 3 x protection and 1 x measurement for modular devices	1	P1Z529	C73334A 1A178 * / C73334A 1A188 * [2]	Terminal
Type A current terminal, 4 x measurement for modular devices	1	P1Z536	C73334A 1A179 * / C73334A 1A189 * [2]	Terminal
Type B current terminal, 4 x protection for non-modular devices	1	P1Z1869	C73334A 1A 85 * / C73334A 1A185 *	Terminal
Type B current terminal, 3 x protection and 1 x measurement for non-modular devices	1	P1Z1647	C73334A 1A 86 * / C73334A 1A186 *	Terminal
2-pole cross connector for current terminal	3	P1Z543	–	Terminal
Terminal set for IO110, IO112, IO113[1]	1	P1Z1656	–	Terminal
Terminal set and shielding for IO111[1, 3]	1	P1X240	–	Terminal
Terminal set for IO23x[1] (contains 6 individual plugs)	1	P1Z1841	–	Terminal
2-pole cross connector for voltage terminal	6	P1Z550	–	Terminal
Covering cap for current terminal block	1	P1Z567	–	Terminal
Covering cap for voltage terminal block	8	P1Z574	–	Terminal
Transport safety, current terminal	2	P1X222	–	Terminal
Transport safety, voltage terminal	10	P1X231	–	Terminal
Terminal for direct connection to 400 V low voltage	1	P1X301	–	Terminal
USB covers (10 each for CP 100, 200, 300)	10	P1X213	–	Accessories
Cable, integrated operation panel, 0.43 m	1	P1Z666	–	Accessories
Cable, detached operation panel, 2.50 m (for retrofitting surface-mounting housing with integrated operation panel in surface-mounting housing with detached operation panel)	1	P1Z1878	–	Accessories
Cable, detached operation panel, 5.00 m (for retrofitting surface-mounting housing with integrated operation panel in surface-mounting housing with detached operation panel)	1	P1Z2132	–	Accessories
Cable set, COM link cable	1	P1Z673	–	Accessories
Set of angle rails (contains 2 individual rails)	1	P1Z1850	–	Accessories
Labeling strips, LEDs/function keys	10	P1Z697	–	Accessories
Labeling strips, push-buttons	5	P1Z2752	–	Accessories
Set of parts, mounting bracket 1/2 (contains 2 individual rails)	1	P1Z703	–	Accessories
Set of parts, mounting bracket 2/3 (contains 2 individual rails)	1	P1Z710	–	Accessories
Set of parts, mounting bracket 5/6 (contains 2 individual rails)	1	P1Z727	–	Accessories
Set of parts, mounting bracket 1/1 (contains 2 individual rails)	1	P1Z734	–	Accessories
Screw cover set 1/3, type C11 (contains 2 x 2 individual covers)	2	P1Z901	–	Accessories

Description	Article per Packaging Unit	Order no. (Short Designation)	Part Number (for Identification only)	Component Type
Screw cover set 1/3, type C22 (contains 2 x 2 individual covers)	2	P1Z2512	–	Accessories
Screw cover set 1/6, type C21 (contains 2 x 2 individual covers)	2	P1Z1281	–	Accessories
Cover plate for unused plug-in module positions	1	P1Z680	–	Accessories
Cover panel 1/6	5		–	Accessories
Bus termination plate	2	P1Z1496	–	Accessories
Panel surface mounting assembly frame (for mounting a 7xx81 or 7xx82 device in the panel surface mounting)	1	P1X73	–	Accessories
SDHC memory card for 7KE85	1	P1Z2530	–	Accessories
Battery holder	10	P1X91	–	Accessories
Connecting cable for 2nd row	1	P1Z2655	–	Accessories
DIGSI 5 USB 2.0 cable	1	P1Z2859	–	Accessories
SFP RJ45, 10 units	10	P1Z3201	–	Accessories
SFP Single-mode, 24 km, 10 units	10	P1Z3210	–	Accessories
Point sensor with line length of 3 m	1	P1X19	–	Sensors for arc protection
Point sensor with line length of 4 m	1	P1X28	–	Sensors for arc protection
Point sensor with line length of 5 m	1	P1X37	–	Sensors for arc protection
Point sensor with line length of 7 m	1	P1X277	–	Sensors for arc protection
Point sensor with line length of 10 m	1	P1X46	–	Sensors for arc protection
Point sensor with line length of 15 m	1	P1X55	–	Sensors for arc protection
Point sensor with line length of 20 m	1	P1X64	–	Sensors for arc protection
Point sensor with line length of 35 m	1	P1X82	–	Sensors for arc protection
Line sensor, length 3 m	1	P1X107	–	Sensors for arc protection
Line sensor, length 10 m	1	P1X116	–	Sensors for arc protection
Line sensor, length 20 m	1	P1X125	–	Sensors for arc protection
Line sensor, length 30 m	1	P1X134	–	Sensors for arc protection
Line sensor, length 40 m	1	P1X143	–	Sensors for arc protection
Supply line for line sensors 3 m	1	P1X152	–	Sensors for arc protection
Supply line for line sensors 5 m	1	P1X161	–	Sensors for arc protection
Supply line for line sensors 10 m	1	P1X170	–	Sensors for arc protection

[1] Recommended tightening torque when screwing down the terminal on the rear plate: 0.3 Nm

[2] When ordering individual current terminals, for example, the identification number **C73334A 1A177 *** changes to **C73334A 1A187 ***.

[3] The set comprises terminals and shielding for IO111 for the terminal positions M and N.

A Appendix

A.1 Hardware/Firmware Compatibility List

Component/ Product Feature	Modular	Non-modular (7xx82)	Non-modular (7xx81)	V01.00	V02.00	V03.00	V04.00	V05.00	V06.01	V06.10	V07.00	V07.30	V07.50	V07.60	V07.80	V07.82	V07.90	V08.01	V08.03	V08.30	V08.40	V08.60	V08.80	V08.83	V09.20	V09.30	V09.31	V09.40	V09.50	V09.60	V09.70
Modules																															
CP100	–	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	–	–	–	–	–	–	–
CP150	–	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■
PS101	–	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO101	–	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO102	–	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO103	–	■	–	–	–	–		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO110	–	■	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO111	–	■	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO112	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO113	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO141	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■
CP200	■	–	–	■	■	■	■	■	■	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
CP300_1	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CP300_2[39]	■	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PS201	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CB202	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PS203	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PS204	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO201	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO202	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO203	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO204	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO205	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO206	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO207	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO208	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO209	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO210	■	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO211	■	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO212	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO214	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO215	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO216	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO218	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■
IO230	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO231	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

39 Security-Chip Upgrade

Component/ Product Feature	Modular	Non-modular (7xx82)	Non-modular (7xx81)	V01.00	V02.00	V03.00	V04.00	V05.00	V06.01	V06.10	V07.00	V07.30	V07.50	V07.60	V07.80	V07.82	V07.90	V08.01	V08.03	V08.30	V08.40	V08.60	V08.80	V08.83	V09.20	V09.30	V09.31	V09.40	V09.50	V09.60	V09.70
IO232	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■
IO233	■	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IO240	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■
IO245	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■[40]	■	■	■	■
PB201	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Plug-In Modules																															
USART-AB-1EL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AC-2EL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Plug-In Module USART-AD-1FO	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AE-2FO	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AF-1LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AG-1LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AH-1LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AJ-1LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AK-1LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AU-2LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AV-2LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AW-2LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AX-2LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
USART-AY-2LDFO	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ETH-BA-2EL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ETH-BA-2EL-R2	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■
ETH-BB-2FO	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ETH-BB-2FO-R2	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■
ETH-BD-2FO	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ANAI-CA-4EL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ANAI-CE-2EL	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■
ARC-CD-3FO	■	■	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LEDs/Push-buttons																															
12 LEDs	–	–	■	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
16 LEDs	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
32 LEDs	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
48 LEDs	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
64 LEDs	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
80 LEDs	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
8 push-buttons/LEDs (NE) + 16 LEDs	■	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

40 Only with 6MU85 in the 1/6 module

Component/ Product Feature	Modular	Non-modular (7xx82)	Non-modular (7xx81)	V01.00	V02.00	V03.00	V04.00	V05.00	V06.01	V06.10	V07.00	V07.30	V07.50	V07.60	V07.80	V07.82	V07.90	V08.01	V08.03	V08.30	V08.40	V08.60	V08.80	V08.83	V09.20	V09.30	V09.31	V09.40	V09.50	V09.60	V09.70
8 push-buttons/LEDs (NE) + 32 LEDs	■	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
8 push-buttons/LEDs (NE) + 48 LEDs	■	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
8 push-buttons/LEDs (NE) + 64 LEDs	■	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Significant Features																															
Two end-fault protection[41]	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	–	–	–	–	–	–	–	–	–	–
Two end-fault protection, expand-able[41]	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■
Three end-fault protection[41]	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Multi-end-fault protection[41]	■	■	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
8 current/voltage transformers[42]	■	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
16 current/voltage transformers[42]	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
24 current/voltage transformers[42]	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
32 current/voltage transformers[42]	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
40 current/voltage transformers[42]	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1 zone, 3 fields incl.[43]	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2 zones, 4 fields incl.[43]	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2 zones, 4 fields incl. TrAbb[43]	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6 zones, 6 fields incl.[43]	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6 zones, 6 fields incl., TrAbb[43]	■	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6Z, 6F incl., TrAbb, only CBFP[43]	■	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
FE: 6 zones[43]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■
FE: 20 zones[43]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■

41 Only available for devices 7SD* and 7SL*
42 Only available for 7KE devices*
43 Only available for device 7SS85

Component/ Product Feature	Modular	Non-modular (7xx82)	Non-modular (7xx81)	V01.00	V02.00	V03.00	V04.00	V05.00	V06.01	V06.10	V07.00	V07.30	V07.50	V07.60	V07.80	V07.82	V07.90	V08.01	V08.03	V08.30	V08.40	V08.60	V08.80	V08.83	V09.20	V09.30	V09.31	V09.40	V09.50	V09.60	V09.70
FE: 20 zones, only circuit-breaker failure protection[43]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■
FE: 6 zones, inc. TrAbb[43]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■
FE: 20 zones, inc. TrAbb[43]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■
4 synchronization points[43]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■
8 synchronization points[43]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■
25 Hz, 50 Hz, 60 Hz application[44]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■
16.7 Hz application[44]	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■
Function Points																															
No class or no change	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■
I base	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 10 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 20 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 30 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 40 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 50 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 57 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 100 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 125 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 150 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 175 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 200 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 225 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

44 Only for the 7ST86 device

Component/ Product Feature	Modular	Non-modular (7xx82)	Non-modular (7xx81)	V01.00	V02.00	V03.00	V04.00	V05.00	V06.01	V06.10	V07.00	V07.30	V07.50	V07.60	V07.80	V07.82	V07.90	V08.01	V08.03	V08.30	V08.40	V08.60	V08.80	V08.83	V09.20	V09.30	V09.31	V09.40	V09.50	V09.60	V09.70
Base + 250 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 275 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 300 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 325 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 350 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 375 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 400 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 425 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 450 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 475 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 500 function points	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 600 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 700 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 800 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 900 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 1000 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 1100 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 1200 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 1300 function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Base + 1400 function points	■	■	■	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■
Base + 1400+ function points	■	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	–	–	–	–	–	–
Integrated Ethernet Port J																															
For DIGSI 5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Component/ Product Feature	Modular	Non-modular (7xx82)	Non-modular (7xx81)	V01.00	V02.00	V03.00	V04.00	V05.00	V06.01	V06.10	V07.00	V07.30	V07.50	V07.60	V07.80	V07.82	V07.90	V08.01	V08.03	V08.30	V08.40	V08.60	V08.80	V08.83	V09.20	V09.30	V09.31	V09.40	V09.50	V09.60	V09.70
DIGSI 5 and IEC 61850 / conditional	■	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
DIGSI 5 and IEC 61850 / GOOSE with CP100	–	■	■	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
DIGSI 5 and IEC 61850 / GOOSE with CP300	■	–	–	–	–	–	–	–	–	–	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Literature

/1/ Distance Protection, Line Differential Protection, and Overcurrent Protection for 3-Pole Tripping – 7SA82, 7SD82, 7SL82, 7SA84, 7SD84, 7SA86, 7SD86, 7SL86, 7SJ86
C53000-G5040-C010

/2/ Distance and Line Differential Protection, Breaker Management for 1-Pole and 3-Pole Tripping – 7SA87, 7SD87, 7SL87, 7VK87
C53000-G5040-C011

/3/ Overcurrent Protection – 7SJ82/7SJ85
C53000-G5040-C017

/4/ Overcurrent Protection – 7SJ81
C53000-G5040-C079

/5/ Motor Protection – 7SK82/85
C53000-G5040-C024

/6/ Transformer Differential Protection – 7UT82, 7UT85, 7UT86, 7UT87
C53000-G5040-C016

/7/ Generator Protection – 7UM85
C53000-G5040-C027

/8/ Busbar Protection – 7SS85
C53000-G5040-C019

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Glossary

Control display

The control display becomes visible for devices with a large display after pressing the CTRL key. The diagram contains the switching devices to be controlled in the feeder, with status representation. The control display serves for the bushing of the switching operations. Defining this display is part of the project engineering.

DCF77

The high-precision official time is determined in Germany by the Physikalisch-Technische Bundesanstalt PTB in Brunswick. The atomic clock unit of the PTB transmits this time via the long-wave time signal transmitter in Mainflingen near Frankfurt/Main. The emitted time signal can be received within a radius of approx. 1500 km from Frankfurt/Main.

GOOSE

Generic **O**bject-**O**riented **S**ubstation **E**vent

Ground

The conductive ground whose electric potential can be set equal to 0 at every point. In the area of grounding conductors, the ground can have a potential diverging from 0. The term **reference ground** is also used for this situation.

Grounding

The grounding is the entirety of all means and measures for grounding.

IEC

International **E**lectrotechnical **C**ommission - International Electrotechnical Standardization Body

Parameterization

Comprehensive term for all setting work on the device. You can set parameters for the protection functions with DIGSI 5 or sometimes also directly on the device.

PB Client

Process-**B**us client. The sampled measured values subscriber is designated as a process-bus client.

RSTP

Rapid-**S**panning **T**ree **P**rotocol

SFP

Small **F**orm-Factor **P**luggable

SNMP

Single **N**etwork **M**anagement **P**rotocol

SNTP

Single **N**etwork**T**ime **P**rotocol

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