SIEMENS

# SIMATIC TDC

# SIMATIC TDC hardware

System Manual




08/2015

A5E01114865-10

# Legal information

## Warning notice system

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

**⚠DANGER**

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

**⚠WARNING**

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

**⚠CAUTION**

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

**NOTICE**

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

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

## Qualified Personnel

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

## Proper use of Siemens products

Note the following:

**⚠WARNING**

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

## Trademarks

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

## Disclaimer of Liability

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

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# Preface

## Purpose of this manual

This manual describes the principles of using the functions of the hardware components, while setting the focus on the corresponding Technology and Drive Control components SIMATIC TDC.

## Basic knowledge required

This manual is intended for commissioning personnel. Comprehension of this manual requires general knowledge of automation engineering.

## Scope of the manual

This manual is valid for SIMATIC D7-SYS as of version 8.1.

## Position in the information landscape

This manual is part of the documentation package for the Technology and Drive Control components FM 458, SIMATIC TDC and SIMATIC D7-SYS.

| Title | Content |
|---|---|
| System and Communication Configuration D7-SYS (http://support.automation.siemens.com/WW/view/de/8776461/0/en) | **Just a few steps away from the first project**<br>This section provides an extremely simple introduction into the methodology of the structure and programming of the SIMATIC TDC control system. It is interesting especially for first-time users.<br>**System software**<br>This section communicates basic knowledge of the structure of a CPU's operating system and application programs. It should be used under the aspect of obtaining an overview of programming methodology and using this information as a basis for designing user programs.<br>**Configuring communication**<br>This section communicates basic knowledge of the communication possibilities and how to configure links to communication partners. |
| D7-SYS - STEP 7, configuring CFCs and SFCs (http://support.automation.siemens.com/WW/view/de/8776786/0/en) | **Basic software**<br>This section explains the principles of the usage and functions of the STEP 7 automation software. Newcomers are provided an outline of the procedures to follow when configuring, programming, and commissioning a station.<br>While working with the basic software, you can directly rely on the Online Help system that offers support when it comes to detailed questions on using the software.<br>**CFC**<br>The CFC language (Continuous Function Chart) offers you the possibility of designing graphic interconnections for blocks.<br>While working with the particular software, you can always consult the Online Help to get answers to detailed questions regarding the use of the editors/compiler.<br>**SFC**<br>Configuring sequential controls using SIMATIC S7 SFCs (Sequential Function Chart).<br>You create the sequential chart in the SFC Editor based on various graphic resources and position the SFC elements of the chart according to defined rules. |
| Hardware | These manuals form a reference for the entire hardware spectrum. |
| D7-SYS Selecting function blocks (http://support.automation.siemens.com/WW/view/de/14952400/0/en) | The Reference Manual provides you with an overview of all of the function blocks for the corresponding Technology and Drive Control components SIMATIC TDC, FM 458-1 DP as well as the T400 and SIMADYN D systems which are being phased out.<br>**Section 1**<br>This section describes the function blocks that can be configured in **all target systems** of SIMATIC D7-SYS.<br>**Section 2**<br>This section describes the function blocks that can be configured **only** for SIMATIC TDC.<br>**Section 3**<br>This section describes the function blocks that can be configured **only** for the FM 458-1 DP application module.<br>**Section 4**<br>This section describes the function blocks that can be configured **only** for SIMADYN D and T400. |

## Signpost

As first-time user, you should use the manual as follows:

- Read the initial sections before using the software so that you become familiar with the terminology and procedural principles.
- You can then go ahead and use the respective sections of the manual, for example, if you intend to run a specific task (e.g. loading programs).

If you have already gained some experience while running a small project, you can read individual sections of the manual in order to obtain information on specific topics.

## Special notes

The objective of the user part of this manual is to provide information on basic procedures, but does not contain any detailed instructions with individual step sequences. For more information on the software dialogs and their handling, refer to the Online Help.

## Recycling and disposal

The products can be recycled due to their low-pollutant content. Contact a certified electronic-waste disposal company to recycle and dispose of your old equipment in an environment-friendly manner.

## Additional support

- You can find information on the technical support offer in the appendix (Page 221) to this documentation.
- You can find the offer for technical documentation for the individual SIMATIC products and systems on the Internet.
- You can find the online catalog and online ordering system on the Internet.

## Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. You can find more information about industrial security on the Internet.

To stay informed about product updates as they occur, sign up for a product-specific newsletter. You can find more information on the Internet.

## See also

IndustrialSecurity (http://www.siemens.com/industrialsecurity)

http://support.automation.siemens.com (http://support.automation.siemens.com)

## Open Source Software

Open-source software is used in the firmware of the product described. Open Source Software is provided free of charge. We are liable for the product described, including the open-source software contained in it, pursuant to the conditions applicable to the product. Siemens accepts no liability for the use of the open source software over and above the intended program sequence, or for any faults caused by modifications to the software.

For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices.

You can find this information on the supplied CD/DVD.

# Table of contents

# Installation and EMC guidelines

# 1

**Note**

These Operating Instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

If you need further information or encounter special problems that are not adequately treated in the operating instructions, you can obtain the necessary information from your local Siemens office.

Furthermore, the contents of these Operating Instructions shall not become a part of or modify any prior or existing agreement, commitment, or legal relationship. All obligations on the part of Siemens AG are contained in the respective sales contract which also contains the complete and solely applicable warranty conditions. These contractual guarantee provisions are neither broadened nor restricted by the text in these operating instructions.

## 1.1 Qualified personnel

in the context of the operating manual or of warning notices on the product itself are persons familiar with installation, assembly, commissioning and operation of the product and holding qualifications appropriate to their activity, such as:

1. Trained and authorized to power up, shut down, ground and tag electrical circuits and equipment in accordance with safety standards.
2. Trained in the proper care and use of protective equipment in accordance with safety standards.

## 1.2 Danger and warning information

**⚠ WARNING**

**Danger, high voltage**

During operation of electrical devices, certain parts of these devices are necessarily under dangerous voltage.

Ignorance of the safety instructions may result in severe injury or property damage.

Particularly the warning notes in the corresponding Operating Instructions must be strictly observed.

**NOTICE**

**Electrostatic sensitive devices**

The modules contain components that are sensitive to electrostatic charge. Always discharge your body before you touch an electronic module. This can be done quite simply by touching a conductive, grounded object immediately before you handle the component (e.g. bright metal parts of the control cabinet, grounding contact of socket outlet.)

**NOTICE**

**Lifting and carrying heavy loads**

Note the regulations/notes on lifting and carrying heavy loads.

**NOTICE**

**Cleaning the devices**

Use only a vacuum cleaner and dry cloths to clean the devices.

# 1.3 Introduction

## What is EMC ?

Electromagnetic compatibility (EMC) is the ability of an electrical device to function, fault-free in a specified electromagnetic environment without influencing the environment in an inadmissible fashion.

This design and EMC Directive supplements the documentation on the individual components.

The SIMATIC TDC control system consists of individual components (e.g. racks, modules, interface modules, operator control panels, position transmitters). The components can be installed in the widest range of system configurations to suit individual requirements. In an environment that contains distributed components it is imperative not to neglect interference and to conform with special installation and EMC requirements of the plant.

EMC therefore represents a quality feature for

- **Intrinsic immunity to interference:** Resistance against internal electrical disturbance variables
- **Immunity to external interference:** Resistance of the system against external electromagnetic disturbance variables
- **Degree of interference emission**: Environmental effects caused by electromagnetic radiation

## Operational reliability and immunity to interference

The manufacturer of the control system and users (including end customers) must take specific measures in order to achieve the maximum possible operational reliability and safety and interference immunity for a complete system (control and drive system).

Proper functioning of SIMATIC TDC can only be ensured if all of these measures have been observed in compliance with legal provisions (2004/108/EC).

## 1.4 CE label

Our products meet the requirements and protection objectives of the EC Directives listed below and comply with Harmonized European Standards (EN) for programmable controllers that were published in the Official Journals of the European Community:

- 2006/95/EC "Electrical equipment for use within specific voltage limits" (Low-voltage directive)
- 2004/108/EC "Electromagnetic Compatibility" (EMC Directive)

The EC Declarations of Conformity are available to relevant authorities at the following address:

Siemens AG

Digital Factory

Factory Automation

DF FA AS DH AMB

PO box 1963

92209 Amberg / Germany

## 1.5 EMC Directive

SIMATIC products are designed for use in industrial environments.

### Industrial aera of applicaion

- Interference emission requirements to EN 61000-6-4: 2007 + A1:2011
- Immunity to interference requirements to EN 61000-6-2: 2005

## 1.6 Low-voltage directive

The products listed in the table below fulfill the requirements of EU directive 2006/95/EC, "Low-voltage Directive". Compliance with this EC directive was tested in accordance with DIN 61131-2 (corresponds to IEC 61131-2).

The following components are also affected in SIMATIC TDC:

| Name | Article number |
|---|---|
| UR5213 | 6DD 1682-0CH0 |
| PS5213 | 6DD 1683-0CH0 |
| UR5213 | 6DD 1682-0CH2 |
| UR6021 | 6DD 1682-0CH3 |
| SB 60 | 6DD 1681-0AF4 |
| SB 70 | 6DD 1681-0AG2 |

These components are compliant with requirements of the Low-voltage Directive.

## 1.7 Machinery directive

In accordance with the Machinery Directive 2006/42/EC, it must be ensured that a failure or malfunction of SIMATIC TDC will not trigger a hazardous state of the machine/plant. This must always be taken into account when configuring the machine/system.

The system may not be commissioned until it has been proven that the final product is in compliance with the directive.

### Expert personnel

Only expert personnel may configure, commission, service and operate SIMATIC TDC.

### Input of external voltages

An external voltage source (e.g. pulse encoder) that is connected to SIMATIC TDC module inputs must be shut down simultaneously with the shutdown or failure of the SIMATIC TDC power supply.

## 1.8 Installation

SIMATIC TDC components are considered open equipment that must be installed in metallic enclosures containing shielding and equipotential busbars in compliance with the requirements of IEC 61131-2 (11.1.2; mechanical strength, flame resistance, stability and shock protection are significant here).

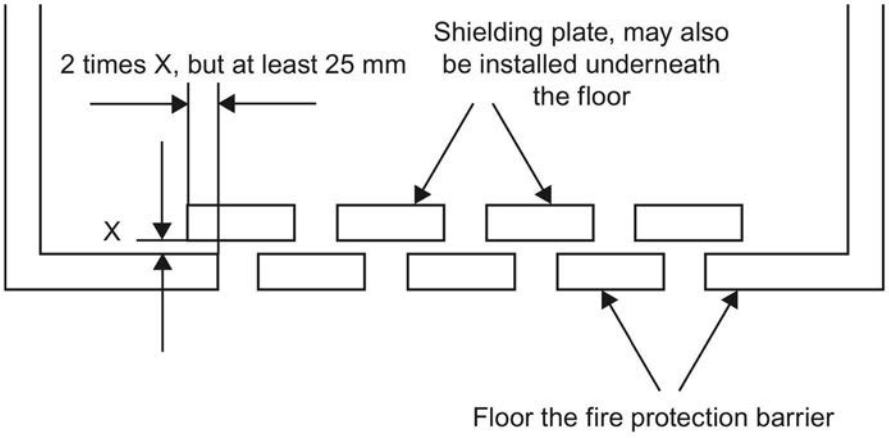
## 1.9 Fire protection

As output power exceeds the limit of circuitry with power limiting to IEC 61010-1 / IEC 61131-2, malfunction of a SIMATIC TDC component may pose the risk of fire according to IEC 61010-1 / IEC 61131-2. In order to prevent spreading of fire, suitable measures must be taken to prevent ignition of adjacent parts or components as a result of burning parts that possibly drop out of a component.

Two examples of a fire protection barrier to IEC 61010-1

## Example 1

### Partition below the rack



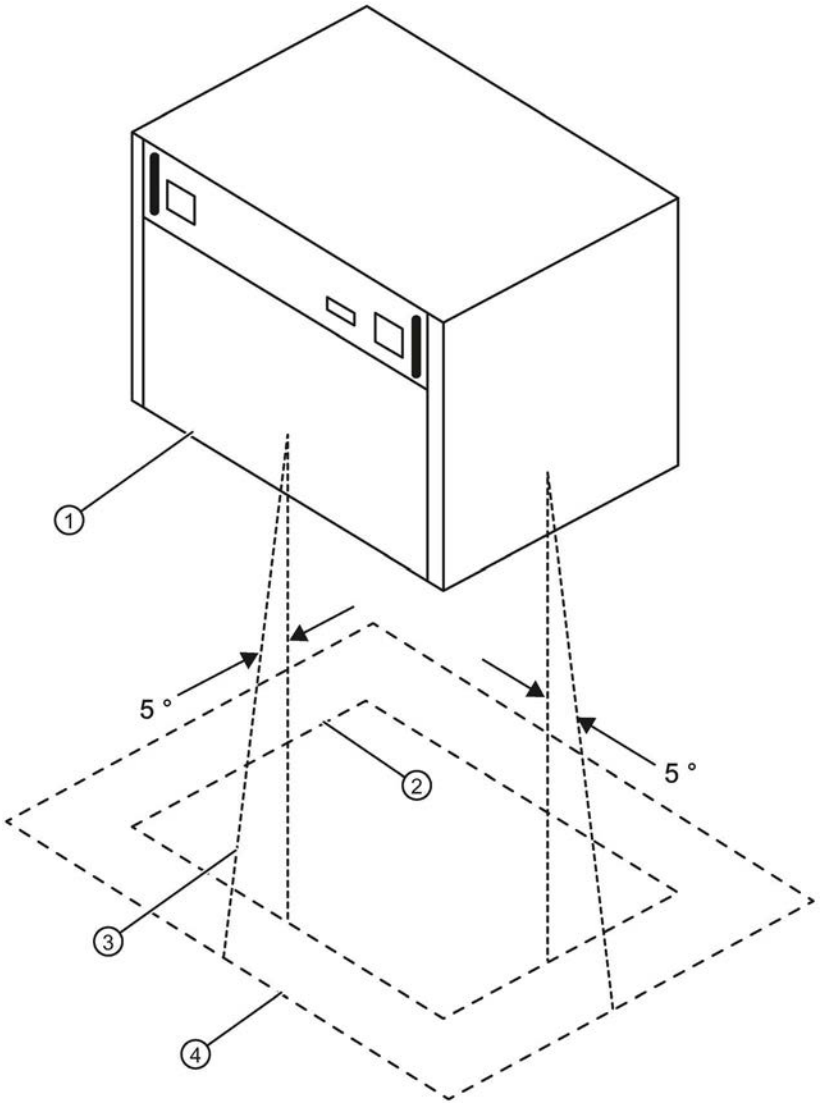

## Example 2

### Metal panel

Accepted perforation of a metal panel

| Minimum thickness [mm] | Maximum diameter of the holes [mm] | Minimum hole pitch, center-center [mm] |
|---|---|---|
| 0.76 | 1.1 | 1.7 (35 holes/100 $mm^2$) |
| 0.76 | 1.2 | 2.4 |
| 0.89 | 1.9 | 3.2 (10 holes/100 $mm^2$) |
| 0.99 | 1.6 | 2.7 |

**Minimum size of the fire protection barrier**




① Rack
② Vertical projection of the rack
③ $+5^0$ from the vertical projection profile
④ Minimum size of the barrier

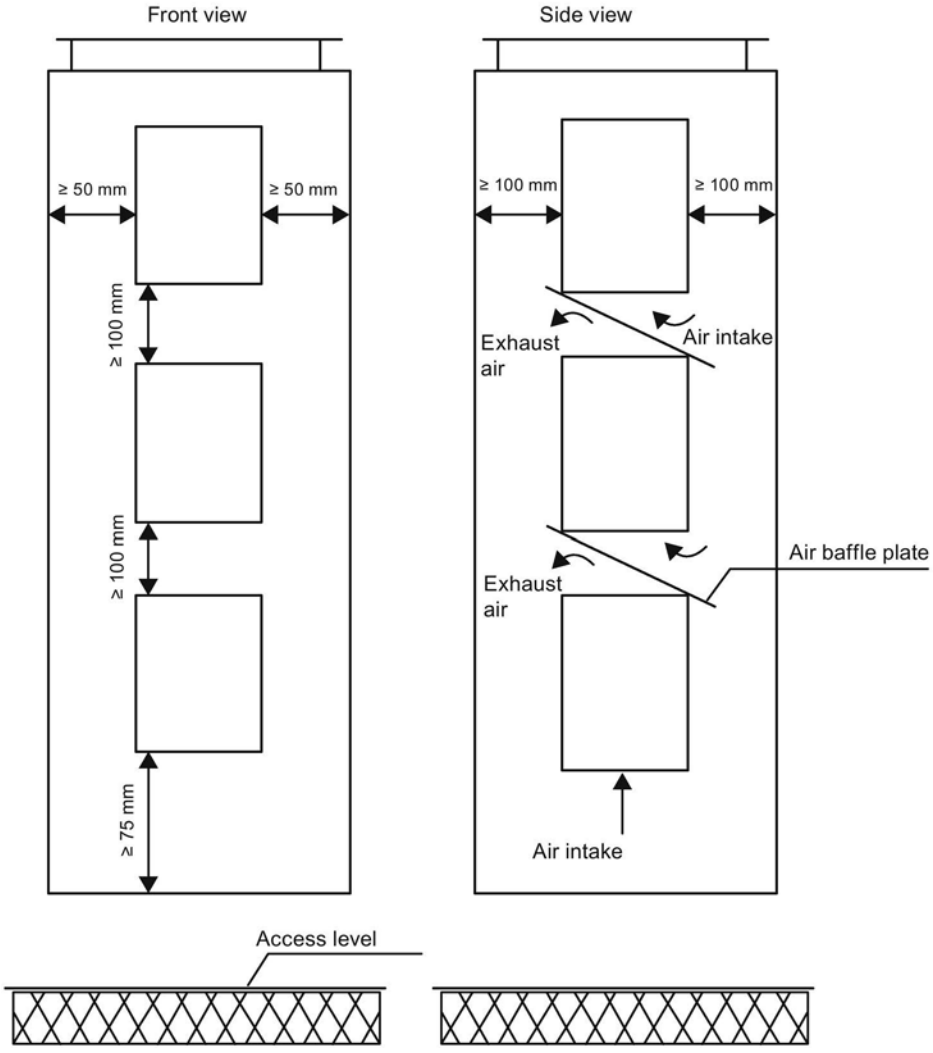
## 1.10 Control cabinet

- All control cabinets must be equipped with a grounding/equipotential busbar that must be connected directly to the cabinet frame at both ends.
- It is not allowed to operate contactors without protective circuit in a control cabinet containing SIMATIC TDC components.
- If contactors without protective circuit are operated in a control cabinet next to the SIMATIC TDC cabinet, the cabinets must be partitioned by means of a sheet steel panel.
- All control cabinets in which SIMATIC TDC components are operated must be equipped with a shielding busbar that must be connected directly at both ends to the cabinet frame.
- It is not allowed to use gas discharge lamps in the cabinet.
- The cabinet must be designed to enable unobstructed air convection.

## Arrangement and clearances

The following minimum dimensions must be maintained for stacked installations of SIMATIC TDC racks:

e.g. control cabinet 2200 x 600 x 600 mm

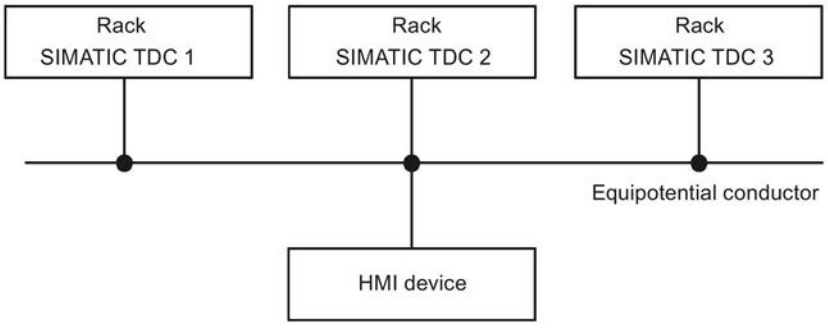


# 1.11 Equipotential bonding

In order to ensure disturbance-free operation, the networked components may not develop different potentials. For this reason, all components must be interconnected by means of equipotential bonding with a minimum cross-section of 16 $mm^2$.

## Principle of the connection

All components (racks, power supplies, etc.) that are connected by signal cables must also be interconnected by means of equipotential bonding (exception: components with fiber-optic connections).

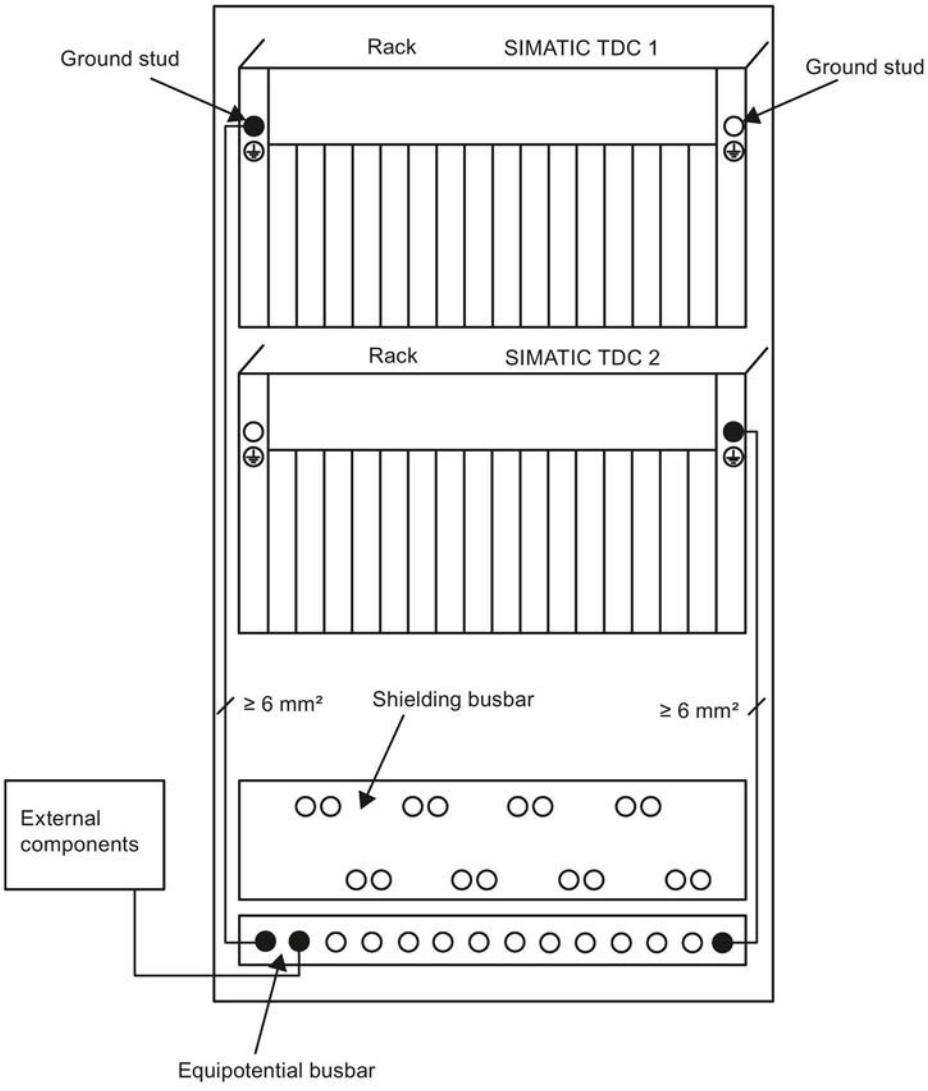



## Equipotential busbar

An equipotential busbar should be provided in each control cabinet to facilitate wiring.

All internal and external components must be interconnected with this equipotential busbar.

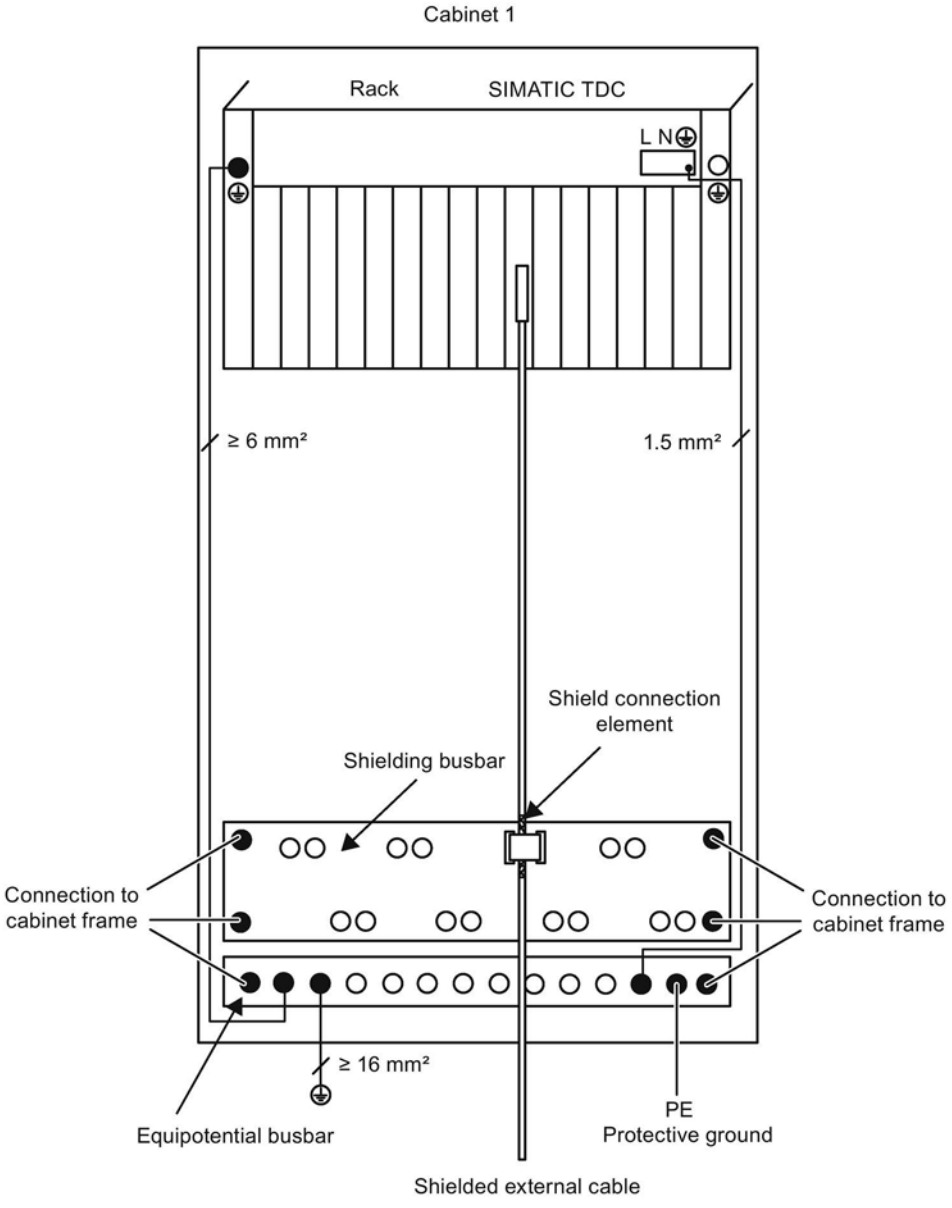
## Schematic circuit diagram



## Practical application examples

### Termination of an external shielded cable

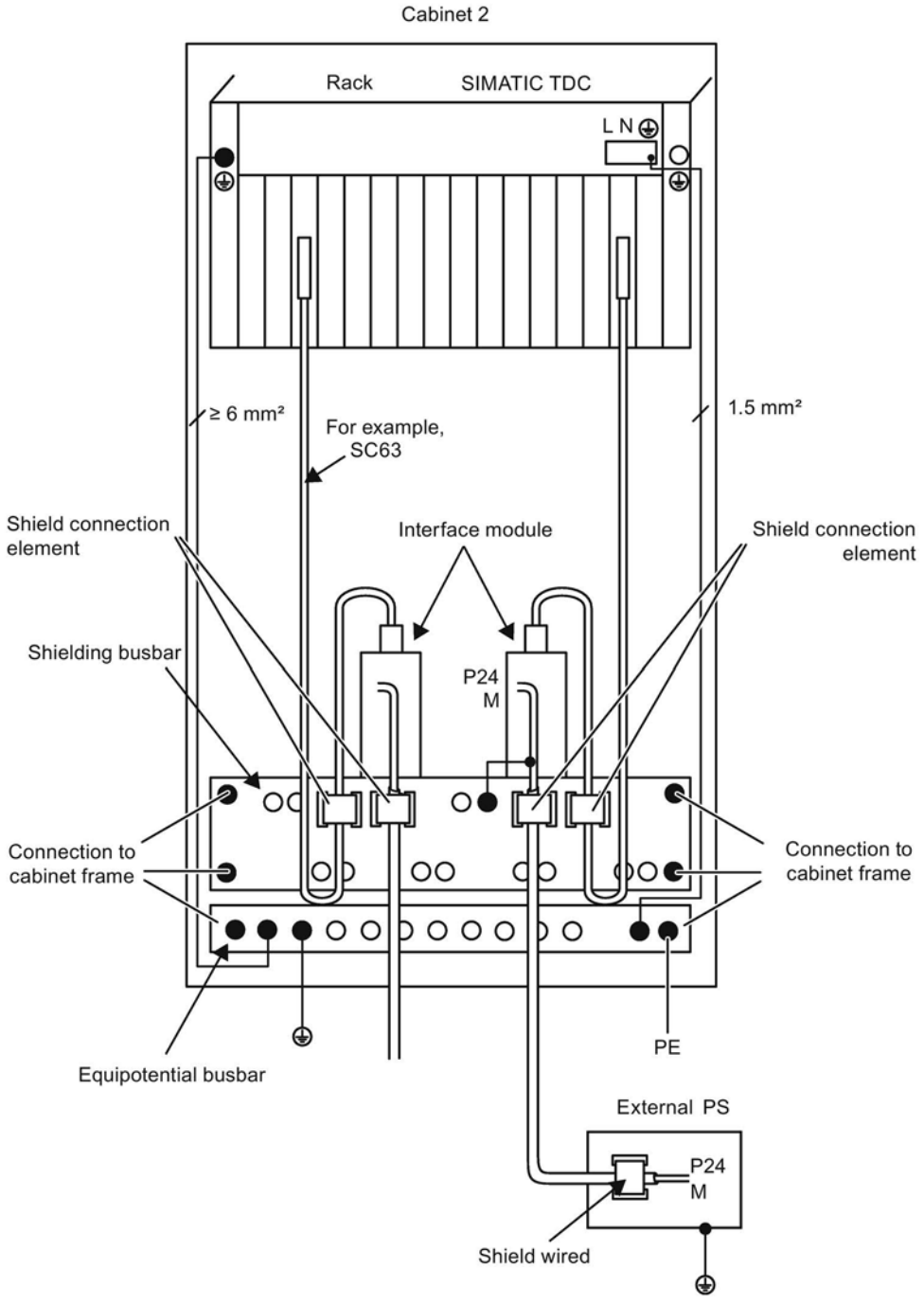
The shield must be connected to the shielding bus.



**Termination of an external shielded cable with supply via interface module**

The shield must be connected to the shielding bus.

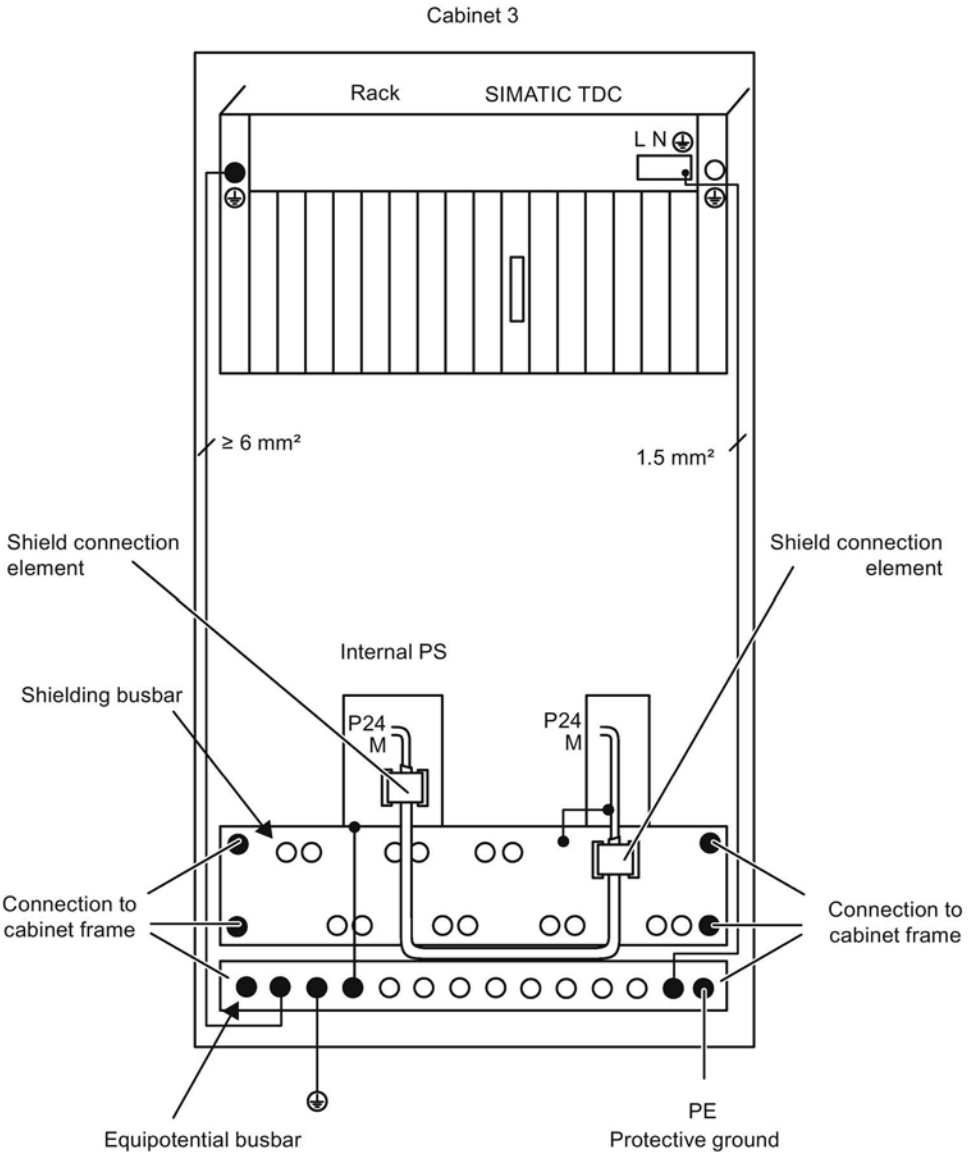
Ground of the external power supply must be wired to the shielding busbar, or to the equipotential busbar.



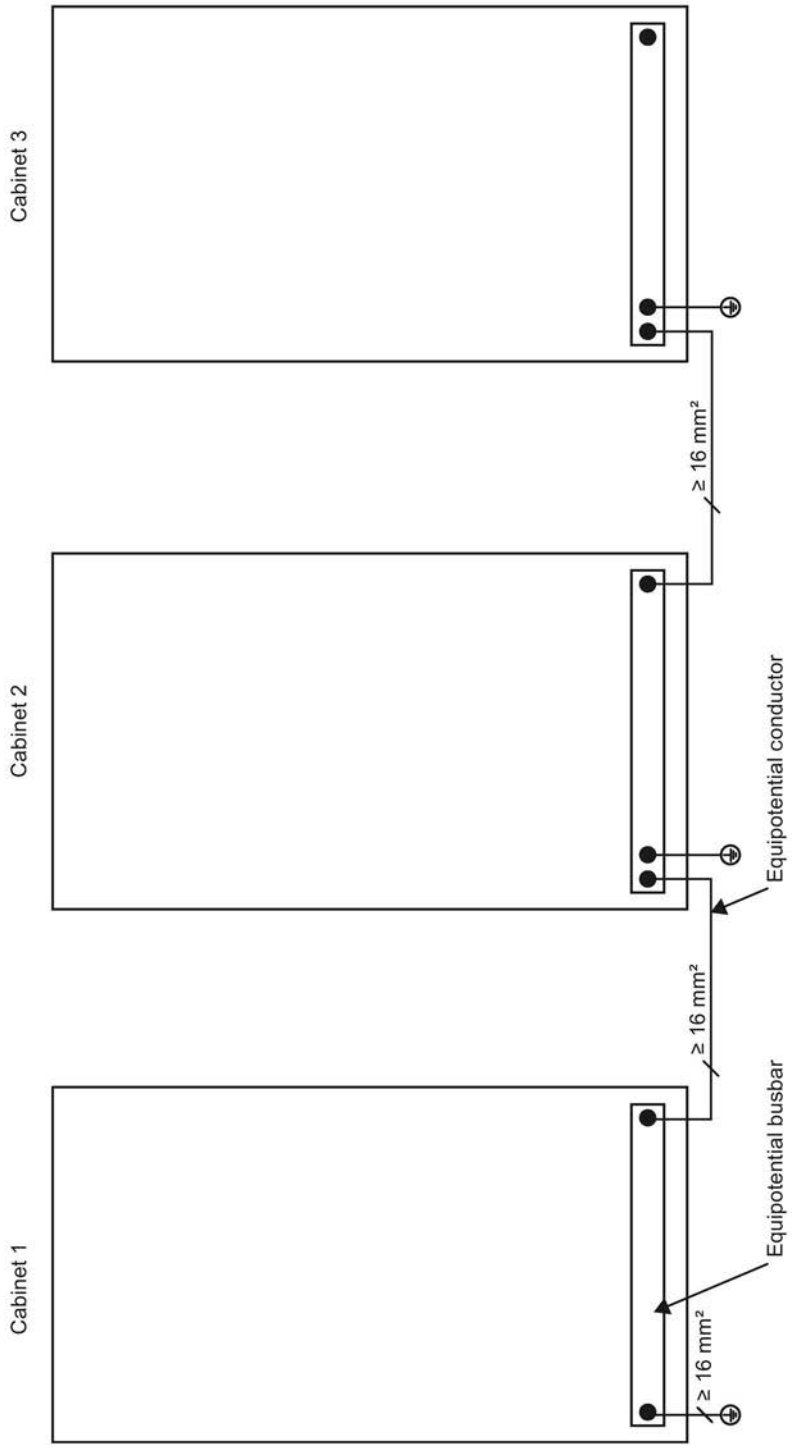
**Termination of an internal power supply via interface module**

The shield must be connected to the shielding bus.

Ground of the internal power supply must be connected to the shielding busbar, or to the equipotential busbar.



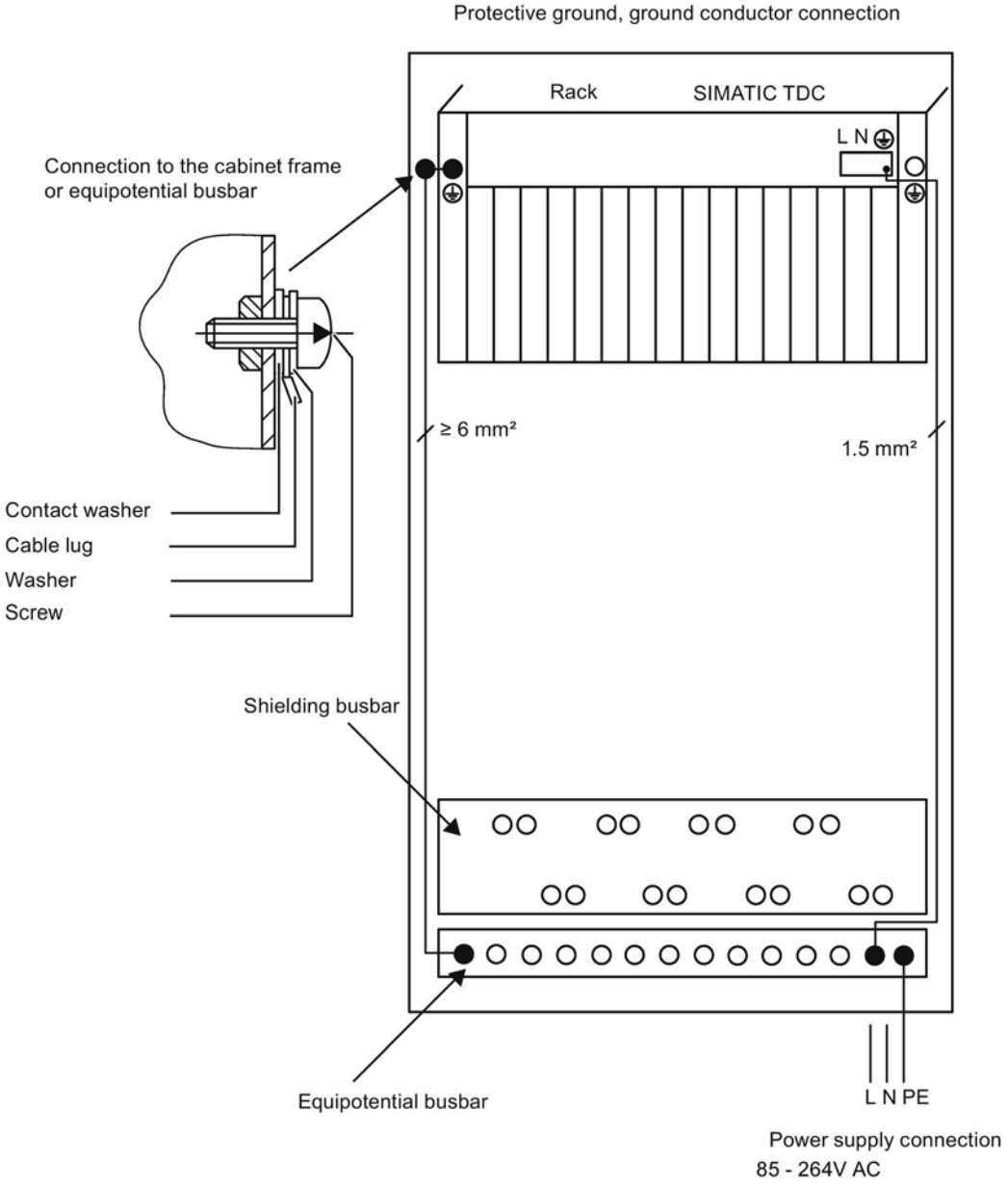
**Example of grounding and potential equalization**



## 1.12 Protective ground

Protective ground is bonded to the cabinets or components via PE conductor. It is required in SIMATIC TDC for safe operation and as interference suppression measure.

The protective conductor must be routed and dimensioned in accordance with IEC 61131-2 (11.9).

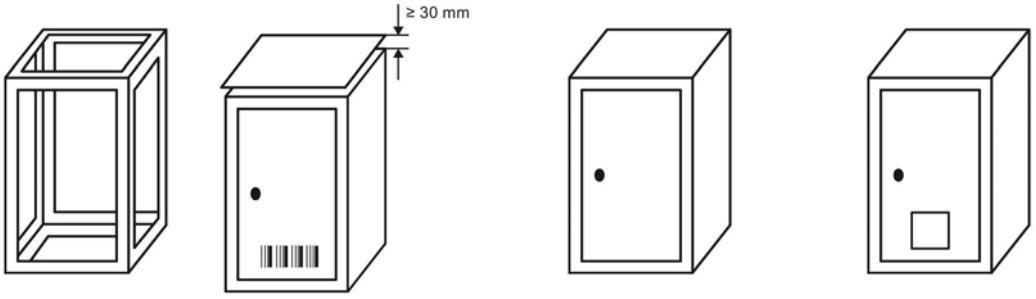


# 1.13 Power losses in the control cabinet

The dissipation capability of a cabinet and therefore the air intake temperature of the rack depends on the type of cabinet, on the ambient temperatures and on the internal arrangement of the devices.

## Built-in versions

1) 2) 3) 4)




| 1) | 2) | 3) | 4) |
|---|---|---|---|
| Frame / panel | Control cabinet (open) with open-circuit ventilation<br>Air vents > 600 cm² | Cabinet (closed) with intrinsic convection and forced convection | Closed cabinet with heat exchanger |

For installation variants 1) and 2), it is presumed that there is a clearance of at least 1 meter between the top of the control cabinet and the building's ceiling.

## SHUTDOWN MODE

Using the SHUTDOWN MODE switch the user can select whether to shut down the rack immediately on failure of the first fan, or not until an additional fan failure.

| Shutdown mode | |
|---|---|
| ONE / ON | Shutdown is initiated upon the failure of one fan |
| TWO / OFF | Shutdown is initiated upon the failure of one or more fans |

For additional rack-specific information see:

UR6021 (6DD1682-0CH3) Control and display elements (Page 43)

UR5213 (6DD1682-0CH2) Control and display elements (Page 57)

UR5213 (6DD1682-0CH0) Control and display elements (Page 69)

**Note**

In the SHUTDOWN MODE, the internal output voltages of the rack are switched off. External voltages connected to the module input must be switched off simultaneously (refer to section Machinery directive (Page 17)).

## Air intake temperature

The maximum air intake temperature on the SIMATIC TDC may not be exceeded. The following limits are valid, depending on the "shutdown mode" switch setting.

| Shutdown mode | Maximum air intake temperature up to 2000 m above sea level |
|---|---|
| ONE / ON<br>Shutdown on fan failure | 60° Centigrade |
| TWO / OFF<br>Shutdown on failure of two fans | 35° Centigrade |

# 1.14 Power supply

## Measures against disturbance voltages

The following notes related to the EMI/EMC measures to take for systems/plants should be observed in order to avoid disturbance peaks on the supply cables in the cabinet:

## Interference suppression on mains

The power supply of the rack already has a line filter with sufficient attenuation (refer to "Manufacturers declaration").

For more demanding applications, you can install an additional line filter (e.g. 250 V AC / 10 A) or overvoltage arrester in the mains line, as close as possible to the cable entry on the cabinet. Ground of the line filter/arrester must be wired to the equipotential busbar of the cabinet using the shortest possible conductor length.

## 24 V power supply

To attenuate external interference, a line filter must be provided for the 24 V power supply of the digital I/O (e.g. SIFI-B line filter, Order No. B84112-B-.... from Epcos/NF 1-1 line filter of Phoenix Contact). This filter should be installed as close as possible to the terminal block. The shield connections of the line filter must be bonded to ground across the shortest possible distance.

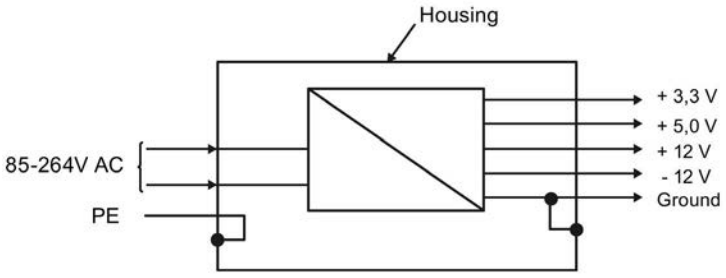
The 24 V power supply must also be equipped with lightning/overvoltage protection.

For more information, refer to the installation manual "SIMATIC Automation Systems S7-400, Hardware and Installation (http://support.automation.siemens.com/WW/view/de/1117849/0/en)".

| NOTICE |
| --- |
| **Network devices**<br>Safe electrical isolation to IEC 61131-2 IEC 61131-2 (11.1.2.1.3) must be ensured for all power supply units operated on SIMATIC TDC devices and modules. |

### Potentials of power supply

In SIMATIC TDC, the ground connections of all secondary voltages are grouped and bonded to the rack enclosure in order to improve the signal to interference ratio and to ensure proper grounding.




## 1.15 Rack

- The rack must be bonded to the grounding/equipotential busbar using the shortest possible conductor with a minimum cross-section of 16 mm²; refer to Equipotential bonding (Page 22).
- All modules and front panels must be screwed onto the rack. This rule also applies to commissioning phase!
- Unused slots must be provided with SIMATIC TDC dummy front panels type SR 51 6DD 1682-0DA1.
- The connectors must be screwed/interlocked to the front panel.
- The limit of the air intake temperature may not be exceeded on the rack; refer to Control cabinet (Page 20). The rack must be installed in a way that safely excludes heat accumulation; refer to Fire protection (Page 17).
- The air intake of the rack must be free of dust as far as possible. The air intake of the rack (bottom) must be cleaned at cyclic intervals depending on the degree of soiling.

**Note**

The modules may **not** be inserted or removed while the rack is on live voltage. Exception: Memory sub-modules MC 5xx / MMCs.

As a matter of principle it is not advisable to remove and insert memory sub-modules or front connectors on the live component.

For module-specific notes, refer to the corresponding user documentation (hardware).

# 1.16 Cables

- **All signal cables** you install must be shielded. All cables assembled by users must be wired with strain relief.
- **Serial signal lines** must be shielded. The shield must be bonded to a metalized connector housing, as well as to the shielding busbar. The cable shielding may not be wired to pin 1 of the connector.
- The **power cable** for the rack power supply does not require shielding. The permitted operating voltage of the power cable used may not be less than the supply voltage.
- **Power supply cables** for safety extra low voltages (e.g. 24 V DC) must be shielded. A power supply cable that is routed via interface module must be bonded to the shielding busbar as specified in section "Connection via interfacee module".
- **External power supply ground** must be bonded to the equipotential busbar; refer to "Equipotential bonding (Page 22)".
- **Cables on system side** and cables interconnecting the interface module with SIMATIC TDC should not be routed through the same cable duct.
- A minimum clearance of > 10 cm must be maintained **between signal lines and power cables** carrying voltages less than 500 V and > 30 cm to power cables carrying voltages of more than 1 kV.

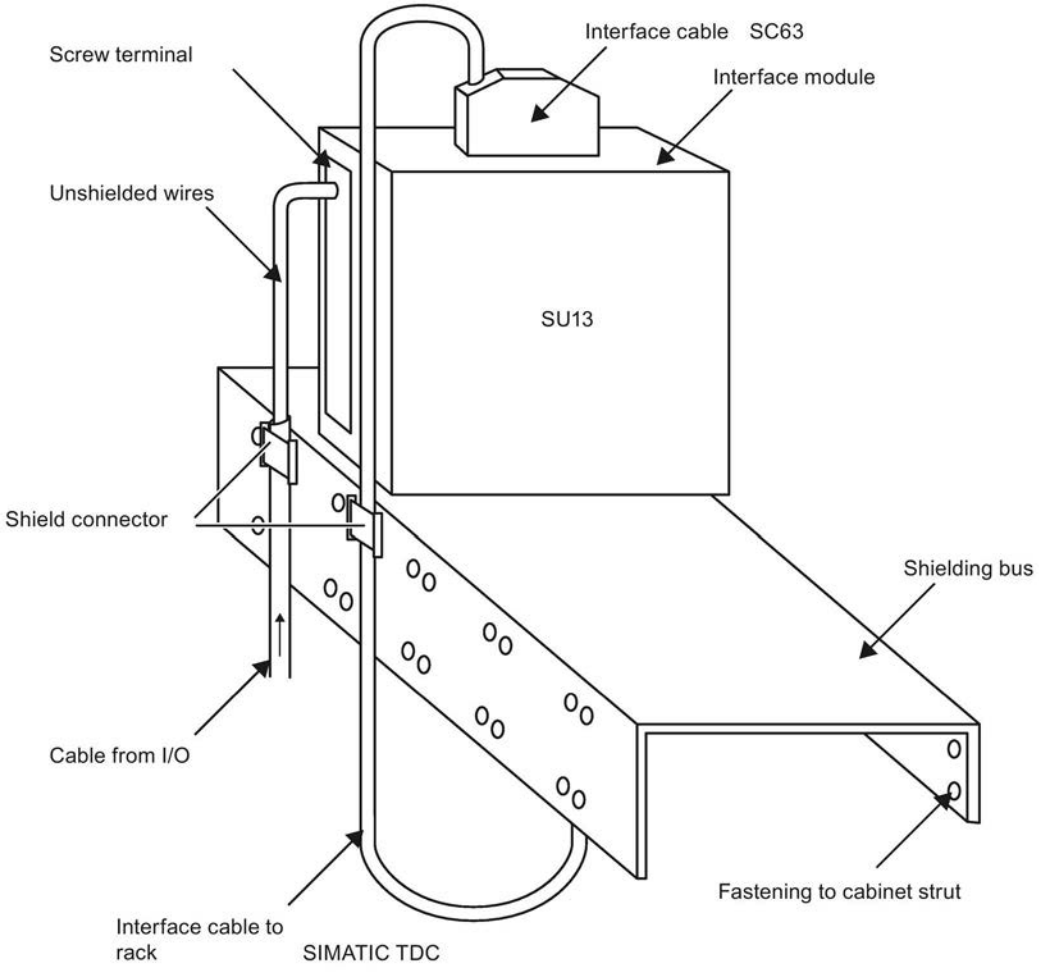
### Design and temperature resistance

All cables must be made of copper and be able to resist temperatures of up to at least 90 °C.

## Connection via interface module

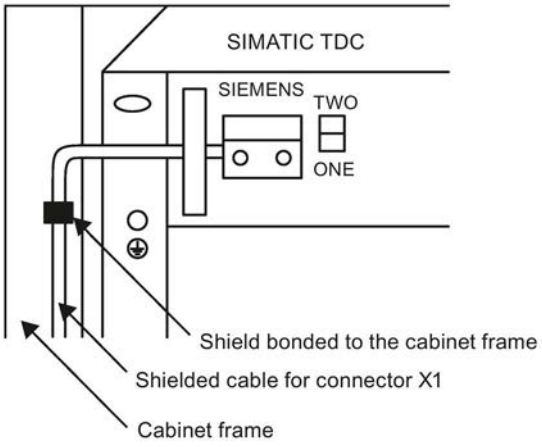
If interface modules are used, the shields of system-side cables and of routed the interface module to SIMATIC TDC must be bonded to ground directly above or below the interface module. Unshielded conductors that are terminated to screw terminals should be kept as short as possible.

All lines should be kept as short as possible.



### Connector X1 (UR6021 6DD1682-0CH3 and UR5213 6DD1682-0CH2)

The cable wired to connector X1 on the rack must be shielded. The shield should be terminated as close as possible to connector X1. You can connect conductor cross-sections from 0.5 $mm^2$ to 1.5 $mm^2$.




Comment: We recommend using ferrules when using flexible cables.

# 1.17 ESD Directives

Almost all of the SIMATIC TDC modules contain highly integrated components. Due to their technology, these components are highly sensitive to overvoltage and, therefore, to ESD.

## ESD

The abbreviation stands for **e**lectro**s**tatic **d**ischarge

Modules equipped with such components are identified by the following warning label on component side:

Electrostatic sensitive components can be destroyed by voltages and power levels far below human perception. Components or modules are possibly exposed to such voltages when touched by humans who have not been not electrostatically discharged. Following such voltage peaks, it is usually impossible to identify malfunction of the component immediately, as it needs an extended operating time before such malfunctions are disclosed.

## Handling ESD modules

- As a matter of principle, you should never touch electronic modules unless this is unavoidable in the course of work to be carried out on the component.
- Do not touch components unless
  - you are continuously grounded by means of an ESD bracelet, or
  - or by wearing ESD shoes, or ESD shoe grounding strips.
- Always discharge your body before you touch an electronic module. This can be done quite simply by touching a conductive, grounded object immediately before you handle the component (e.g. bright metal parts of the control cabinet, water pipe etc.)
- Modules may not come into contact with highly insulating materials that are subject to electrostatic charge, e.g. plastic foils, insulating table plates, clothing made of artificial fiber.
- Modules must always be placed onto conductive surfaces (table with ESD mat, conductive ESD foam rubber, ESD packaging bags, ESD transport containers, cardboard or paper mats).
- Modules may not be brought close to data terminals, monitors, or television sets.

## Measuring and modifying ESD modules

- Measurements may only be taken on the modules when
  - The measuring devices is grounded (e.g. via PE conductor), or
  - The measuring head has been briefly discharged (e.g. by touching a bright metal part of the control enclosure) prior to measurement with an electrically isolated measuring device.

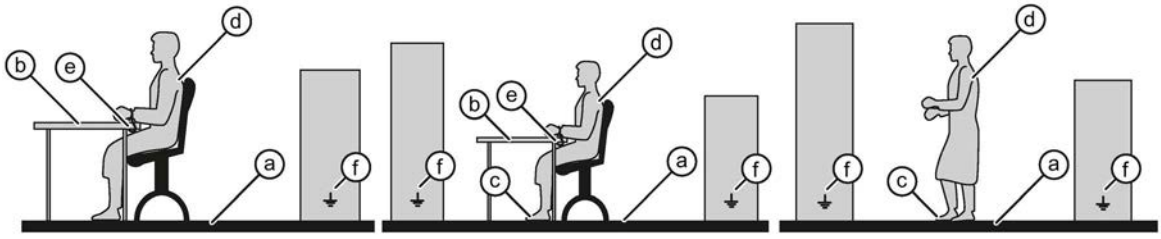
Always use ESD soldering irons for soldering work on modules, or at least grounded soldering tips.

## Shipping modules

Modules and components must always be stored and shipped in conductive packing materials (e. g. metalized plastic boxes, metal containers).

If using non-conductive packaging, you must protect the modules with a wrapping of made of conductive material, e.g. conductive foam rubber, or household aluminum foil.

The following figure once again emphasizes the necessary ESD protective measures.




a Conductive flooring
d ESD coat
b ESD tables = ESD chain
c ESD shoes
f Ground connection of the cabinets
e ESD bracelet

# General technical specifications

# 2

## 2.1 Climatic conditions

Table 2- 1

| | |
|---|---|
| Storage and transport conditions | IEC 60721 Part 3-2 Class 2K1, without condensation |
| Storage temperature | -40 °C to +70 °C |
| Operating conditions | IEC 60721 Part 3-3 Class 3K3, stationary use, weather-protected |
| Operating temperatures<br>(air intake temperature) | 0 °C to + 60 °C; shutdown mode ONE<br>0 °C to + 35 °C; shutdown mode TWO<br>refer to "Power losses in the control cabinet (Page 29)" |
| Atmospheric pressure<br>Storage<br>Operation | <br>1080 to 660 hPa (corresponds to -1000 m to +3500 m)<br>1080 to 795 hPa (corresponds to -1000 m to +2000 m) |
| Pollutant stress<br>Gases posing the risk of malfunction<br><br><br>Dust posing the risk of malfunction | <br>ISA-S71.04 severity level G3<br>$SO_2$ 10 $cm^3/m^3$<br>$H_2S$ 1 $cm^3/m^3$<br>Conditions of use according to IEC 60721, Part 3-3; Class 3S2 (without sand in air) |

## 2.2 Electrical protection and safety requirements

| | |
|---|---|
| Safety regulations | IEC 61131-2 |
| Protection class | Protection class I (with PE/ground conductor) |
| Protection against the ingress of foreign particles and water | IP 20 |

## 2.3 External supply of the SIMATIC TDC modules (digital outputs)

Safety extra low voltage (SELV/PELV circuit) to IEC 60364-4-41.

## 2.4 Mechanical requirements

The following table provides information on the type and scope of checks regarding mechanical ambient conditions.

| Tested for | Test standard | Note |
|---|---|---|
| Vibrations | Vibration test according to IEC 60068-2-6 (sine) | Type of vibration: Frequency cycles with a rate of change of 1 octave/minute<br>10 Hz ≤ f ≤ 58 Hz, constant amplitude 0.075 mm<br>58 Hz ≤ f ≤ 150 Hz, constant acceleration 1 g<br>Duration of vibration: 10 frequency cycles per axis in each of the 3 axes which are perpendicular to each other |
| Shock | Shock test according to IEC 60068-2-27 | Type of shock: half-sine<br>Strength of shock: 15 g peak value, 11 ms duration<br>Shock direction: 3 shocks each in +/– direction in each of the three perpendicular axes |

## 2.5 Electromagnetic requirements (industry)

| | |
|---|---|
| Interference emission | EN 61000-6-4 : 2007 + A1:2011 |
| Immunity to interference | EN 61000-6-2 : 2005 |

| NOTICE |
|---|
| **Using two-way radios and mobile telephones**<br>The use of two-way radios and mobile phones in the immediate range of SIMATIC TDC can influence the operation of the device. |

# Rack

# 3

## 3.1 Rack UR6021 (6DD1682-0CH3)

### 3.1.1 Areas of application

Rack UR6021 with 21 slots forms the mechanical base for SIMATIC TDC

The system power supply is installed in the rear area of rack.

There is a fan tray in the upper part of the rack, which includes the monitoring and signaling functions in addition to the fans.

The fan tray can be ordered as spare part (6DD1683-0CH3) and can be replaced by qualified personnel.

A high-performance 64-bit backplane bus supports high-speed data exchange between the inserted modules.

The CPU555 used in UR6021 supports P0 functionality.

For fast, direct communication between CPU555 modules, the rack UR6021 has a P0 connector in slots 01, 02, 03, 04, 09, 11, 13 and 15. Each CPU555 can communicate with up to 7 additional CPU555 by means of the PCIe interface via the backplane bus (P0 connector). This means that a point-to-point connection always exists between any two CPU555 modules.

#### See also

Ventilation/cooling (Page 49)

## 3.1.2 Mechanical layout

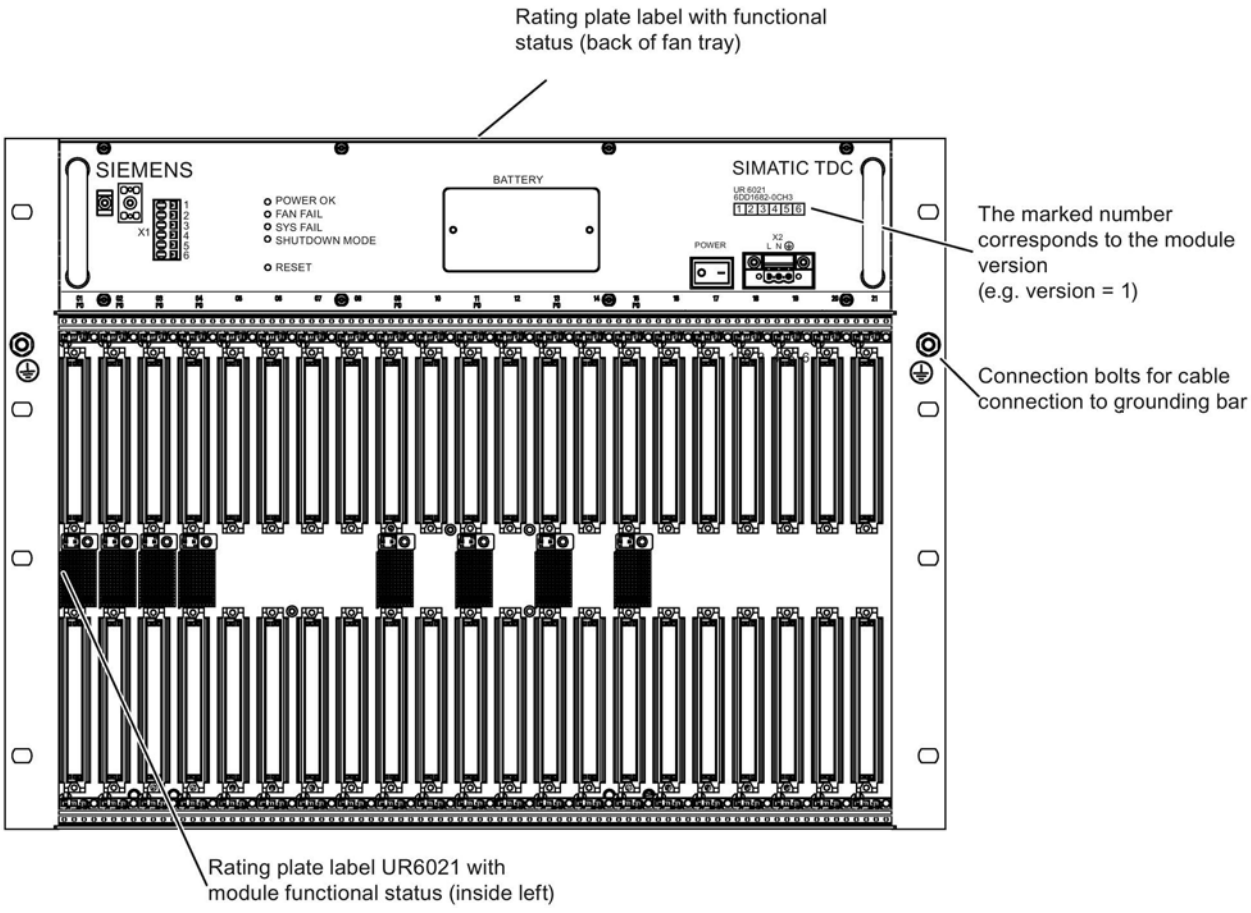



Figure 3-1 Rack UR6021 (front view)

### Fan tray (6DD1683-0CH3)

The fan tray is inserted and screwed into the upper part of the rack. The fan tray contains six fans and the control and monitoring functions for the rack.

## 3.1.3 Control and display elements

### X1

3 signaling relays, 230 V AC floating potential (3 x 2 contacts)

**Note**

**Mixed assignment**

Contacts consisting of combinations of safety extra-low voltage and hazardous voltages are not permitted.

### SHUTDOWN MODE

A system shutdown mode can be set in accordance with the switch position S1.1 (in the battery compartment) as response to the failure of one or two fans.

- OFF = Shutdown on failure of two fans (SHUTDOWN MODE LED = on)
- ON = Shutdown on failure of one fan (SHUTDOWN MODE LED = flashes)

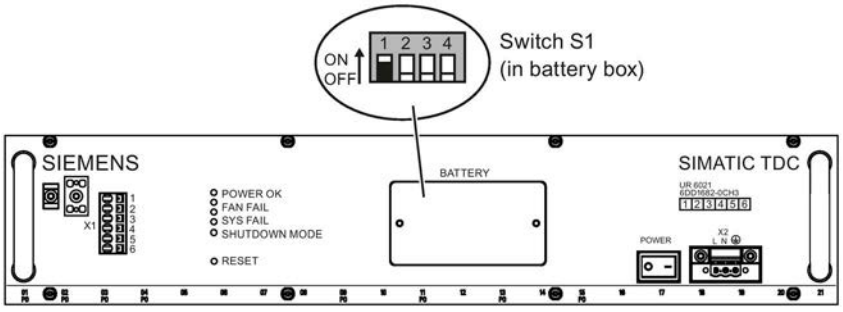



Figure 3-2 Front view of the fan tray

### LED

The four LEDs signal the operating state of the rack.

### RESET

You can restart all modules by pressing the submerged pushbutton (rack RESET).

### BATTERY

Backup battery compartment (1 x AA lithium battery)

### X2

Line voltage connection

## 3.1.4 Status and fault displays

Table 3- 1 Status displays for UR6021

| LED | Display | Rack state |
|---|---|---|
| **POWER OK** (green or red) | green is on | fault-free operation |
| | red is on | fault (refer to voltage monitoring) |
| **FAN FAIL** (red) | Off | fault-free operation |
| | On | fault (at least one fan has failed) |
| **SYSFAIL** (red) | Off | fault-free operation |
| | On | System was stopped |
| **SHUTDOWN MODE** (yellow) | On | Shutdown on failure of two fans (corresponds to the OFF position of switch S1.1) |
| | Flashes | Shutdown on failure of one fan (corresponds to the ON position of switch S1.1) |

## 3.1.5 Power supply

### Mains connection

Mains is connected to the 3-pin screw terminal block on the right side of the power supply unit.

**Note**

Always use the integrated strain relief for the mains cable on the 3-pin screw terminal block.

The pin assignment is printed onto the front panel.

| | |
|---|---|
| Input voltage | 120/230 V AC<br>110/220 V DC |
| Test voltage<br>Primary ↔ PE | <br>1500 V AC |
| Power consumption | 800 W (apparent power approx. 835 VA) |
| Cable cross-section | 3 x 1.5 $mm^2$ (copper stranded wires dressed with wire end ferrules with ISO insulating collars; stripped length: 10-12 mm according to the used wire end ferrule) |
| Input current | $I_n$ = 9 A<br>$I_s$ = < 40 A (inrush peak) |
| External fuse (dimensioning) | The power supply is equipped with an internal 20 A fuse. This means that only the mains supply has to be fused.<br>It is recommended to use a standard 16 A thermo magnetic circuit-breaker (B characteristic).<br>Alternatively, a slow-acting fuse may be used. |

**Note**

A mains disconnect unit must be provided during installation of the rack.

## 3.1.6 Wiring diagram

| X2 | Pin | Function |
|---|---|---|
| Screw terminal with screw lock (3x1.5 mm², stranded wires dressed with wire end ferrules with insulating collars)<br>Make sure that the strain relief is properly mounted. | L | Line conductor |
| | N | Neutral conductor |
| | ⏚ | PE/ground conductor |

| X1 | Pin | Function |
|---|---|---|
| Cage clamp terminal (0.5 mm² – 1.5 mm², stripped length 7 mm, stranded wires dressed with wire end ferrules with insulating collars)<br>Make sure that the strain relief is properly mounted. | 1, 2 | SYSFAIL signaling contact |
| | | NC contact |
| | 3, 4 | POWER signaling contact |
| | | NO contact |
| | 5, 6 | FAN FAIL signaling contact |
| | | NO contact |

**⚠ WARNING**

**PE terminal**

The PE/ground conductor must be connected to the power supply.

The PE/ground terminal on the rack (min. 6 mm²) is inappropriate.

The PE/ground conductor must be green with yellow stripe (green/yellow).

Ungrounded installation of the rack is not planned.

## 3.1.7 Voltage monitoring

### Input voltage

The input voltage is monitored for low level.

| Input voltage | Reaction |
|---|---|
| Undervoltage < approx. 85 V | **ACFAIL** signal and CPU STOP, shutdown of output voltages <85 V |

Voltage dips ≤ 20 ms are buffered.

The power supply unit and therefore the system are restarted automatically on recovery from a voltage dip below the permissible mains voltage.

The power on/off sequence (e.g. generation of a RESET or SYSFAIL signal) corresponds to the reaction to manual operation of the mains switch.

## Output voltage

All output voltages are monitored (e.g. for overload/short-circuit).

| Voltage monitoring functions at the power supply outlet | Reaction |
|---|---|
| +5 V in the range from 4.75 V to 5.35 V | “POWER OK” LED is lit green; |
| + 3.3 V in the range from +3.18 V to +3.5 V<br>+ 12 V in the range from +11 V to +13 V<br>- 12 V in the range from -11 V to -13 V | |

In all other cases, the “POWER OK” LED is lit red.

## System failure alarm

Select the "Object properties" in the "STOP" tab of **HW Config** to configure the response of the relevant module to a system failure alarm (bus signal ***SYSFAIL**=low):

- The other modules also change to STOP
- The other modules remain in RUN

## 3.1.8 Battery backup

### Battery connection

A backup battery must be installed in the battery box to enable the backup of configured values on power failure (using SAV function blocks).

### Technical specifications of the battery

| Backup battery | |
|---|---|
| Article number | 6ES7971-0BA00 |
| Type | 1 x Lithium AA |
| Rated voltage | 3.6 V |
| Rated capacity | 2.3 Ah |

You may only use batteries that have been approved by Siemens!

**⚠ WARNING**

**Handling lithium batteries**

Risk of injury, damage to assets, and emission of pollutants. Improper handling of a Lithium battery may cause its explosion and incorrect disposal of used lithium batteries may lead to emission of pollutants. For these reasons, you should strictly observe the following notes:

- Do not throw new or waste batteries into an open fire, or perform any soldering work on the cell body (max. temperature 100° C)
- Do not recharge waste batteries - risk of explosion!
- Do not open the battery.
- Always replace battery with one of the same type. Always order replacements from Siemens.

  This ensures that you are in possession of a short circuit-proof type.
- You should return waste batteries to the battery manufacturer, dispose of the batteries as special waste at a recycling facility.

### Backup time

Sample calculation:

Capacity of the backup battery: 2.3 Ah, 63 % is assumed for calculation.

Backup current: 200 µA (monitoring 20 µA + max. 180 µA for the slots, CPU555/CPU551 needs 3 µA)

Backup time = 2.3 Ah * 0.63 / 200 µA = 7,245h = 300 days

This time is valid for a rack that is switched off. Only the battery monitoring function draws a current of 20 µA while the rack is powered on.

It is recommended to replace the batteries at annual intervals. The backup function is deactivated when the fan tray is removed.

### Battery voltage monitoring

The CPU module inserted in slot 1 detects missing or low backup batteries and signals these states with a flashing "b".

### Battery replacement

Unscsrew and remove the lid of the battery compartment to remove the battery.

Observe correct polarity when inserting the battery. You should also take care not to bend the connection tabs of the battery holder during replacement.

To prevent data loss, you should always replace the battery while the rack is powered on.

### See also

Ventilation/cooling (Page 49)

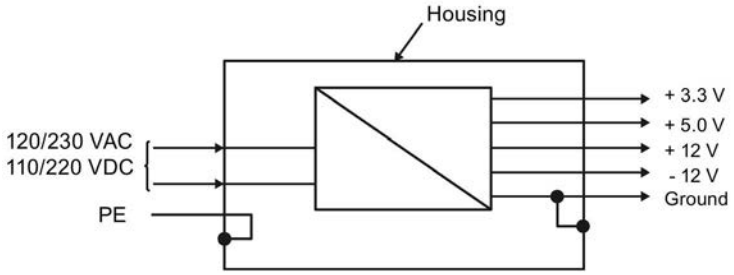
## 3.1.9 Modules

Make sure that the modules you insert are properly aligned in their relevant slot.

| NOTICE |
| --- |
| **Damaging of the ESD braid**<br>Do not push the modules towards the left when inserting these, because you would risk damage to the ESD braid of the modules already inserted. Observe this particularly at slot 1, as a metal spring has been installed in this slot.<br>If the ESD braid or a metal spring is severely damaged, the module can no longer be used because there is a risk of a short circuit with the potentials of a neighboring module. |

## 3.1.10 Power supply potentials

In SIMATIC TDC, the ground connections of all secondary voltages are grouped and bonded to the rack enclosure in order to improve the signal to interference ratio and to ensure proper grounding.




## 3.1.11 Ventilation/cooling

The rack is equipped with a fan tray with 6 fans for forced convection of the modules and the system power supply.

Since the rack is not equipped with an air filter, you should provide a filter on the cabinet if necessary.

**Note**

For more information, refer to section "Control cabinet (Page 20)".

**Note**

**FANOPH**

Using the FANOPH function block, you can read out the operating hours counter of the fan from the first CPU555 and monitor it for a limit.

## Fan monitor

The fans are monitored (speed). Activation of the monitoring function is delayed in order to enable the reliable startup of the rack after you switched on power.

On failure of one or two fans, the power supply is shut down depending on the operating mode in order to prevent thermal destruction of the modules.

The operating mode (SHUTDOWN MODE) is selected using switch S1.1, which is integrated in the power supply. The power supply is shut down if one fan has failed and switch position "ON" is set, or if two fans have failed and switch position "OFF" (default) is set.

| NOTICE |
| --- |
| **Safe isolation from supply** |
| Switch off power to the rack before you remove the screws of the battery compartment. |

The battery compartment cover must be unscrewed to actuate switch S1.

| NOTICE |
| --- |
| **ESD Directives** |
| Observe the corresponding ESD directives. |

The operating mode setting is indicated by the "SHUTDOWN MODE" LED on the front panel.

See section "Status and fault displays (Page 44)".

| NOTICE |
| --- |
| **Forced cooling** |
| If the modules require forced cooling (e.g. CPU555), always set the "SHUTDOWN MODE" slide switch S1.1 to "ON" for air intake temperatures from 0 °C to 60 °C. |
| You may only set the position of switch S1.1 to "OFF" if it can be ensured that the air intake temperature at the rack does not exceed 50 °C. |
| The power supply is not shut down on failure of a single fan, but the corresponding backplane bus signal (FANAL*) is activated and can be detected by the configuration software. |

## Replacing the fan tray

The fan tray is can be ordered as a replacement part and be replaced.

| Fan try | |
|---|---|
| Article number | 6DD1683-0CH3 |

Electrostatic sensitive components can be destroyed by voltages and power levels far below human perception. Components or modules are possibly exposed to such voltages when touched by humans who have not been not electrostatically discharged. Following such voltage peaks, it is usually impossible to identify malfunction of the component immediately, as it needs an extended operating time before such malfunctions are disclosed.

| NOTICE |
|---|
| **Replacing the fan tray**<br>If the fan tray is damaged, it may not be installed. |

Proceed as follows to replace the fan tray:

1. Make sure that the leads to X2 and possibly X1 are de-energized and secure them against reconnection.
2. Ensure that adjacent live parts cannot be touched.
3. Remove the power connector X2.
4. If necessary, remove the wires to X1 (including the strain relief and shield connection).
5. Loosen the 8 screws on the top and bottom of the fan tray.
6. Pull the fan tray out of the rack by the handles.

| ⚠ CAUTION |
|---|
| **Sharp-edged front panel**<br>The edges and corners of the front plate of the fan tray may cause injury. Use suitable protective gloves to remove and install it. |

7. Slide the new fan tray into the rack until it clicks and the faceplate is flush to the front panel.
8. Fasten the fan tray (8 screws on the top and bottom of the fan tray).
9. Insert a new backup battery; see section "Battery backup (Page 47)".
10. If necessary, connect the wires to X1 (including the strain relief and shield connection).
11. Connect the power connector X2.
12. Switch on the power again.

## Signaling relay

Three 230 V signaling relays with floating potential facilitate external evaluation of the rack system states.

| NOTICE |
| --- |
| **Assignment of the contacts**<br>Contacts consisting of combinations of safety extra-low voltage and hazardous voltages are not permitted. |

| Signaling relay | Terminal X1 | Contact in switched off state | Contact in error-free operation | LED in error-free operation |
| --- | --- | --- | --- | --- |
| SYSFAIL | 1.2 | Closed | Closed | Off |
| POWER | 3.4 | Open | Closed | green is on |
| FAN FAIL | 5.6 | Open | Closed | Off |

## 3.1.12 Technical specifications

### Article number

| | |
|---|---|
| Rack UR6021 | 6DD1682-0CH3 |

### General data

| | |
|---|---|
| Safety | EN 61131-2 |
| Degree of protection | IP 20 |
| Protection class | Protection class 1 with PE/ground conductor |

| | |
|---|---|
| Storage temperatures | -40 °C to +70 °C |
| Operating temperatures | 0 °C to +60 °C |
| Relative air humidity | 5 % to 95 %, no condensation |
| Atmospheric pressure | Operation: 1080 hPa to 795 hPa<br>Storage: 1080 hPa to 660 hPa |

### Power input

| | |
|---|---|
| Rated input voltage<br>• Rated value<br><br>• Permissible range | <br>• 120 V AC to 230 V AC<br>110 V DC to 220 V DC<br>• 85 V AC to 264 V AC (wide-range input)<br>93.5 V DC to 253 V DC |
| Rated input current<br>• At 120 V AC<br>• At 230 V AC<br>• At 110 V DC<br>• At 220 V DC | <br>• 6.7 A<br>• 3.5 A<br>• 7.3 A<br>• 3.7 A |
| Max. inrush current | < 40 A |
| Line frequency<br>• Rated value (AC)<br>(DC)<br>• Permissible range | <br>• 50/60 Hz<br>(0 Hz)<br>• 47-63 Hz |
| Power factor | EN 61000-3-2 |
| Pollution degree | 2 |
| Overvoltage category | II |
| Power failure backup | min. 20 ms |

## Output voltages of the power supply

| Rated output voltage | Output current | |
|---|---|---|
| | Total | for the modules |
| +5 V | 120 A | 79 A |
| +3.3 V | 60 A | 36 A |
| +12 V | 17 A | 5 A |
| -12 V | 17 A | 5 A |

**Note**

Make sure that you do not exceed a total of 600 W (continuous load at 60 °C). This must be ensured i your configuration.

The output currents of the individual modules are listed in the respective description.

All outputs are sustained short circuit-proof and **do not** need a basic load.

## Battery

| | |
|---|---|
| Current load | Approx. 20 µA for the monitoring and<br>max. 180 µA for the slots 1-21 |

## Relay contacts (X1)

| | |
|---|---|
| Rated voltage (AC) | 230 V (max. 264 V) |
| Rated current | 2 A |

| NOTICE |
|---|
| **Assignment of the contacts**<br>Contacts consisting of combinations of safety extra-low voltage and hazardous voltages are not permitted. |

## Dimensions

| | |
|---|---|
| Number of rack slots | 21 |
| Dimensions W x H x D [mm] | approx. 482.6 x 354.9 x 343 |
| Weight | Approx. 20 kg |

## Dimensional drawing

Dimensions in mm

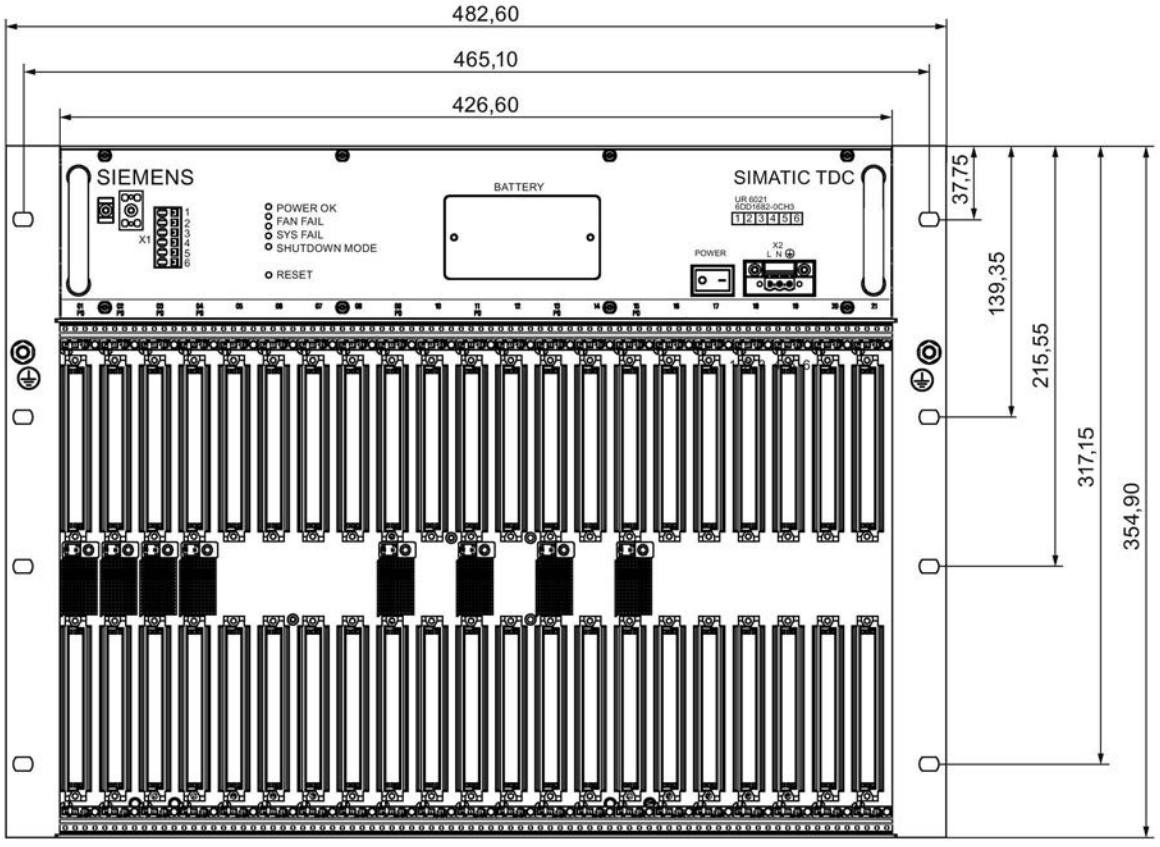



Figure 3-3 Dimension drawing of rack UR6021

# 3.2 Rack UR5213 (6DD1682-0CH2)

## 3.2.1 Areas of application

Rack UR5213 with 21 slots forms the mechanical base for SIMATIC TDC and features an integrated system power supply and integrated system fans. A high-performance 64-bit backplane bus supports high-speed data exchange between the inserted modules.

## 3.2.2 Mechanical layout

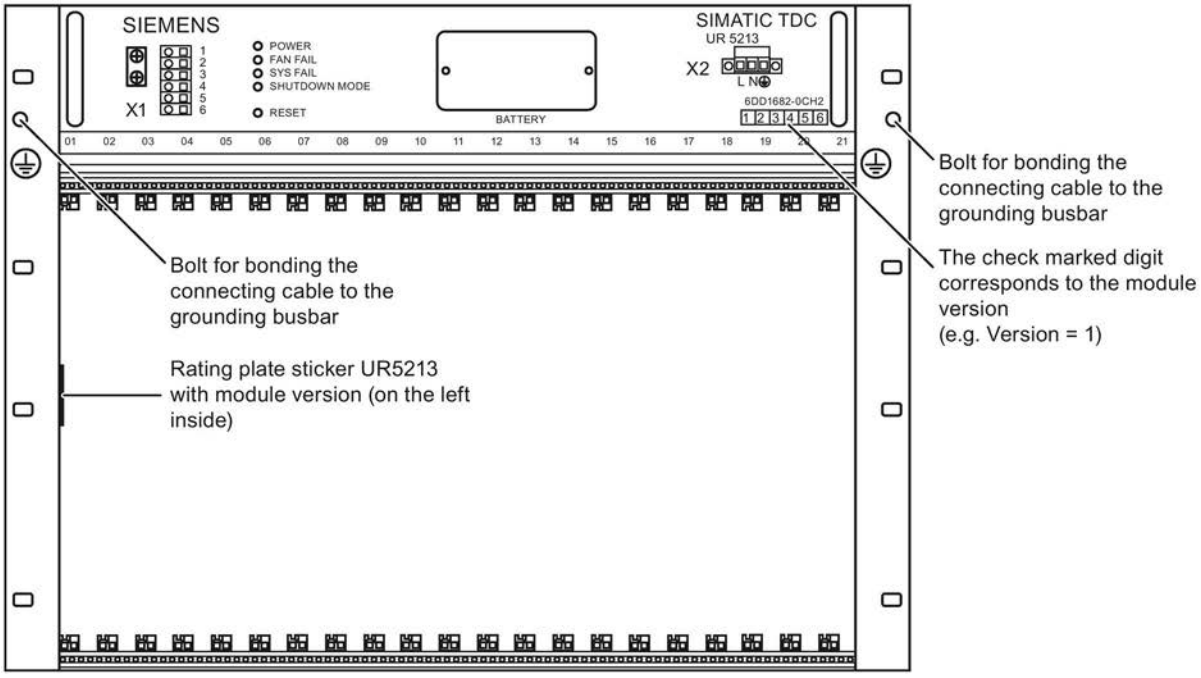



Figure 3-4 Rack UR5213 (front view)

### Power supply

The power supply with integrated fan for forced convection is installed in the rear section of the rack.

## 3.2.3 Control and display elements

### X1

3 signaling relays, 230 V floating potential (3 x 2 contacts)

### SHUTDOWN MODE

A system shutdown mode can be set in accordance with the switch position S1.4 (in the battery box) as response to the failure of one or two fans.

The operating mode setting is indicated by the "SHUTDOWN MODE" LED on the front panel.

- OFF = Shutdown on failure of two fans (SHUTDOWN MODE LED = off)
- ON = Shutdown on failure of one fan (SHUTDOWN MODE LED = on)

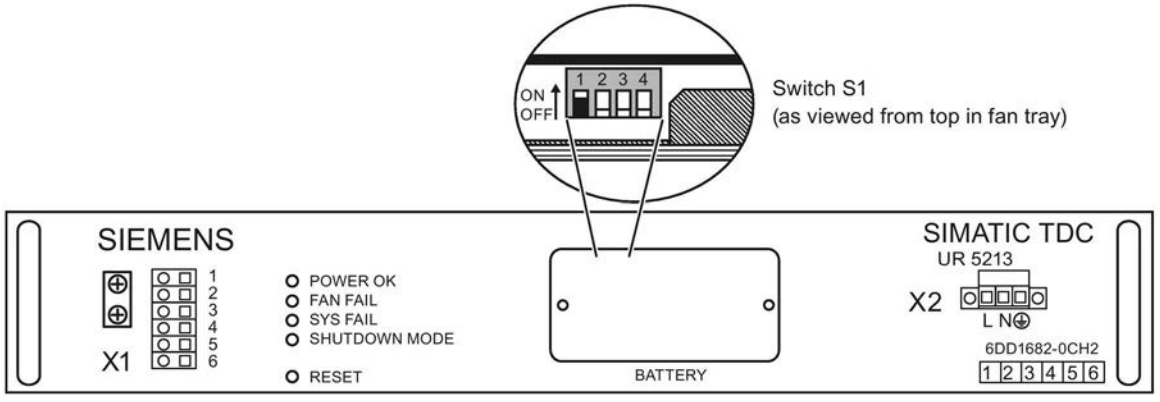



Figure 3-5 Front view of the fan tray

### LED

The four LEDs signal the operating state of the rack.

### RESET

You can restart all modules by pressing the submerged pushbutton (rack RESET).

### BATTERY

Backup battery compartment (1 x AA lithium battery)

### X2

Line voltage connection

## 3.2.4 Status and fault displays

Table 3- 2 Status displays for UR5213

| LED | Display | Rack state |
|---|---|---|
| **POWER** (green or red) | green is on | fault-free operation |
| | red is on | fault (refer to voltage monitoring) |
| **FAN FAIL** (red) | Off | fault-free operation |
| | On | fault (at least one fan has failed) |
| **SYSFAIL** (red) | Off | fault-free operation |
| | On | System was stopped |
| **SHUTDOWN Mode** (yellow) | On | Shutdown on failure of two fans (corresponds to the OFF position of switch S1.4) |
| | Flashing | Shutdown on failure of one fan (corresponds to the ON position of switch S1.4) |

## 3.2.5 Power supply

### Mains connection

Mains is connected to the 3-pin screw terminal block on the right side of the power supply unit.

**Note**

Always use the integrated strain relief for the mains cable on the 3-pin screw terminal block.

The pin assignment is printed onto the front panel.

| | |
|---|---|
| Input voltage | 85–264 V AC |
| Test voltage<br>Primary ↔ PE | <br>1350 V AC |
| Power consumption | 800 W (apparent power approx. 835 VA) |
| Conductor cross-section | 3x1.5 mm2 (stranded wires dressed with wire end ferrules with ISO insulating collars) |
| External fuse<br>(dimensioning) | In = 9 A<br>Is = <40 A (inrush peak)<br>The power supply is equipped with an internal 20 A fuse. This means that only the mains supply has to be fused. It is recommended to use a standard 16 A thermo magnetic circuit-breaker (B characteristic).<br>Alternatively, a slow-acting fuse may be used. |

**Note**

A mains disconnect unit must be provided during installation of the rack.

## 3.2.6 Wiring diagram

| X2 | Pin | Function |
|---|---|---|
| Screw terminal with screw lock (3*1.5 $mm^2$, stranded wires dressed with wire end ferrules with insulating collars)<br>Make sure that the strain relief is properly mounted. | L | Line conductor |
| | N | Neutral conductor |
| | ⏚ | PE/ground conductor |

| X1 | Pin | Function |
|---|---|---|
| Cage clamp terminal (0.5 $mm^2$ –1.5 $mm^2$, stranded wires dressed with wire end ferrules with insulating collars)<br>Make sure that the strain relief is properly mounted. | 1, 2 | SYSFAIL signaling contact |
| | | NC contact |
| | 3, 4 | POWER signaling contact |
| | | NO contact |
| | 5, 6 | FAN FAIL signaling contact |
| | | NO contact |

**⚠ WARNING**

The **PE/ground conductor** must be connected to the power supply. A PE/ground terminal on the rack is inappropriate. The PE/ground conductor must be green with yellow stripe (green/yellow).

Ungrounded installation of the rack is not planned.

## 3.2.7 Voltage monitoring

### Input voltage

The input voltage is monitored for low level.

| Input voltage | Reaction |
|---|---|
| Undervoltage < approx. 85 V | **ACFAIL** signal and CPU STOP, shutdown of output voltages <85V |

Voltage dips ≤ 20 ms are buffered.

The power supply unit and therefore the system are restarted automatically on recovery from a voltage dip below the permissible mains voltage.

The power on/off sequence (e.g. generation of a RESET or SYSFAIL signal) corresponds to the reaction to manual operation of the mains switch.

### Output voltage

All output voltages are monitored (e.g. for overload/short-circuit).

| Voltage monitoring functions at the power supply outlet | Reaction |
|---|---|
| +5 V in the range from 4.75 V to 5.35 V | “POWER OK” LED is lit green; |
| + 3.3 V in the range from +3.18 V... +3.5 V<br>+ 12 V in the range from +11 V to +13 V<br>- 12 V in the range from -11 V to -13 V | |

In all other cases, the “POWER OK” LED is lit red.

### System failure alarm

Select the "Object properties" in the "STOP" tab of **HWConfig** to configure the response of the relevant module to a system failure alarm (bus signal ***SYSFAIL**=low):

- Modules can reset their digital and analog outputs
- CPU modules can go into the "STOP" state ("H" is displayed permanently)

## 3.2.8 Battery backup

### Battery connection

A backup battery must be installed in the power supply circuit to enable the backup of configured values on power failure (using SAV function blocks).

### Technical specifications of the battery

| Backup battery | |
|---|---|
| Article number | 6ES7971-0BA00 |
| Type | 1 x Lithium AA |
| Rated voltage | 3.6 V |
| Rated capacity | 2.3 Ah |

You may only use batteries that have been approved by Siemens!

**⚠ WARNING**

**Handling lithium batteries**

Risk of injury, damage to assets, and emission of pollutants. Improper handling of a Lithium battery may cause its explosion and incorrect disposal of used lithium batteries may lead to emission of pollutants. For these reasons, you should strictly observe the following notes:

- Do not throw new or waste batteries into an open fire, or perform any soldering work on the cell body (max. temperature 100° C), or recharge the battery - risk of explosion! Do not open the battery and always replace it with one of the same type. Always order replacements from Siemens. This ensures that you are in possession of a short circuit-proof type.
- You should return waste batteries to the battery manufacturer, dispose of the batteries as special waste at a recycling facility.

### Backup time

Sample calculation:

Capacity of the backup battery: 2.3 Ah, 63 % is assumed for calculation

Backup current: 200 µA (monitoring 20 µA + max. 180 µA for the slots, a CPU 551 needs 2.2 µA )

Backup time = 2.3 Ah * 0.63 / 200 µA = 7.245h = 300 days

This time is valid for a rack that is switched off. Only the battery monitoring function draws a current of 20 µA while the rack is powered on.

It is recommended to replace the batteries at annual intervals. The backup function is deactivated while the fan tray is removed.

### Battery voltage monitoring

The CPU module inserted in slot 1 detects missing or low backup batteries and signals these states with a flashing "b".

### Battery replacement

Unscsrew and remove the lid of the battery compartment to remove the battery. Observe correct polarity when inserting the battery. You should also take care not to bend the connection tabs of the battery holder during replacement.

You should always replace the battery while the rack is powered on in order to prevent data loss.

## 3.2.9 Modules

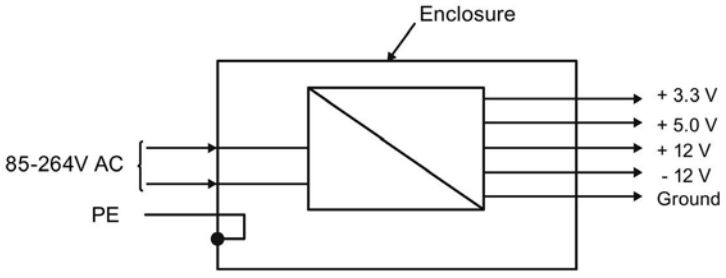
Make sure that the modules you insert are properly aligned in their relevant slot.

| ⚠ WARNING |
| --- |
| Do not push the modules towards the left when inserting these, because you would risk damage to the ESD braid of the modules already inserted. |

Observe this particularly at slot 1, as a metal spring has been installed in this slot.

## 3.2.10 Power supply potentials

In SIMATIC TDC, the ground connections of all secondary voltages are grouped and bonded to the rack enclosure in order to improve the signal to interference ratio and to ensure proper grounding.



## 3.2.11 Ventilation/cooling

The rack is equipped with three fans for forced convection of the modules and with one fan for the system power supply.

Since the rack is not equipped with an air filter, you should provide a filter on the cabinet if necessary.

**Note**

For more information, refer to section "Equipotential bonding (Page 22)".

### Fan monitoring

The fans are monitored (speed). Activation of the monitoring function is delayed in order to enable the reliable startup of the rack after you switched on power.

On failure of one or two fans, the power supply is shut down depending on the operating mode in order to prevent thermal destruction of the modules.

Select the operating mode (SHUTDOWN MODE) using switch S1.4 that is integrated in the power supply. The power supply is shut down if one fan has failed and switch position "ON" is set, or if two fans have failed and switch position "OFF" is set.

To set switch S1, unscrew the front panel and slightly pull it forward until you can reach the switch through the gap. Switch off power to the rack before you open the panel.

**⚠ WARNING**

Switch off power to the rack before you remove the front panel screws.

**⚠ CAUTION**

Observe the corresponding ESD Directives.

The operating mode setting is indicated by the "SHUTDOWN MODE" LED on the front panel.

Refer to chapter “Status and fault displays”.

**⚠ WARNING**

Always set the “Shutdown mode” dip switch S1.4 to “ON” for modules requiring forced convection (e.g. CPU551) at air intake temperatures from 0  C to 60 °C.

You may only set the position of switch S1.4 to "OFF” if it can be assured that the air intake temperature at the rack does not exceed 35 °C.

The power supply is not shut down on failure of a single fan, but the corresponding backplane bus signal (FANAL*) is activated and can be detected by the configuration software.

## Signaling relay

Three 230 V signaling relays with floating potential facilitate external evaluation of the rack's system states.

Table 3- 3 Signaling relay

| Signaling relay | Terminal X1 | Contact in switched off state: | Contact in error-free operation | LED in error-free operation |
|---|---|---|---|---|
| SYSFAIL | 1,2 | Closed | Closed | Off |
| POWER | 3,4 | Open | Closed | green is on |
| FAN FAIL | 5,6 | Open | Closed | Off |

## 3.2.12 Technical specifications

### Article number

| | |
|---|---|
| Rack UR5213 | 6DD1682-0CH2 |

### General data

| | |
|---|---|
| Safety | EN 61131-2 |
| Degree of protection | IP 20 |
| Protection class | Protection class 1 with PE/ground conductor |

| | |
|---|---|
| Storage temperatures | -40 °C to +70 °C |
| Operating temperatures | 0 °C to +60 °C |
| Relative air humidity | 5 % to 95 %, no condensation |
| Atmospheric pressure | Operation: 1080 hPa to 795 hPa<br>Storage: 1080 hPa to 660 hPa |

### Power input

| | |
|---|---|
| Input voltage<br>• Rated value<br>• Permissible range | 120/230 V AC<br>220 V DC<br>85 V AC to 264 V AC<br>198 V DC to 253 V DC (extended range input) |
| Rated input current<br>• At 120 V AC<br>• At 230 V AC<br>• At 220 V DC | <br>4.45 A<br>2.3 A<br>2.38 A |
| Max. inrush current | < 40 A |
| Line frequency<br>• Rated value<br>• Permissible range | <br>50/60 Hz<br>47-63 Hz |
| Power factor | EN 61000-3-2 |
| Overvoltage category | II |
| Pollution degree | 2 |
| Power failure backup | min. 20 ms |

## Output voltages

The following lists the maximum current load on the output voltages of the rack.

| Rated output voltage | Max. output current load on the module type |
|---|---|
| +5 V | 36 A |
| +3.3 V | 44 A |
| +12 V | 4.6 A |
| -12 V | 4 A |

Total output power may not exceed 320 W. This must be ensured i your configuration.

The output currents are listed in the respective description.

The output power limit of 320 W is not exceeded even in a full assembly of the rack consisting of the module types CPU551, SM500, CP51M1, CP50M1 and CP52A0.

**Note**

If using other modules, you must check the individual maximum currents and verify the maximum load of 320 W.

All outputs are sustained short circuit-proof and **do not** need a basic load.

## Battery

| | |
|---|---|
| Current load | Approx. 20 µA for the monitoring function and max. 180 µA for slots 1-21 |

## Relay contacts

| | |
|---|---|
| Rated voltage (AC) | 230 V (max. 264 V) |
| Rated current | 2 A |

## Dimensions

| | |
|---|---|
| Number of rack slots | 21 |
| Dimensions W x H x D [mm] | approx. 482.6 x 354.9 x 343 |
| Weight | Approx. 20 kg |

## Dimensional drawing

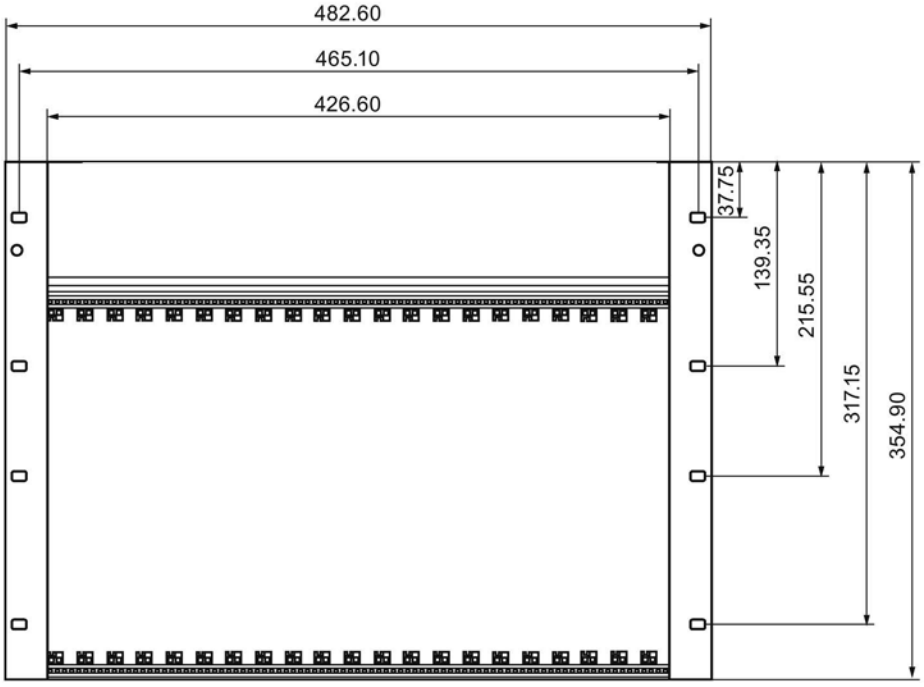



Figure 3-6 Dimensional drawing of rack UR5213

# 3.3 Rack UR5213 (6DD1682-0CH0)

## 3.3.1 Areas of application

Rack UR5213 with 21 slots forms the mechanical base for SIMATIC TDC and features an integrated system power supply and integrated system fans. A high-performance 64-bit backplane bus supports high-speed data exchange between the inserted modules.

## 3.3.2 Mechanical layout

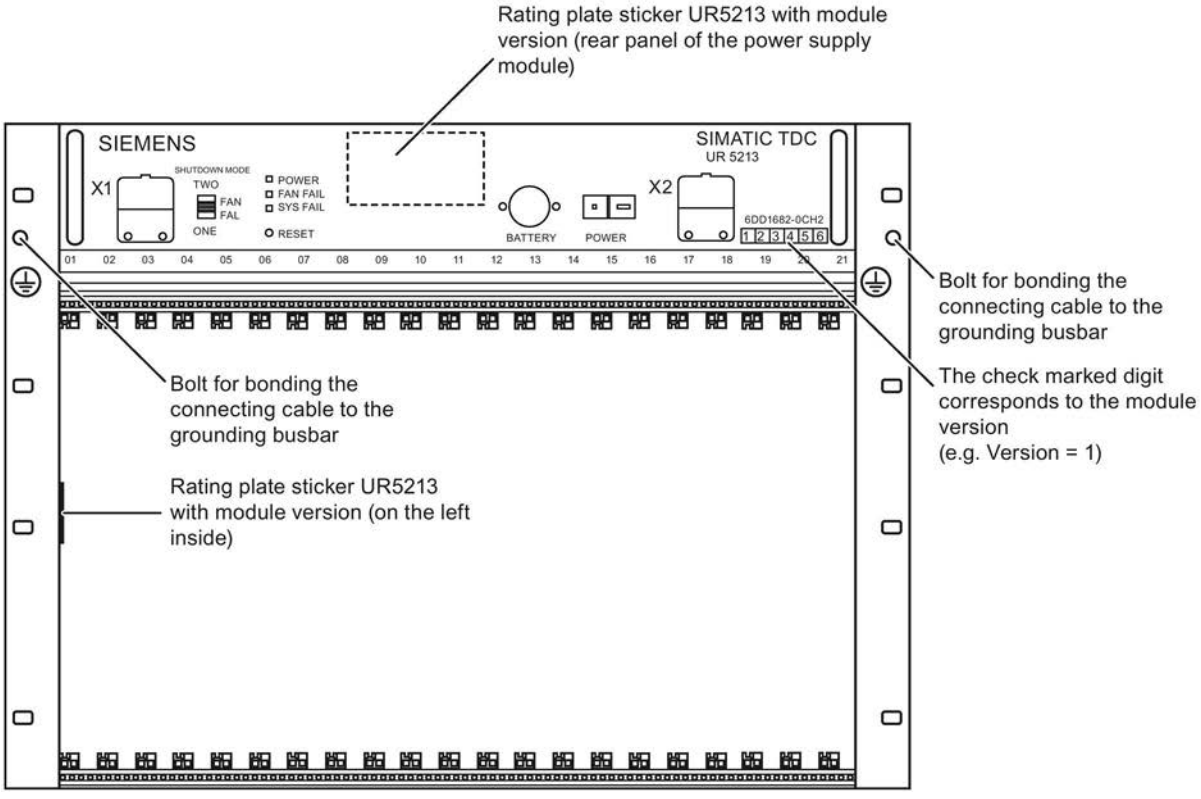



Figure 3-7 Rack UR5213 (front view)

### PS5213 power supply

The power supply with three fans is inserted and screw mounted in the upper section of the rack.

### 3.3.3 Control and display elements

#### X1

3 signaling relays, 230 V floating potential (3 x 2 contacts)

#### SHUTDOWN MODE

A system stop triggered by fan failure can be set based on the switch position, i.e. “ONE” setting for failure of one fan, or “TWO” setting for failure of two fans.

#### LED

The three LEDs display the rack's operating status.

#### RESET

You can restart all modules by pressing the submerged pushbutton (rack RESET).

#### BATTERY

Compartment for backup batteries

(2 x 1.5 V leak-proof alkaline manganese cells type AA)

#### POWER

Mains switch

#### X2

Line voltage connection

#### Front panel

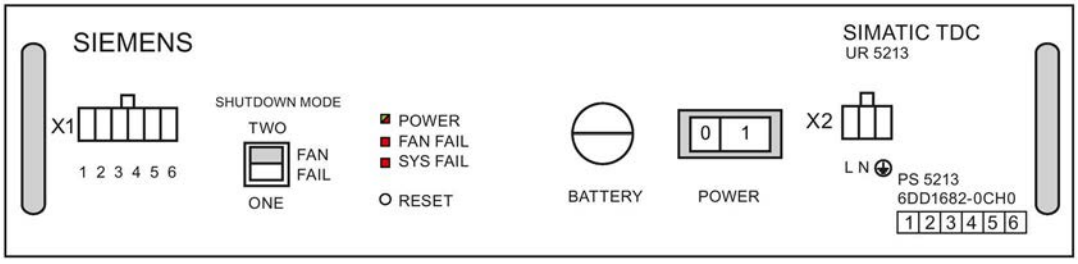



Figure 3-8 Front view of the power supply unit

## 3.3.4 Status and fault displays

Table 3- 4 Status displays for UR5213

| LED | Display | Rack state |
|---|---|---|
| **POWER** (green or red) | green is on | fault-free operation |
| | red is on | fault (refer to voltage monitoring) |
| **FAN FAIL** (red) | Off | fault-free operation |
| | On | fault (at least one fan has failed) |
| **SYSFAIL** (red) | Off | fault-free operation |
| | On | System was stopped |

## 3.3.5 Power supply

### Mains connection

Mains is connected to the 3-pin screw terminal block on the right side of the power supply unit.

The pin assignment is printed onto the front panel.

| | |
|---|---|
| Input voltage | 90 - 264 V AC<br>Derating 85 – 90 V |
| Dielectric strength<br>• Mains inlet / PE<br>• Mains inlet / SELV<br>• SELV / PE | <br>1500 V AC<br>3000 V AC<br>500 V AC |
| Power consumption | 800 W (apparent power approx. 835 VA) |
| L | Phase conductor L |
| N | Neutral conductor N |
| ⏚ | Ground conductor PE |
| External fuse<br>(dimensioning) | In = 9 A<br>Is = <50 A (inrush peak)<br>The power supply is equipped with an internal 12 A fuse. This means that only the mains supply has to be fused. It is recommended to use a standard 16 A thermo magnetic circuit-breaker (B characteristic).<br>Alternatively, a slow-acting fuse may be used. |

**⚠ WARNING**

The **PE/ground conductor** must be connected to the power supply. A PE/ground terminal on the rack is inappropriate. The PE/ground conductor must be green with yellow stripe (green/yellow).

## 3.3.6 Voltage monitoring

### Input voltage

The input voltage is monitored for low level.

| Input voltage | Reaction |
|---|---|
| Undervoltage < approx. 90 V | • **ACFAIL** signal and CPU STOP, shutdown of output voltages <85V |

Voltage dips ≤ 15 ms are buffered.

The power supply and therefore the system will be restarted on recovery from voltage dips to approx. 5 % of the rated mains voltage and a duration longer than approx. 3 seconds.

The power on/off sequence (e.g. generation of a RESET or SYSFAIL signal) corresponds to the reaction to manual operation of the mains switch.

The rack goes into standby state following voltage interruption of a duration shorter than approx. 3 and dip to no less than approx. 5 % of the rated mains voltage. A usual power off sequence precedes this state.

This state can only be cleared by cycling power off and on by means of the mains switch.

### Output voltage

All output voltages are monitored (e.g. for overload/short-circuit).

| Voltage monitoring functions at the power supply outlet | Reaction |
|---|---|
| +5 V in the range from 4.75 V to 5.35 V | “POWER OK” LED is lit green; |
| + 3.3 V in the range from +3.18 V... +3.5 V<br>+ 12 V in the range from +11 V to +13 V<br>- 12 V in the range from -11 V to -13 V | |

In all other cases, the “POWER OK” LED is lit red.

### System failure alarm

Select the "Object properties" in the "STOP" tab of **HWConfig** to configure the response of the relevant module to a system failure alarm (bus signal ***SYSFAIL**=low):

- Modules can reset their digital and analog outputs
- CPU modules can go into the "STOP" state ("H" is displayed permanently)

## 3.3.7 Battery backup

### Battery connection

In order to backup configured values to memory on power failure (using the SAV function blocks), you need to install two commonly available size AA leak-proof alkaline manganese batteries with a rated voltage of 1.5 V in the power supply circuit.

It is recommended to replace the batteries at annual intervals.

The backup function is no longer available if you remove the power supply unit (e.g. in the case of malfunction, or fan replacement).

### Battery voltage monitoring

The CPU module inserted in slot 1 detects missing or low backup batteries and signals these states with a flashing "b".

### Battery replacement

You should always replace the battery while the rack is powered on in order to prevent data loss.

Note that **while installing** the battery you also need to take corresponding **measures** in preparation for its **replacement**.

## 3.3.8 Ventilation/cooling

The PS5213 power supply is equipped with three fans.

Since the rack is not equipped with an air filter, you should provide a filter on the cabinet if necessary.

### Fan monitoring

The fans are monitored (speed). Activation of the monitoring function is delayed in order to enable the reliable startup of the rack after you switched on power.

On failure of one or two fans, the power supply is shut down in order to prevent thermal destruction of the modules. Use the "Shutdown Mode" dip switch to select the mode (the switch has the “ONE” or “TWO” settings). With switch position “ONE”, a power supply shutdown is triggered on failure of at least one fan and in switch position “TWO” by the failure of at least two fans.

**⚠ WARNING**

Always set the “Shutdown mode” dip switch S1.4 to “ONE” for modules requiring forced convection (e.g. CPU550) at air intake temperatures from 0  C to 55 °C.

You may only set switch position "TWO" if it can be assured that the air intake temperature at the rack does not exceed 35 °C. The power supply is not shut down on failure of a single fan, but the corresponding backplane bus signal (FANAL*) is activated and can be detected by the configuration software.

### Fan replacement

At an ambient temperature of 55 °C, it is recommended to replace the fans at intervals of approx. **40,000 operating hours**. The power supply must be removed for fan replacement. Users cannot replace the fans.

### Signaling relay

Three 230V signaling relays with floating potential facilitate external evaluation of the rack's system states.

Table 3- 5 Signaling relay

| Signaling relay | Terminal X1 | Contact in switched off state | Contact in error-free operation | LED in error-free operation |
|---|---|---|---|---|
| SYSFAIL | 1,2 | Closed | Closed | Off |
| POWER | 3,4 | Open | Closed | green is on |
| FAN FAIL | 5,6 | Open | Closed | Off |

## 3.3.9 Technical specifications

### Article number

| | |
|---|---|
| Rack UR5213 | 6DD1682-0CH0 |

### General data

| | |
|---|---|
| Safety | EN 61131-2 |
| Degree of protection | IP 20 |
| Protection class | Protection class 1 with PE/ground conductor |

| | |
|---|---|
| Storage temperatures | -40 °C to +70 °C |
| Operating temperatures | 0 °C to +55 °C |
| Relative air humidity | 5 % to 95 %, no condensation |
| Atmospheric pressure | Operation: 1080 hPa to 795 hPa<br>Storage: 1080 hPa to 660 hPa |

### Power input

| | |
|---|---|
| Input voltages (AC) | 90 V - 264 V |
| Rated input current | Typically < 10 A |
| Max. inrush current | < < 50 A |
| Frequency | 47 Hz to 63 Hz |
| Power factor | EN 61000-3-2 |
| Power failure backup | min. 15 ms |

### Output voltages

| Rated output voltage | Output current |
|---|---|
| +5 V | 60 A |
| +3.3 V | 60 A |
| +12 V | 8 A |
| -12 V | 8 A |

All outputs are sustained short circuit-proof and **do not** need a basic load.

### Battery

| | |
|---|---|
| Current load | approx. 10 µA for each inserted CPU module |

### Dimensions

| | |
|---|---|
| Number of rack slots | 21 |
| Dimensions W x H x D [mm] | approx. 482.6 x 354.9 x 343 |
| Weight | Approx. 20 kg |

## 3.4 Slot covers

### Application

Slot cover SR51 is used to protect unused slots of the rack. This is necessary to ensure proper ventilation and EMC compatibility of the system.

### Article number

| | |
|---|---|
| Slot cover SR51 | 6DD1682-0DA1 |

# CPU modules

# 4

## 4.1 CPU module CPU555

### 4.1.1 Areas of application

CPU555 is a graphically freely configurable processor module, enabling the implementation of sophisticated highly dynamic control functions.

Use cases include:

- Roll nip controls
- Hydraulic positioning functions
- Strip cooling systems
- HVDCT control systems (high voltage DC transmission)

**Note**

**Note the following:**

- CPU555 can only be used in the rack UR6021.
- CPU555 can only be configured with a version V8.1 or higher of the D7-SYS automation software.
- The floating point unit used supports Floating Point data types, operations and exception handling as defined in IEEE Standard 754 (2008). Floating point numbers are calculated internally with 80 bits. This results in fewer rounding errors as compared to calculations with only 64 bits (CPU551).
- The CPU555 does not apply substitute values for invalid real values. This method provides higher performance. Typically, invalid real values result from corrupted data from external interfaces. Calculating with invalid real values can have unintended results. Checking the input values with the CHK_R function block is recommended. With the CHK_R function block, you can assign a substitute value for an error scenario.
- Operation of the CPU555 together with a CPU551 is **not** approved.
- Operation of the CPU555 together with a CPU550 is **not** approved.
- Operation of the CPU555 with the CP5100 and CP50M0 modules that are being phased out is not possible.
- Use of a CP50M1 in combination with a CPU555 is only possible as of a firmware version ≥ 4
- Use of a CP51M1 in combination with a CPU555 is only possible as of a functional status ≥ 8
- Use of a CP52A0 in combination with a CPU555 is only possible as of a functional status ≥ 9
- Use of a CP53M0 in combination with a CPU555 is only possible as of a functional status ≥ 7
- Use of an SM500 in combination with a CPU555 is only possible as of a functional status ≥ 13

## 4.1.2 Control and display elements

### LED display

The processor number, states and faults are displayed using a 5x7 dot matrix LED array.

### Acknowledge button S1

This button has two functions:

- Clearing the fault display:

  The acknowledge button can be used to clear sporadic or non-critical fault displays on the 5x7 dot matrix LED. An additional fault is displayed after the first one has been acknowledged.

- Digital signal input can be evaluated using the ASI function block.

## Front panel

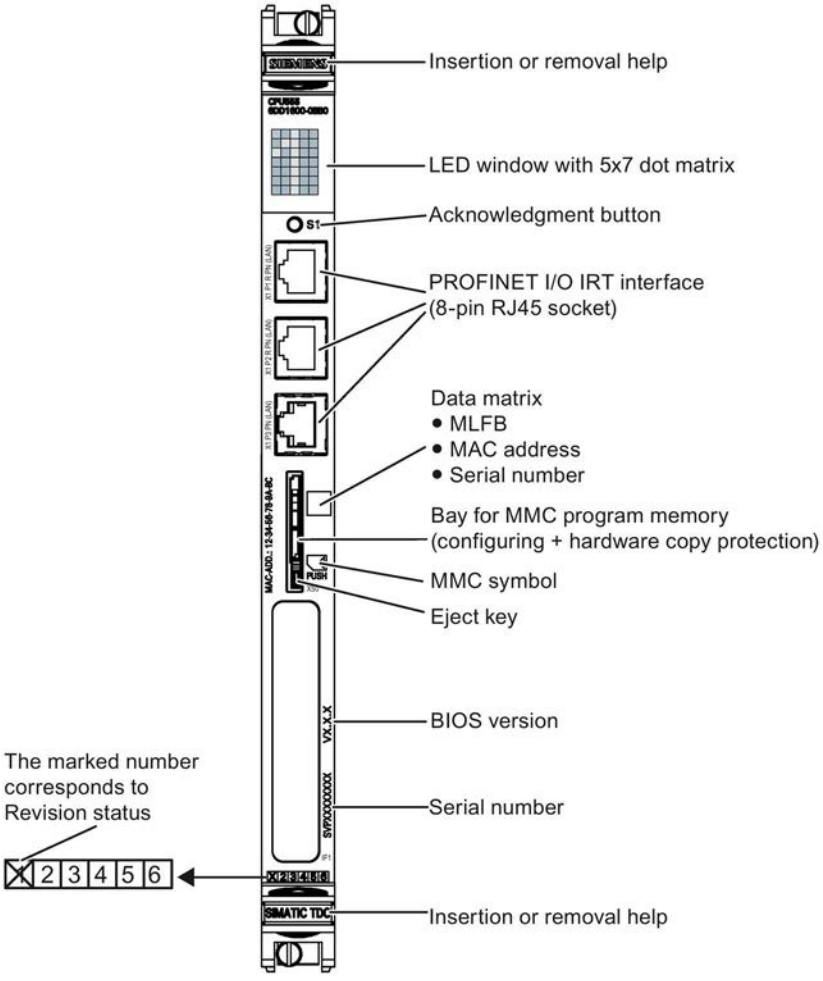



Figure 4-1 Front view of CPU555

## 4.1.3 Status and fault displays

The dot matrix shows the configured number of the CPU module (1 to 20) in normal operation. Faults are indicated by a letter that informs you of the type of fault.

Slow alternation between the light and dark state of the dot matrix is referred to as flashing in the following table.

**Note**

**Maximum assembly**

The CPU module CPU555 can only be operated in the rack UR6021.

A maximum of eight CPU555 can be inserted in a UR6021.

Table 4- 1 Operating and fault states of CPU555

| Display | Operating and fault states | Can be cleared with S1 |
|---|---|---|
| 1...20 | Configured number of the CPU module in normal operation.<br>User program is running | No |
| A | **User error**<br>User program is running<br>Diagnostics event, user-defined by means of USF function block | Yes |
| All 35 dots off | Initialization phase:<br>User program is not running<br>Individual initialization phases during startup are indicated by means of a colored circle and consecutive numbers. | No |
| All 35 dots flashing | Module failure:<br>User program is not running<br>• Hardware failure => replace CPU555<br>• Fatal software error => contact the Hotline | No |
| All 35 dots on | Partial power failure, FPGA1 failure or errors on the module:<br>User program is not running<br>• Hardware failure => replace CPU555<br>• Fatal hardware fault => contact the Hotline | No |
| 0 | **Initialization error**<br>User program is not running<br>Diagnostics should start at the CPU module that was the first to display fault message “0”.<br>• Flashing "0" Faults on this module<br>• Permanent "0": Faults on a different module<br>If none of the CPU modules can be identified as having been the first one, then the one inserted to the extreme left should first be selected of those which display a "0". | No |

| Display | Operating and fault states | Can be cleared with S1 |
|---|---|---|
| b | **Monitoring error**<br>User program is running<br>Low-priority errors during initialization that allow the start of normal operation and that are detected in the background process, e.g.: e.g.<br>• missing or low backup battery<br>• Missing program memory module<br>• Fan failure<br>• Invalid real value<br>• PN bus/group error (flashing; faulty module)<br>Note: The PN bus/group error can also be acknowledged while it is still pending. After acknowledgment, this error is not displayed again until it occurs again (new incoming event/error). | Yes |
| C | **Communication error**<br>User program is running<br>Incorrect configuration of communication, or connection error<br>For more information on diagnostics functions, refer to the manual "D7-SYS - STEP 7, CFC and SFC configuring (http://support.automation.siemens.com/WW/view/de/8776786/0/en)", chapter Basic software, section "Diagnostics".<br>(Initial error = flashing; additional errors = continuous display) | No |
| d | **User stop**<br>User program is not running<br>Selection in the "Target system/Operating state" menu<br>User stop results in a stop of all CPUs in the same rack.<br>• Permanent "d":<br>Module is in STOP, triggered by another CPU.<br>• Flashing "d"<br>Module is in STOP, triggered by this CPU itself. | No |

| Display | Operating and fault states | Can be cleared with S1 |
|---|---|---|
| E | **Task Manager error**<br>User program is running<br>• Flashing "I": Initial error<br>• Static "I":<br>Sequential error after a lower priority error<br>The following errors are possible:<br>• *Cycle errors*<br>A task could not be completed within the sampling time.<br>• *Task overflow*<br>If a task that has not been not assigned top priority but needs to be restarted.<br>• *No free local buffer*<br>The data buffer is no longer released. The task start will be skipped.<br>• *Software time monitoring*<br>If the basic sampling time is not processed four times in succession. The basic clock cycle timer is re-initialized with the configured basic sampling time and processing is continued.<br>For more information on diagnostics functions, refer to the manual "D7-SYS - STEP 7, CFC and SFC configuring (http://support.automation.siemens.com/WW/view/de/8776786/0/en)", chapter Basic software, section "Diagnostics". | Yes |
| H | **System error**<br>User program is not running<br>Hardware or software problems causing a program crash.<br>• Flashing "H" Faults on this module<br>• Permanent "H": Faults on a different module<br>For more information on diagnostics functions, refer to the manual "D7-SYS - STEP 7, CFC and SFC configuring (http://support.automation.siemens.com/WW/view/de/8776786/0/en)", chapter Basic software, section "Diagnostics". | No |

### 4.1.4 Application notes and immunity to interference

- Fan operation is necessary.
- Interference-proof operation is only possible if the CPU555 is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see "Control and display elements (Page 79)").
- The module may not be inserted or removed while the rack is on live voltage.
- A CPU must be inserted into the first slot of the rack.

| NOTICE |
| --- |
| **CPU555 in the UR6021 rack** |
| CPU555 may only be used in the rack UR6021. |
| No CPU555 may be inserted in slot 21 when the UR6021 rack is used. |

**Note**

For more information on fan operation, refer to section "Rack (Page 41)".

For more information on EMC and environmental conditions, refer to section "General technical specifications (Page 39)".

### 4.1.5 Connection options

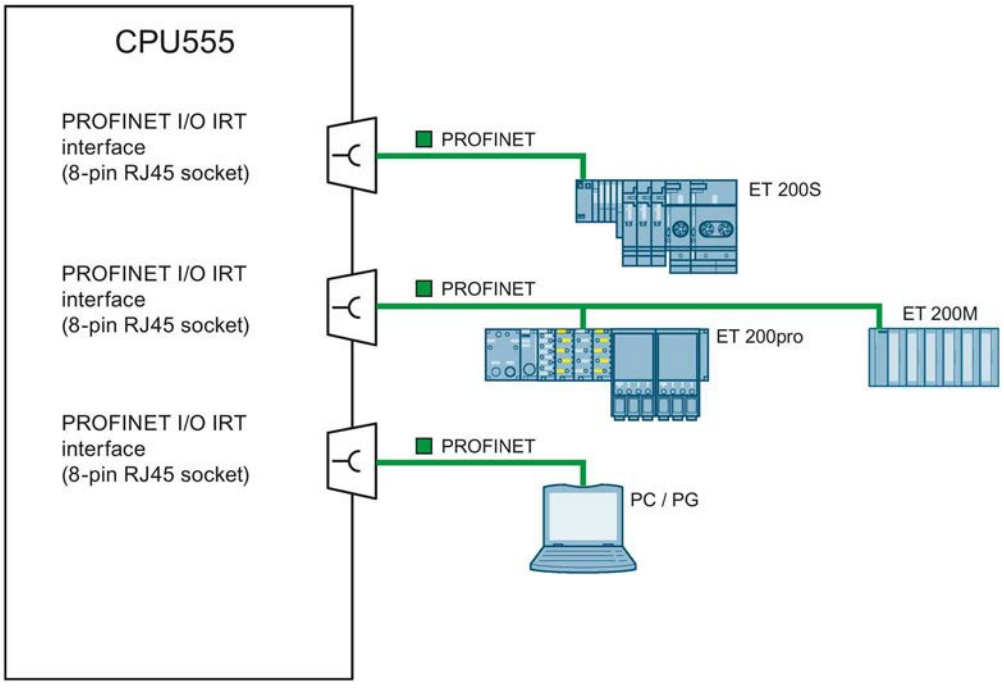



Figure 4-2 Connection examples of CPU555

## 4.1.6 Additional components

Table 4- 2 Additional components for CPU555

| Component | Designation | Article No. |
|---|---|---|
| Program memory (2 MB) | S7 MICRO MEMORY CARD | 6ES7953-8LL31-0AA0 |
| Program memory (4 MB) | S7 MICRO MEMORY CARD | 6ES7953-8LM31-0AA0 |
| Program memory (8 MB) | S7 MICRO MEMORY CARD | 6ES7953-8LP31-0AA0 |

Table 4- 3 Connecting cable

| Designation | Article No. |
|---|---|
| SIMATIC NET, Industrial Ethernet TP XP CORD RJ45/RJ45, dressed with 2 x RJ45 connectors, length ... | 6XV1870-3R... |

For information on additional products, refer to: Product catalog (https:eb.automation.siemens.com)

## 4.1.7 Pin assignments

### PROFINET I/O interface (X1 P1 R PN (LAN), X1 P2 R PN (LAN), X1 P3 PN (LAN))

The PROFINET I/O IRT connection (10/100 Mbps) is connected to the 8-pole RJ-45 plug socket with polarity reversal protection.

Table 4- 4 Pin assignment of X1 P1 R PN (LAN), X1 P2 R PN (LAN), X1 P3 PN (LAN) (RJ-45 socket)

| PIN | Designation |
|---|---|
| 1 | TXP (Transmit Data +) |
| 2 | TXN (Transmit Data -) |
| 3 | RXP (Receive Data +) |
| 4 | n.c. |
| 5 | n.c. |
| 6 | RXN (Receive Data -) |
| 7 | n.c. |
| 8 | n.c. |
| Enclosure | PE (shield) |

## 4.1.8 Note on firmware update

**Note**

**Updating the firmware**

- Firmware updates are available, if needed, on the Internet (http://www.siemens.com/automation/service&support) under "Downloads".
- Check regularly if firmware updates are available.
  Always install the latest firmware on the CPU555 to receive the latest security updates and feature enhancements.

| NOTICE |
| --- |
| **No firmware update during operation**<br>Note that a firmware update cannot take place during operation but only at plant standstill. |

| NOTICE |
| --- |
| **Qualified Personnel**<br>Only qualified personnel are permitted to perform the firmware update (see Qualified personnel (Page 13))! |

Table 4- 5 Operating states of the CPU555 during the firmware update

| Display | Operating state |
| --- | --- |
| **Initialization phase** | |
| ■ | LED test (approx. 1 sec) |
| • | Firmware start (flashing) |
| 0 | Operating system start |
| 1...9 | Operating system initialization / Startup |
| **Update** | |
| F | Firmware update in progress (F flashing) |
| ✓ | Firmware update completed |

## 4.1.9 Technical specifications/performance features

**Note**
**CPU555 in the UR6021**

The CPU module CPU555 can only be operated in the rack UR6021.

UR6021 can be equipped with a maximum of eight CPU555.

### Article number

| | |
|---|---|
| CPU module CPU555 | 6DD1600-0BB0 |

### CPU

| | |
|---|---|
| Processor | 64-bit Intel CPU |
| Clock frequency | 2 GHz |

| | |
|---|---|
| Communications processor | 32-bit CPU |
| Clock frequency | 450 MHz |

**Note**
**Removal and insertion**

Removal and insertion of the module is not permitted during operation.

### Processor

| | |
|---|---|
| SDRAM | 2 GB DDR3-1333 MHz (667 MHz) |
| Caches | • L1 cache: 32 KB data + 32 KB instruction<br>• L2 cache: 256 KB data/instruction<br>• L3 cache: 3 MB |

### Communications processor

| | |
|---|---|
| SDRAM | 256 MB DDR2-400 (150 MHz) |
| Cache | • L1 cache: 32 KB data + 32 KB instruction |

### Shared communication memory

| | |
|---|---|
| SRAM (battery buffered) | 1 MB |

### Module slots

| | |
|---|---|
| Number | 3 |
| Allocation of the slots | • Program memory S7 MMC (X4)<br>• PMC-/XMC plug-in cards (X5) [1] |
| [1] PMC/XMC plug-in cards are currently not provided. | |

### Time

| | |
|---|---|
| Resolution | 0.1 ms |

### Fast CPU-CPU communication

CPU555 supports P0 functionality.

Each CPU555 can communicate with up to 7 additional CPU555 by means of the PCIe interface via the backplane bus (P0 connector). This means that a point-to-point connection always exists between any two CPU555 modules (see Areas of application (Page 41)).

### Programming

The user program executed on the CPU module is configured on a PC using STEP 7 / HW Config and CFC and then downloaded to program memory.

The program memory must be located in the CPU module slot provided (X4).

Direct user program download from the PC to program memory in the CPU module via PROFINET interface (online loading).

### User program size

The size of the user program (compressed to approx. 50 %) that was downloaded to program memory and the size of free program memory can be viewed in the CFC by selecting the following menu command:

- PLC / Load / Info

### Utilization

Average load (measured with block PSL) should not exceed 90%, since this may lead to sporadic overload.

## Program memory

The user program created in CFC is downloaded to program memory. Program memory features Flash EPROM (2, 4 or 8 MB).

Program memory for user program: See Additional components (Page 85)

## PROFINET interfaces

| LAN interfaces | PROFINET I/O interfaces [1] |
|---|---|
| • Support of distributed I/O<br>• Operating control and monitoring<br>• Communication with a PC<br>• Download function<br>• TCP/UDP communication with other CPUs<br>• Set time of day | • X1 P1 R PN (LAN): 10/100 Mbps<br>• X1 P2 R PN (LAN): 10/100 Mbps<br>• X1 P3 PN (LAN): 10/100 Mbps |

1) All X1 interfaces have the same IP address

## I/O address range

| | |
|---|---|
| Inputs | 8192 bytes |
| Outputs | 8192 bytes |

## Process image partition

| | |
|---|---|
| Quantity | 1 |
| Address area | |
| Inputs, max. | 8192 bytes |
| Outputs, max. | 8192 bytes |

## Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V | 4.26 A (max. 7.98 A) |
| +3.3 V | 2.94 A (max. 3.95 A) |
| Backup battery | 3 µA (max. 27 µA) |

## Power losses/fan

| | |
|---|---|
| Typical power losses (5 V / 3.3 V) | 31 W (21.3 W / 9.7 W) |
| Fan required | Yes |

## Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight | 0.34 kg |

## Degree of protection

| | |
|---|---|
| Degree of protection according to DIN 40050 | IP00 |

# 4.2 CPU module CPU550/CPU551

## 4.2.1 Areas of application

The CPU550/CPU551 processor module can be customized by means of graphic interface and enables the realization of demanding, highly dynamic automatic control systems.

Use cases include:

- Roll nip controls
- Hydraulic positioning functions
- Strip cooling systems

## 4.2.2 Using the CPU551 - 6DD1600-0BA3

´Please note the following when using the CPU module CPU551 with the article number 6DD1600-**0BA3**.

### Configuration

**Note**

**Configuration**

- Up to D7-SYS V8.0: To configure the CPU module CPU551 "6DD1600-**0BA3**" in HW Config, select the CPU551 "6DD1600-**0BA2**".
- For system and communications configuration, select SIMATIC D7-SYS as of V5.2.
- Only use memory cards whose configuration was created with SIMATIC D7-SYS as of V5.2.

### Operation with CP53M0

**Note**

**CPU551 with CP53M0**

To operate the CPU module CPU551 (6DD1600-0BA3) with the communications module CP53M0, use only a communications module CP53M0 with a **functional status > 5**.

## Operation with CP51M1

**Note**

**CPU551 with CP51M1**

To operate the CPU module CPU551 (6DD1600-0BA3) with the communications module CP51M1, use only a communications module CP51M1 with a **functional status > 7**.

## Substitute value behavior

**Note**

**Floating decimal calculation**

Please note that if you have selected the option "Use substitute values for invalid Real values" that the calculation with invalid Real values (NaN) can return different results with versions 6DD1600-0BA1 and 6DD1600-0BA2 of CPU module CPU551.

## 4.2.3 Control and display elements

### LED display

The processor number, states and faults are displayed using a 5x7 dot matrix LED array.

### Acknowledge button S1

This button has two functions:

- Clearing the fault display:

  The acknowledge button can be used to clear sporadic or non-critical fault displays on the 5x7 dot matrix LED. An additional fault is displayed after the first one has been acknowledged.

- Digital signal input can be evaluated using the ASI function block.

### Front panel

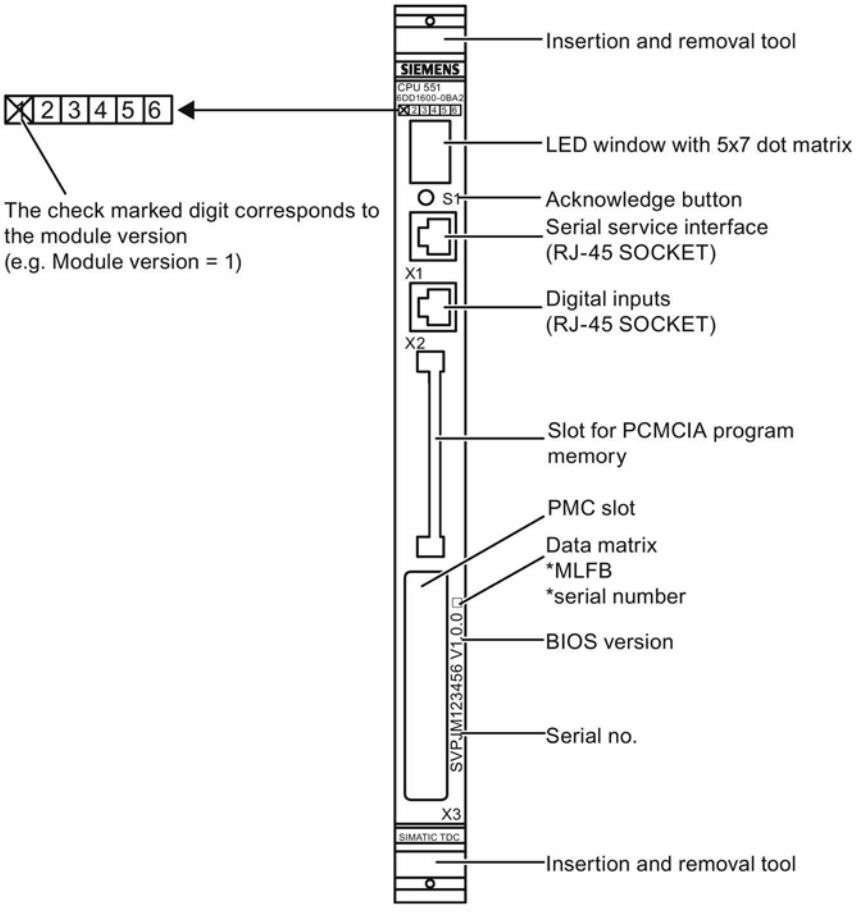



Figure 4-3 Front panel of CPU551

### 4.2.4 Status and fault displays

The configured number of the CPU module (1...20) is displayed in normal operation. Faults are indicated by a letter that informs you of the type of fault.

Slow alternation between the lit and dark state of the 5x7 dot matrix LEDs is referred to as flashing in the following table.

Table 4- 6 Operating and fault states of CPU550/CPU551

| Display | Operating and fault states | Can be cleared with S1 |
|---|---|---|
| **1... 20** | Configured number of the CPU module in normal operation.<br>User program is running | No |
| **A** | **User error**<br>User program is running<br>Diagnostics event, user-defined by means of USF function block | Yes |
| **All 35 dots off** | Initialization phase:<br>User program is not running<br>Individual initialization phases during startup are indicated by means of consecutive numbers. | No |
| **All 35 dots flashing** | Module failure:<br>User program is not running<br>• Hardware failure => replace CPU550/CPU551<br>• Fatal software error => contact the Hotline | No |
| **0** | **Initialization error**<br>User program is not running<br>Diagnostics should start at the CPU module that was the first to display fault message “0”.<br>• Flashing "0" Faults on this module<br>• Permanent "0": Faults on a different module<br>If none of the CPU modules can be identified as having been the first one, then of those which display a "0", the one inserted to the extreme left should first be selected. | No |
| **b** | **Monitoring error**<br>User program is running<br>Low-priority errors during initialization that allow the start of normal operation and that are detected in the background process, e.g.: For example,<br>• missing, low backup battery<br>• Missing program memory module<br>• Fan failure<br>• Invalid floating value (substitute value will be used) | Yes |

| Display | Operating and fault states | Can be cleared with S1 |
|---|---|---|
| C | **Communication error**<br>User program is running<br>Incorrect configuration of communication, or connection error<br>For more information on diagnostics functions, refer to the manual "D7-SYS - STEP 7, CFC and SFC configuring", chapter Basic software, section "Diagnostics". | No |
| d | **User stop** (not with CPU550)<br>User program is not running<br>User stop results in a stop of all CPUs in the same rack.<br>• Permanent "d":<br>Module is in STOP, triggered by another CPU.<br>• Flashing "d"<br>Module is in STOP, triggered by this CPU itself. | No |

| Display | Operating and fault states | Can be cleared with S1 |
|---|---|---|
| E | **Task Manager error**<br>User program is running<br>• Flashing "I": Initial error<br>• Static "I":<br>Sequential error after a lower priority error<br>The following errors are possible:<br>• *Cycle errors*<br>A task could not be completed within the sampling time.<br>• *Task overflow*<br>If a task that has not been not assigned top priority needs to be restarted.<br>• *No free local buffer*<br>The data buffer is no longer released. The task start will be skipped.<br>• *Software time monitoring*<br>If the basic sampling time is not processed four times in succession. The basic clock cycle timer is re-initialized with the configured basic sampling time and processing is continued.<br>For more information on diagnostics functions, refer to the manual "D7-SYS - STEP 7, CFC and SFC configuring (http://support.automation.siemens.com/WW/view/de/8776786/0/en)", chapter Basic software, section "Diagnostics". | Yes |
| H | **System error**<br>User program is not running<br>Hardware or software problems causing a program crash.<br>• Flashing "H" Faults on this module<br>• Permanent "H": Faults on a different module<br>For more information on diagnostics functions, refer to the manual "D7-SYS - STEP 7, CFC and SFC configuring (http://support.automation.siemens.com/WW/view/de/8776786/0/en)", chapter Basic software, section "Diagnostics". | No |

### 4.2.5 Application notes and immunity to interference

- Fan operation is necessary.
- Interference-proof operation is only possible if the CPU550/CPU551 is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see "Control and display elements (Page 93)").
- The module may not be inserted or removed while the rack is on live voltage.
- A CPU must be inserted into the first slot of the rack.

**Note**

For more information on fan operation, refer to chapter "Rack (Page 41)".

For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)".

### 4.2.6 Connection options

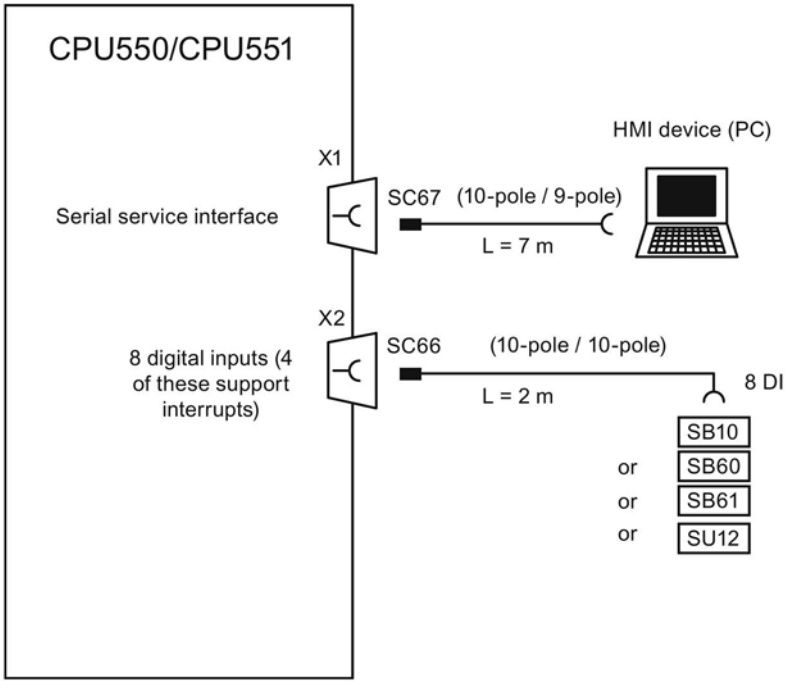



Figure 4-4 Connection options of CPU550/CPU551

## 4.2.7 Additional components

Table 4- 7 Additional components for CPU550/CPU551

| Component | Designation | Article number |
|---|---|---|
| Program memory (4 MB) | MC 500 | 6DD1610-0AH4 |
| Program memory (8 MB) | MC 510 | 6DD1610-0AH6 |
| Program memory (2 MB) | MC 521 | 6DD1610-0AH3 |
| PC connecting cable<br>(10-pole/9-pole) | SC67 | 6DD1684-0GH0 |
| Cable for digital inputs<br>(10-pole/10-pole) | SC66 | 6DD1684-0GG0 |
| Interface module<br>Electrical 1:1 wiring, no signal conversion | SB10 | 6DD1681-0AE2 |
| Interface module with electrical isolation and signal conversion | SB60 | 6DD1681-0AF4 |
| Interface module with electrical isolation and signal conversion | SB61 | 6DD1681-0EB3 |
| Interface module<br>Electrical 1:1 wiring, no signal conversion | SU12 | 6DD1681-0AJ1 |

## 4.2.8 Pin assignments

### Serial service interface (X1)

An control or configuration PC is connected to the 10-pin RJ-45 socket with polarity reversal protection using the SC67 PC cable.

Table 4- 8 Pin assignment of X1 and cable SC67

| X1 | | | SC67 | |
|---|---|---|---|---|
| PIN | Designation | | PIN CPU side | PIN PC side |
| 1 | DCD (Data Carrier Detect) | | n.c. | n.c. |
| 2 | RxD (Receive Data) | | 2 | 3 |
| 3 | TxD (Transmit Data) | | 3 | 2 |
| 4 | DTR (Data Terminal Ready) | | n.c. | n.c. |
| 5 | GND (Ground) | | 5 | 5 |
| 6 | DSR (Data Set Ready) | | n.c. | n.c. |
| 7 | RTS (Request to Send) | | n.c. | n.c. |
| 8 | CTS (Clear to Send) | | n.c. | n.c. |
| 9 | RI (Ring Indicator) | | n.c. | n.c. |
| 10 | (n.c.) | | n.c. | |
| n.c.: n.c. | | | | |

## Digital inputs (X2)

An interface module is connected to the 10-pin RJ-45 socket with polarity reversal protection via cable SC66.

Table 4- 9 Pin assignment X2 and cable SC66

| X2 | | | SC66 | |
|---|---|---|---|---|
| **PIN** | **Designation** | | **PIN CPU side** | **PIN PC side** |
| 1 | Ground | | n.c. | n.c. |
| 2 | Digital input 0 (supports interrupts) | | 2 | 1 |
| 3 | Digital input 1 (supports interrupts) | | 3 | 2 |
| 4 | Digital input 2 (supports interrupts) | | 4 | 3 |
| 5 | Digital input 3 (supports interrupts) | | 5 | 4 |
| 6 | Digital input 4 | | 6 | 5 |
| 7 | Digital input 5 | | 7 | 6 |
| 8 | Digital input 6 | | 8 | 7 |
| 9 | Digital input 7 | | 9 | 8 |
| 10 | Ground | | 10 | 10 |
| n.c.: n.c. | | | | |

## 4.2.9 Technical specifications/performance features

### Article number

| | |
|---|---|
| CPU module CPU550 | 6DD1600-0BA0 |
| CPU module CPU551 | 6DD1600-0BA1 /<br>6DD1600-0BA2 /<br>6DD1600-0BA3 |

The CPU modules CPU551 with the article numbers 6DD1600-0BA1 and 6DD1600-0BA2 have been replaced by the modules with the article number 6DD1600-0BA3.

**Note**

Where two different values are specified for a feature (separated by "/") in the manual, the first is valid for the module with article number 6DD1600-0BA1 and the second for the module with article number 6DD1600-0BA2 and the third for modules with the article number 6DD1600-0BA3.

### CPU

| | | | |
|---|---|---|---|
| CPU | 6DD1600-0BA1 | | |
| | | 6DD1600-0BA2 | |
| | | | 6DD1600-0BA3 |
| Processor | 64 bit RISC processor | | |
| Clock frequency | 266 MHz | 500 MHz | 800 MHz |

### Memory

| | | | |
|---|---|---|---|
| CPU | 6DD1600-0BA1 | | |
| | | 6DD1600-0BA2 | |
| | | | 6DD1600-0BA3 |

| | | | |
|---|---|---|---|
| SDRAM / DDR2-DRAM<br>• During initialization, the user program is loaded from program memory and expanded (Boot Flash is available separately)<br>• Data memory for the operating system, communication, message buffer, and Trace | 32 MB | 128 MB | 1 GB |
| SRAM<br>Buffered SRAM (by means of external battery in the rack) contains the following data that must be backed up to retentive memory on power failure:<br>• Fault diagnostics of the operating system ("exception buffer")<br>• Max. 993 process variables configured with **SAV** function block<br>• Data recorded using the Trace function or the message system (SRAM can be optionally configured) | 256 KB | 512 KB | 512 KB |
| Synchronized L1 cache | 64 KB | 64 KB | 64 KB |
| Synchronized L2 cache | ext. L2 cache | int. L2 cache | |
| | 512 KB | 256 KB | 512 KB |
| Synchronized L3 cache | ext. L3 cache | | int. L3 cache |
| | 2 MB | 8 MB | 1 MB |

## Module slots

| | |
|---|---|
| Number | 3 |
| Allocation of the slots | • Program memory MC5xx<br>• PMC plug-in cards[1)] |
| [1)] PMC plug-in cards are currently not provided. | |

## Time

| | |
|---|---|
| Resolution | 0.1 ms |

## Programming

The user program executed on the CPU module is configured on a PC using STEP7/HWConfig and CFC and then downloaded to program memory.

The program memory must be located in the CPU module slot provided.

There are two ways of loading the user program:

- **Offline loading**

  Carried out on the PC using an integrated or external PCMCIA programming adapter ("PC card").

- **Online download**

  Direct user program download from the PC to program memory in the CPU module via serial service interface.

## User program size

The size of the user program (compressed to approx. 50 %) that was downloaded to program memory and the size of free program memory can be viewed in the CFC by selecting the following menu command:

- PLC / Load / Info

## Utilization

Average load (measured with block PSL) should not exceed 95 %, since this may lead to sporadic overload.

## Program memory

The user program created in CFC is downloaded to program memory. Program memory is realized with Flash EPROM (2, 4 or 8 MB) and 8 KB EEPROM cache memory.

The following program memory may be used optionally, depending on the size of the user program:

- MC500 (4 MB)
- MC510 (8 MB)
- MC521 (2 MB)

## Software security

The module provides a socket for hardware blocks for implementation of a software security function for the user program.

| CPU module CPU551 | Number of sockets for hardware blocks |
|---|---|
| 6DD1600-0BA1 | 1 |
| 6DD1600-0BA2 | 2 * |
| 6DD1600-0BA3 | 2 * |

* can be configured as necessary

This hardware block can be checked using a special function block.

- Additional information on request.

## Digital inputs

| | |
|---|---|
| Number | 8 |
| Version | 4 of the 8 digital inputs support interrupts |
| Electrical isolation | No |
| Input voltage<br>• Rated voltage<br>• For 0 signal<br>• For 1 signal | <br>24 V<br>-1 V to +6 V<br>+13.5 V to +33 V |
| Input current<br>• For 0 signal, normally<br>• For 1 signal, normally | <br>0 mA<br>3 mA |
| Delay time per channel, max.<br>(Minimum cycle during which interrupt tasks can be triggered.) | 100 µs |

## Interfaces

| | |
|---|---|
| Serial service interface (X1)<br>• Functions for the user program<br>– Testing and commissioning<br>– Loading the program<br>• Service report<br>• Transmission rate | RS232 interface (V.24)<br><br>with CFC or “Basic commissioning”<br>from the PC<br>DUST1<br>19.2 Kbps |

## Communication

| Communication functions | Local CPU coupling |
|---|---|
| Max. number of configured send/receive channels (independent of the protocol used) | 1000 |

## Voltage, currents

| Rated voltages at 25 °C | Typical current consumption | |
|---|---|---|
| | 6DD1600-0BA1<br>6DD1600-0BA2 | 6DD1600-0BA3 |
| +5 V | 1.5 A | 1.3 A |
| +3.3 V | 2.0 A | 1.7 A |
| +12 V | 40 mA | 20 mA |
| -12 V | 40 mA | 20 mA |
| Backup battery | 2.2 / 3 µA | |

## Power losses/fan

| | 6DD1600-0BA1<br>6DD1600-0BA2 | 6DD1600-0BA3 |
|---|---|---|
| Typical power losses | 15 W | 13 W |
| Fan required | Yes | |

## Dimensions

| | 6DD1600-0BA1<br>6DD1600-0BA2 | 6DD1600-0BA3 |
|---|---|---|
| Number of slots required in the rack | 1 | |
| Dimensions W x H x D [mm] | 20 x 233 x 160 | |
| Weight | 0.6 kg | 0.5 kg |

# Signal modules

# 5

## 5.1 SM500 signal module

### 5.1.1 Areas of application

The SM500 signal module provides analog and digital I/O, as well as incremental and absolute encoder connections.

Use cases include:

- Central connection of drives
- Connection of analog and digital actuators and sensors
- Status display by means of integrated LEDs

### 5.1.2 Control and display elements

#### LED displays

The SM500 signal module is equipped with 8 LEDs. H1 and H2 provide information about the current module state.

Table 5- 1 LED displays of signal module SM500

| LED designation (color) | Function |
|---|---|
| H1 (green) and H2 (red) | Module status display |
| H3 (green) and H4 (green) | Can be controlled by means of function block BIQ8 (digital output). |
| H5 (green) and H6 (green) | |
| H7 (green) and H8 (green) | |

### Front panel

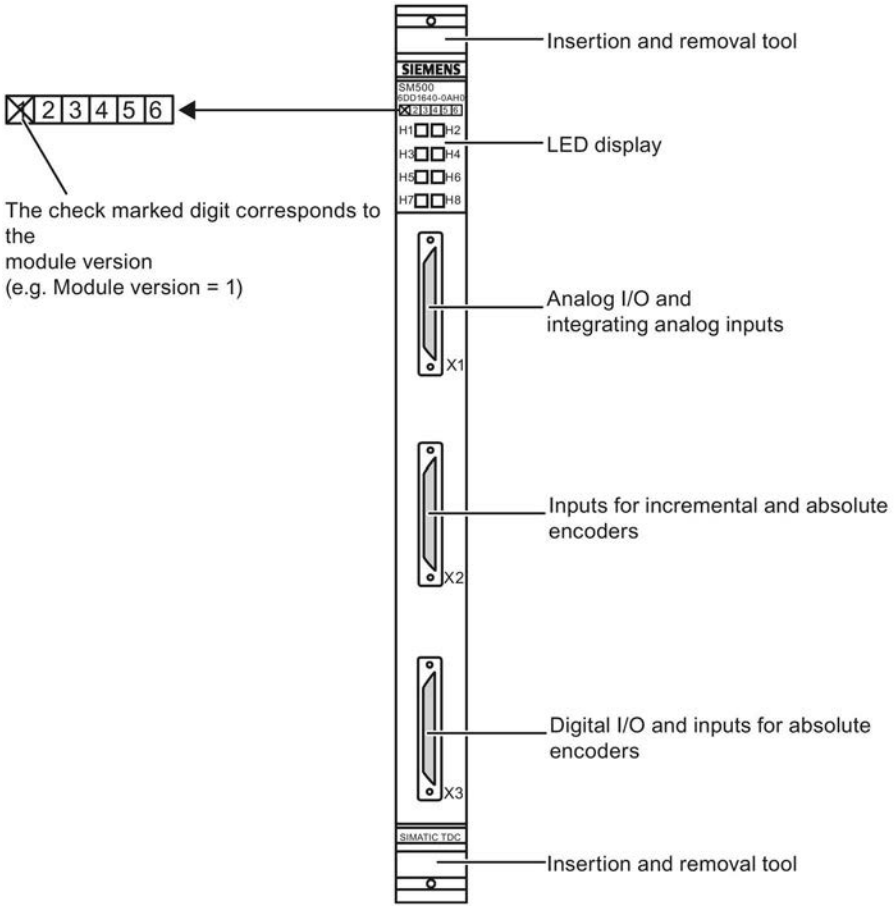



Figure 5-1 Front panel of SM500

## 5.1.3 Status and fault displays

### Status displays for SM500

Table 5- 2 Status displays for signal module SM500

| LED display | | Module status |
|---|---|---|
| H1 | H2 | |
| Off | Off | During voltage run-up |
| Off | On | FPGAs are configured, module is not initialized |
| On | Off | Module is initialized and operating error-free |
| On | On | After 3.3 V voltage failure<br>• Hardware failure => Power-down the rack and replace the SM500 |

## 5.1.4 Application notes and immunity to interference

- Fan operation is required
- Interference-proof operation is only possible if the SM500 is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see Control and display elements (Page 105)).
- The module may not be inserted or removed while the rack is on live voltage.

**Note**

For more information on fan operation, refer to chapter "Rack (Page 41)"!

For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)"!

## 5.1.5 Connection options

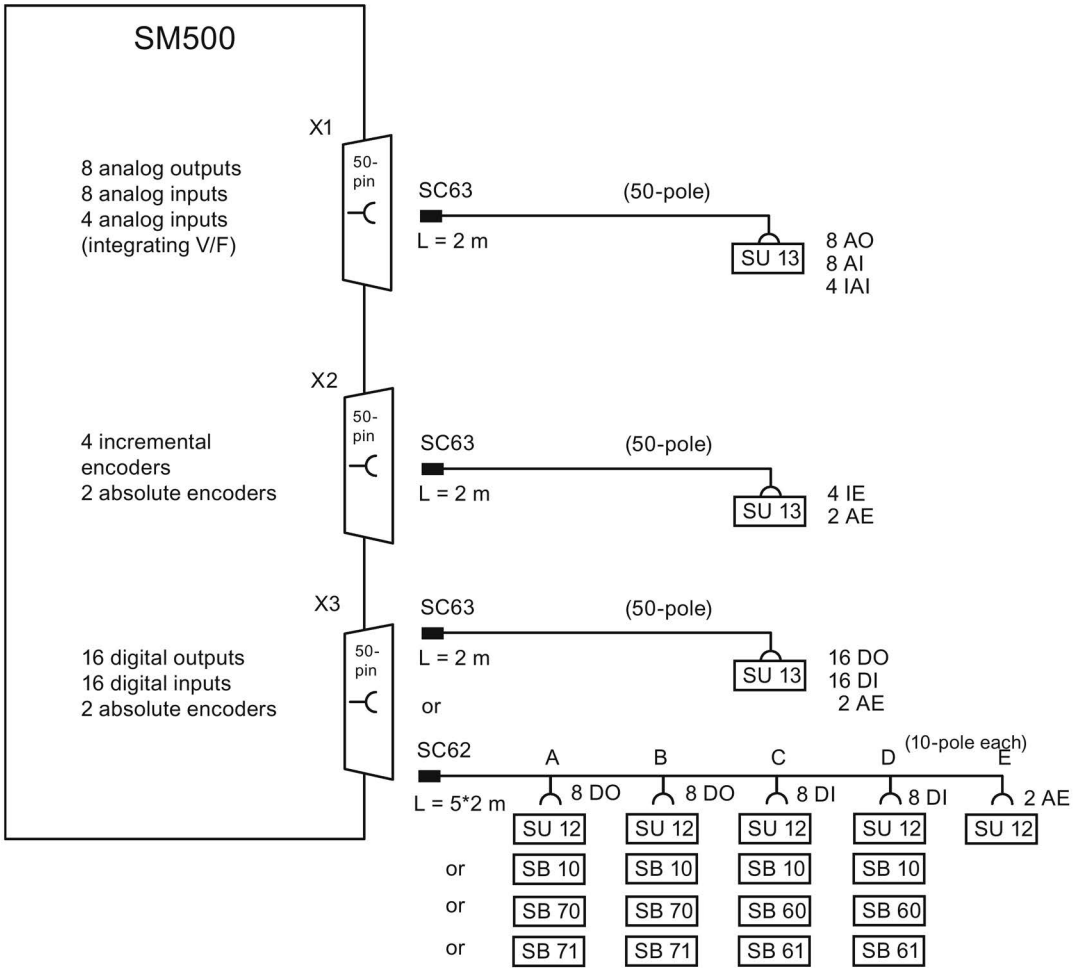



Figure 5-2 Connection options of SM500

## 5.1.6 Additional components

Table 5- 3 Cables and interface modules for signal module SM500

| Component | Designation | Article number |
|---|---|---|
| Cable for SM500<br>(50-pole/5*10-pole) | SC62 | 6DD1684-0GC0 |
| Cable for digital inputs (50-pole/50-pole) | SC63 | 6DD1684-0GD0 |
| Interface module<br>Direct wiring (1:1 wiring), 10 screw terminals, no signal conversion | SU12 | 6DD1681-0AJ1 |
| Interface module<br>Direct wiring (1:1 wiring), 50 screw terminals, no signal conversion | SU13 | 6DD1681-0GK0 |
| Interface module<br>Direct wiring (1:1 wiring), 8 digital I/O, LED, no signal conversion | SB10 | 6DD1681-0AE2 |
| Interface module<br>8 digital inputs, conversion, 120 V to 24 V (module signal level), LED, electrical isolation | SB60 | 6DD1681-0AF4 |
| Interface module<br>8 digital inputs, conversion 48 V to 24 V, LED, electrical isolation | SB61 | 6DD1681-0EB3 |
| Interface module<br>8 digital outputs, conversion, 24 V to 120 V (change-over relay), LED, electrical isolation | SB70 | 6DD1681-0AG2 |
| Interface module<br>8 digital outputs, conversion 25 V to 48 V (transistor) | SB71 | 6DD1681-0DH1 |

## 5.1.7 Incremental encoder input settings

Depending on the type of encoder used (15 V or 5 V encoder), switches S1 and S2 must be set on the module corresponding to the following table.

Each track (A/VW, B/RW, N/-) of a channel has a switch that can be used to set the appropriate encoder type:

- Switch open (OFF):

  15 V encoder, switching threshold 7 V

- Switch closed (ON):

  5 V encoder, switching threshold 0 V

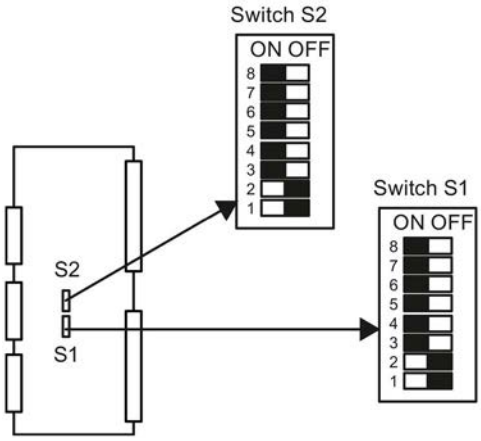
All tracks (A/VW, B/RW, N/-) of a channel must have the same switch setting for operation.

### Settings for encoder type with switches S1 and S2

Table 5- 4 Switch settings for 5 V and 15 V encoders

| Channel | Track | Switches | 15 V encoder | 5 V encoder |
|---|---|---|---|---|
| Encoder 1 | A/VW | S1, 1 | OFF | ON |
| | B/RW | S1, 2 | | |
| | N/- | S1, 3 | | |
| Encoder 2 | A/VW | S1, 4 | OFF | ON |
| | B/RW | S1, 5 | | |
| | N/- | S1, 6 | | |
| Encoder 3 | A/VW | S2, 1 | OFF | ON |
| | B/RW | S2, 2 | | |
| | N/- | S2, 3 | | |
| Encoder 4 | A/VW | S2, 4 | OFF | ON |
| | B/RW | S2, 5 | | |
| | N/- | S2, 6 | | |

The Switches S1.7 / S1.8 and S2.7 / S2.8 are without function.




Switches S1 and S2 for setting the threshold for incremental encoders

(see encoder synchronization)

Position of switches S1 and S2 on the module

## 5.1.8 Pin assignments

### Connection X1 with cable SC63

The assignment of the screw terminals at interface module SU13 corresponds to the connector assignment of X1.

Table 5- 5 Pin assignment of X1

| X1 | Designation | SU13 | | X1 | Designation | SU13 |
|---|---|---|---|---|---|---|
| 1 | Analog output 1+ | 1 | | 26 | Analog output 5+ | 26 |
| 2 | Analog output 1 - | 2 | | 27 | Analog output 5 - | 27 |
| 3 | Analog output 2+ | 3 | | 28 | Analog output 6+ | 28 |
| 4 | Analog output 2 - | 4 | | 29 | Analog output 6 - | 29 |
| 5 | Analog output 3+ | 5 | | 30 | Analog output 7+ | 30 |
| 6 | Analog output 3 - | 6 | | 31 | Analog output 7 - | 31 |
| 7 | Analog output 4+ | 7 | | 32 | Analog output 8+ | 32 |
| 8 | Analog output 4 - | 8 | | 33 | Analog output 8 - | 33 |
| 9 | - | 9 | | 34 | - | 34 |
| 10 | Ground, DA converter | 10 | | 35 | Ground, DA converter | 35 |
| 11 | Analog input 1 + | 11 | | 36 | Analog input 5 + | 36 |
| 12 | Analog input 1 - | 12 | | 37 | Analog input 5 - | 37 |
| 13 | Analog input 2+ | 13 | | 38 | Analog input 6+ | 38 |
| 14 | Analog input 2 - | 14 | | 39 | Analog input 6 - | 39 |
| 15 | Analog input 3+ | 15 | | 40 | Analog input 7+ | 40 |
| 16 | Analog input 3 - | 16 | | 41 | Analog input 7 - | 41 |
| 17 | Analog input 4+ | 17 | | 42 | Analog input 8 + | 42 |
| 18 | Analog input 4 - | 18 | | 43 | Analog input 8 - | 43 |
| 19 | - | 19 | | 44 | - | 44 |
| 20 | Ground, AD converter | 20 | | 45 | Ground, AD converter | 45 |
| 21 | Integrating analog input 1+ | 21 | | 46 | Integrating analog input 3 + | 46 |
| 22 | Integrating analog input 1- | 22 | | 47 | Integrating analog input 3 - | 47 |
| 23 | Integrating analog input 2 + | 23 | | 48 | Integrating analog input 4 + | 48 |
| 24 | Integrating analog input 2 - | 24 | | 49 | Integrating analog input 4 - | 49 |
| 25 | Ground, analog input | 25 | | 50 | Ground, analog input | 50 |

## Pin assignment X2 with cable SC63

The assignment of the screw terminals at interface module SU13 corresponds to the connector assignment of X2.

Table 5- 6 Pin assignment of X2

| X2 | Designation | SU13 | | X2 | Designation | SU13 |
|---|---|---|---|---|---|---|
| 1 | Incremental encoder 1, track A+ | 1 | | 26 | Incremental encoder 2, track A+ | 26 |
| 2 | Incremental encoder 1, track A- | 2 | | 27 | Incremental encoder 2, track A- | 27 |
| 3 | Incremental encoder 1, track B+ | 3 | | 28 | Incremental encoder 2, track B+ | 28 |
| 4 | Incremental encoder 1, track B- | 4 | | 29 | Incremental encoder 2, track B- | 29 |
| 5 | Incremental encoder 1, track N+ | 5 | | 30 | Incremental encoder 2, track N+ | 30 |
| 6 | Incremental encoder 1, track N- | 6 | | 31 | Incremental encoder 2, track N- | 31 |
| 7 | Incremental encoder 3, track A+ | 7 | | 32 | Incremental encoder 3, track B+ | 32 |
| 8 | Incremental encoder 3, track A- | 8 | | 33 | Incremental encoder 3, track B- | 33 |
| 9 | Incremental encoder 3, track N+ | 9 | | 34 | Incremental encoder 3, track N- | 34 |
| 10 | Ground, encoder | 10 | | 35 | Ground, encoder | 35 |
| 11 | Incremental encoder 4, track A+ | 11 | | 36 | Alarm input 1 | 36 |
| 12 | Incremental encoder 4, track A- | 12 | | 37 | Alarm input 2 | 37 |
| 13 | Incremental encoder 4, track B+ | 13 | | 38 | Alarm input 3 | 38 |
| 14 | Incremental encoder 4, track B- | 14 | | 39 | Alarm input 4 | 39 |
| 15 | Incremental encoder 4, track N+ | 15 | | 40 | Alarm acknowledgment output 1 | 40 |
| 16 | Incremental encoder 4, track N- | 16 | | 41 | Alarm acknowledgment output 2 | 41 |
| 17 | Monitoring input 1 | 17 | | 42 | Alarm acknowledgment output 3 | 42 |
| 18 | Monitoring input 2 | 18 | | 43 | Alarm acknowledgment output 4 | 43 |
| 19 | Monitoring input 3 | 19 | | 44 | 15 V encoder power supply | 44 |
| 20 | Monitoring input 4 | 20 | | 45 | Ground, encoder | 45 |
| 21 | Absolute encoder 3, data D+ | 21 | | 46 | Absolute encoder 4, data D+ | 46 |
| 22 | Absolute encoder 3, data D- | 22 | | 47 | Absolute encoder 4, data D- | 47 |
| 23 | Absolute encoder 3, clock C+ | 23 | | 48 | Absolute encoder 4, clock C+ | 48 |
| 24 | Absolute encoder 3, clock C- | 24 | | 49 | Absolute encoder 4, clock C- | 49 |
| 25 | Ground, encoder SSI | 25 | | 50 | Ground, encoder SSI | 50 |

## Connector X3 with cable SC63

The assignment of the screw terminals at interface module SU13 corresponds to the connector assignment of X3.

Table 5- 7 Pin assignment of X3

| X3 | Designation | SU13 | | X3 | Designation | SU13 |
|---|---|---|---|---|---|---|
| 1 | Digital output 1 | 1 | | 26 | Digital input 1 | 26 |
| 2 | Digital output 2 | 2 | | 27 | Digital input 2 | 27 |
| 3 | Digital output 3 | 3 | | 28 | Digital input 3 | 28 |
| 4 | Digital output 4 | 4 | | 29 | Digital input 4 | 29 |
| 5 | Digital output 5 | 5 | | 30 | Digital input 5 | 30 |
| 6 | Digital output 6 | 6 | | 31 | Digital input 6 | 31 |
| 7 | Digital output 7 | 7 | | 32 | Digital input 7 | 32 |
| 8 | Digital output 8 | 8 | | 33 | Digital input 8 | 33 |
| 9 | Ext. power supply +24V | 9 | | 34 | - | 34 |
| 10 | External ground | 10 | | 35 | External ground | 35 |
| 11 | Digital output 9 | 11 | | 36 | Digital input 9 | 36 |
| 12 | Digital output 10 | 12 | | 37 | Digital input 10 | 37 |
| 13 | Digital output 11 | 13 | | 38 | Digital input 11 | 38 |
| 14 | Digital output 12 | 14 | | 39 | Digital input 12 | 39 |
| 15 | Digital output 13 | 15 | | 40 | Digital input 13 | 40 |
| 16 | Digital output 14 | 16 | | 41 | Digital input 14 | 41 |
| 17 | Digital output 15 | 17 | | 42 | Digital input 15 | 42 |
| 18 | Digital output 16 | 18 | | 43 | Digital input 16 | 43 |
| 19 | Ext. power supply +24V | 19 | | 44 | - | 44 |
| 20 | External ground | 20 | | 45 | External ground | 45 |
| 21 | Absolute encoder 1, data D+ | 21 | | 46 | Absolute encoder 2, data D+ | 46 |
| 22 | Absolute encoder 1, data D- | 22 | | 47 | Absolute encoder 2, data D- | 47 |
| 23 | Absolute encoder 1, clock C+ | 23 | | 48 | Absolute encoder 2, clock C+ | 48 |
| 24 | Absolute encoder 1, clock C- | 24 | | 49 | Absolute encoder 2, clock C- | 49 |
| 25 | Ground, encoder SSI | 25 | | 50 | Ground, encoder SSI | 50 |

## Connector X3 with cable SC62

Only specific signal types are available at the cable ends of SC62 which can only be used for the matching interface modules (refer to "Connection options (Page 107)").

## Terminal assignment, interface modules

Table 5- 8 Terminal assignment of the interface modules

| Module type | Terminal *(x=1...8)* | Significance |
|---|---|---|
| SB10 | x<br>5x | 1:1 screw terminal connection<br>• Signal<br>• Reference potential (ground or P24) |
| SB60 | x1<br>x2<br>x4 | Digital inputs 115/120 V<br>• Ground<br>• Digital input 115 V<br>• Digital input 120 V |
| SB61 | x<br>1x<br>5x | Digital inputs 24/48 V<br>• Digital input 24 V<br>• Digital input 48 V<br>• Reference |
| SB70 | x1<br>x2<br>x4 | Digital outputs (relay)<br>• Root (center contact)<br>• NC contact<br>• NO contact |
| SB71 | x<br>5x | Digital outputs (transistor)<br>• Signal<br>• Ground |

## Terminal assignment at cable SC62, end A

Table 5- 9 Terminal assignments of the interface modules at connector X3, SC62 cable end A

| X3 | Designation | SU12 | SB10 | SB70 | SB71 |
|---|---|---|---|---|---|
| 1 | Digital output 1 | 1 | 1/51 | 11/12/14 | 1/51 |
| 2 | Digital output 2 | 2 | 2/52 | 21/22/24 | 2/52 |
| 3 | Digital output 3 | 3 | 3/53 | 31/32/34 | 3/53 |
| 4 | Digital output 4 | 4 | 4/54 | 41/42/44 | 4/54 |
| 5 | Digital output 5 | 5 | 5/55 | 51/52/54 | 5/55 |
| 6 | Digital output 6 | 6 | 6/56 | 61/62/64 | 6/56 |
| 7 | Digital output 7 | 7 | 7/57 | 71/72/74 | 7/57 |
| 8 | Digital output 8 | 8 | 8/58 | 81/82/84 | 8/58 |
| 9 | Ext. power supply +24V | 9 | 1P | 1P | 1P |
| 10 | External ground | 10 | 1M | 1M | 1M |

## Terminal assignment at cable SC62, end B

Table 5- 10 Terminal assignments of the interface modules at connector X3, SC62 cable end B

| X3 | Designation | SU12 | SB10 | SB70 | SB71 |
|---|---|---|---|---|---|
| 11 | Digital output 9 | 1 | 1/51 | 11/12/14 | 1/51 |
| 12 | Digital output 10 | 2 | 2/52 | 21/22/24 | 2/52 |
| 13 | Digital output 11 | 3 | 3/53 | 31/32/34 | 3/53 |
| 14 | Digital output 12 | 4 | 4/54 | 41/42/44 | 4/54 |
| 15 | Digital output 13 | 5 | 5/55 | 51/52/54 | 5/55 |
| 16 | Digital output 14 | 6 | 6/56 | 61/62/64 | 6/56 |
| 17 | Digital output 15 | 7 | 7/57 | 71/72/74 | 7/57 |
| 18 | Digital output 16 | 8 | 8/58 | 81/82/84 | 8/58 |
| 19 | Ext. power supply +24V | 9 | 1P | 1P | 1P |
| 20 | External ground | 10 | 1M | 1M | 1M |

## Terminal assignment at cable SC62, end C

Table 5- 11 Terminal assignments of the interface modules at connector X3, SC62 cable end C

| X3 | Designation | SU12 | SB10 | SB60 | SB61 |
|---|---|---|---|---|---|
| 26 | Digital input 1 | 1 | 1/51 | 14/12/11 | 1/11/51 |
| 27 | Digital input 2 | 2 | 2/52 | 24/22/21 | 2/12/52 |
| 28 | Digital input 3 | 3 | 3/53 | 34/32/31 | 3/13/53 |
| 29 | Digital input 4 | 4 | 4/54 | 44/42/41 | 4/14/54 |
| 30 | Digital input 5 | 5 | 5/55 | 54/52/51 | 5/15/55 |
| 31 | Digital input 6 | 6 | 6/56 | 64/62/61 | 6/16/56 |
| 32 | Digital input 7 | 7 | 7/57 | 74/72/71 | 7/17/57 |
| 33 | Digital input 8 | 8 | 8/58 | 84/82/81 | 8/18/58 |
| 34 | - | 9 | 1P | 1P | 1P |
| 35 | External ground | 10 | 1M | 1M | 1M |

## Terminal assignment at cable SC62, end D

Table 5- 12 Terminal assignments of the interface modules at connector X3, SC62 cable end D

| X3 | Designation | SU12 | SB10 | SB60 | SB61 |
|---|---|---|---|---|---|
| 36 | Digital input 9 | 1 | 1/51 | 14/12/11 | 1/11/51 |
| 37 | Digital input 10 | 2 | 2/52 | 24/22/21 | 2/12/52 |
| 38 | Digital input 11 | 3 | 3/53 | 34/32/31 | 3/13/53 |
| 39 | Digital input 12 | 4 | 4/54 | 44/42/41 | 4/14/54 |
| 40 | Digital input 13 | 5 | 5/55 | 54/52/51 | 5/15/55 |
| 41 | Digital input 14 | 6 | 6/56 | 64/62/61 | 6/16/56 |
| 42 | Digital input 15 | 7 | 7/57 | 74/72/71 | 7/17/57 |
| 43 | Digital input 16 | 8 | 8/58 | 84/82/81 | 8/18/58 |
| 44 | - | 9 | 1P | 1P | 1P |
| 45 | External ground | 10 | 1M | 1M | 1M |

## Terminal assignment at cable SC62, end E

Table 5- 13 Terminal assignments of the interface module at connector X3, SC62 cable end E

| X3 | Designation | SU12 |
|---|---|---|
| 21 | Absolute encoder 1, data D+ | 1 |
| 22 | Absolute encoder 1, data D- | 2 |
| 23 | Absolute encoder 1, clock C+ | 3 |
| 24 | Absolute encoder 1, clock C- | 4 |
| 25 | Ground, encoder SSI | 5 |
| 46 | Absolute encoder 2, data D+ | 6 |
| 47 | Absolute encoder 2, data D- | 7 |
| 48 | Absolute encoder 2, clock C+ | 8 |
| 49 | Absolute encoder 2, clock C- | 9 |
| 50 | Ground, encoder SSI | 10 |

## 5.1.9 Technical specifications/performance features

### Article number

| | |
|---|---|
| SM500 signal module | 6DD1640-0AH0 |

### Analog outputs

| | |
|---|---|
| Number | 8 |
| Version | Output with associated ground |
| Electrical isolation | No |
| Output voltage range | -10 V to +10 V |
| Output current | ± 10 mA |
| Resolution | 12 bits |
| Typical conversion time per channel | 4 µs |
| Tolerance<br>• Differential linearity error, max.<br>• Gain error, max.<br>• Offset error, max. | <br>± 1 LSB (monotony guaranteed)<br>± 0.3%<br>± 24 LSB |
| Slew rate | approx. 3.5 V/µs |
| Voltage output<br>• Short-circuit protection<br>• Short-circuit current | <br>Yes (to ground)<br>Approx. 100 mA |

### Analog inputs

| | |
|---|---|
| Number | 8 |
| Version | Differential inputs |
| Electrical isolation | No |
| Input voltage range | -10 V to +10 V |
| Resolution | 12 bits |
| Conversion time per channel, max | approx. 20 µs |
| Tolerance<br>• Differential linearity error, max.<br>• Gain error, max.<br>• Offset error, max. | <br>± 1 LSB (No missing code)<br>± 0.3%<br>± 5 LSB |
| Input resistance | 20 kΩ |
| Input filter | 34 kHz |
| Reverse polarity protection | Yes, as differential inputs are used |

## Integrating analog inputs

| | |
|---|---|
| Number | 4 |
| Version | Differential inputs |
| Electrical isolation | No |
| Input voltage range | -10 V to +10 V |
| Resolution | Depending on the integration time,<br>e.g. 15 bits for a 4 ms integration time. |
| Integration time per channel, max | Configurable |
| Tolerance<br>Integral linearity error, max.<br>Gain error, max.<br>Typical offset error | 0.05%<br>1%<br>2 LSB (software adjustment) |
| Input resistance | 470 kΩ |
| Input filter | 2 kHz |
| Reverse polarity protection | Yes, as differential inputs are used |

## Digital outputs

| | |
|---|---|
| Number | 16 |
| Electrical isolation | No |
| External power supply<br>• Rated voltage<br>• Perm. area<br>• short-term<br>• Current consumption, max., no load | <br>24 V<br>20.4 V to 28.8 V<br>35 V (for max. 0.5 s)<br>40 mA |
| Output voltage range<br>• With 0 signal, max.<br>• With 1 signal, min. | <br>3 V<br>ext. Supply voltage – 2.5 V |
| Output current<br>• With 0 signal, min.<br>• at 1 signal<br>– Rated value<br>– Valid range, max. | <br>-20 µA<br><br>50 mA<br>100 mA |
| Delay time | 100 µs |
| Switching frequency of outputs<br>With resistance load, max. | 6 kHz |
| Short-circuit protection to<br>• Ground<br>• External power supply | <br>yes<br>No |

| | |
|---|---|
| Short-circuit current, max. | 250 mA |
| Total current of outputs (up to 60 °C) | 16 x 50 mA |
| Limiting of inductive cut-off voltages | ext. Supply voltage +1 V |

## Digital inputs

| | |
|---|---|
| Number | 16 |
| Electrical isolation | No |
| Input voltage<br>• Rated voltage<br>• For 0 signal<br>• For 1 signal | <br>24 V<br>-1 V to + 6 V<br>+13.5 V to +33 V |
| Input current<br>• For 0 signal, normally<br>• For 1 signal, normally | <br>0 mA<br>3 mA |
| Delay time per channel, max. | 100 µs |

## Incremental encoder

Encoder types that conform to technical specifications may be connected to the incremental encoder inputs.

| | | |
|---|---|---|
| Number | 4 | |
| Connectable types | Incremental encoders with 90º track phase offset | Incremental encoders with separate up/down tracks |
| Version | Differential inputs,<br>selectable 15 V (HTL) or 5 V (TTL) encoder signal | |
| Track signals | Tracks A, B with/without zero pulse | Up/down tracks |
| Phase difference of track signals, min. | 200 ns | |
| Pulse frequency, max. | 1 MHz | 2.5 MHz |
| Interference pulse suppression | Configurable | |
| Electrical isolation | No | |
| Input voltage<br>• 15 V – encoder:<br>– Valid range<br>– at 0 signal<br>– at 1 signal<br>• 5 V – encoder<br>– Valid range<br>– at 0 signal<br>– at 1 signal | <br><br>-30 V to +30 V<br>-30 V to +4 V<br>+8 V to +30 V<br><br>-7 V to + 7 V<br>-7 V to –0.7 V<br>+1.5 V to +7 V | |

| | |
|---|---|
| Input current<br>• 15 V – encoder (typ., abs.)<br>• 5 V – encoder (typ., abs.) | <br>5 mA<br>1.5 mA |
| Monitoring output | Not available |
| Monitoring input | Specification as for digital inputs |
| Interrupt reset output<br>• Short-circuit protection to<br>– Ground<br>– External power supply<br>• Short-circuit current, max. | <br><br>yes<br>No<br>20 mA |
| Interrupt input<br>Input voltage<br>• Valid range<br>• 0 signal, max.<br>• 1 signal, min.<br>Input current<br>• 0 signal, min.<br>• 1 signal, min. | <br><br>0 V to 5 V<br>< 0.5 V<br>> 2.0 V<br><br>-2.8 mA<br>-1.6 mA |

## Absolute encoders

| | |
|---|---|
| Number | 4 |
| Version | Differential inputs, RS485 signal level |
| Connectable types | |
| Log files | SSI, EnDat |
| Data formats | Gray code, binary |
| Data direction<br>• Unidirectional<br>• Bidirectional | <br>SSI: Unidirectional<br>EnDat : Bidirectional |
| Data bits | SSI: 25 + parity<br>EnDat : variable |
| Pulse frequency, max. | 2 MHz |
| Electrical isolation | No |
| Input voltage | RS485 signal level |

## Sensor supply voltage

| | |
|---|---|
| Version | |
| Typical output voltage | 13.5 V |
| Output current, max. | 150 mA (short circuit-proof, short-circuit current approx. 250 mA) |

## Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V | 1 A |
| +3.3 V | 50 mA |
| +12 V | 300 mA |
| -12 V | 300 mA |

## Power losses/fan

| | |
|---|---|
| Typical power losses | 12.5 W |
| Fan required | yes |

## Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight, approx. | 0.7 kg |

# Communication modules

# 6

## 6.1 CP50M1 communication module

### 6.1.1 Areas of application

CP50M1 is a communication module with communication memory function and two PROFIBUS DP interfaces (MPI interface only on X1).

Use cases include:

- Interfacing with distributed I/O devices and/or drives (master and/or slave function)
- Central commissioning of all CPU modules in the rack (MPI nodes)
- Buffer memory for data exchange between CPU modules
- Function for routing to other CP modules
- Connection of SIMATIC visualization components, e.g.: WinCC, or OP/TD

#### Replacing a CP50M0 with a CP50M1

**Note**

**Replaceent parts compatibility**

The CP50M1 is not compatible with CP50M0 as a replacement part.

If a CP50M0 is replaced by a CP50M1, it must be re-configured in HW Config.

| | CP50M0 | CP50M1 |
|---|---|---|
| Article number | 6DD1661-0AD0 | 6DD1661-0AD1 |
| PROFIBUS DP interface (X1 / X2) | 2<br>(X1 + X2 optionally DP or MPI) | 2<br>(X1 optionally DP or MPI) |
| MPI interface | 2 | 1 |
| Parameter assignment and diagnostics interface | yes | yes |
| Function for routing to other CP modules | no | yes |
| Communication memory | ---- | SDRAM, 1MB |
| Buffer memory module | DRAM, 8 MB | SDRAM, 8 MB |
| VMEbus configuration memory | ---- | NOR Flash, 512 KB |

| | CP50M0 | CP50M1 |
|---|---|---|
| **Rated voltage** | Current consumption | Current consumption |
| **+5 V** | 1 A | 1 A |
| **+3.3 V** | --- | 100 mA |
| **+12 V** | --- | 20 mA |
| **-12 V** | --- | 10 mA |
| **Ext. battery (min. 2.2 V, typ. 3.0 V)** | 350 nA | --- |
| **Typical power losses** | 5 W | 5.5 W |
| **Fan required** | yes | no |
| **Slots required** | 1 | 1 |
| **Dimensions W x H x D (mm)** | 20 x 233 x 160 | 20 x 233 x 160 |
| **Weight** | 0.34 kg | 0.6 kg |

## 6.1.2 Control and display elements

### LED displays

LEDs H1, H2, H7 and H8 indicate the operating state of communication module CP50M1.

LEDs H3 to H6 provide information about the current operating state of the two PROFIBUS DP channels.

### Front panel

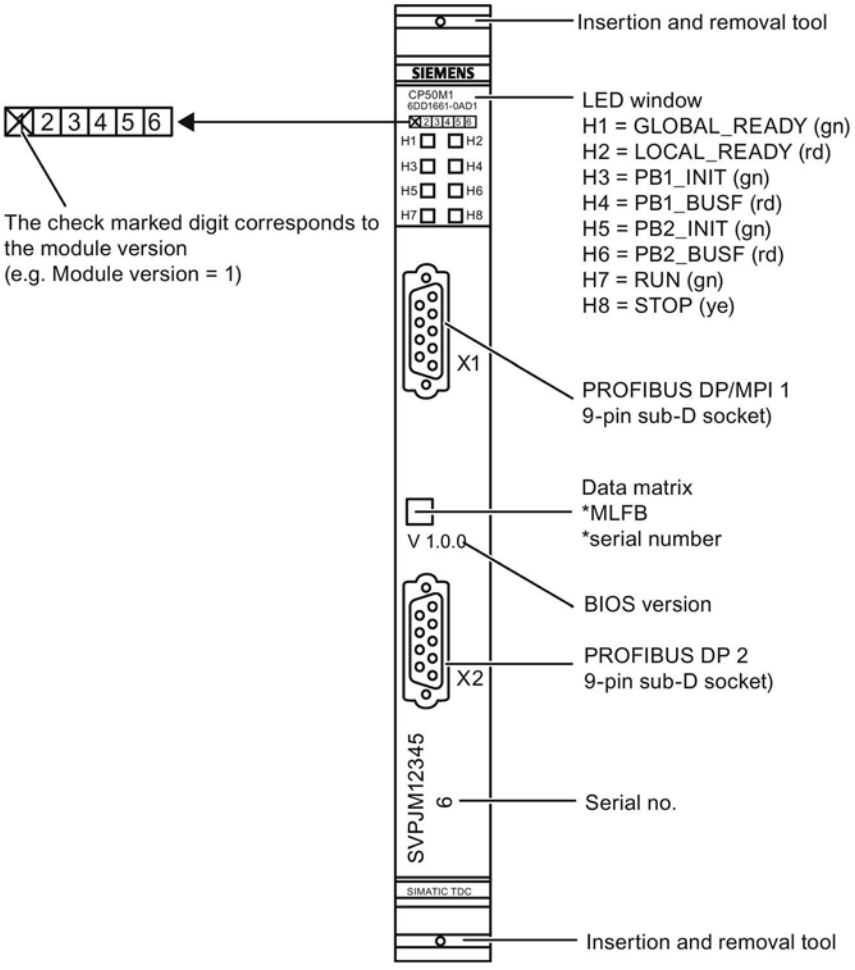



Figure 6-1 Front panel of CP50M1

## 6.1.3 Status and fault displays

### Status displays for operation of the CP50M1 module

Table 6- 1 Operating state displays for CP50M1 (LED H1 and H2)

| Display | | Operation state |
|---|---|---|
| H1 (green) | H2 (red) | |
| Off | Off | CP50M1 is switched off or not parameterized |
| Off | On | CP50M1 is ready but not yet initialized |
| On | Off | CP50M1 has been initialized |
| On | On | Power failure on CP50M1 |

Table 6- 2 Operating state displays for CP50M1 (LED H7 and H8)

| Display | | Operation state |
|---|---|---|
| H7 (green) | H8 (yellow) | |
| Off | Off | Module is switched off (off-current state) |
| Off | On | STOP operating state<br>Initialization error, no valid configuration found |
| Flashing | Off | CP50M1 startup |
| On | Off | RUN operating state<br>Startup completed, CP50M1 is in normal operation |

### Status displays for PROFIBUS DP interfaces

Table 6- 3 Operating state displays for CP50M1 (LED H3 to H6)

| LED | Display | Operation state |
|---|---|---|
| H3 (green) | On | CP50M1, PB-DP1 is initialized and ready |
| H4 (red) | On | CP50M1, PB-DP1 bus error |
| | Flashing | CP50M1, one or several slaves connected to the PB-DP1 interface are not responding |
| H5 (green) | On | CP50M1, PB-DP2 is initialized and ready |
| H6 (red) | On | CP50M1, PB-DP2 bus error |
| | Flashing | CP50M1, one or several slaves connected to the PB-DP2 interface are not responding |

### 6.1.4 Application notes and immunity to interference

- Interference-free operation is only possible if the CP50M1 is firmly attached to the subrack. Insert the module and then bolt it onto the rack accordingly (two screw heads, "Control and display elements (Page 125)").
- The module may not be inserted or removed while the rack is on live voltage.
- The factory setting of switch S1 may not be changed (refer to "Connection options (Page 127)").

**Note**

For more information on fan operation, refer to chapter "Rack (Page 41)"!

For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)"!

### 6.1.5 Connection options

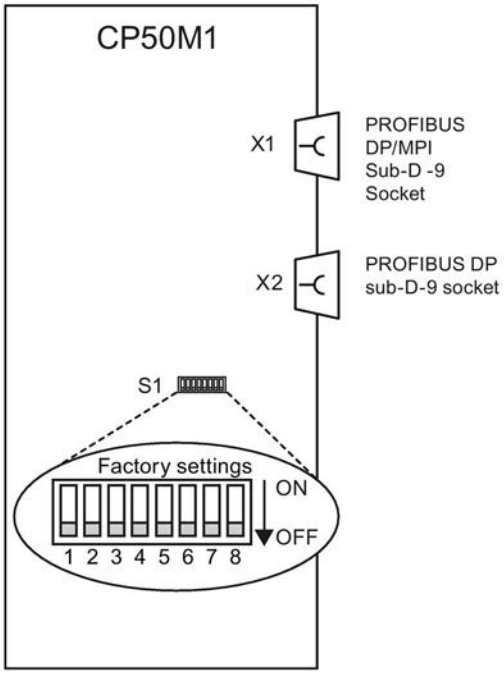



Figure 6-2 Connection options of CP50M1

## 6.1.6 Additional components

### Examples for PROFIBUS RS485 bus connector

- 6ES7972-0BA12-0XA0 (90°; without PG socket)
- 6ES7972-0BA12-0XA0 (90°; without PG socket)
- 6ES7972-0BA42-0XA0 (35°; without PG socket)
- 6ES7972-0BB42-0XA0 (35°; without PG socket)
- 6ES7972-0BA30-0XA0 (30°; without PG socket)

### Examples for fabricated cables (RS485)

- 6XV1830-1CH15 (1.5 m)
- 6XV1830-1CH30 (3 m)
- 6XV1830-2AH30 (3 m; PG)
- 6XV1830-2AH50 (5 m; PG)
- 6XV1830-2AN10 (10 m; PG)

**Note**

You can find more information in the SIMATIC NET Catalog IK PI or in the SIMATIC S7 Catalog.

## 6.1.7 Pin assignments

### PROFIBUS DP/MPI interface X1 and X2

The following connections are assigned to the 9-pin sub-D receptacle:

- PROFIBUS interface, RS 485 format and electrical isolation
- 5 V power supply for Optical Link Modules (OLM) with electrical isolation

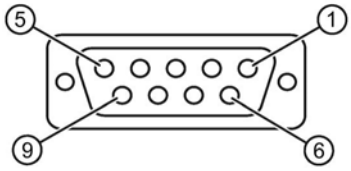



Table 6- 4 Pin assignment of X1 and X2

| Pin | Designation | Explanation |
|---|---|---|
| 1 | n.c. | n.c. |
| 2 | PB1/2_M24V | Ground, non-isolated |
| 3 | PB1/2_RS458_B | Line B |
| 4 | PB1/2_RTSAS | RTS from AS |
| 5 | 1/2MEXT | Ground P5, electrically isolated (to supply OLMs) |
| 6 | 1/2P5EXT | P5 electrically isolated (to OLM supply) (5 V DC/90 mA) |
| 7 | PB1/2_P24MPI | P24, non-isolated (24 V DC/150 mA) |
| 8 | PB1/2_RS458_A | Line A |
| 9 | PB1/2_RTSPG | RTS from programming device (n.c.) |
| Enclosure | Shield | |

## 6.1.8 Technical specifications/performance features

### Article number

| | |
|---|---|
| CP50M1 communication module | 6DD1661-0AD1 |

### Memory

| | |
|---|---|
| Communication memory | SRAM, 1 MB |
| Buffer memory module | SDRAM, 8 MB |
| **Note:**<br>Of several CP50M1 that are inserted in a rack, only the CP at the extreme left has the communication memory function. All others may only be configured as pure communication modules (2 PROFIBUS DP/MPI interfaces). | |
| VMEbus configuration memory | NOR Flash, 512 KB |

### Interfaces

2 PROFIBUS interfaces (X1 and X2) – X1 can be configured as DP or MPI

**Note**

The two interfaces X1 and X2 are to be considered as one unit when assigning the DP address (addresses in the shared address space may be assigned only once, i.e. if the entire address space is is used for one interface, the second interface can no longer be used).

| | |
|---|---|
| PROFIBUS DP interfaces<br>• Master or slave interface for PROFIBUS DP, including “Shared Input”, SYNC, and FREEZE functions<br>• Multimastering supported<br>• Transmission rates<br>• Frame length per slave<br>• Status display via LEDs | RS 485 format<br>• 9.6 kbps to 12 Mbps<br>• max. 244 bytes<br>• See Status and fault displays (Page 126) |
| MPI interfaces<br>• Status display via LEDs<br>• PG/OP services can be used | • See Status and fault displays (Page 126)<br>• E.g. coupling with the configuration station (CFC in test mode) |
| Power supply to Optical Link Modules (OLM) with electrical isolation | See Pin assignments (Page 129) |

## Communication

| | |
|---|---|
| Communication functions | • PROFIBUS DP coupling<br>• MPI coupling<br>• Buffer memory coupling |

## Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V DC (from rack) | 1A |
| External battery (min. 2.2 V, typically 3.0 V) | 350 nA |

## Power losses/fan

| | |
|---|---|
| Typical power losses | 5 W |
| Fan required | Yes, external fan |

## Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight | 0.34 kg |

# 6.2 CP51M1 communication module

## 6.2.1 Areas of application

CP51M1 is an Industrial Ethernet interface with buffer memory function. It can be used for the following applications:

- Exchange of process data with other CP51M1 and SIMATIC Industrial Ethernet modules (e.g. CP443-1)
- Visualization of process data in WinCC
- Visualization of messages in WinCC
- Exchange of process data with third-party systems (e.g. process computers)
- Central commissioning and diagnostics of all CPU modules in the rack
- Buffer memory for data exchange between CPU modules
- Time synchronization for uniform system time

## 6.2.2 Control and display elements

### LED displays

LEDs H1, H2, H7 and H8 indicate the operating state of communication module CP51M1.

LEDs H3 to H6 provide information about the current network traffic.

### Front panel

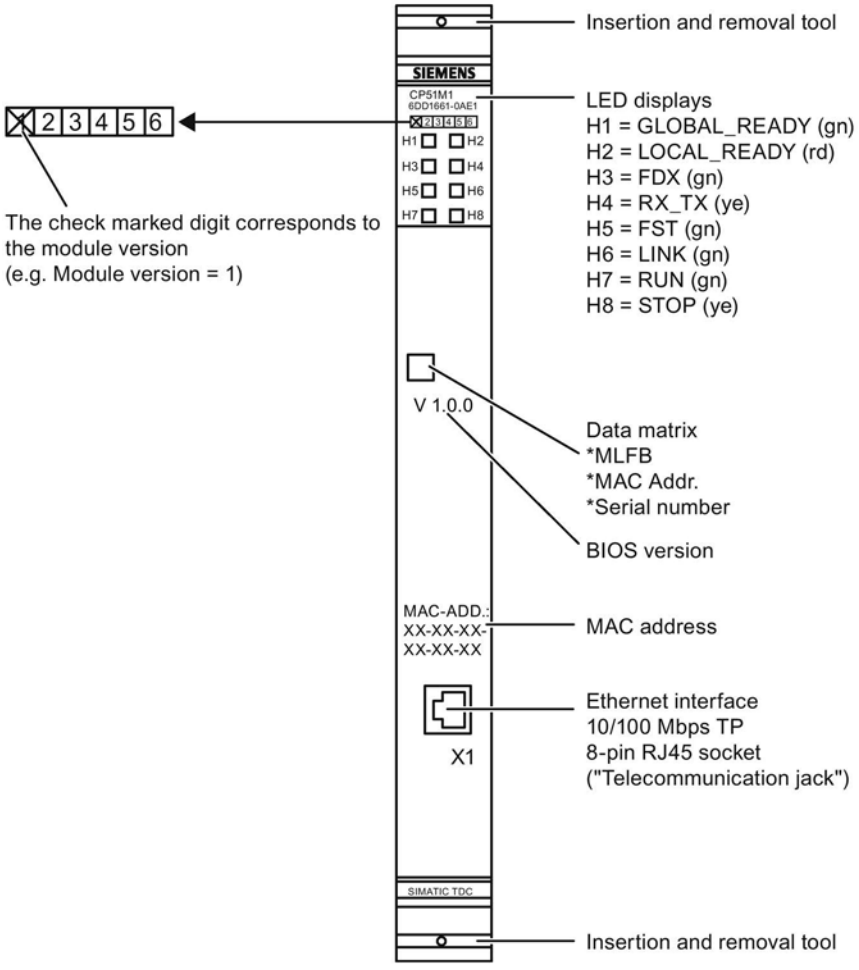



Figure 6-3 Front panel of CP51M1

## 6.2.3 Status and fault displays

### Status displays for module operation

Table 6- 5 Operating state displays for CP51M1 (LED H1 and H2)

| Display | | Operation state |
|---|---|---|
| H1 (green) | H2 (red) | |
| Off | Off | CP51M1 is switched off or not parameterized |
| Off | On | CP51M1 is ready but not yet initialized |
| On | Off | CP51M1 is initialized |
| On | On | Power failure on CP51M1 |

Table 6- 6 Operating state displays for CP51M1 (LED H7 and H8)

| Display | | Operation state |
|---|---|---|
| H7 (green) | H8 (yellow) | |
| Off | Off | Module is switched off (off-current state) |
| Off | On | STOP operating state<br>Initialization error, no valid configuration found |
| Flashing | Off | CP51M1 startup |
| On | Off | RUN operating state<br>Startup completed, CP51M1 is in normal operation |

### Status displays for network operation

Table 6- 7 Operating state displays for CP51M1 (LED H3 to H6)

| LED | Display | Operation state |
|---|---|---|
| H3 (green) | On | CP51M1 has at least one full duplex connection |
| H4 (yellow) | On | Data traffic in transmit and/or receive direction on Ethernet |
| H5 (green) | On | CP51M1 is communicating via Fast Ethernet (100 Mbps) |
| | Flashing | CP51M1 is in the "auto-sensing phase“ |
| H6 (green) | On | CP51M1 is connected (link) to an Ethernet compatible device (hub, switch, PC) |

## 6.2.4 Application notes and immunity to interference

- Interference-proof operation is only possible if CP51M1 is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see "Control and display elements (Page 133)").
- The module may not be inserted or removed while the rack is on live voltage.
- The factory setting of switch S1 may not be changed (refer to "Connection options (Page 135)").

**Note**

For more information on fan operation, refer to chapter "Rack (Page 41)"!

For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)"!

## 6.2.5 Connection options

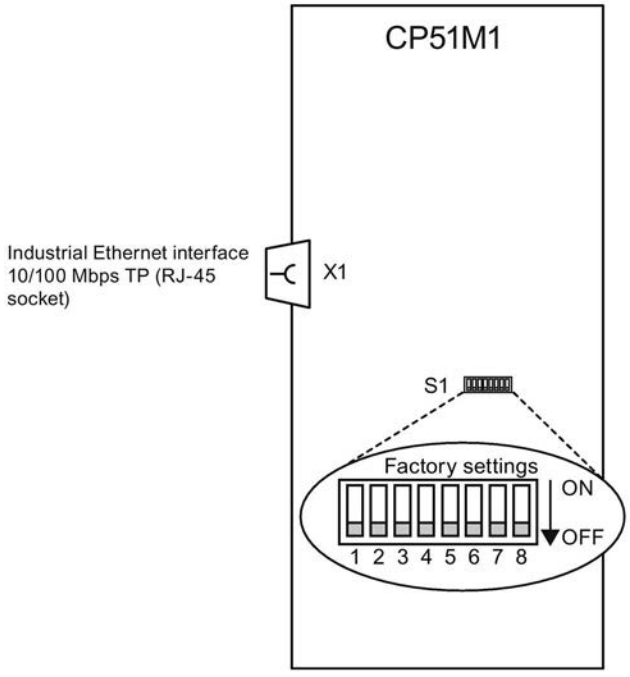



Figure 6-4 Connection options of CP51M1

## 6.2.6 Additional components

### Connecting cables

| Designation | Article number |
|---|---|
| SIMATIC NET, Industrial Ethernet TP XP CORD RJ45/RJ45, dressed with 2 x RJ45 connectors, length ... | 6XV1870-3R... |

You can find more information in the SIMATIC NET Catalog IK PI or in the Siemens Industry Mall (https://mall.industry.siemens.com).

For more information on networks and their cabling, refer to the following documentation:

- Industrial Ethernet/PROFINET

  Passive Network Components system manual
  (http://support.automation.siemens.com/WW/view/de/84922825/0/en)
- Industrial Ethernet/PROFINET

  Industrial Ethernet system manual
  (http://support.automation.siemens.com/WW/view/de/27069465/0/en)

## 6.2.7 Pin assignments

### Industrial Ethernet interface X1, 10/100 Mbps TP(RJ-45 jack)

Table 6- 8 Pin assignment of X1 (RJ-45 jack)

| PIN | Designation |
|---|---|
| 1 | TX+ |
| 2 | TX - |
| 3 | RX+ |
| 4 | 75 ohm termination |
| 5 | 75 ohm termination |
| 6 | RX- |
| 7 | 75 ohm termination |
| 8 | 75 ohm termination |
| Enclosure | Shield |

## 6.2.8 Technical specifications/performance features

### Article number

| | |
|---|---|
| CP51M1 communication module | 6DD1661-0AE1 |

### Memory

| | |
|---|---|
| Communication memory | SRAM, 512 KB |
| Buffer memory module | SDRAM, 8 MB |

**Note**

Of several CP51M1 that are inserted in a rack, only the CP51M1 at the far left has the communication memory function.

### Network interface

| | |
|---|---|
| Industrial Ethernet (10/100BTX) X1 | |
| • Log files | TCP/IP, UDP and ISO over TCP/IP (RFC1006) for S7 Communication (programming device/ OS) |
| • TCP/IP frame lengths | 32 KB |
| • UDP frame lengths | 2048 bytes |
| • Transmission modes | Refresh, Handshake, Multiple and Select |
| • Autosensing | For 10 Mbit or 100 Mbit networks |
| • Autonegotiation | For 10 Mbit or 100 Mbit networks and full duplex / half duplex |
| | Can be set |
| | 1500 $V_{AC}$ |
| • Default router | |
| • Dielectric strength to IEEE 802.3 | |

### Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V DC (from rack) | 1.044 A |
| External battery (min. 2.2 V, typically 3.0 V) | 350 nA |

## Power losses/fan

| | |
|---|---|
| Typical power losses | 5.22 W |
| Fan required | Yes, external fan |

## Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight | 0.34 kg |

# 6.3 GDM memory module CP52M0

## 6.3.1 Areas of application

### GlobalDataMemory

**G**lobal**D**ata**M**emory (**GDM**) facilitates data exchange between all CPU modules in all racks of the system.

Since central memory supports the synchronous coupling of up to 44 racks, it is possible to operate up to 836 CPU modules in a maximum system configuration.

A separate rack is used for GDM. The UR5213 rack provides 21 slots for the use of **memory module CP52M0 (slot 1)** and an appropriate number of CP52IO interface modules (slots 2-12).

Each rack that is coupled with GDM must be equipped with a CP52A0 access module. These racks are interconnected with GDM by means of fiber-optic cables in a star topology.

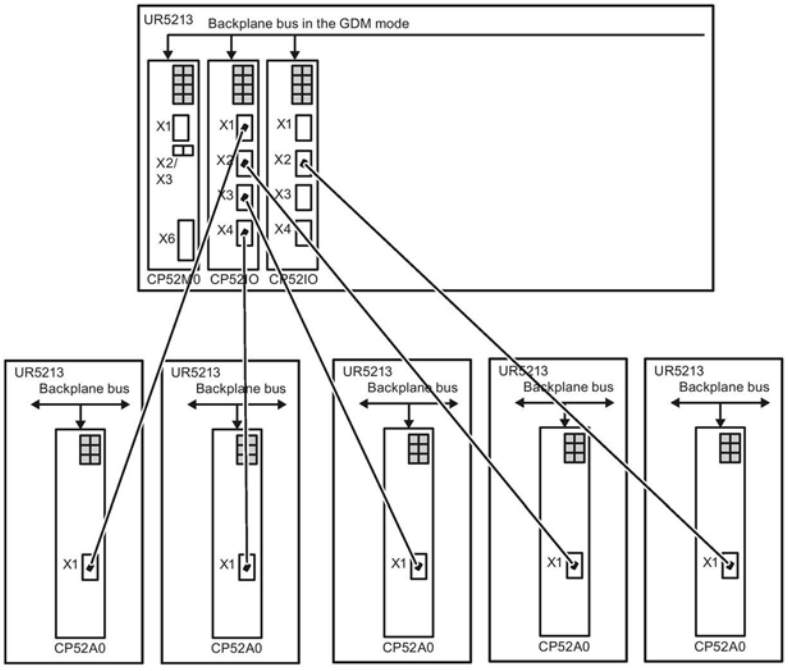



Figure 6-5 Example of a GDM system with 5 racks that are coupled with FOCs

## CP52M0 function

The CP52M0 GDB memory module provides 2 MB of central memory for the GlobalDataMemory system. This memory module handles the entire data traffic between the processors in the coupled racks.

Data is exchanged between the GDM interface modules CP52IO and the CP52M0 via the backplane bus.

CP52M0 reads the fault and diagnostics registers from all fiber-optic interfaces of the CP52IOs inserted in the GDM rack and detects and evaluates the central operating state of all fiber-optic interfaces. The results is made available at the digital outputs of CP52M0 for further analysis.

## 6.3.2 Control and display elements

### LED displays

The CP52M0 GDM memory module is equipped with 8 LEDs.

H1 and H2 provide information on the current operating state of the CP52M0 GDM memory module

Table 6- 9 LED displays of the CP52M0 GDM memory module

| LED designation (color) | Function |
|---|---|
| H1 (green) and H2 (red) | Module status display |
| H3 (green) and H4 (red) | Display of error states (see Status and fault displays (Page 134)) |
| H5 (green) and H6 (red) | |
| H7 (green) and H8 (green) | |

### Front panel

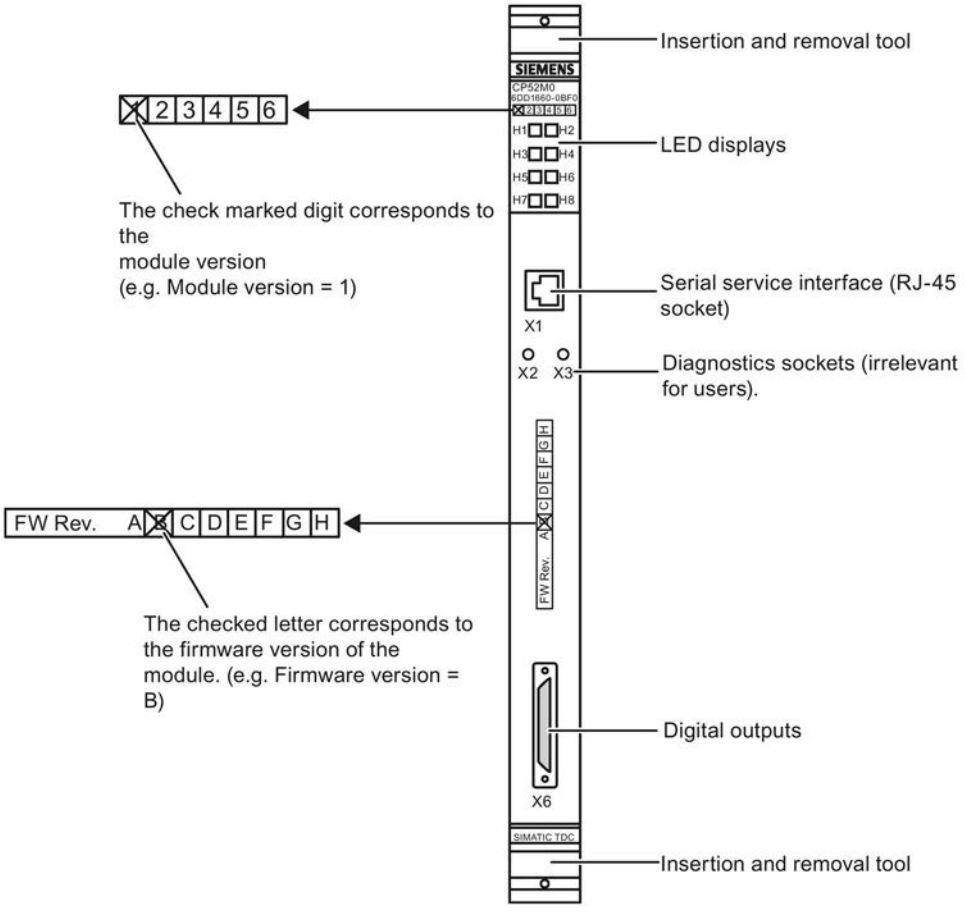



Figure 6-6 Front panel of CP52M0

## 6.3.3 Status and fault displays

### Status displays for CP52M0

Table 6- 10 LED status displays for the CP52M0 GDM memory module

| LED display | | Status of the CP52M0 module |
|---|---|---|
| H1 | H2 | |
| Off | Off | During voltage run-up |
| Off | On | All FPGAs in the GDM rack (CP52M0 and CP52IO) are parameterized; the module is initialized |
| On | Off | The module i initialized and operates without errors |
| On | On | After 3.3 V or 2.5 V voltage failure<br>• Hardware failure => Switch off the rack and replace CP52M0 |

### Status displays at the digital outputs

Table 6- 11 Status displays at the digital outputs of CP52M0

| Digital output | Display/status |
|---|---|
| DA01 to 11 | Indicate the CP52IO slot (slots 2-12) from which the operating state of the four fiber-optic interfaces is displayed on DA12-DA15. The operating state display of the individual CP52IO modules is cycled at seconds intervals. |
| DA12 to 15 | Indicate the operating state of the four fiber-optic interfaces of a CP52IO (DA12 fiber-optic interface 1, DA13 fiber-optic interface 2, etc.).<br>• Logical status "1" => FOC interface is OK<br>• Logical status "0" => Error at FOC interface, or CP52IO is missing |
| DA16 | • Logical status "1" => RUN operating state<br>• Logical status "0" => STOP operating state |

## Fault displays of CP52M0

Table 6- 12 Status and fault displays of CP52M0

| LED display | | Error states |
|---|---|---|
| H3 | Flashing | Monitoring error<br>• Non-critical error during initialization; normal operation may be started. |
| H4 | Flashing | Initialization error<br>• The start of normal operation is prevented if system initialization errors were found.<br>Initialization error due to incorrect insertion of CP52M0.<br>=> The module must be inserted in slot 1. |
| H5 | - | No function |
| H6 | Flashing | System error<br>• STOP operating state (fatal system fault): Hardware or software problems causing a program crash. |
| H7 | Flashing | Communication error<br>• Communication error:<br>Incorrect configuration of communication or communication connection |
| H8 | Flashing | Task Manager error<br>The following errors are possible:<br>• *Cycle errors*<br>A task could not be completed within the sampling time.<br>• *Task overflow*<br>If the task is not assigned top priority, but needs to be restarted.<br>• *No free local buffer*<br>The data buffer is no longer released. The task start will be skipped.<br>• *Software time monitoring*<br>If the basic sampling time is not processed four times in succession. The basic clock cycle timer is re-initialized with the configured basic sampling time and processing continued. |

## 6.3.4 Application notes and immunity to interference

### Application notes

- CP52M0 must be inserted **in slot 1** of the rack (UR5213).
- You may only use **one CP52M0** in the rack.
- The module may not be inserted or removed while the rack is on live voltage.

---

**Note**

**Additional circuit for lightning and overvoltage protection**

Please note the following concerning the use of the external 24V power supply for the digital outputs of the the module in accordance with IEC61000-4-5:

- An external circuit is necessary (see also section "General technical specifications, design and EMC directives (Page 13)")
- In addition to the overvoltage protection, two additional suppressor diodes have to be installed on the 24V supply voltage of the CP52M0.

---

### Immunity to interference

Interference-proof operation is only possible if the CP52M0 is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see "Control and display elements (Page 141)").

---

**Note**

**Fan operation, EMC and environmental conditions**

- For more information on fan operation, refer to chapter "Rack (Page 41)".
- For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)".

---

## Wiring the diode

**Note**

The suppressor diode 1.5KE36CA is bidirectional, and for this reason the polarity is unimportant.

1. Install a suppressor diode between the shield and +24 .
2. Install a suppressor diode between the shield and M (ground).

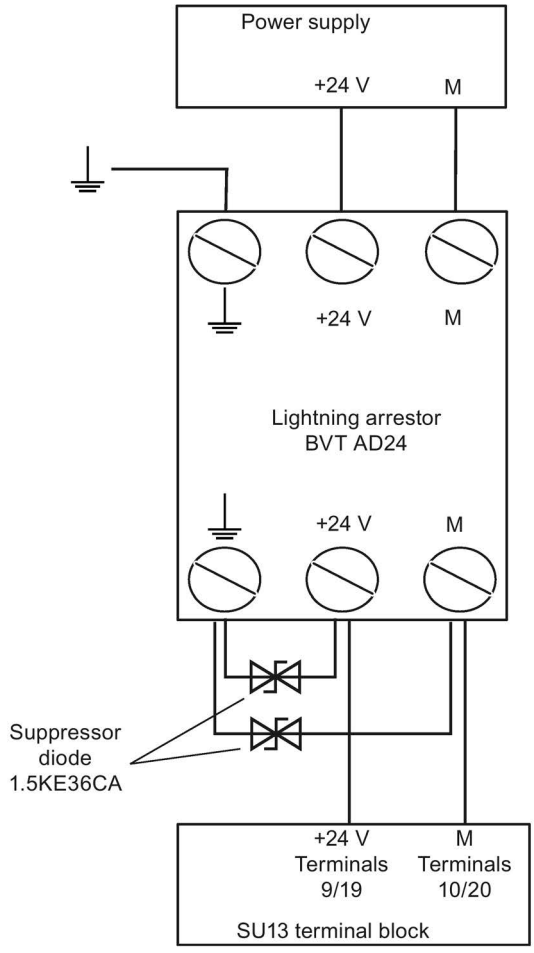



Figure 6-7 Circuit for the suppressor diodes on the lightning arrestor

### Additional components

The following additional components are available:

- **Surge arrester BLITZDUCTOR VT**

  Type: BTV AD 24
  available under the number: 918 402

  DEHN + SÖHNE GmbH + Co KG
  Postfach 1640
  92306 Neumarkt, Germany

- **Suppressor diode**

  Type: 1.5KE36CA (1500W)
  Manufacturer: e.g. STMicroelectronics, Vishay

## 6.3.5 Connection options

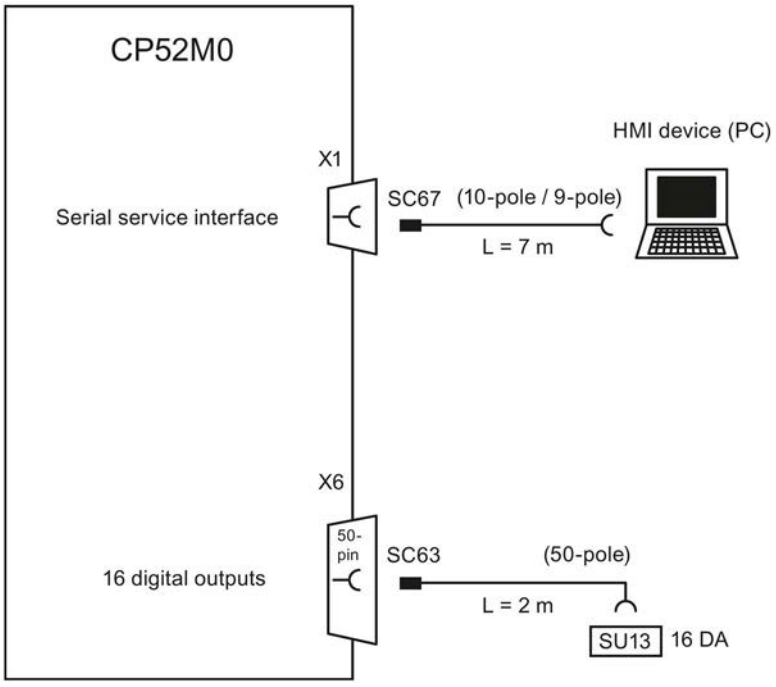



Figure 6-8 Connection options of CP52M0

## 6.3.6 Additional components

Table 6- 13 Additional components for CP52M0

| Component | Designation | Article number |
|---|---|---|
| Cable for digital outputs<br>(50-pole/50-pole) | SC63 | 6DD1684-0GD0 |
| PC connecting cable<br>(10-pole/9-pole) | SC67 | 6DD1684-0GH0 |
| Interface module<br>Direct wiring (1:1 wiring), 50 screw terminals, no signal conversion | SU13 | 6DD1681-0GK0 |

## 6.3.7 Pin assignments

### Serial service interface (X1)

A control or configuration PC is connected to the 10-pin RJ-45 jack with polarity reversal protection using the SC67 PC cable.

Table 6- 14 Pin assignment of X1 and cable SC67

| X1 | | | SC67 | |
|---|---|---|---|---|
| PIN | Designation | | PIN CPU side | PIN PC side |
| 1 | DCD (Data Carrier Detect) | | n.c. | n.c. |
| 2 | RxD (Receive Data) | | 2 | 3 |
| 3 | TxD (Transmit Data) | | 3 | 2 |
| 4 | DTR (Data Terminal Ready) | | n.c. | n.c. |
| 5 | GND (Ground) | | 5 | 5 |
| 6 | DSR (Data Set Ready) | | n.c. | n.c. |
| 7 | RTS (Request to Send) | | n.c. | n.c. |
| 8 | CTS (Clear to Send) | | n.c. | n.c. |
| 9 | RI (Ring Indicator) | | n.c. | n.c. |
| 10 | (n.c.) | | n.c. | |
| n.c.: not connected | | | | |

## Connector X6 with cable SC63

The assignment of the screw terminals on interface module SU13 corresponds to the pin assignment of X6.

Table 6- 15 Pin assignment of X6

| X6 | Designation | SU13 | | X6 | Designation | SU13 |
|---|---|---|---|---|---|---|
| 1 | Digital output 1 | 1 | | 26 | n.c. | 26 |
| 2 | Digital output 2 | 2 | | 27 | n.c. | 27 |
| 3 | Digital output 3 | 3 | | 28 | n.c. | 28 |
| 4 | Digital output 4 | 4 | | 29 | n.c. | 29 |
| 5 | Digital output 5 | 5 | | 30 | n.c. | 30 |
| 6 | Digital output 6 | 6 | | 31 | n.c. | 31 |
| 7 | Digital output 7 | 7 | | 32 | n.c. | 32 |
| 8 | Digital output 8 | 8 | | 33 | n.c. | 33 |
| 9 | Ext. power supply +24V | 9 | | 34 | n.c. | 34 |
| 10 | External ground | 10 | | 35 | External ground | 35 |
| 11 | Digital output 9 | 11 | | 36 | n.c. | 36 |
| 12 | Digital output 10 | 12 | | 37 | n.c. | 37 |
| 13 | Digital output 11 | 13 | | 38 | n.c. | 38 |
| 14 | Digital output 12 | 14 | | 39 | n.c. | 39 |
| 15 | Digital output 13 | 15 | | 40 | n.c. | 40 |
| 16 | Digital output 14 | 16 | | 41 | n.c. | 41 |
| 17 | Digital output 15 | 17 | | 42 | n.c. | 42 |
| 18 | Digital output 16 | 18 | | 43 | n.c. | 43 |
| 19 | Ext. power supply +24V | 19 | | 44 | n.c. | 44 |
| 20 | External ground | 20 | | 45 | External ground | 45 |
| 21 | n.c. | 21 | | 46 | n.c. | 46 |
| 22 | n.c. | 22 | | 47 | n.c. | 47 |
| 23 | n.c. | 23 | | 48 | n.c. | 48 |
| 24 | n.c. | 24 | | 49 | n.c. | 49 |
| 25 | n.c. | 25 | | 50 | n.c. | 50 |
| n.c.: not connected | | | | | | |

## 6.3.8 Technical specifications/performance features

### Article number

| | |
|---|---|
| GDM memory module CP52M0 | 6DD1660-0BF0 |

### Memory

| | |
|---|---|
| SRAM | 2 MB |

### Interfaces

| | |
|---|---|
| Serial service interface (X1)<br>• Transmission rate | RS232 interface (V.24)<br>• 19.2 Kbps |

### Digital outputs

| | |
|---|---|
| Number | 16 |
| Electrical isolation | No |
| External power supply<br>• Rated voltage<br>• Perm. area<br>• short-term<br>• Current consumption, max., no load | <br>24 V<br>20.4 V to 28.8 V<br>35 V (for max. 0.5 s)<br>40 mA |
| Output voltage range<br>• With 0 signal, max.<br>• With 1 signal, min. | <br>3 V<br>ext. Supply voltage – 2.5 V |
| Output current<br>• With 0 signal, min.<br>• at 1 signal<br>• Rated value<br>• Valid range, max. | <br>-20 µA<br><br>50 mA<br>100 mA |
| Delay time | 100 µs |
| Switching frequency of outputs<br>With resistance load, max. | 6 kHz |
| Short-circuit protection to<br>• Ground<br>• External power supply | <br>yes<br>No |
| Short-circuit current, max. | 250 mA |

| | |
|---|---|
| Total current of outputs (up to 60 °C) | 16 x 50 mA |
| Limiting of inductive cut-off voltages | ext. Supply voltage +1 V |

## Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V | 0.4 A |
| +3.3 V | 0.7 A |
| +12 V | 10 mA |
| -12 V | 10 mA |

## Power losses/fan

| | |
|---|---|
| Typical power losses | 4.5 W |
| Fan required | No |

## Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight, approx. | 0.6 kg |

# 6.4 CP52IO GDM interface module

## 6.4.1 Areas of application

### GlobalDataMemory

**G**lobal**D**ata**M**emory (**GDM**) enables data exchange between **all** CPU modules in all racks of the system.

Since central memory supports the synchronous coupling of up to 44 racks, it is possible to operate up to 836 CPU modules in a maximum system configuration.

A separate rack is used for GDM. The CP52M0 memory module (slot 1) and an appropriate number of **CP52IO interface modules (slots 2-12)** are accommodated in the UR5213 rack with 21 slots.

Each rack that is coupled with GDM must be equipped with a CP52A0 access module. These racks are interconnected with GDM by means of fiber-optic cables in a star topology.

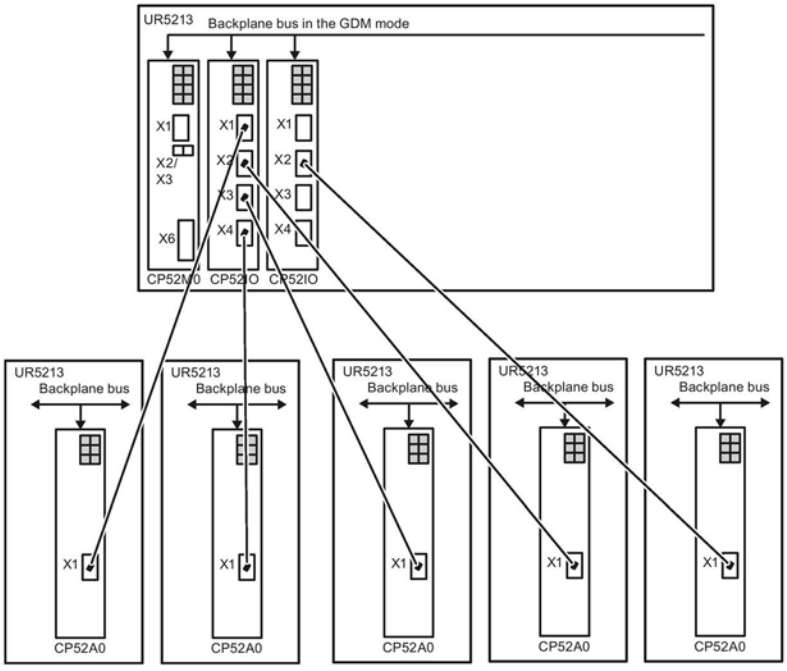



Figure 6-9 Example of a GDM system with 5 racks that are coupled with FOCs

## 6.4.2 Control and display elements

### LED displays

The CP52IO GDM interface module is equipped with 8 LEDs. These indicate whether or not valid frames are received or transmitted at GDM access module CP52A0.

Table 6- 16 LED displays of the CP52IO GDM interface module

| LED designation (color) | Function |
|---|---|
| H1 (green) | FOC interface 1 transmits data |
| H2 (yellow) | FOC interface 1 receives data |
| H3 (green) | FOC interface 2 transmits data |
| H4 (yellow) | FOC interface 2 receives data |
| H5 (green) | FOC interface 3 transmits data |
| H6 (yellow) | FOC interface 3 receives data |
| H7 (green) | FOC interface 4 transmits data |
| H8 (yellow) | FOC interface 4 receives data |

## Front panel

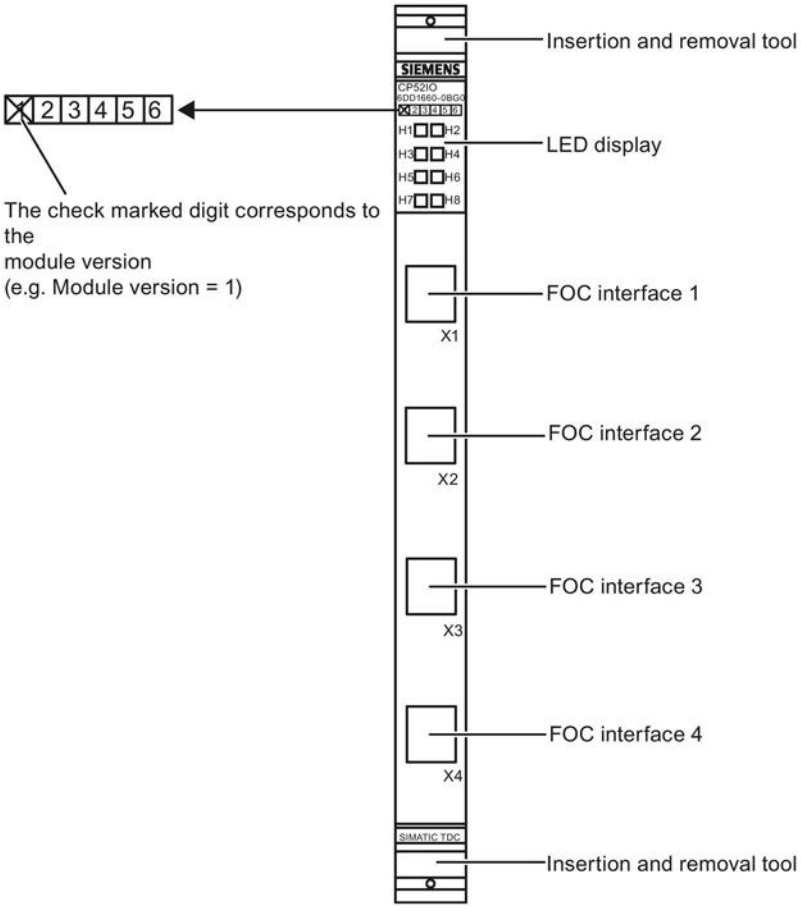



Figure 6-10 Front panel of CP52IO

## 6.4.3 Status and fault displays

### Status displays for CP52IO

Table 6- 17 Status and fault displays of the CP52IO GDM interface module

| LED display | | State |
|---|---|---|
| H1 | Off | No data transfer to the CP52A0 GDM access module |
| H3 | Glowing*)/lit | Data transfer to the CP52A0 GDM access module |
| H5<br>H7 | Flashing with 0.5 Hz | The CP52IO module is inserted in the wrong slot |
| H2 | Off | Missing or incorrect data transfer from the CP52A0GDM access module |
| H4 | Glowing*)/lit | Error-free data transfer from the CP52A0 GDM access module |
| H6<br>H8 | Flashing with 0.5 Hz | The CP52IO module is inserted in the wrong slot |
| *) The brightness of the LED indicates the density of periodic data traffic. | | |

## 6.4.4 Application notes and immunity to interference

The CP52IO GDM access modules in the racks are connected to the CP52A0 GDM interface module via fiber-optic cables (FOC). Up to four racks can be connected to each CP52IO.

- The CP52IO modules must be inserted between **slots 2 and 12**.
- Free slots between the individual modules are allowed.
- The rack may be equipped with a maximum of 11 CP52IO interface modules.
- Modules may not be inserted in slots 13 - 21.
- You may insert the fiber-optic cables into the FOC interfaces of CP52IO to suit your application.
- It is not necessary to occupy all FOC interfaces of CP52IO.
- Memory access rates do not depend on which CP52IO the fiber-optic cable is connected,
- as all FOC interfaces are assigned the same priority.
- Interference-proof operation is only possible if the CP52IO is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see "Control and display elements (Page 152)").
- The module may not be inserted or removed while the rack is on live voltage.

**Note**

- For more information on fan operation, refer to chapter "Rack (Page 41)"!
- For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)"!

## 6.4.5 Connection options

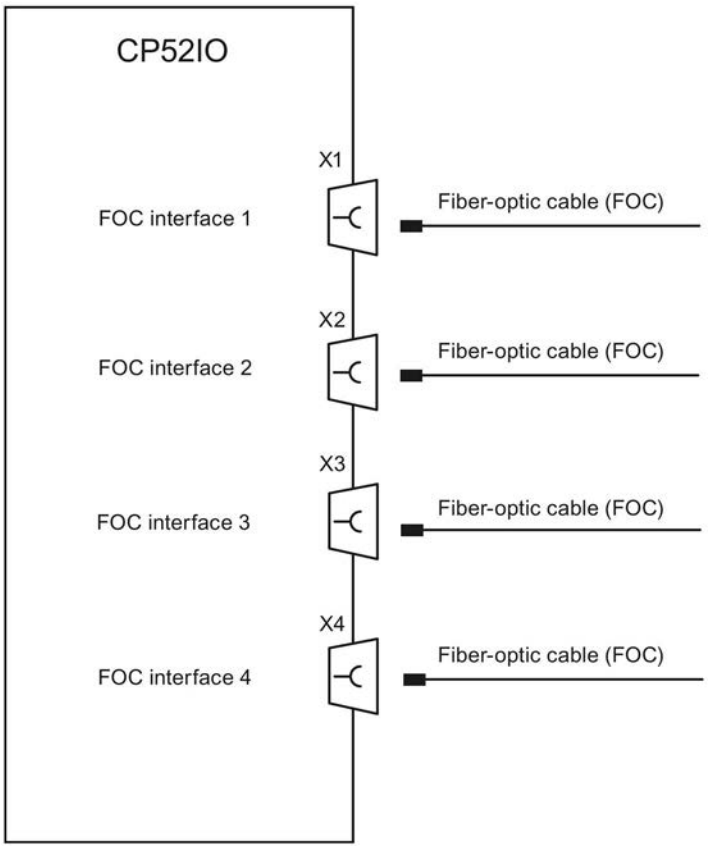



Figure 6-11 Connection options of CP52IO

## 6.4.6 Additional components

### Fiber-optic cable (FOC)

A fiber-optic cable with a **core diameter of 62.5 µm/125 µm** is used to interconnect the CP52A0 GDM access module with the CP52IO GDM interface module. The cables are connected using **Duplex SC connectors**.

The **max. cable length** for the connection between CP52IO and CP52A0 is **200 m.**

The fiber-optic cables must be assembled in accordance with the plant topology and can be ordered from the following supplier:

Ehret GmbH

Über der Elz 2

79312 Emmendingen

## 6.4.7 Pin assignments

### FOC interfaces X1 to X4

The fiber-optic cables are connected to the front connectors X1 to X4 by means of Duplex SC connector.

## 6.4.8 Technical specifications/performance features

### Article number

| | |
|---|---|
| CP52IO GDM interface module | 6DD1660-0BG0 |

### Interface

| | |
|---|---|
| FOC interface | |
| • Number | • 4 |
| • Data transmission speed | • 640 Mbps |
| • Code | • 8B/10B |
| • Checksum test | • CRC |

### Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V | 3.0 A |
| +3.3 V | 0.8 A |

### Power losses/fan

| | |
|---|---|
| Typical power losses | 18 W |
| Fan required | yes |

### Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight | 0.6 kg |

# 6.5 CP52A0 GDM access module

## 6.5.1 Areas of application

### GlobalDataMemory

**G**lobal**D**ata**M**emory (**GDM**) enables data exchange between **all** CPU modules in all racks of the system.

Since central memory supports the synchronous coupling of up to 44 racks, it is possible to operate up to 836 CPU modules in a maximum system configuration.

A separate rack is used for GDM. The CP52M0 memory module (slot 1) and an appropriate number of CP52IO interface modules (slots 2-12) are accommodated in the UR5213 rack with 21 slots.

Each rack that is coupled with GDM must contain a **CP52A0 access module**. These racks are interconnected with GDM by means of fiber-optic cables in a star topology.

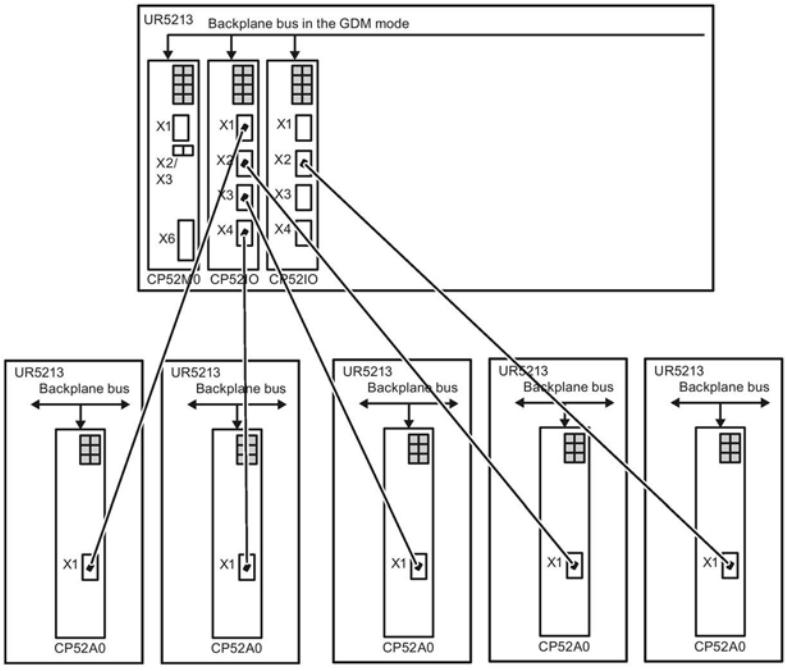



Figure 6-12 Example of a GDM system with 5 racks that are coupled with FOCs

## 6.5.2 Control and display elements

### LED displays

The CP52A0 GDM access module is equipped with six LEDs that provide information on the current operating state of the module.

Table 6- 18 LED displays of the CP52A0 GDM access module

| LED designation (color) | Function |
|---|---|
| H1 (green) | Operating state of the CP52A0 GDM access module |
| H2 (red) | |
| H3 (green) | FOC interface is transmitting data |
| H4 (yellow) | FOC interface is receiving error-free data |
| H5 (green) | Startup ID |
| H6 (yellow) | Send authorization for clock triggers or base sampling time |

### Front panel

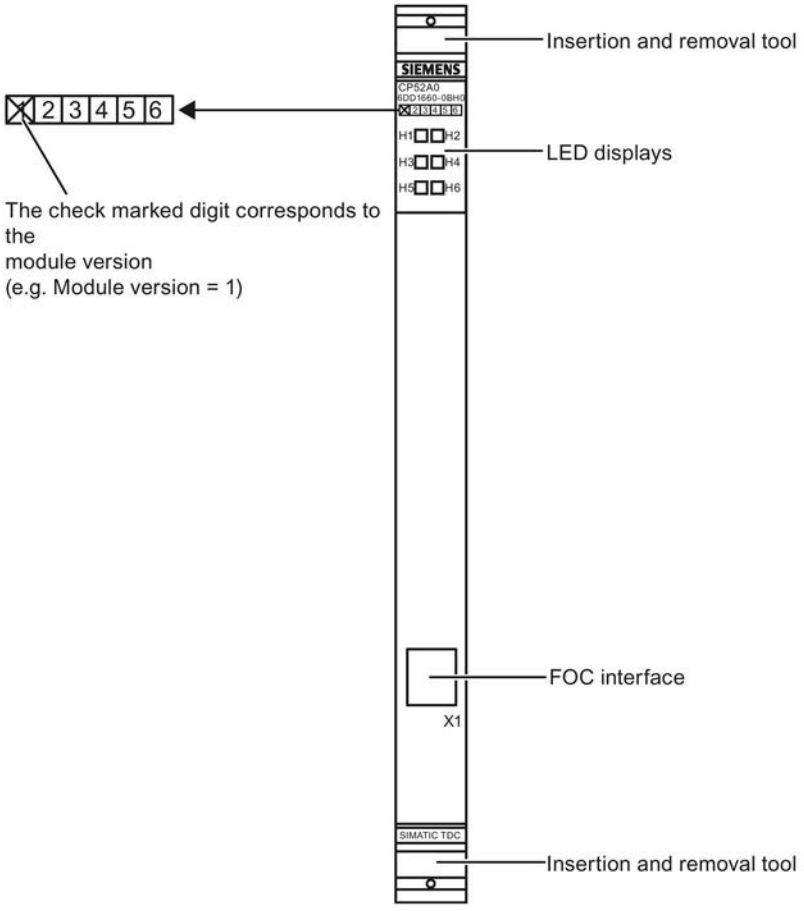



Figure 6-13 Front panel of CP52A0

## 6.5.3 Status and fault displays

### Status displays for CP52A0

Table 6- 19 Status displays for the CP52A0 GDM access modules

| LED display | | Module status |
|---|---|---|
| H1 | H2 | |
| Off | Off | During voltage run-up |
| Off | On | FPGAs are configured, module is not initialized |
| On | Off | Module is initialized and operating error-free |
| On | On | After 3.3 V or 2.5 V voltage failure<br>• Hardware failure => Switch off the rack and replace CP52A0 |

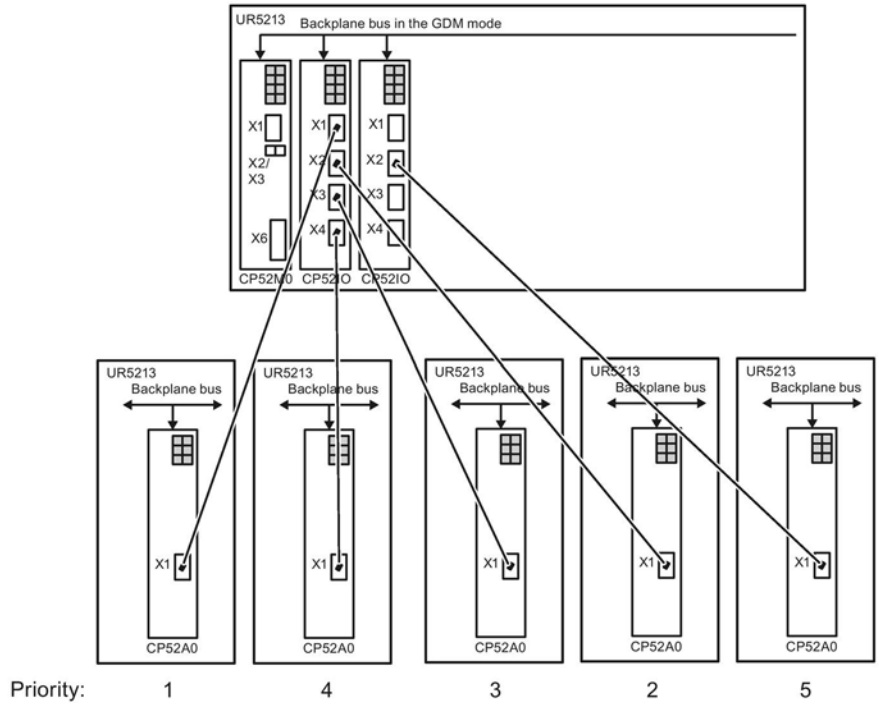
### Status displays for communication

Table 6- 20 Status and fault displays of the CP52A0 GDM access module

| LED display | | State |
|---|---|---|
| H3 | Off | No data transmission to the CP52IO GDM interface module |
| | Glowing*)/lit | Data transmission to the CP52IO GDM interface module |
| H4 | Off | Missing or faulty data transmission from the CP52IO GDM interface module |
| | Glowing*)/lit | Error-free data transmission from the CP52IO GDM interface module |
| H5 | Off | No ramp-up ID from the CP52IO GDM interface module |
| | On | Ramp-up ID set |
| H6 | Off | Clock trigger and base sampling time are parameterized and have send authorization from CP52IO |
| | On | The clock trigger and basic sampling time have been parameterized for transmission but have no transmit authorization from the CP52IO (priority logic is inhibiting one of the two signals) |
| *) The brightness of the LED indicates the density of periodic data traffic. | | |

## 6.5.4 Application notes and immunity to interference

- The entire user application is configured in the racks that contain the access modules.
- The trigger signals, clock trigger and base sampling time can only be sent independently of one another from one CP52A0. CP52A0 supports transmission and receiving of these signals. HWConfig is used to define whether the module receives or sends.
- If the clock trigger and basic sampling time were configured for transmission on several access modules, the trigger signal is always transmitted from the CP52A0 that is connected with a CP52IO whose FOC interface is located on the extreme top left in the rack (refer to the example of priority logic).




- The SYSFAIL* and alarm trigger trigger signals can be simultaneously sent and received from every CP52A0.
- Interference-proof operation is only possible if the CP52M0 is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see "Control and display elements (Page 158)").
- The module may not be inserted or removed while the rack is on live voltage.

**Note**

- For more information on fan operation, refer to chapter "Rack (Page 41)"!
- For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)"!

## 6.5.5 Connection options

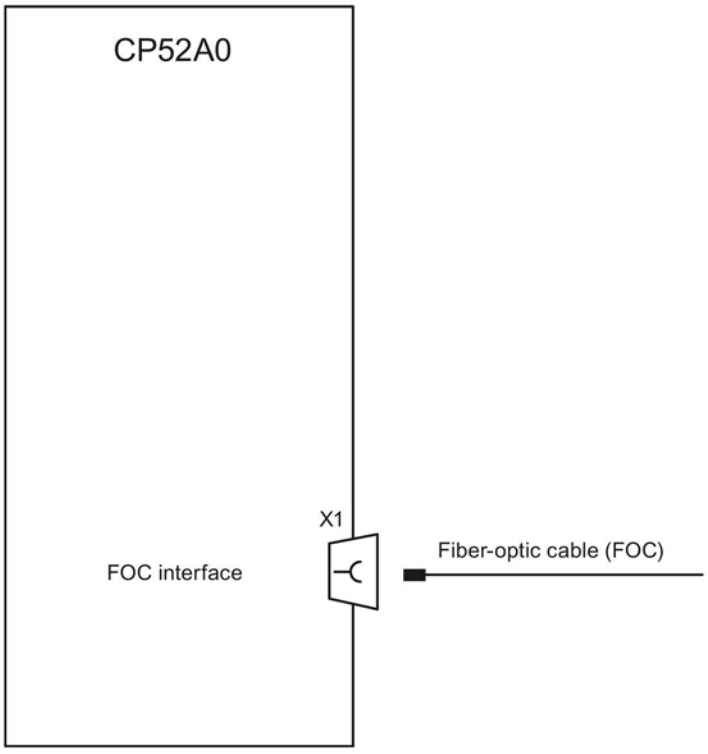



Figure 6-14 Connection options of CP52A0

## 6.5.6 Additional components

### Fiber-optic cable (FOC)

A fiber-optic cable with a **core diameter of 62.5 µm/125 µm** is used to interconnect the CP52A0 GDM access module with the CP52IO GDM interface module. The cable is connected by means of **Duplex SC connectors**.

The **max. cable length** for the connection between CP52IO and CP52A0 is **200 m**.

The fiber-optic cables must be assembled in accordance with the plant topology and can be ordered from the following supplier:

Ehret GmbH

Über der Elz 2

79312 Emmendingen

## 6.5.7 Pin assignments

### Fiber-optic cable interfaces X1

The fiber-optic cables are connected via a Duplex SC connector at connector X1 on the front panel

## 6.5.8 Technical specifications/performance features

### Article number

| | |
|---|---|
| CP52A0 GDM access module | 6DD1660-0BH0 |

### Interface

| | |
|---|---|
| FOC interface<br>• Number<br>• Data transmission speed<br>• Code<br>• Checksum test | <br>1<br>640 Mbps<br>8B/10B<br>CRC |

### Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V | 1.5 A |
| 3.3 V | 0.4 A |

### Power losses/fan

| | |
|---|---|
| Typical power losses | 9 W |
| Fan required | No |

### Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight | 0.6 kg |

# 6.6 CP53M0 coupling module

## 6.6.1 Areas of application

### Rack coupling

Coupling module CP53M0 is used to couple a SIMATIC TDC system to a SIMADYN D system for high-speed data exchange, e.g. when expanding SIMADYN D systems.

CP53M0 is equipped with a buffer memory for data exchange between the CPU modules in the rack.

The CP53M0 can be parameterized as master or slave for data exchange with other racks.

#### 6.6.1.1 CP53M0 as slave

CP53M0 is parameterized in HW Config for operation in slave mode. A CS12/CS13/CS14 in a SIMADYN D rack can be connected to the FOC connectors X1/X2. Additional CS22 or CP53M0 can be connected to the other connectors of CS13/CS14.

The FOC connectors X3/X4 do not have any function in this mode.

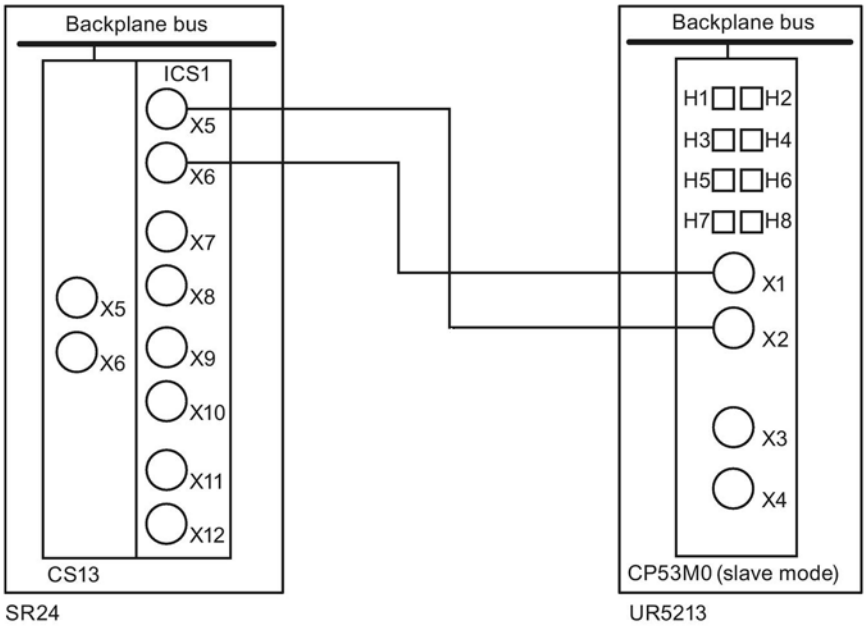



Figure 6-15 Options for connecting CP53M0 as slave to the CS13

Table 6- 21 Pin assignment of CP53M0 operated on the SIMADYN D module CS13 and CS14

| ICS1 | CP53M0 (1) | CP53M0 (2) | CP53M0 (3) | CP53M0 (4) |
|---|---|---|---|---|
| X5 | X2 | | | |
| X6 | X1 | | | |
| X7 | | X2 | | |
| X8 | | X1 | | |
| X9 | | | X2 | |
| X10 | | | X1 | |
| X11 | | | | X2 |
| X12 | | | | X1 |
| | X3 (no function) | | | |
| | X4 (no function) | | | |

The listing in the "Pin assignments of CP53M0 an SIMADYN D modules CS13 and CS14" table above also applies to the second ICS1 on CS14.

If less than four slave modules are connected to an ICS1, the fiber-optic cables can be inserted as required in pairs.

### 6.6.1.2 CP53M0 as master

CP53M0 is parameterized in HW Config for operation in master mode (default). In this mode, two slave modules can be connected to CP53M0 (CS22 or CP53M0 (parameterized as slave)).

## Example 1

**Connecting two SIMADYN D CS22 modules to CP53M0**

One CS22 is connected to each of the FOC connectors X1/X2 or X3/X4 in a SIMADYN D rack.

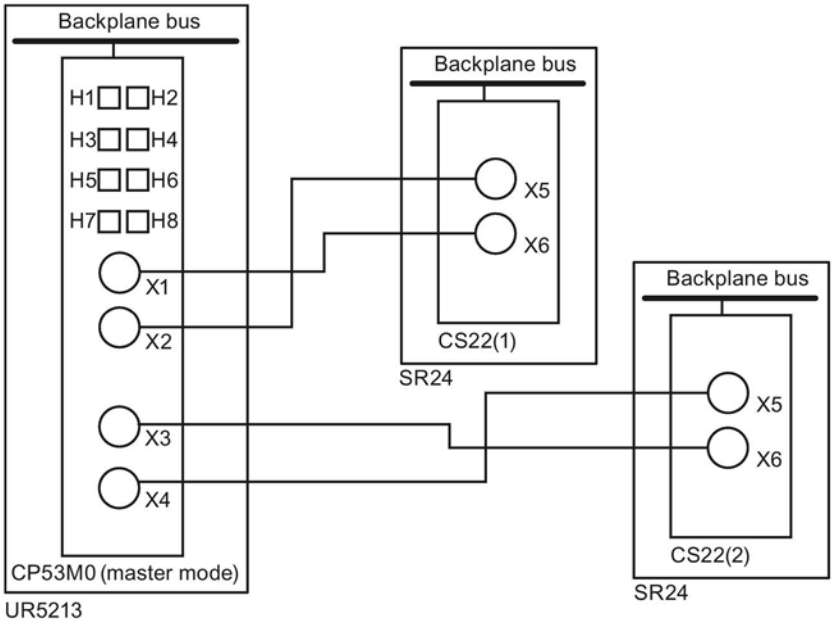



Figure 6-16 Options for connecting the CS22 to CP53M0 that is operating in master mode

Table 6- 22 Pin assignment of two CS22 on a CP53M0

| CP53M0 | CS22(1) | CS22(2) |
|---|---|---|
| X1 | X6 | |
| X2 | X5 | |
| X3 | | X6 |
| X4 | | X5 |

## Example 2

### Coupling SIMATIC TDC racks

CP53M0 can be used to couple up to three SIMATIC TDC racks. In this case, CP53M0 is parameterized for operation in master mode in one rack and in slave mode in the other two racks.

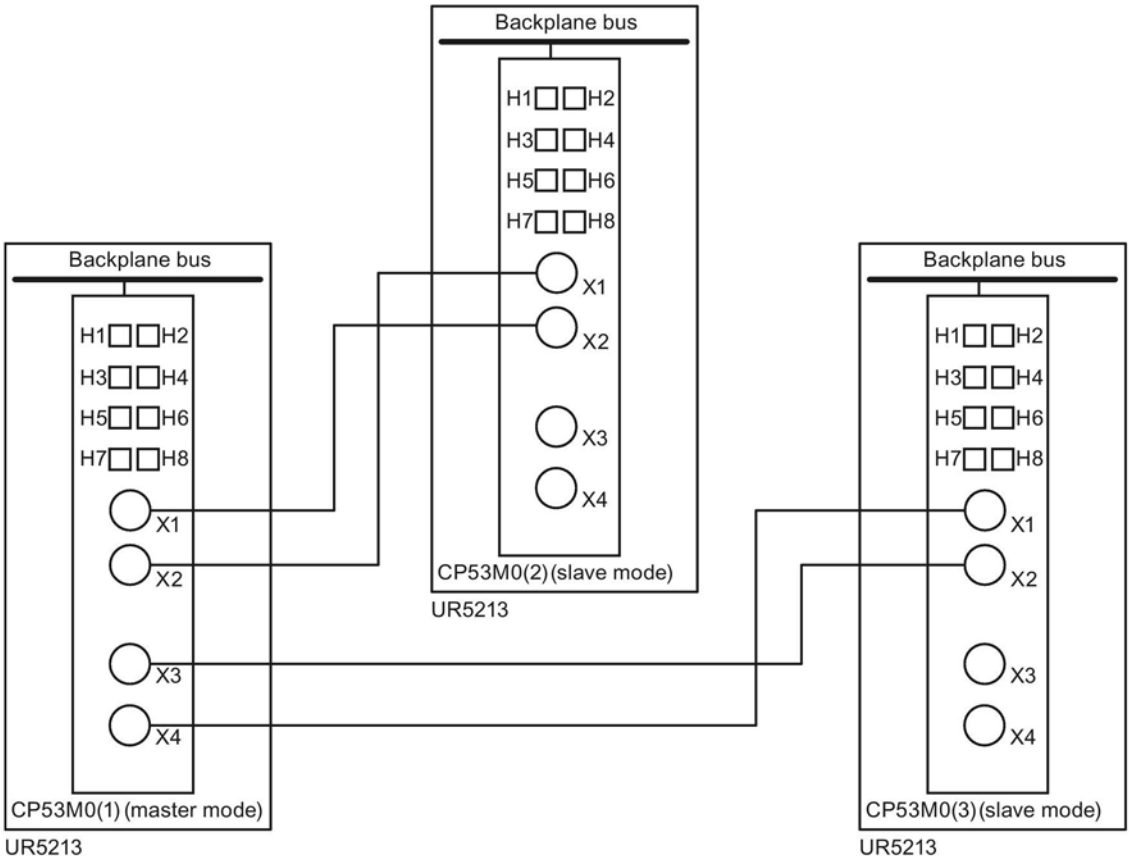



Figure 6-17 Coupling three SIMATIC TDC racks

Table 6- 23 Options of connecting two CP53M0 slaves to a CP53M0 master

| CP53M0 (1) | CP53M0 (2) | CP53M0 (3) |
|---|---|---|
| X1 | X2 | |
| X2 | X1 | |
| X3 | | X2 |
| X4 | | X1 |
| | X3 (no function) | |
| | X4 (no function) | |

## 6.6.2 Control and display elements

### LED displays

The CP53M0 coupling module is equipped with 8 LEDs that provide information on the current operating state of the module.

Table 6- 24 LED displays of the CP53M0 coupling module

| LED designation (color) | Function |
|---|---|
| H1 (green) | Operating state of coupling module CP53M0 |
| H2 (red) | |
| H3 (green) | Status startup frame to X1/X2 |
| H4 (yellow) | Data transmission to X1/X2 |
| H5 (green) | Status startup frame to X3/X4 |
| H6 (yellow) | Data transmission to X3/X4 |
| H7 (green) | Status fiber-optic cable link to X1/X2 |
| H8 (green) | Status fiber-optic cable link to X3/X4 |

## Front panel

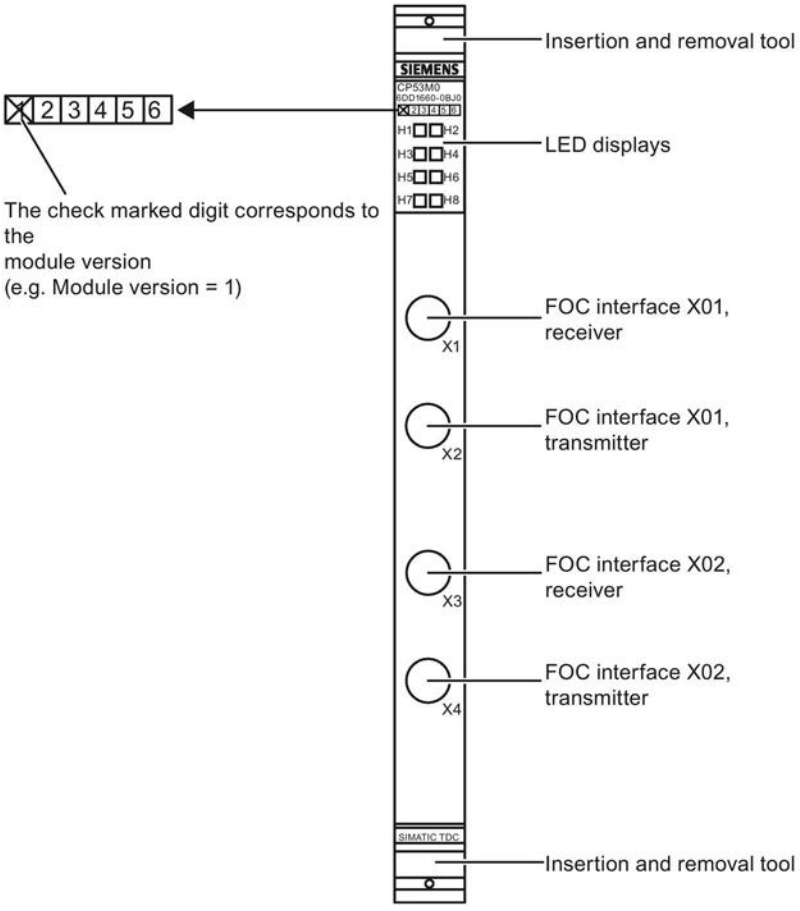



Figure 6-18 Front panel of CP53M0

## 6.6.3 Status and fault displays

### Status displays for CP53M0

Table 6- 25 Status displays for coupling module CP53M0

| LED display | | Module status |
|---|---|---|
| H1 | H2 | |
| Off | Off | During voltage run-up |
| Off | On | FPGAs are configured, module is not initialized |
| On | Off | Module is initialized and operating error-free |
| On | On | After 3.3, 2.5 V or 1.2 V voltage failure<br>• Hardware failure => Switch off the rack and replace the CP53M0 |

### Status displays for communication

Table 6- 26 Status and fault displays of coupling module CP53M0

| LED display | | State |
|---|---|---|
| H3 | Off | Master mode:<br>CP53M0 is not transmitting a startup frame to X1/2<br>Slave mode:<br>CP53M0 is not receiving a startup frame via X1/X2 |
| | On | Master mode:<br>CP53M0 is transmitting startup frames to X1/2<br>Slave mode:<br>CP53M0 is receiving startup frames via X1/X2 |
| H4 | Off | Master mode:<br>No acknowledgment of data access from the slave at X1/X2<br>Slave mode:<br>No acknowledgment of data access at X1/X2 |
| | Glowing*) | Master mode:<br>Acknowledgment of data access from the slave at X1/X2<br>Slave mode: Acknowledgment of data access at X1/X2 |
| H5 | Off | Master mode: CP53M0 is transmitting startup frames at X3/4<br>Slave mode: No function |
| | On | Master mode: CP53M0 is transmitting startup frames at X3/4<br>Slave mode: No function |
| H6 | Off | Master mode: No acknowledgement of data access from the slave at X3/X4<br>Slave mode:<br>No function |

| LED display | | State |
|---|---|---|
| | Glowing*) | Master mode:<br>Acknowledgment of data access from the slave at X1/X2<br>Slave mode:<br>No function |
| H7 | Off | Receiver, FOC interface X1/X2 has no valid receive signals |
| | On | Receiver, FOC interface X1/X2 has a valid receive signal |
| H8 | Off | Master mode:<br>Receiver FOC interface X3/X4 has no valid receive signal<br>Slave mode:<br>No function |
| | On | Master mode:<br>Receiver FOC interface X3/X4 has valid receive signal<br>Slave mode:<br>No function |
| *) The brightness of the LED indicates the intensity of periodic data traffic. | | |

## 6.6.4 Application notes and immunity to interference

- If CP53M0 is operated in master mode, the clock trigger, alarm trigger, or basic sampling time trigger signals are transmitted.
- These signals are received on the CP53M0 in slave mode and routed to the backplane bus in accordance with the parameterization in HWConfig or CFC configuration (clock trigger).
- A CS22 at a CP53M0 in master mode receives the clock trigger, alarm trigger, or basic sampling time trigger signals.
- A CP53M0 in slave mode on a CS12/CS13/CS14 receives the clock trigger, alarm trigger, or basic sampling time trigger signals.
- If several CP53M0 in the same rack are configured for operation in slave mode and route the alarm interrupt to the backplane bus, the CPU cannot identify the CP53M0 that triggered the alarm interrupt.
- Interference-proof operation is only possible if the CP53M0 is firmly attached to the rack. Insert the module and then bolt it onto the rack accordingly (two screw heads, see "Control and display elements (Page 167)").
- The racks may be switched on and off independently. The coupling is automatically restored.
- The module may not be inserted or removed while the rack is on live voltage.
- Before switching on power to a rack, verify that all connectors of the FOC couplings involved have been inserted. It is not allowed to insert or remove the fiber-optic cables at runtime.
- If no fiber-optic cables are inserted, protect the transmit and receive terminals using appropriate caps.

**Note**

See also:

- For more information on fan operation, refer to chapter "Rack (Page 41)"!
- For more information on EMC and environmental conditions, refer to chapter "General technical specifications (Page 39)"!

## 6.6.5 Connection options

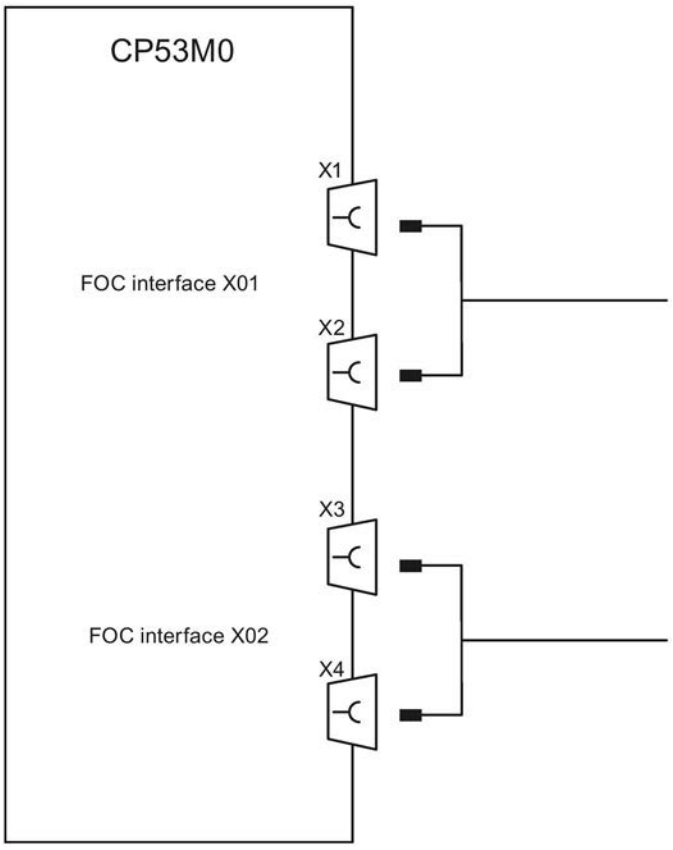



Figure 6-19 Connection options of CP53M0

## 6.6.6 Additional components

### Fiber-optic cable (FOC)

The following cable is used to connect communication module CP53M0 to an additional CP53M0, or to a CS12/CS13/CS14/CS22:

SIMATIC NET, STANDARD FIBER-OPTIC CABLE, SPLITTABLE, DRESSED WITH 4 x BFOC CONNECTORS

Article number: 6XV1820-5Bxyz (xyz: length code)

For information on available lengths, refer to the interactive catalog in the A&D MALL.

The **max. cable length** is **300 m**.

## 6.6.7 Pin assignments

### FOC connectors X1 – X4

The FOC cables are connected by means of BFOC connector to the front connectors X1-X4. For more information, refer to chapter “Areas of application”.

## 6.6.8 Technical specifications/performance features

### Article number

| | |
|---|---|
| CP53M0 coupling module | 6DD1660-0BJ0 |

### Memory

| | |
|---|---|
| Communication memory | SRAM, 128 KB |
| Buffer memory module | SDRAM, 8 MB |

**Note**

If several CPxxMx are used in a rack, only the CPxxMx on the extreme left has the buffer memory function.

### Interface

| | |
|---|---|
| FOC interface | |
| • Number | 2 (master mode)<br>1 (slave mode) |
| • Data transmission speed | 96 Mbps |
| • Code | 5B/6B |

### Voltage, currents

| Rated voltages at 25 °C | Typical current consumption |
|---|---|
| +5 V | 0.3 A |
| 3.3 V | 0.5 A |

## Power losses/fan

| | |
|---|---|
| Typical power losses | 3.1 W |
| Fan required | No |

## Dimensions

| | |
|---|---|
| Number of slots required in the rack | 1 |
| Dimensions W x H x D [mm] | 20 x 233 x 160 |
| Weight | 0.6 kg |

# Interface module 7

## 7.1 Interface module SB10

### Article number

6DD1681-0AE2

### Description

The interface module transfers digital signals from SIMATIC TDC components to the system, or receives digital signals from the system and transfers these to SIMATIC TDC components. The connection to SIMATIC TDC components is realized via the cables SC62 or SC66 and via terminals on system side. There is no electrical isolation between the SIMATIC TDC components side and system side.

### Module design

- Enclosure for snap-on mounting to rails
- Ribbon cable connector (X1):
  - 8 pins for digital signals, 24 V DC
  - 2 pins for 1P, 1M supply voltages
- Connector (X2), 2 x 8-pole:
  - 8 terminals for 24 V DC digital signals
  - 8 terminals for reference potentials (1M, 1P is also possible)
- 1 terminal pair X3: 1P and 1M
- Double test socket X5: 1P(+), 1M(G)
- LED displays for diagnostics

### Voltage supply on SIMATIC side

The SIMATIC TDC voltage supply is fed to terminal X3:

| Terminal X3 | Voltage SIMATIC side |
|---|---|
| 1P | +24 V |
| 1M | 0 V |

Connect the cables using accessory kit SM11 "Power supply connector for interface modules" (article number: 6DD1680-0BB0)

The maximum conductor cross-section at terminal X3 is 2.5 mm².

### Green LED

The voltage supply on SIMATIC TDC side is indicated by a green LED (P).

### Red LED

The supply voltage on SIMATIC TDC side (1P, 1M) is short-circuited (fault).

### Test socket

Voltages 1P and 1M can be used via the double test socket (G; +) to simulate an input signal for SIMATIC TDC.

| Double test socket X5 | Voltage |
|---|---|
| + (1P of X3) | +24 V |
| G (1M of X3) | 0 V |

**⚠ WARNING**

**Explosion hazard**

It is not allowed to use the X5 test sockets in potentially explosive environments.

**Note**

When wiring the supply voltage, observe the “Installation and EMC Directives” chapter in the User Manual.

## 7.1.1 Signals

### Yellow LED

The status of each of the 8 signals (1...8) is displayed by means of a yellow LED. Each signal is provided a screw terminal on the two terminal blocks X2:

- Terminals 1 to 8 for digital signals
- Terminals 51 to 58 for reference points

### Reference potential of the signals

The reference points of the signals may be derived from 1M or 1P potential. The polarity is selected on the module by means of soldering bridge:

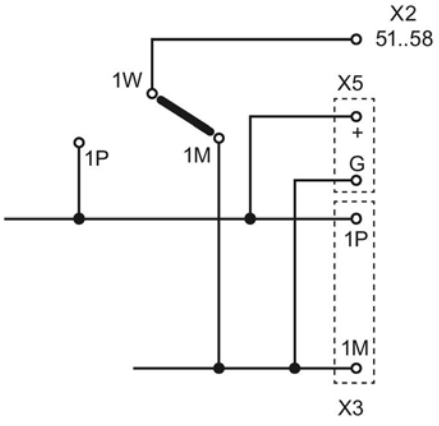



Figure 7-1 Soldering bridge for setting the signal reference points

**Note**

Bridge 1M-1W is inserted in the factory

## 7.1.2 Application notes

The interface module is suitable for vertical **and** horizontal mounting positions.

### Other information

For more information on EMC and environmental conditions, refer to section "General technical specifications (Page 39)"!

### Example

The following figure shows a typical application:

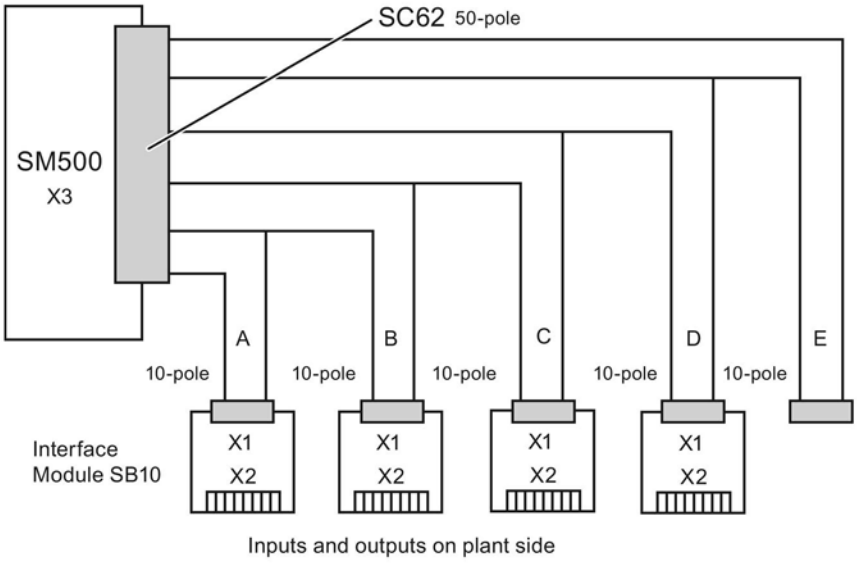



Figure 7-2 Application example of an SB10 interface module on the digital I/O module SM500

The digital signals on system side are connected directly to the SIMATIC TDC modules via the interface module. A cable SC62 is used accordingly.

## 7.1.3 Technical specifications

### General data

| | |
|---|---|
| Mounting system | Suitable for snap-on mounting on rails |
| Dimensions W x H x D [mm] | 45 x 129 x 160 mm |
| Weight | Approx. 0.28 kg |

### Ambient temperatures

| | |
|---|---|
| Ambient temperatures | max. 60°°C |

### Power supply

| **Description** | | **SIMATIC TDC** |
|---|---|---|
| Supply voltage ($V_V$) at rated value | | 24 V DC |
| Valid range | | 20.4 V to 28.8 V DC |
| Briefly t<500 ms | | 1.5 x $V_{rated}$ |
| Current consumption | | |
| | At rated value [1)] | 20 mA |
| | Maximum current per supply line | 400 mA |
| [1)] LED intrinsic consumption without load on system modules | | |

The maximum current of 1 A may not be exceeded on connector X3 if the supply of several terminal blocks is routed via this connector.

### Digital signals

| | |
|---|---|
| Number | 8 |
| Rated voltage | 24 V DC |
| Maximum current per channel | 30 mA |

## 7.1.4 Pin assignment

### Ribbon cable connector X1

The cables SC62 or SC66 are used to connect the interface modules to the SIMATIC TDC components (for more information, refer to the SIMATIC TDC Documentation).

### Terminal block X2

Table 7- 1 Pin assignment of the digital I/O of interface module SB10

| Terminal | Designation |
|---|---|
| 1 | Channel 1 (digital input/output 1) |
| 2 | Channel 2 (digital input/output 2) |
| 3 | Channel 3 (digital input/output 3) |
| 4 | Channel 4 (digital input/output 4) |
| 5 | Channel 5 (digital input/output 5) |
| 6 | Channel 6 (digital input/output 6) |
| 7 | Channel 7 (digital input/output 7) |
| 8 | Channel 8 (digital input/output 8) |
| 51 | Reference busbar, 1M (1P can be set) |
| 52 | Reference busbar, 1M (1P can be set) |
| 53 | Reference busbar, 1M (1P can be set) |
| 54 | Reference busbar, 1M (1P can be set) |
| 55 | Reference busbar, 1M (1P can be set) |
| 56 | Reference busbar, 1M (1P can be set) |
| 57 | Reference busbar, 1M (1P can be set) |
| 58 | Reference busbar, 1M (1P can be set) |

### Conductor cross-section

The minimum conductor cross-section for the terminal block X1 is 0.2mm² and the maximum is 2.5 mm².

## 7.1.5 Block diagram

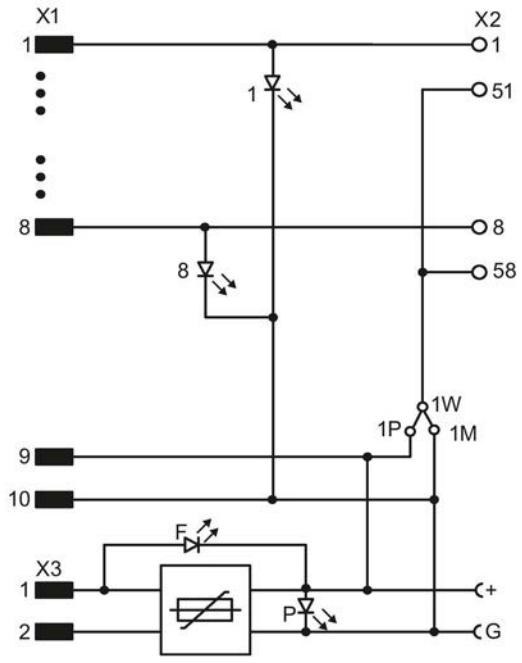



Figure 7-3 Block diagram of interface module SB10

# 7.2 Interface module SB60

## Article number

6DD1681-0AF4

## Description

Interface module SB60 is used to adapt 8 digital input signals with electrical isolation to the signal level of SIMATIC TDC by means of optocoupler. The input signal voltage can amount to 120 V DC or AC.

The eight digital inputs and the SIMATIC TDC rack are electrically separated. The eight digital inputs are electrically isolated with respect to one another.

The cables SC62 or SC66 are used to connect the interface modules to the SIMATIC TDC components (for more information, refer to the SIMATIC TDC Documentation).

## Module design

- Enclosure for snap-on mounting to rails
- Ribbon cable connector (X1):
  - 8 pins for digital outputs
  - 2 pins for 1P, 1M
- Connector (X2), 2 x 12-pole:
  - 8 terminals for 120 V digital inputs
  - 8 terminals for reference potentials
- 1 terminal pair X3:
  - 1P and 1M for the voltage on SIMATIC side
- LED displays for diagnostics
- Optocoupler for electrical isolation between inputs and outputs

## Voltage supply on SIMATIC side

The SIMATIC TDC voltage supply is fed to terminal X3:

| Terminal X3 | Voltage on SIMATIC TDC side |
|---|---|
| 1P | +24 V |
| 1M | 0 V |

Connect the cables using accessory kit SM11 "Power supply connector for interface modules" (article number: 6DD1680-0BB0) The maximum conductor cross-section at terminal X3 is 2.5 mm².

**Note**

When wiring the supply voltage, observe the “Installation and EMC Directives” chapter in the User Manual.

**⚠ WARNING**

**Safe electrical isolation is guaranteed only between the inputs and outputs**

The system side (rack including 24V power supply) is safely isolated from dangerous voltages on plant side (8 output signals).

**The input circuits are only galvanically isolated.**

The input circuits on plant side are only isolated galvanically. Circuits consisting of combinations of safety extra-low voltage and hazardous voltages are not allowed.

## Green LED

The voltage supply (1P, 1M) on SIMATIC side is displayed by a green LED (P).

## Red LED

The supply voltage on SIMATIC TDC side (1P, 1M) is short-circuited (fault).

## 7.2.1 Signals

Signals up to a maximum of 120 V (nominal value) DC or AC can be connected at the SB60 interface module.

### Yellow LED

The status of the binary interface module outputs (binary inputs for SIMATIC TDC) is indicated using yellow LEDs (1...8).

Terminal block X2 provides two screw terminals for each signal:

- terminals 12, 22, ... up to 82 for binary signals 120 V
- terminals 11, 21, ... up to 81 for the reference point

**Note**

When wiring the signal lines to the terminals, observe “Installation and EMC Directives” in the User Manual.

## 7.2.2 Application notes

The interface module is designed **only for vertical mounting positions** due to thermal losses to be dissipated.

### Other information

For more information on EMC and environmental conditions, refer to section "General technical specifications (Page 39)"!

## 7.2.3 Technical specifications

### General data

| | |
|---|---|
| Mounting system | Suitable for snap-on mounting on rails |
| Dimensions W x H x D [mm] | 45 x 129 x 160 mm |
| Weight | Approx. 0.32 kg |

### Ambient temperatures

| | |
|---|---|
| Ambient temperatures | max. 60°°C |

### Power supply

| | |
|---|---|
| Supply voltage ($V_s$)<br>Rated value | <br>24 V DC |
| Valid range | 20.4 V to 28.8 V DC |
| Briefly t<500 ms | 1.5 x $V_{rated}$ |
| Rated current consumption | 90 mA |

The maximum current of 1 A may not be exceeded on connector X3 if the supply of several terminal blocks is routed via this connector.

### Digital inputs

| | | |
|---|---|---|
| Number | | 8 |
| Nominal input voltage | | 120 V AC/DC |
| | '1 signal' | 98 V to 132 V |
| | '0 signal' | 0 V to 33 V [1)] |
| Input current (‘1signal’) | | Max. 3 mA |
| Dielectric strength | | Safety isolation guaranteed:<br>- between inputs and outputs<br>Electrical isolation guaranteed:<br>- between input circuits<br>Test voltage 1125 V AC |
| [1)] or open-circuit input | | |

## 7.2.4 Pin assignment

### Flat connector X1

The cables SC62 or SC66 are used to connect the interface modules to the SIMATIC TDC components (for more information, refer to the SIMATIC TDC Documentation).

### Digital inputs terminal block X2

Table 7- 2 Pin assignment of the digital inputs of interface module SB60

| Terminal | 120 V | Channel No. |
|---|---|---|
| 11 | Reference | Channel 1 |
| 21 | Reference | Channel 2 |
| 31 | Reference | Channel 3 |
| 41 | Reference | Channel 4 |
| 51 | Reference | Channel 5 |
| 61 | Reference | Channel 6 |
| 71 | Reference | Channel 7 |
| 81 | Reference | Channel 8 |
| 12 | 120 V input | Channel 1 |
| 22 | 120 V input | Channel 2 |
| 32 | 120 V input | Channel 3 |
| 42 | 120 V input | Channel 4 |
| 52 | 120 V input | Channel 5 |
| 62 | 120 V input | Channel 6 |
| 72 | 120 V input | Channel 7 |
| 82 | 120 V input | Channel 8 |
| 14 | n.c. | Channel 1 |
| 24 | n.c. | Channel 2 |
| 34 | n.c. | Channel 3 |
| 44 | n.c. | Channel 4 |
| 54 | n.c. | Channel 5 |
| 64 | n.c. | Channel 6 |
| 74 | n.c. | Channel 7 |
| 84 | n.c. | Channel 8 |

### Conductor cross-section

The minimum conductor cross-section for the terminal block X1 is 0.2mm² and the maximum is 2.5 mm².

## 7.2.5 Block diagram

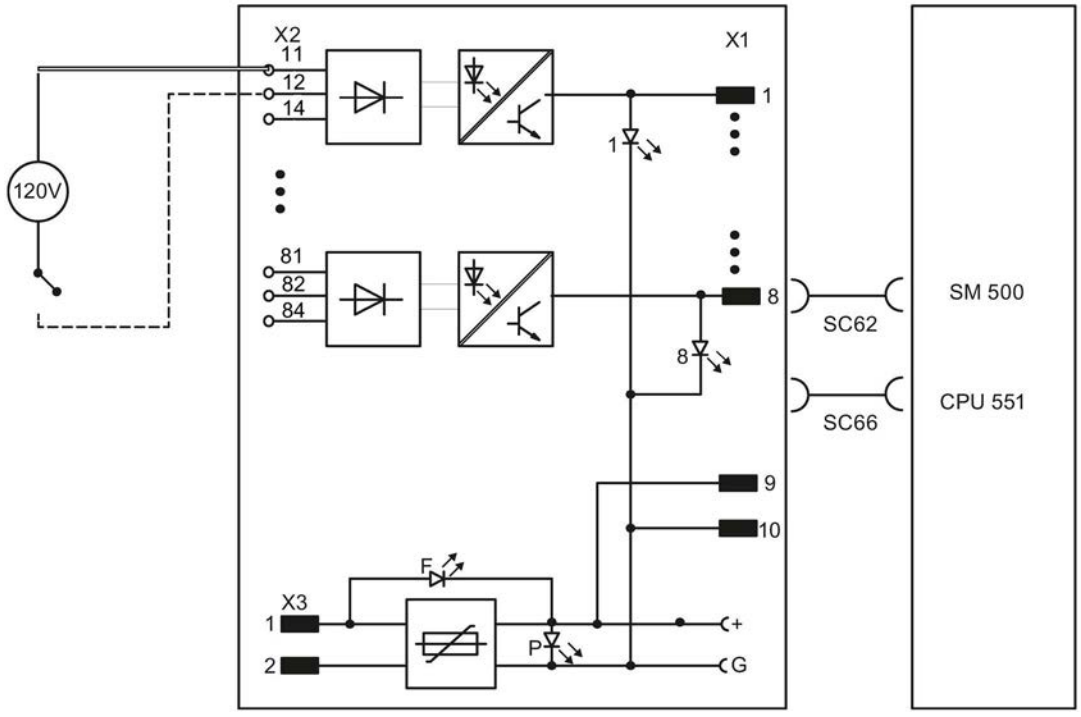



Figure 7-4 Block diagram of interface module SB60

# 7.3 Interface module SB61

## Article number

6DD1681-0EB3

## Description

Interface module SB61 is used to adapt 8 digital input signals with electrical isolation to the signal level of SIMATIC TDC components.

The cables SC62 or SC66 are used to connect the interface modules to the SIMATIC TDC components (for more information, refer to the SIMATIC TDC Documentation).

## Module design

- Enclosure for snap-on mounting to rails
- Ribbon cable connector (X1):
  - 8 pins for digital outputs
  - 2 pins for 1P, 1M
- Connector (X2), 2 x 12-pole:
  - 8 terminals for 24 V digital inputs
  - 8 terminals for 48 V digital inputs
  - 8 terminals for reference potentials
- 1 terminal pair X3: 1P, 1M (voltage supply on SIMATIC TDC side)
- 1 terminal pair X4: 2P, 2M (voltage supply on plant side)
- Pin header for short-circuit plugs
- Double test socket X5:2P (+), 2M (G)
- LED displays for diagnostics
- Optocoupler for electrical isolation between inputs and outputs

## Voltage supply on SIMATIC side

The SIMATIC TDC voltage supply is fed to terminal X3:

| Terminal X3 | Voltage on SIMATIC TDC side |
|---|---|
| 1P | +24 V |
| 1M | 0 V |

Connect the cables using accessory kit SM11 "Power supply connector for interface modules" (article number: 6DD1680-0BB0)

The maximum conductor cross-section at terminal X3 is 2.5 mm².

### Green LED

The voltage supply (1P, 1M) on SIMATIC TDC-side is indicated by a green LED (P).

### Red LED

The supply voltage on SIMATIC TDC-side (1P, 1M) is short-circuited (fault).

## 7.3.1 Signals

### Voltage supply on plant side

24/48 V DC is available for the system side signals at terminal block X4:

| Terminal X4 | Voltage on plant side |
|---|---|
| 2P | +24/48 V |
| 2M | 0 V |

Connect the cables using accessory kit SM11 "Power supply connector for interface modules" (article number: 6DD1680-0BB0)

The maximum conductor cross-section at terminal X4 is 2.5 mm².

### Test socket

The power supply for the plant/system side is available at double test socket X5 (G; +):

| Double test socket X5 | Voltage on plant side |
|---|---|
| +(2P of X4) | +24/48 V |
| G(2M of X4) | 0 V |

**⚠ WARNING**

**Explosion hazard**

It is not allowed to use the X5 test sockets in potentially explosive environments.

**Note**

When wiring the supply voltage, observe the “Installation and EMC Directives” chapter in the User Manual.

### Yellow LED

The status of each of the eight signals is displayed by a yellow LED (1...8).

### Terminal block for digital signals

There are three screw connections on terminal strip X2 for each signal:

- terminals 1 to 8 for 24 V binary signals
- terminals 11 to 18 for 48 V binary signals
- Terminals 51 to 58 for reference potential

## 7.3.2 Application notes

Plant/system-side signal voltages of 48V or 24V DC can be processed using the interface module. The plant/system side of the module has 8 electrically isolated input channels. Using short-circuit connectors (X11), the connection of each channel can be electrically isolated from one another, or connected to a common reference point:

### Inputs, electrically isolated

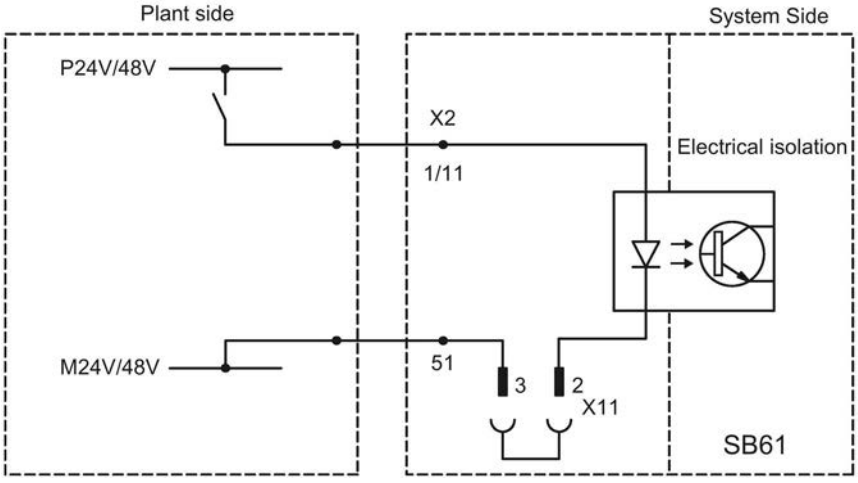



Figure 7-5 Position of the jumpers for electrically isolated inputs

### Inputs with common reference potential

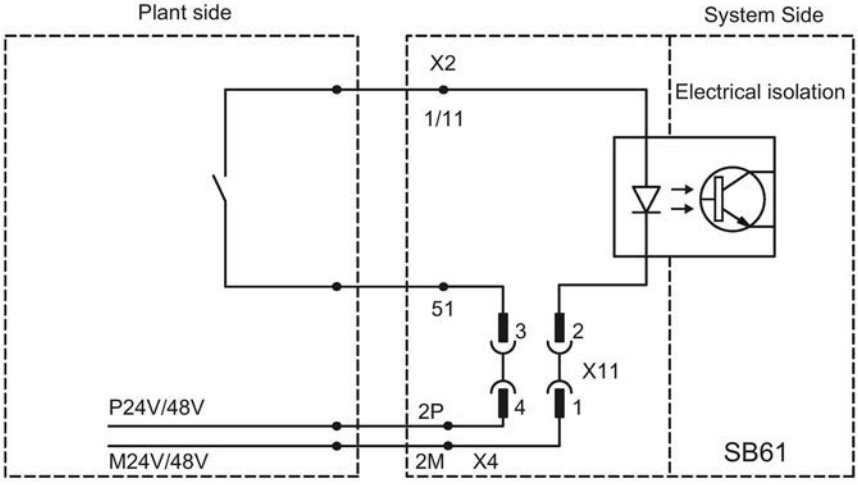



Figure 7-6 Position of the jumpers for inputs with common reference potential

| ⚠ CAUTION |
| --- |
| All outputs have a common reference potential in delivery state, i. e. each terminal pair X11 to X18 is equipped with two short-circuit plugs. |

## Position of the jumpers

The jumpers (short-circuit plugs) are located in enclosure behind the lid section facing away from the LEDs. These are **only accessible after the interface module has been removed**.

The potential assignment between the plant and system side is defined as follows:

Table 7- 3 Position of the short-circuit plug (jumper)

| Reference potential of inputs | Position of the short-circuit plug (jumper) |
| --- | --- |
| The input circuits are additionally electrically isolated | Connector X1n[1)] :2:3 inserted |
| Inputs with common reference potential | Connector X1n :1:2 and X1n :3:4 inserted |
| [1)] n = number of input 1 to 8 | |

**Note**

The **potential reference** can be set separately for each input.

The interface module is designed **only for vertical mounting positions** due to thermal losses to be dissipated.

## Other information

For more information on EMC and environmental conditions, refer to section "General technical specifications (Page 39)"!

The following figure shows a typical application:

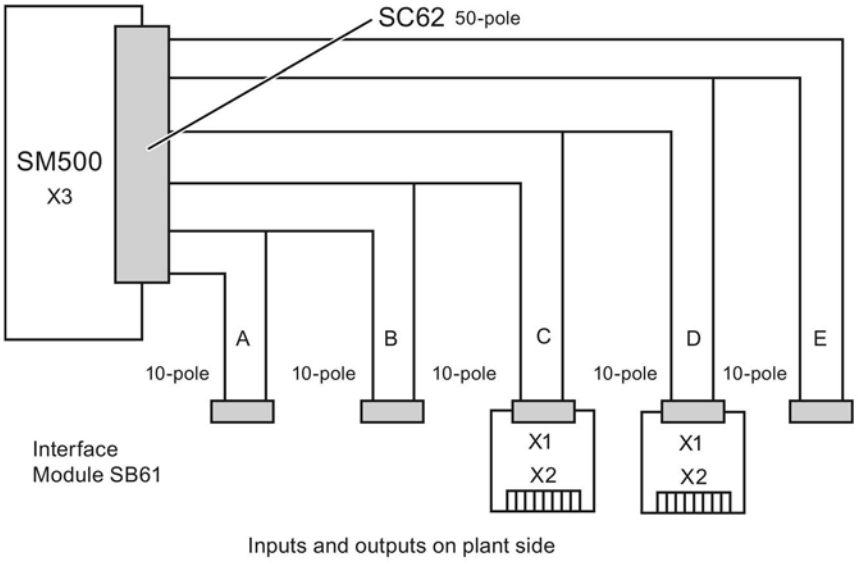



Figure 7-7 Application example of an SB61 interface module on digital I/O module SM500

## 7.3.3 Technical specifications

### General data

| | |
|---|---|
| Mounting system | The enclosure is suitable for snap-on mounting to rails |
| Dimensions W x H x D [mm] | 45 x 129 x 160 mm |
| Weight | Approx. 0.32 kg |

### Ambient temperatures

| | |
|---|---|
| Ambient temperatures | max. 60°°C |

### Power supply

| | SIMATIC TDC | Plant side 24 V DC | Plant side 48 V DC |
|---|---|---|---|
| Supply voltage ($V_s$) | 24 V DC | 24 V DC | 48 V DC |
| Valid range | 20 V DC to 30 V DC | 20 V DC to 30 V DC | 40 V DC to 60 V DC |
| Briefly t<500 ms | 1.5 x $V_{rated}$ | 1.5 x $V_{rated}$ | 1.5 x $V_{rated}$ |
| Rated current consumption | 90 mA | 50 mA | 50 mA |

The maximum current of 1 A may not be exceeded on connector X3 if the supply of several terminal blocks is routed via this connector. The maximum current of 2 A may not be exceeded on connector X4 if the supply of several terminal blocks is routed via this connector

### Digital inputs

| | | Plant side 24 V DC | Plant side 48 V DC |
|---|---|---|---|
| Number | | 8 | 8 |
| Input voltage for | | | |
| | '1 signal' | 13 V DC to 30 V DC | 26 V DC to 60 V DC |
| | '0 signal' | -3 V to +6 V [1] | -3 V to +12 V [1] |
| Input current (‘1signal’) | | 6 mA | 6 mA |
| [1] or open-circuit input | | | |

## 7.3.4 Pin assignment

### Flat connector X1

Use cable SC62 and SC66 to connect the interface module to the SIMATIC TDC components (for further information, refer to the documentation for the SIMATIC TDC components).

### Digital inputs, terminal block X2

Table 7- 4 Pin assignment of the digital inputs of interface module SB61

| Terminal | Inputs, electrically isolated | Inputs with common reference potential | Channel No. |
|---|---|---|---|
| 1 | +24 V input | | Channel 1 |
| 2 | +24 V input | | Channel 2 |
| 3 | +24 V input | | Channel 3 |
| 4 | +24 V input | | Channel 4 |
| 5 | +24 V input | | Channel 5 |
| 6 | +24 V input | | Channel 6 |
| 7 | +24 V input | | Channel 7 |
| 8 | +24 V input | | Channel 8 |
| 11 | +48 V input | | Channel 1 |
| 12 | +48 V input | | Channel 2 |
| 13 | +48 V input | | Channel 3 |
| 14 | +48 V input | | Channel 4 |
| 15 | +48 V input | | Channel 5 |
| 16 | +48 V input | | Channel 6 |
| 17 | +48 V input | | Channel 7 |
| 18 | +48 V input | | Channel 8 |
| 51 | Input 24 V/48 V | 2P(+24 V) | Channel 1 |
| 52 | Input 24 V/48 V | 2P(+24 V) | Channel 2 |
| 53 | Input 24 V/48 V | 2P(+24 V) | Channel 3 |
| 54 | Input 24 V/48 V | 2P(+24 V) | Channel 4 |
| 55 | Input 24 V/48 V | 2P(+24 V) | Channel 5 |
| 56 | Input 24 V/48 V | 2P(+24 V) | Channel 6 |
| 57 | Input 24 V/48 V | 2P(+24 V) | Channel 7 |
| 58 | Input 24 V/48 V | 2P(+24 V) | Channel 8 |

### Conductor cross-section

The minimum conductor cross-section for the terminal block X1 is 0.2mm² and the maximum is 2.5 mm².

## 7.3.5 Block diagram

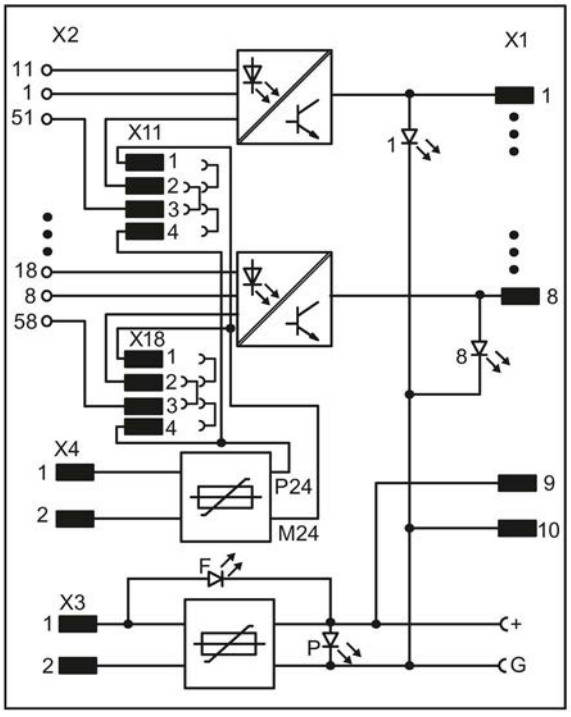



Figure 7-8 Block diagram of interface module SB61

# 7.4 Interface module SB70

## Article number

6DD1681-0AG2

## Description

Interface module SB70 is used to adapt eight digital output signals from SIMATIC TDC to the signal level of the plant by means of relay circuits.

The voltage of the output signal may amount up to max. 120 V DC or AC.

Cable SC62 is used to connect the interface module to the SIMATIC TDC components (for further information, refer to the documentation for the SIMATIC TDC components).

## Module design

- Enclosure for snap-on mounting to rails
- Ribbon cable connector (X1):
  - 8 pins for digital inputs
  - 2 pins for 1P, 1M
- Connector (X2), 2 x 12-pole
  - 8 terminals for the NO contact
  - 8 terminals for the NC contact
  - 8 terminals for the center contact
- 1 terminal pair X3: 1P, 1M (voltage on SIMATIC TDC side)
- Double test socket X5: 1P(+), 1M(G)
- LED displays for diagnostics
- Relays for the electrical isolation of inputs and outputs
- PTC thermistor as line protection downstream of the voltage supply on SIMATIC side

## Voltage supply on SIMATIC side

The SIMATIC TDC voltage supply is fed to terminal X3:

| Terminal X3 | Voltage on SIMATIC TDC side |
|---|---|
| 1P | +24 V |
| 1M | 0 V |

Connect the cables using accessory kit SM11 "Power supply connector for interface modules" (article number: 6DD1680-0BB0)

The maximum conductor cross-section at terminal X3 is 2.5 mm².

**Note**

When wiring the supply voltage, observe the “Installation and EMC Directives” chapter in the User Manual.

**⚠ WARNING**

**Isolation**

**Safe electrical isolation is guaranteed only between the inputs and outputs**

The system side (rack including 24V power supply) is safely isolated from hazardous voltages on plant side (8 output signals).

**The output circuits are only isolated galvanically.**

The output circuits on plant side are only isolated galvanically. Circuits consisting of combinations of safety extra-low voltage and hazardous voltages are not allowed.

## Green LED

The voltage supply on SIMATIC TDC side is indicated by a green LED (P).

## Red LED

The supply voltage on SIMATIC TDC side (1P, 1M) is short-circuited (fault).

## Test socket

The SIMATIC TDC supply voltage is available on the double test socket X5 (G; +):

| Double test socket X5 | Voltage SIMATIC side |
|---|---|
| + (1P of X3) | +24 V |
| G (1M of X3) | 0 V |

## 7.4.1 Signals

### Yellow LED

The status of each of the 8 signals (1...8) is displayed by means of a yellow LED.

### Terminal block for digital signals

Terminal block X2 provides three screw terminals for each signal to the plant side:

- Terminals 14, 24 ... to 84 for NO contacts
- Terminals 12, 22 ... up to 82 for NC contacts

Terminals 11, 21 ... to 81 as center contact. The corresponding relay contacts are determined as follows:

| Idle state | Connections (screw terminals) |
|---|---|
| Contact closed (NC contact) | n2 - n1 [1)] |
| Contact open (NO contact) | n4 - n1 |
| [1)] n: 1...8, depending on the channel number | |

**Note**

When wiring the signal voltage to the relay contacts, observe the “Installation and EMC Directives” chapter in the User Manual.

## 7.4.2 Application notes

The interface module is suitable for vertical and horizontal mounting positions

### Other information

For more information on EMC and environmental conditions, refer to section "General technical specifications (Page 39)"!

The following figure shows a typical application:

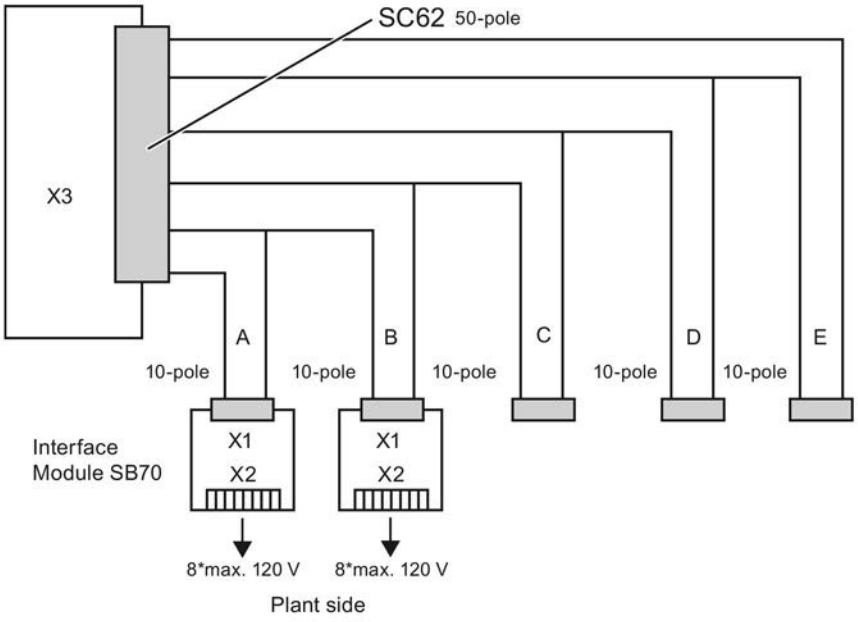



Figure 7-9 Application example of an SB70 interface module on digital I/O module SM500

The digital inputs of the interface module are connected via cable SC62 to the SIMATIC TDC outputs.

## 7.4.3 Technical specifications

### General data

| | |
|---|---|
| Mounting system | Housing can be snapped onto mounting rails |
| Dimensions W x H x D [mm] | 45 x 129 x 160 mm |
| Weight | Approx. 0.37 kg |

### Ambient temperatures

| | |
|---|---|
| Ambient temperatures | max. 60°°C |

### Power supply

| | |
|---|---|
| Rated supply voltage ($V_s$) | 24 V DC |
| Valid range | 20.4 V to 28.8 V DC |
| Briefly t<500 ms | 1.5 x $V_{rated}$ |
| Rated current consumption | 150 mA |

The maximum current of 1 A may not be exceeded on connector X3 if the supply of several terminal blocks is routed via this connector.

### Digital outputs

| | | |
|---|---|---|
| Number | | 8 |
| Switching characteristics of the relay contacts | | |
| | 120 V AC | 2 A |
| | 120 V DC | 0.4 A |
| | 60 V DC | 1 A |
| | < 35 V DC | 2 A |
| Switching frequency | | Max. 20 Hz |
| Dielectric strength | | Safety isolation guaranteed:<br>- between inputs and outputs<br>Electrical isolation guaranteed:<br>- between input circuits<br>Test voltage 1125 V AC |

## 7.4.4 Pin assignment

### Flat connector X1

Use the SC62 cable to connect the interface module to the SIMATIC TDC components (for more information, refer to the SIMATIC TDC documentation).

### Digital inputs, terminal block X2

Table 7- 5 Pin assignment of the digital inputs of interface module SB70, terminal block X2

| Terminal | 120 V | Channel No. |
|---|---|---|
| 11 | Center contact | Channel 1 |
| 21 | Center contact | Channel 2 |
| 31 | Center contact | Channel 3 |
| 41 | Center contact | Channel 4 |
| 51 | Center contact | Channel 5 |
| 61 | Center contact | Channel 6 |
| 71 | Center contact | Channel 7 |
| 81 | Center contact | Channel 8 |
| 12 | NC contact | Channel 1 |
| 22 | NC contact | Channel 2 |
| 32 | NC contact | Channel 3 |
| 42 | NC contact | Channel 4 |
| 52 | NC contact | Channel 5 |
| 62 | NC contact | Channel 6 |
| 72 | NC contact | Channel 7 |
| 82 | NC contact | Channel 8 |
| 14 | NO contact | Channel 1 |
| 24 | NO contact | Channel 2 |
| 34 | NO contact | Channel 3 |
| 44 | NO contact | Channel 4 |
| 54 | NO contact | Channel 5 |
| 64 | NO contact | Channel 6 |
| 74 | NO contact | Channel 7 |
| 84 | NO contact | Channel 8 |

### Conductor cross-section

The minimum conductor cross-section for the terminal block X1 is 0.2mm² and the maximum is 2.5 mm².

## 7.4.5 Block diagram

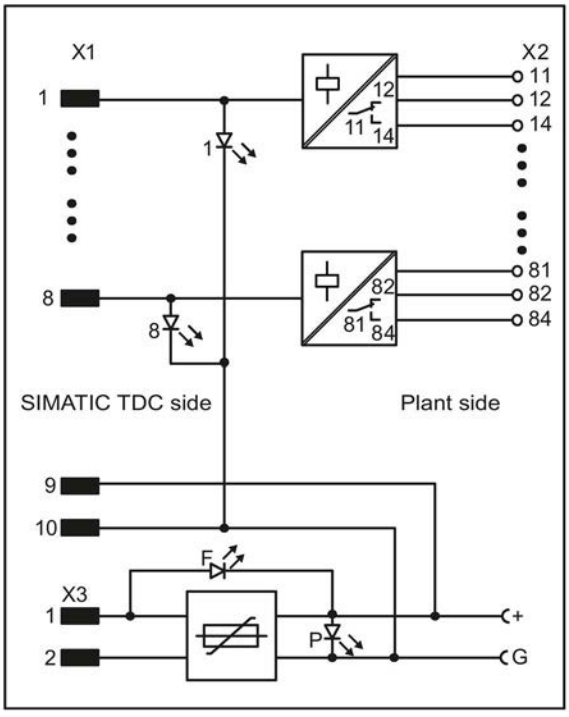



Figure 7-10 Block diagram of interface module SB70

# 7.5 Interface module SB71

## Article number

6DD1681-0DH1

## Description

Interface module SB71 is used to adapt eight digital DC signals from SIMATIC TDC to the signal level on plant side in an electrically isolated circuit.

Cable SC62 is used to connect the interface module to the SIMATIC TDC components (for further information, refer to the documentation for the SIMATIC TDC components).

## Module design

- The enclosure is suitable for snap-on mounting to rails
- Ribbon cable connector (X1):
  - 8 pins for digital inputs
  - 2 pins for 1P, 1M
- Connector (X2), 2x 8-pole
  - 8 terminals for digital outputs, 24/48 V DC
  - 8 terminals for reference potentials
- 1 terminal pair X3: 1P and 1M (voltage supply on SIMATIC TDC side)
- 1 terminal pair X4: 2P, 2M (voltage supply on plant side)
- Double test socket X5: 1P(+), 1M(G)
- LED displays for diagnostics
- Optocoupler for electrical isolation between inputs and outputs

## Voltage supply on SIMATIC side

The SIMATIC TDC voltage supply is fed to terminal X3:

| Terminal X3 | Voltage on SIMATIC TDC side |
|---|---|
| 1P | +24 V |
| 1M | 0 V |

Connect the cables using accessory kit SM11 "Power supply connector for interface modules" (article number: 6DD1680-0BB0)

The maximum conductor cross-section at terminal X3 is 2.5 mm².

### Green LED

The voltage supply on SIMATIC TDC side is indicated by a green LED (P).

### Red LED

The supply voltage on SIMATIC TDC side (1P, 1M) is short-circuited (fault).

### Voltage supply on plant side

The 24/48 V DC power supply voltage for signals on plant side is wired to terminal block X4:

| Terminal X4 | Voltage on plant side |
|---|---|
| 2P | +24/48 V |
| 2M | 0 V |

Connect the cables using accessory kit SM11 "Power supply connector for interface modules" (article number: 6DD1680-0BB0)

The maximum conductor cross-section at terminal X4 is 2.5 mm².

### Test socket

The SIMATIC TDC supply voltage is available on the double test socket X5 (G; +):

| Double test socket X5 | Voltage SIMATIC side |
|---|---|
| + (1P of X3) | +24 V |
| G (1M of X3) | 0 V |

**⚠ WARNING**

**Explosion hazard**

It is not allowed to use the X5 test sockets in potentially explosive environments.

**Note**

When wiring the supply voltage, observe the “Installation and EMC Directives” chapter in the User Manual.

## 7.5.1 Signals

### Yellow LED

The status of each of the eight signals is displayed by a yellow LED (1...8).

### Terminal block for digital signals

Terminal block X2 provides two screw terminals for each signal:

- Terminals 1 to 8 for digital outputs, 24/48 V DC
- Terminals 51 to 58 for reference potential

## 7.5.2 Application notes

The interface module is equipped with a ribbon cable connector X1 that is used to connect the output signals of the SIMATIC TDC system, as well as a terminal block X2 for wiring the plant signals.

The interface module is designed **only for vertical mounting positions** due to thermal losses to be dissipated.

### Other information

For more information on EMC and environmental conditions, refer to section "General technical specifications (Page 39)"!

| ⚠ CAUTION |
| --- |
| Simultaneous operation of more than three digital outputs in short-circuit mode is not allowed due to the maximum permissible thermal losses per interface cubicle. |

The following figure shows a typical application:

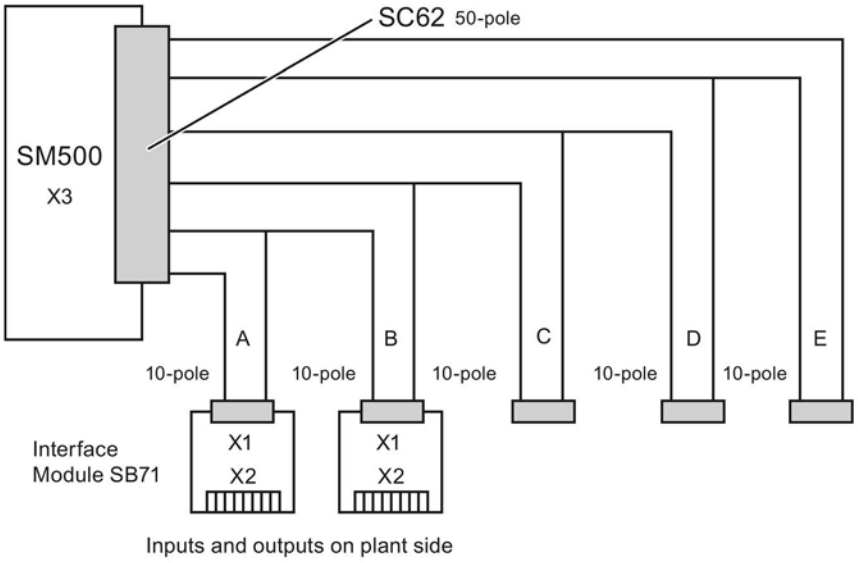



Figure 7-11 Application example of an SB71 interface module on digital I/O module SM500

## 7.5.3 Technical specifications

### General data

| | |
|---|---|
| Mounting system | The enclosure is suitable for snap-on mounting to rails |
| Dimensions W x H x D [mm] | 45 x 129 x 160 mm |
| Weight | Approx. 0.32 kg |

### Ambient temperatures

| | |
|---|---|
| Ambient temperatures | max. 60°°C |

### Power supply

| | SIMATIC TDC | Plant side 24 V DC | Plant side 48 V DC |
|---|---|---|---|
| Supply voltage ($V_s$) | 24 V DC | 24 V DC | 48 V DC |
| Valid range | 20.4 V to 28.8 V DC | 18 V DC to 60 V DC | 18 V DC to 60 V DC |
| Briefly t<500 ms | 1.5 x $V_{rated}$ | 1.5 x $V_{rated}$ | 1.5 x $V_{rated}$ |
| Rated current consumption | 55 mA | 300 mA | 360 mA |

The maximum current of 1 A may not be exceeded on connector X3 if the supply of several terminal blocks is routed via this connector. The maximum current of 2 A may not be exceeded on connector X4 if the supply of several terminal blocks is routed via this connector

### Digital outputs

| | | Plant side 24 V DC | Plant side 48 V DC |
|---|---|---|---|
| Number | | 8 | 8 |
| Output voltage for '1 signal' | | | |
| | at 0 mA output current | ($V_s$-0.6 V) | ($V_s$-1.2 V) |
| | at 20 mA output current | ($V_s$-2.1 V) | ($V_s$-2.0 V) |
| | at 30 mA output current | ($V_s$-2.7 V) | ($V_s$-2.9 V) |
| Output voltage for '0 signal' | | 0 V | 0 V |
| Max. output current (for '1 signal') | | 30 mA | 30 mA |

The digital outputs are sustained short circuit-proof.

## 7.5.4 Pin assignment

### Flat connector X1

Cable SC62 is used to connect the interface module to the SIMATIC TDC components (for further information, refer to the documentation for the SIMATIC TDC components).

### Digital outputs, terminal strip X2

Table 7- 6 Pin assignment of the digital outputs of interface module SB71

| Terminal | Designation |
|---|---|
| 1 | Digital output 1 |
| 2 | Digital output 2 |
| 3 | Digital output 3 |
| 4 | Digital output 4 |
| 5 | Digital output 5 |
| 6 | Digital output 6 |
| 7 | Digital output 7 |
| 8 | Digital output 8 |
| 51 | 0 V, digital output 1 |
| 52 | 0 V, digital output 2 |
| 53 | 0 V, digital output 3 |
| 54 | 0 V, digital output 4 |
| 55 | 0 V, digital output 5 |
| 56 | 0 V, digital output 6 |
| 57 | 0 V, digital output 7 |
| 58 | 0 V, digital output 8 |

### Conductor cross-section

The minimum conductor cross-section for the terminal block X1 is 0.2mm² and the maximum is 2.5 mm².

## 7.5.5 Block diagram

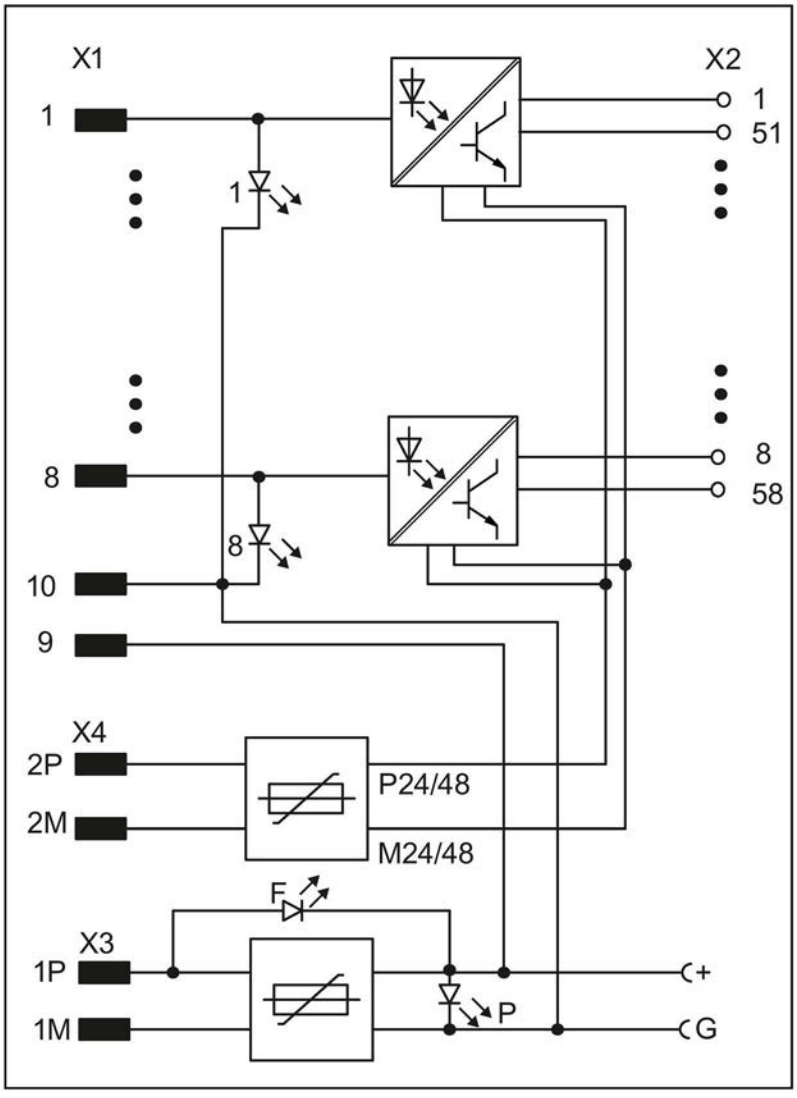



Figure 7-12 Block diagram of interface module SB71

# 7.6 Interface modules SU12 und SU13

## Article number

SU126DD1681-0AJ1

SU136DD1681-0GK0

## General

| SU12 | SU13 |
|---|---|
| Interface module SU12 is a<br>**10-pole** terminal block that is used to wire the analog or digital signals of a<br>**10-pole** ribbon cable connector (SIMATIC side) to cage clamp terminals (plant side). | Interface module SU13 is a<br>**50-pin** terminal block that is used to wire 50 signals routed via a 50-pole connector (SIMATIC side) to screw terminals (plant side). |

## Module design

| | |
|---|---|
| **SU12** | 16 spring-loaded terminals (X2)<br>10 spring-loaded terminals for analog or digital signals on plant side<br>6 unused spring-loaded terminals<br>10-pole connectors X1. |
| **SU13** | 50 screw terminals (X2)<br>Connection of 50 signals<br>50-pole connector X1. |

## 7.6.1 Function description

Interface modules SU12 and SU13 are used to wire a ribbon cable connector X1 on SIMATIC TDC side 1:1 to the terminal blocks X2 on plant side, with the exception of the following terminals.

The following signal lines are fused at the terminals (0.5 A slow-blow, internal resistance 0.25 Ω):

| Interface module | Terminal block X2 |
|---|---|
| SU12 | Pin 1 – 8 |
| SU13 | Pin 8, 17 – 23, 26 – 33, 36 – 43, 46 – 48 |

The following terminals have a protective diode (Schottky diode type Vishay BAT46) for the 24 V supply voltage of digital outputs in the following signal lines:

| Interface module | Terminal block X2 |
|---|---|
| SU12 | Pin 10 |
| SU13 | Pin 10 |

A PTC resistor (internal resistance: 0.9 Ω, e.g. type Epcos B59910-C120-A70) element is installed at the following terminals for short-circuit protection of the 24 V supply voltage of digital outputs in the signal line:

| Interface module | Terminal block X2 |
|---|---|
| SU12 | Pin 9 |
| SU13 | Pin 9 |

### Process signals

The concept of the interface modules support signal flow on both sides. The process signals are transferred without additional electrical isolation and signal preparation.

Table 7- 7 Maximum permissible voltage and current values for signal processing

| | |
|---|---|
| Voltage range | The maximum permitted voltages of the modules to which the interface modules are connected must be maintained. |
| Current range | Max. 0.5 A |

## 7.6.2 Additional components

### Cables for:

The following cables are required to wire the interface modules to the modules:

### SU12

Table 7- 8 Modules and signal cables as additional components for SU12

| Cable | Modules | Connectors |
|---|---|---|
| SC62 | SM500 | X3 |
| SC66 | CPU551 | X2 |

### SU13

Table 7- 9 Modules and signal cables as additional components for SU13

| Cable | Modules | Connectors |
|---|---|---|
| SC63 | SM500 | X1, X2, X3 |
| | CP52M0 | X6 |

## 7.6.3 Application notes

The interface modules are suitable for **vertical and horizontal** mounting positions. The modules must be installed on mounting rails.

### Other information

For more information on EMC and environmental conditions, refer to section "General technical specifications (Page 39)"

## 7.6.4 Pin/terminal assignment X1/X2

The screw terminal numbers of X2 are identical with the numbering of ribbon cable connector in accordance with the pin counting mode.

### Conductor cross-sections

| Interface module | Minimum conductor cross-section on terminal block X2 | Maximum conductor cross section on terminal block X2 |
|---|---|---|
| SU12 | 0.2 mm² | 2.5 mm². |
| SU13 | 0.2 mm² | 1.5 mm². |

### SU12

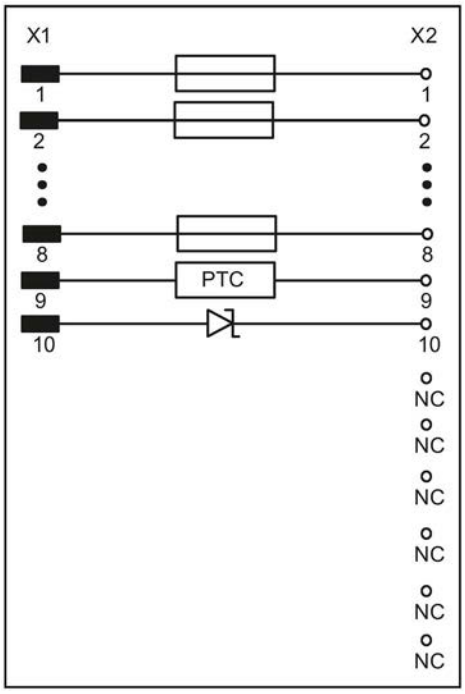



Figure 7-13 SU12 circuit diagram

The components are described in chapter Function description (Page 212).

## SU13

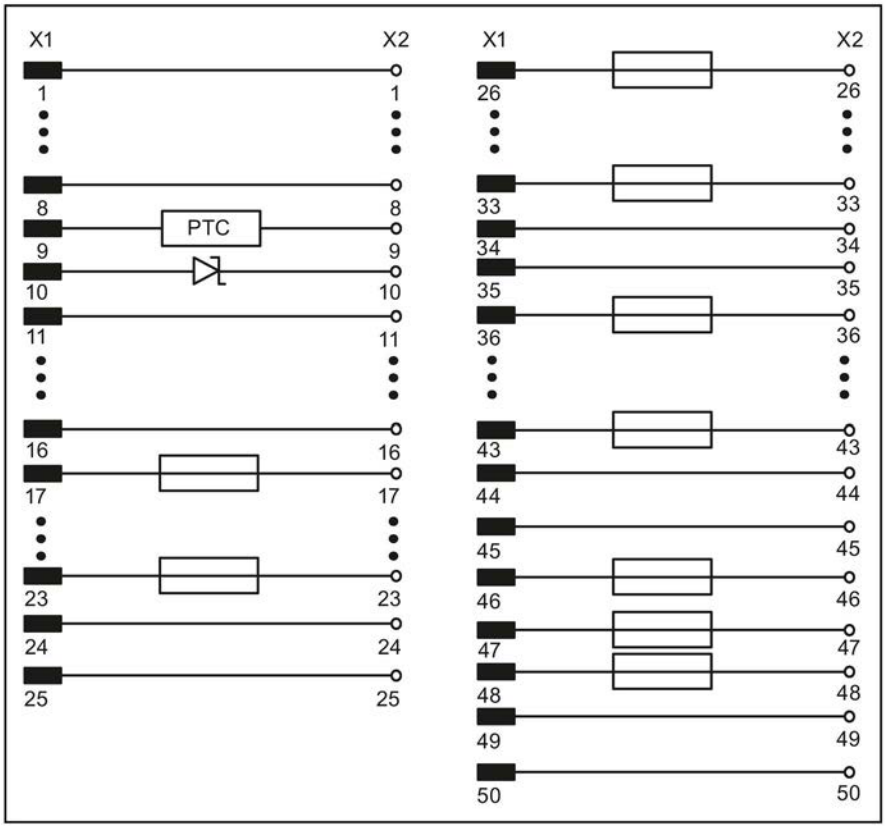



Figure 7-14 SU13 circuit diagram

The components are described in chapter Function description (Page 212).

## 7.6.5 Technical specifications

### General data

| | |
|---|---|
| Dimensions W x H x D [mm] | 45 x 129 x 160 mm |
| Weight | Approx. 0.28 kg |

### Ambient temperatures

| | |
|---|---|
| Ambient temperatures | max. 60°°C |

# Submodules

# 8

## 8.1 Program memory modules CPU555

### Article number

| | |
|---|---|
| Program memory (2 MB) | 6ES7953-8LL31-0AA0 |
| Program memory (4 MB) | 6ES7953-8LM31-0AA0 |
| Program memory (8 MB) | 6ES7953-8LP31-0AA0 |

### Description

The program memory modules are used to store the processor program (including the operating system) you configured in HW Config and CFC and for saving online changes.

### Installation/ programming

The program memory module is inserted into the submodule slot X4 provided on the CPU555 module and can by loaded with the user program in various ways:

- **Offline loading**
  - Via a MMC programming adapter installed on the PC
  - Via a SIMATIC USB prommer (6ES7792-0AA00-0XA0) connecte via USB to the PC
- **Online download**
  - Directly from the PC via a communication link (e.g. PROFINET) into the memory module plugged into the CPU555 module.

### Program size

The volume of configuration data to download to the memory module (compressed to approx. 50 %) and the free program memory space can be viewed in the CFC by selecting:

PLC / Load / Info

## Memory overview

The following table shows the differences in the expansion of the program memory modules:

| Application | S7 MMC | | |
|---|---|---|---|
| | 6ES7953-8LL31-0AA0 | 6ES7953-8LM31-0AA0 | 6ES7953-8LP31-0AA0 |
| Flash memory for storing the configuration and variable operating parameters | 2 MB | 4 MB | 8 MB |

Flash memory is non-volatile and can be electrically programmed and erased.

## Dimensions

| | |
|---|---|
| Dimensions W x H x D [mm] | 24 x 1.4 x 32 |
| Weight | 1.5 g |

# 8.2 Program memory modules CPU550/551

## Article number

| | |
|---|---|
| Program memory module MC500 | 6DD1610-0AH4 |
| Program memory module MC510 | 6DD1610-0AH6 |
| Program memory module MC521 | 6DD1610-0AH3 |

## Description

The program memory modules are used to store the processor program (including the operating system) you configured in HW Config and CFC.

## Installation/ programming

The program memory module is inserted into the submodule slot provided on the CPU module and can by loaded with the user program in two ways:

- By means of an integrated PCMCIA ("PC Card") programming adapter on the PC (**loading in offline mode**)
- Directly from the PC to the memory module inserted in the CPU module via serial communication connection (**download in online mode**)

## Program size

The volume of configuration data to download to the memory module (compressed to approx. 50 %) and the free program memory space can be viewed in the CFC by selecting:

PLC / Load / Info

## Memory overview

The following table shows the differences in the application and expansion of the program memory modules:

| Application | MC521 | MC500 | MC510 |
|---|---|---|---|
| Flash memory for storing the configuration data | 2 MB | 4 MB | 8 MB |
| EEPROM for variable operating parameters | 8 KB | 8 KB | 8 KB |

Flash memory is non-volatile and can be electrically programmed and erased.

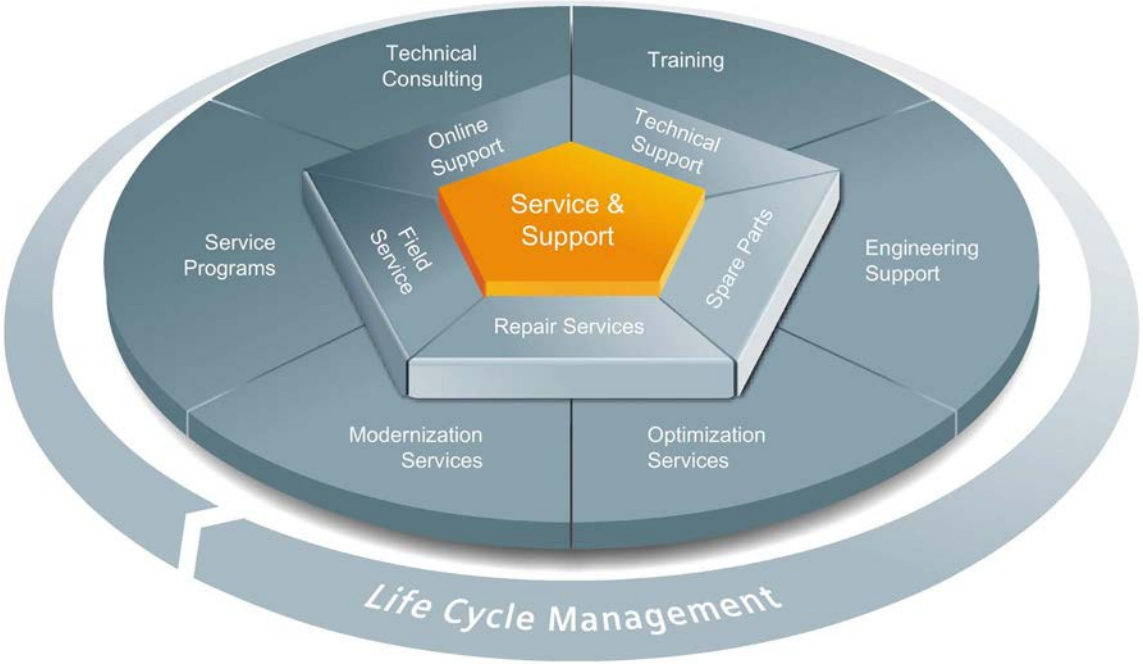
## Dimensions

| | |
|---|---|
| Dimensions W x H x D [mm] | 54 x 85.6 x 3.3 mm |
| Weight | 30 g |

# Service & Support

# A

## A.1 Service & Support

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