SIEMENS

# SINAMICS

# SINAMICS S120
# Equipment Manual for Control Units and Additional System Components

Equipment Manual




(GH1), 03/2006 Edition

6SL3097-2AH00-0BP3

## Safety Guidelines

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**

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

**Caution**

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

**Notice**

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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 device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

## Prescribed Usage

Note the following:

**Warning**

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

## Trademarks

All names identified by ® are registered trademarks of the 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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GERMANY

Order No.: 6SL3097-2AH00-0BP3
03/2006 Edition

# Foreword

## SINAMICS documentation

The SINAMICS documentation is sub-divided into 2 areas:

- General documentation/catalogs
- Manufacturer/service documentation

You will find an overview of the documentation, which is updated on a monthly basis, in the available languages in the Internet under:

http://www.siemens.com/motioncontrol

Following the menu items "Support" → "Technical Documentation" → "Overview of Publications".

The Internet edition of DOConCD, DOConWEB, are available under:

http://www.automation.siemens.com/doconweb

Information on the range of training courses and FAQs (frequently asked questions) are available in the Internet under:

http://www.siemens.com/motioncontrol and there under the menu item "Support"

## Phases of use

Table 1 Table Foreword-1: Phase of use and the available documents/tools

| Phases of use | Tools |
|---|---|
| Orientation | SINAMICS S sales documentation |
| Planning/engineering | SIZER engineering tool |
| Select/order | SINAMICS S Catalogs |
| Configuring/installation | • SINAMICS S120 Equipment Manual for Control Units and Supplementary System Components<br>• SINAMICS S120 Equipment Manual for Booksize Power Units<br>• SINAMICS S120 Equipment Manual for Chassis Power Units<br>• SINAMICS S150 Operating Instructions |
| Commissioning | • STARTER Parameterizing and Commissioning Tool<br>• SINAMICS S120 Getting Started<br>• SINAMICS S120 Commissioning Manual<br>• SINAMICS S120 Commissioning Manual CANopen<br>• SINAMICS S List Manual<br>• SINAMICS S150 Operating Instructions |
| Using/operating | • SINAMICS S120 Commissioning Manual<br>• SINAMICS S List Manual<br>• SINAMICS S150 Operating Instructions |

| Phases of use | Tools |
|---|---|
| Service/maintenance | • SINAMICS S120 Commissioning Manual<br>• SINAMICS S List Manual<br>• SINAMICS S150 Operating Instructions |

## Target group

This manual addresses planners, installation and design engineers.

## Benefits

This manual provides information about the components and functions of the units and provides the target group with information so that they can safely mount/install, configure, check and operate the devices and also troubleshoot them.

## Standard scope

The functionality of the standard scope is described in the following documentation. The machinery construction OEM documents supplements or changes that he makes (the machinery construction OEM).
Functions that are not explained in this documentation may be able to be executed in the drive system. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing.

For the sake of simplicity, this documentation does not contain all detailed information about all types of the product and cannot cover every conceivable case of installation, operation, or maintenance.

## Technical Support

If you have any questions, please contact our Hotline:

**European and African time zones**
A&D Technical Support
Phone: +49 (0) 180 / 5050 - 222
Fax: +49 (0) 180 / 5050 - 223
Internet: http://www.siemens.com/automation/support-request
E-mail: mailto:adsupport@siemens.com
**Asian and Australian time zones**
A&D Technical Support
Phone: +86 1064 719 990
Fax: +86 1064 747 474
Internet: http://www.siemens.com/automation/support-request
E-mail: mailto:adsupport@siemens.com
**American time zones**
A&D Technical Support
Phone: +1 423 262 2522
Fax: +1 423 262 2289
Internet: http://www.siemens.com/automation/support-request
E-mail: mailto:adsupport@siemens.com

## Questions on the manual

If you have any questions (suggestions, corrections) regarding this documentation, please fax or e-mail us at:

Fax: +49 (0) 9131 / 98 - 63315

E-mail: mailto:motioncontrol.docu@siemens.com

Fax form: Refer to the feedback sheet at the end of the document

## Internet address for SINAMICS

http://www.siemens.com/sinamics.

## EC Declaration of Conformance

The EC Declaration of Conformance regarding the EMC Directives is provided

- in the Internet:
  http://www.ad.siemens.de/csinfo
  under the Product/Order No. 15257461
- For the responsible regional offices of the A&D MC business division of Siemens AG

## ESD notices

**Caution**

Electrostatic sensitive devices (ESDs) are individual components, integrated circuits, or boards that may be damaged by either electrostatic fields or electrostatic discharge.

Regulations for handling ESD components:

When handling electronic components, you must ensure that the person carrying out the work, the work place, and packaging are properly grounded.

Personnel in ESD areas with conductive flooring may only handle electronic components if:

They are grounded with an ESD wrist band

They are wearing ESD shoes or ESD shoe grounding straps

Electronic boards should only be touched if absolutely necessary. They must only be handled on the front panel or, in the case of printed circuit boards, at the edge.

Electronic boards must not come into contact with plastics or items of clothing containing synthetic fibers.

Boards must only be placed on conductive surfaces (work surfaces with ESD surface, conductive ESD foam, ESD packing bag, ESD transport container).

Do not place boards near display units, monitors, or television sets (minimum distance from screen: 10 cm).

Measurements must only be taken on boards when the measuring instrument is grounded (via protective conductors, for example) or the measuring probe is briefly discharged before measurements are taken with an isolated measuring device (for example, touching a bare metal housing).

## Safety information

**Danger**

Commissioning must not start until you have ensured that the machine in which the components described here are to be installed complies with Directive 98/37/EC.

SINAMICS S equipment must only be commissioned by suitably qualified personnel.

The personnel must take into account the information provided in the technical customer documentation for the product, and be familiar with and observe the specified danger and warning notices.

When electrical equipment and motors are operated, the electrical circuits automatically conduct a dangerous voltage.

Dangerous mechanical movements may occur in the system during operation.

All work on the electrical system must be carried out when the system has been disconnected from the power supply.

**Warning**

Correct and safe operation of SINAMICS S equipment assumes correct transportation, storage, setup, and installation, as well as careful operation and maintenance.

The details in the catalogs and proposals also apply to the design of special equipment versions.

In addition to the danger and warning information provided in the technical customer documentation, the applicable national, local, and system-specific regulations and requirements must be taken into account.

Only protective extra-low voltages (PELVs) that comply with EN60204-1 must be connected to all connections and terminals between 0 and 48 V.

**Caution**

Operating the equipment in the immediate vicinity (< 1.5 m) of mobile telephones with a transmitter power of > 1 W may lead to incorrect operation.

# Table of contents

# System overview

# 1

## 1.1 Field of application

SINAMICS is the new range of drives from Siemens designed for mechanical and plant engineering applications. SINAMICS offers solutions for all drive tasks:

- Simple pump and fan applications in the process industry.
- Complex individual drives in centrifuges, presses, extruders, elevators, as well as conveyor and transport systems.
- Drive line-ups in textile, plastic film, and paper machines, as well as in rolling mill plants.
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines.

Depending on the application, the SINAMICS range offers the ideal version for any drive task.

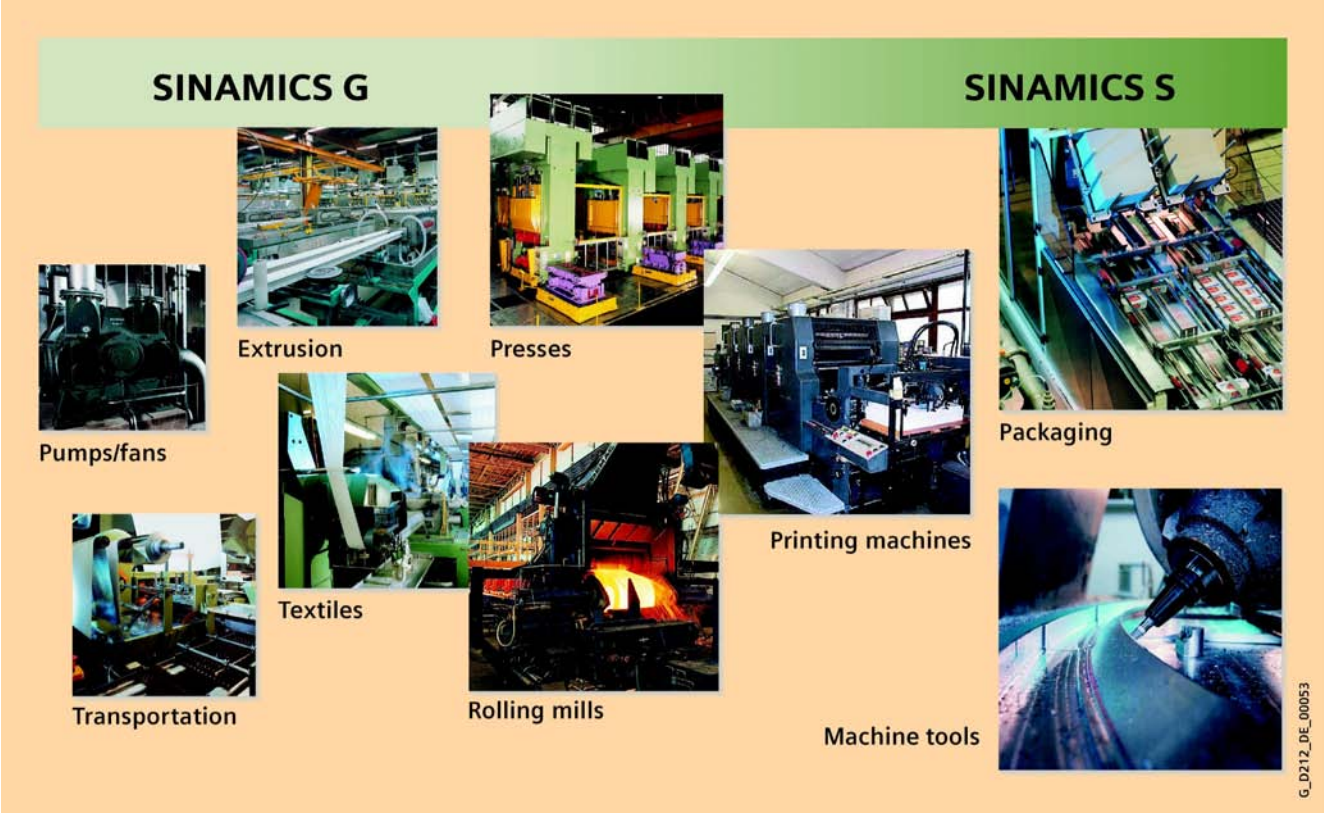



Figure 1-1 SINAMICS applications

## 1.2 Product variants

SINAMICS offers different versions designed to meet a range of requirements:

- SINAMICS G is designed for standard applications with asynchronous motors. These applications have less stringent requirements regarding the dynamics and accuracy of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous/asynchronous motors and fulfills stringent requirements regarding:
  - Dynamics and accuracy
  - Integration of extensive technological functions in the drive control system

## 1.3 Platform Concept and Totally Integrated Automation

All SINAMICS versions are based on a platform concept. Joint hardware and software components, as well as standardized tools for design, configuration, and commissioning tasks ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks with no system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is a part of the Siemens "Totally Integrated Automation" concept. Integrated SINAMICS systems covering configuration, data storage, and communication at automation level, ensure low-maintenance solutions with SIMATIC, SIMOTION, and SINUMERIK.

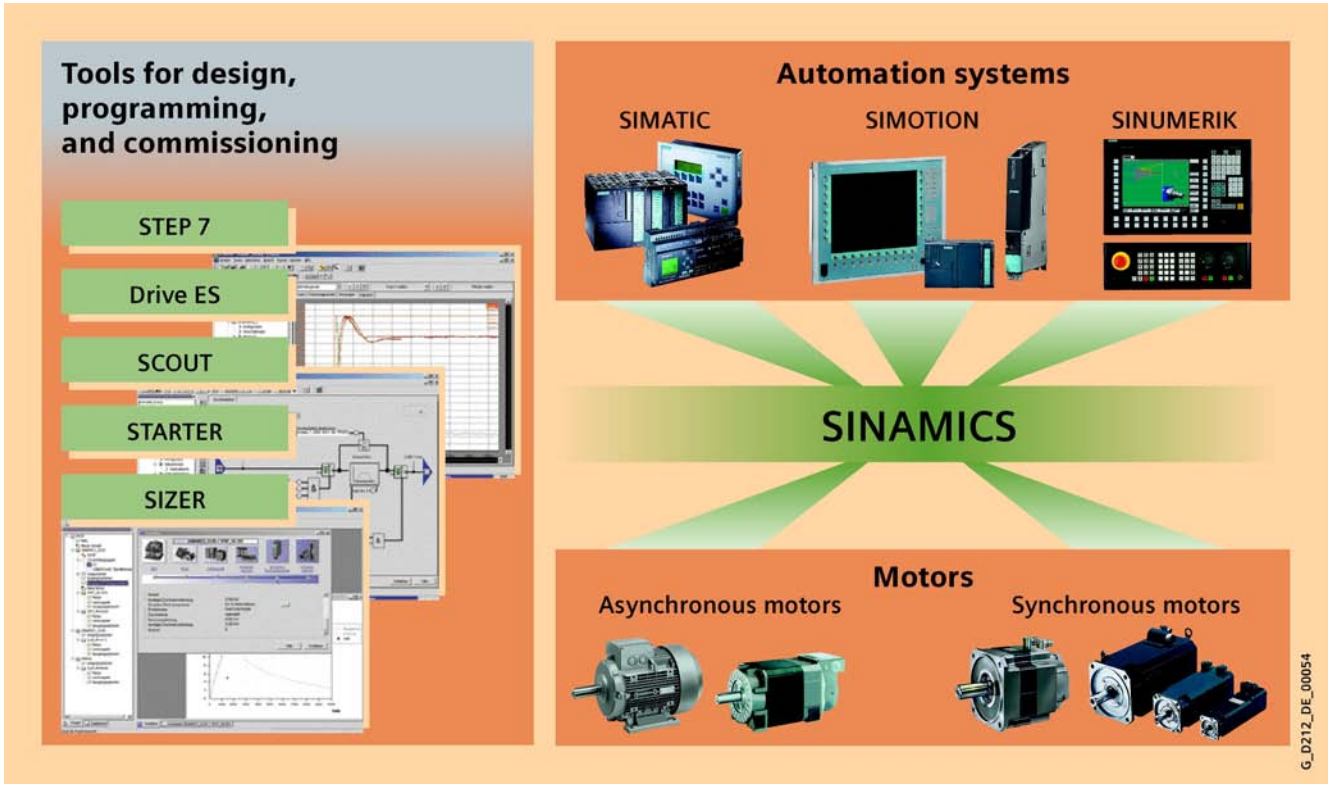



Figure 1-2 SINAMICS as part of the Siemens modular automation system

# 1.4 Introduction

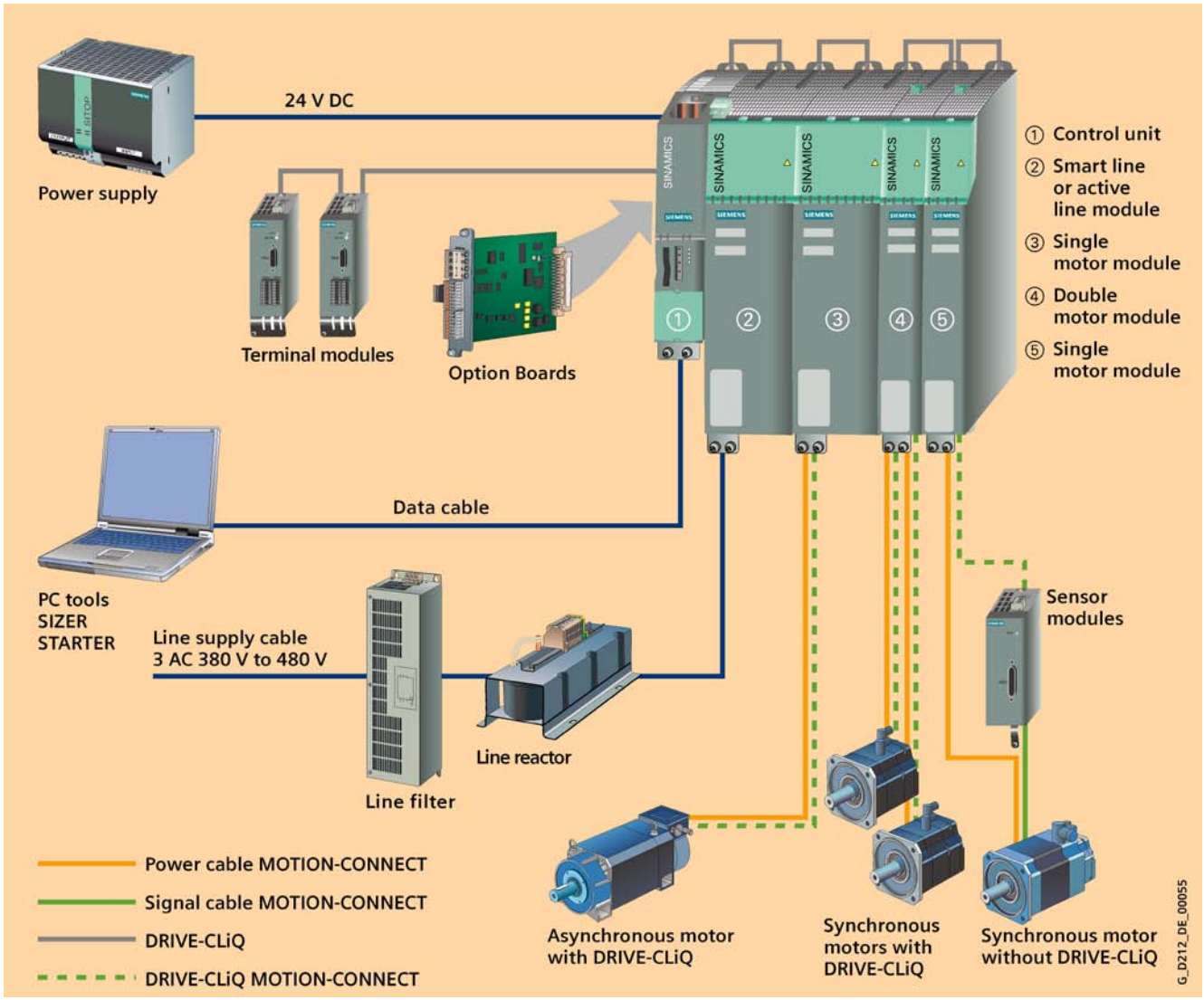



Figure 1-3 SINAMICS S120 system overview

## Modular system for sophisticated drive tasks

SINAMICS S120 solves complex drive tasks for a wide range of industrial applications and is, therefore, designed as a modular system. Users can choose from many different harmonized components and functions to create a solution that best meets their requirements. SIZER, a high-performance engineering tool, makes it easier to choose and determine the optimum drive configuration.

SINAMICS S120 is supplemented by a wide range of motors. Whether torque, synchronous or induction motors, whether rotating or linear motors, all of these motors are optimally supported by SINAMICS S120.

### Drive for multi-axis applications

The trend towards separate axes in mechanical engineering is growing all the time. Where possible, central drives are being replaced by electronically coordinated servo drives. These require drives with a connected DC link, which allows cost-saving energy exchange between braking and driving axes.

SINAMICS S120 features infeeds and inverters that cover a broad power range, are designed for seamless integration, and enable space-saving, multi-axis drive configurations.

### New system architecture with a central Control Unit

Electronically coordinated individual drives work together to perform your drive tasks. Higher-level controllers operate the drives to achieve the required coordinated movement. This requires cyclic data exchange between the control and all the drives. This exchange always had to take place via a field bus, which required a great deal of time and effort for installation and configuration. SINAMICS S120 takes a different approach. A central control unit controls the drive for all connected axes and also establishes the technological links between the axes. Since all the required data is stored in the central Control Unit, it does not need to be transferred. Inter-axis connections can be established within a component and easily configured in the STARTER commissioning tool using a mouse.

Simple technological tasks can be carried out by the SINAMICS S120 Control Unit itself. For complex numerical or motion-control tasks, high-performance SINUMERIK or SIMOTION D modules are used instead.

### DRIVE-CLiQ – the digital interface between SINAMICS components

The SINAMICS S120 components, including the motors and encoders, are interconnected via a joint serial interface called DRIVE-CLiQ. The standardized cables and connectors reduce the variety of different parts and cut storage costs.

Converter boards for converting standard encoder signals to DRIVE-CLiQ are available for third-party motors or retrofit applications.

## Electronic type plates in all components

All SINAMICS S120 components have an electronic type plate. This electronic type plate contains all the relevant technical data about that particular component. In the motors, for example, this data includes the parameters of the electric equivalent circuit diagram and characteristic values for the built-in motor encoder. The Control Unit records this data automatically via DRIVE-CLiQ so that it does not need to be entered during commissioning or when the equipment is replaced.

In addition to the technical data, the type plate includes logistical data (manufacturer ID, order number, and globally unique ID). Since this data can be called up electronically on site or remotely, all the components used in a machine can always be individually identified, which helps simplify servicing.

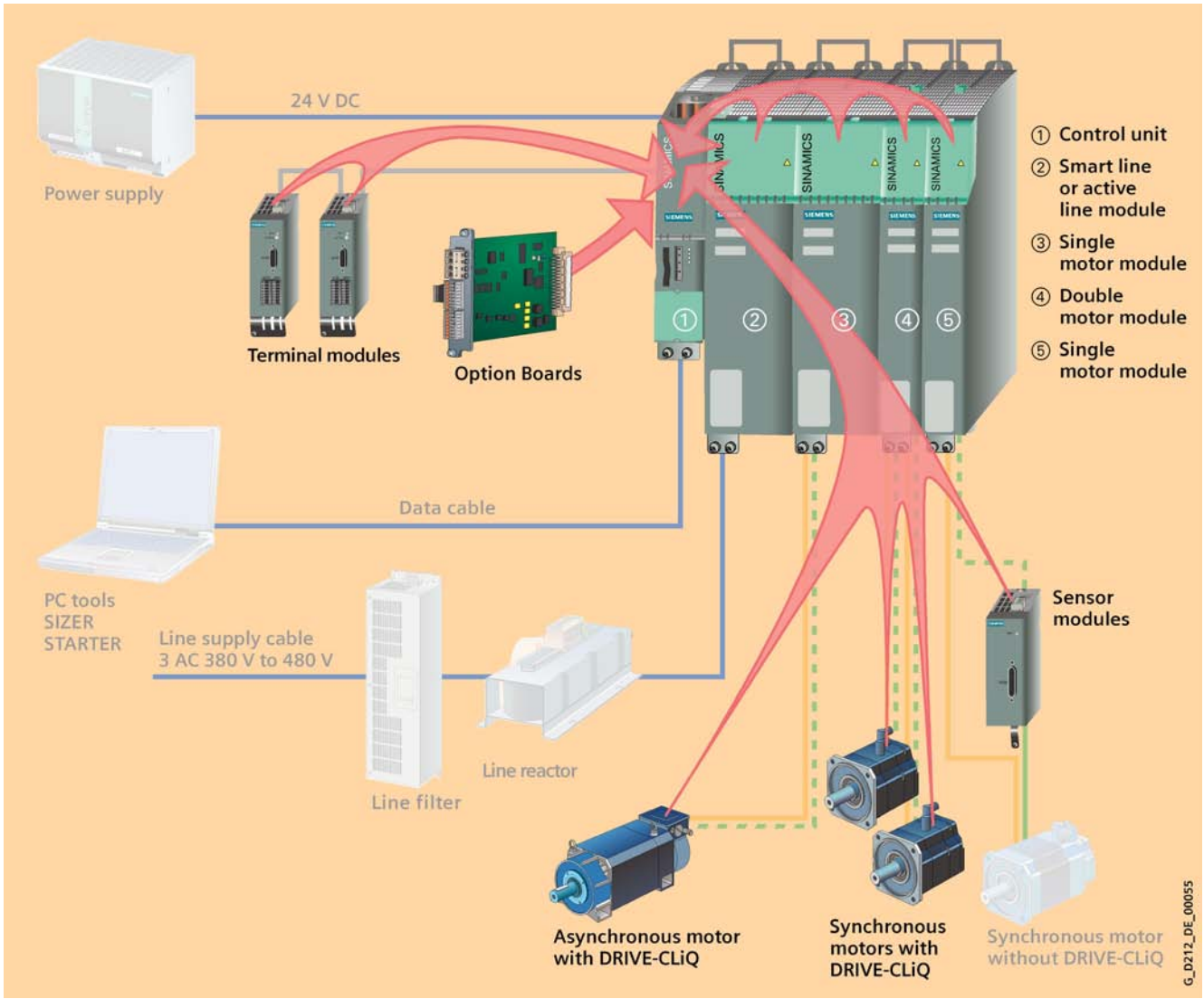



Figure 1-4 The electronic type plate for SINAMICS S120

# 1.5 SINAMICS S120 Components

This overview features the SINAMICS S120 components that are primarily used for multi-axis drive tasks.

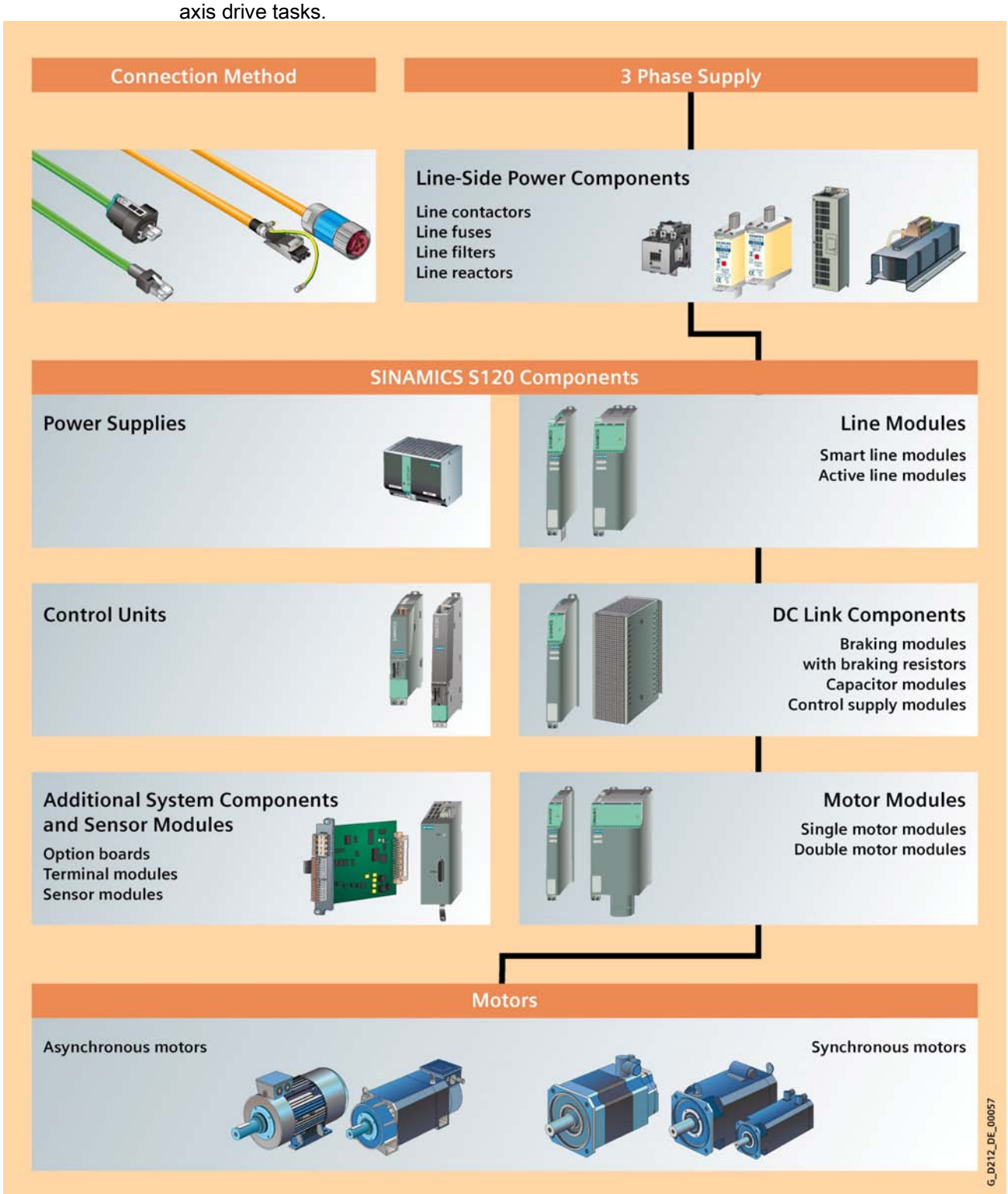



Figure 1-5 SINAMICS S120 component overview

## The following power components are available:

- Line-side power components, such as fuses, contactors, reactors, and filters for switching the power supply and meeting EMC requirements.
- Line modules, which supply power centrally to the DC link.
- DC link components (optional), which stabilize the DC link voltage.
- Motor modules, which act as inverters, receive power from the DC link, and supply the connected motors.

To carry out the required functions, SINAMICS S120 is equipped with:

- A control unit that carries out all drive and technological functions across all axes.
- Additional system components that enhance functionality and offer different interfaces for encoders and process signals.

The SINAMICS S120 components were developed for installation in cabinets. They have the following features and characteristics:

- Easy to handle, simple installation and wiring
- Practical connection system, cable routing in accordance with EMC requirements
- Standardized design, seamless integration
- Internal ventilators (other cooling methods available on request).

# 1.6 Power Sections

## Line modules

Convert the three-phase supply into a DC voltage for the DC link.

- Smart line modules

  The smart line modules generate a non-stabilized DC link voltage and are capable of regenerative feedback.

- Active line modules

  The active line modules generate a stabilized DC link voltage and are capable of regenerative feedback.

## Motor modules

- Convert energy from the DC link for the connected motors with variable voltage and variable frequency.

# 1.7 System data

## Technical Specifications

Unless explicitly specified otherwise, the following technical specifications are valid for components of the SINAMICS S120 booksize drive system.

| **Electrical specifications** | |
|---|---|
| Electronics power supply | 24 V DC, -15/+20 % |
| Conducted radio interference<br>Standard | <br>No conducted radio interference |
| Overvoltage category | Class I to EN 60 664-1 |

| **Ambient conditions** | |
|---|---|
| **The Safety-Integrated safety function:**<br>The components must be protected against conducted contamination (e.g. by installing them in a cabinet with degree of protection IP54).<br>Provided that conducted interference can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly. | |
| Degree of protection | IP20 to EN 60 529 |
| Class of protection | Class I (with protective conductor system) and<br>Class III (PELV) to EN 61 800-5-1 |
| Permissible ambient temperature in operation for Control Units, supplementary system components and Sensor Modules | 0 °C to +55 °C up to 2000 m above sea level.<br>Above an altitude of 2000 m, the max. ambient temperature decreases by 7°C every 1000 m.<br>Installation altitude: max. 5000 m above sea level. |

| **Information on storage, transportation and operation:** | |
|---|---|
| Environmental class<br>• Storage<br>• Transportation<br>• Warning | <br>Class 1C2 to EN 60 721-3-1<br>Class 2C2 to EN 60 721-3-2<br>Class 3C2 to EN 60 721-3-3 |
| Organic/biological influences<br>• Storage<br>• Transportation<br>• Warning | <br>Class 1B1 to EN 60 721-3-1<br>Class 2B1 to EN 60 721-3-2<br>Class 3B1 to EN 60 721-3-3 |
| Vibratory load<br>• Long-term storage<br>• Transportation<br>• Operation | <br>EN 60 721-3-1, Class 1M2 in transport packaging<br>EN 60 721-3-2, Class 2M3 in transport packaging<br>Test values:<br>Frequency range 10 ... 58 Hz<br>With constant deflection = 0.075 mm<br>Frequency range above 58 ... 150 Hz<br>With constant acceleration = 9.81 $m/s^2$ (1 g) |

| **Information on storage, transportation and operation:** | |
|---|---|
| Shock stressing<br>• Long-term storage<br>• Transportation<br>• Operation | <br>EN 60 721-3-1, Class 1M2 in transport packaging<br>EN 60 721-3-2, Class 2M3 in transport packaging<br>Test values for modules/devices with components that are sensitive to shock: 49.05 m/s$^2$ (5 g) / 30 ms<br>Test values for modules/devices that do not have components that are sensitive to shock: 147.15 m/s$^2$ (15 g) / 11 ms |
| Ambient climatic conditions<br>• Storage<br>• Transportation<br>• Warning | <br>Class 1K3 to EN 60 721-3-1<br>Temperature: -40 °C to +70 °C<br>Class 2K4 acc. to EN 60 721-3-2<br>Temperature -40 °C to +70 °C<br>Max. humidity 95 % at 40 °C<br>Class 3K3 acc. to EN 60 721-3-3<br>Moisture condensation, water spray and the formation of ice are not permissible<br>(EN 60 204, Part 1) |
| Degree of contamination | 2 to EN 60 664-1 |
| Installation altitude | Up to 5000 m above sea level |

| **Approbation** | |
|---|---|
| Certification | CE (low-voltage and EMC Directives), cULus<br>(file pos.: E192450, E164110, E70122, and E214113) |

# Control Units

# 2

## 2.1 Introduction

### Description

The Control Unit 320 (CU320) of the SINAMICS S system is designed for use with several drives.

The number of variable-speed drives depends on:

- The required performance
- The required special functions
- The required operating mode (servo, vector, or V/f).

The software and the parameters are stored on a plug-in CompactFlash card.

The option slot is used to expand the number of terminals or adapt to other communication interfaces (to the higher-level control).

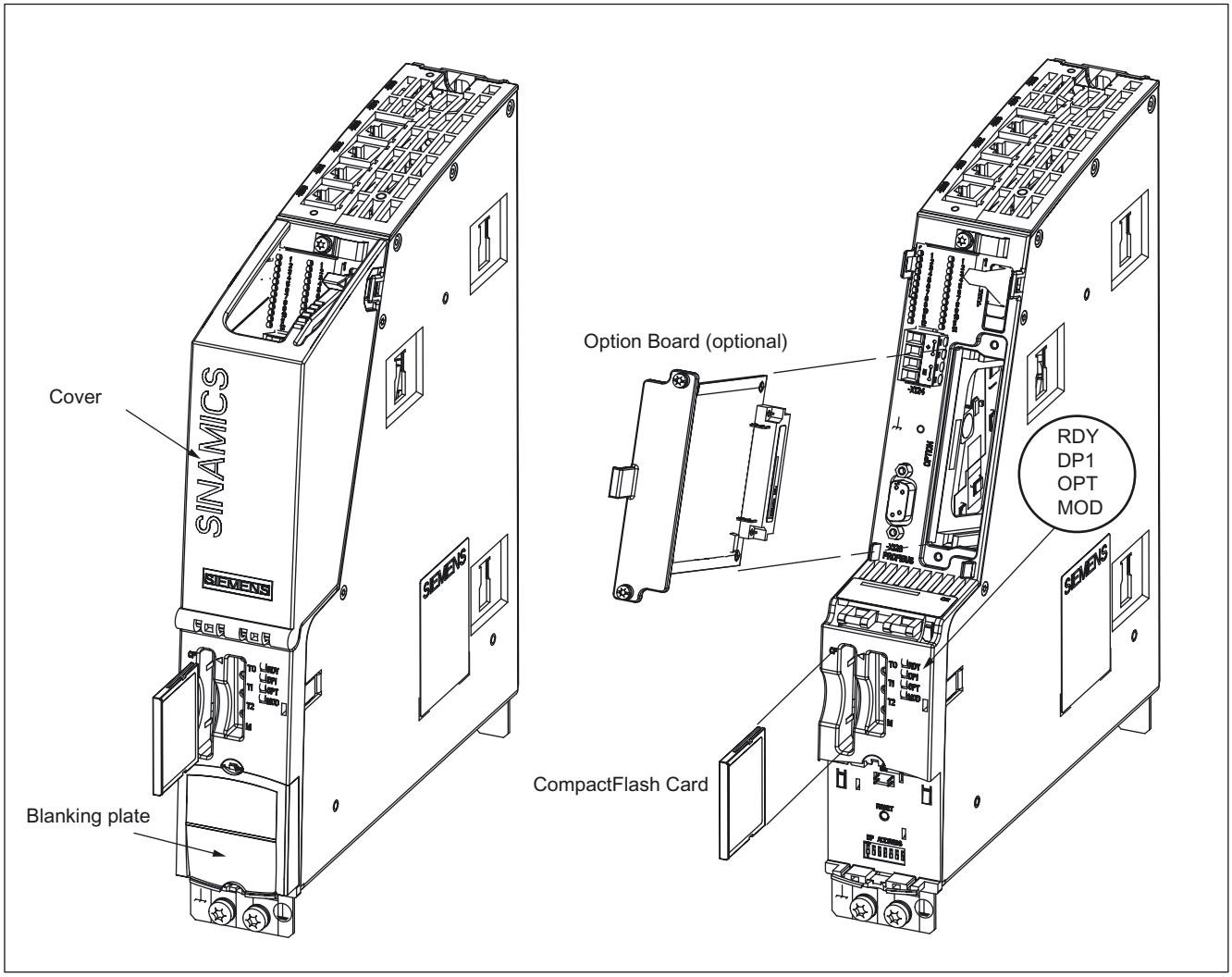



Figure 2-1 Overview Control Unit 320 (CU320)

**Note**

The Control Unit, the Option Board, and the CompactFlash card must be ordered separately.

If your application requires more than one Control Unit, the number can be increased accordingly. The Control Units are then interconnected via PROFIBUS, for example.

A Control Unit communicates with the associated components (Motor Modules, Line Modules, Sensor Modules, Terminal Modules, and so on) via the system-internal DRIVE-CLiQ interface.

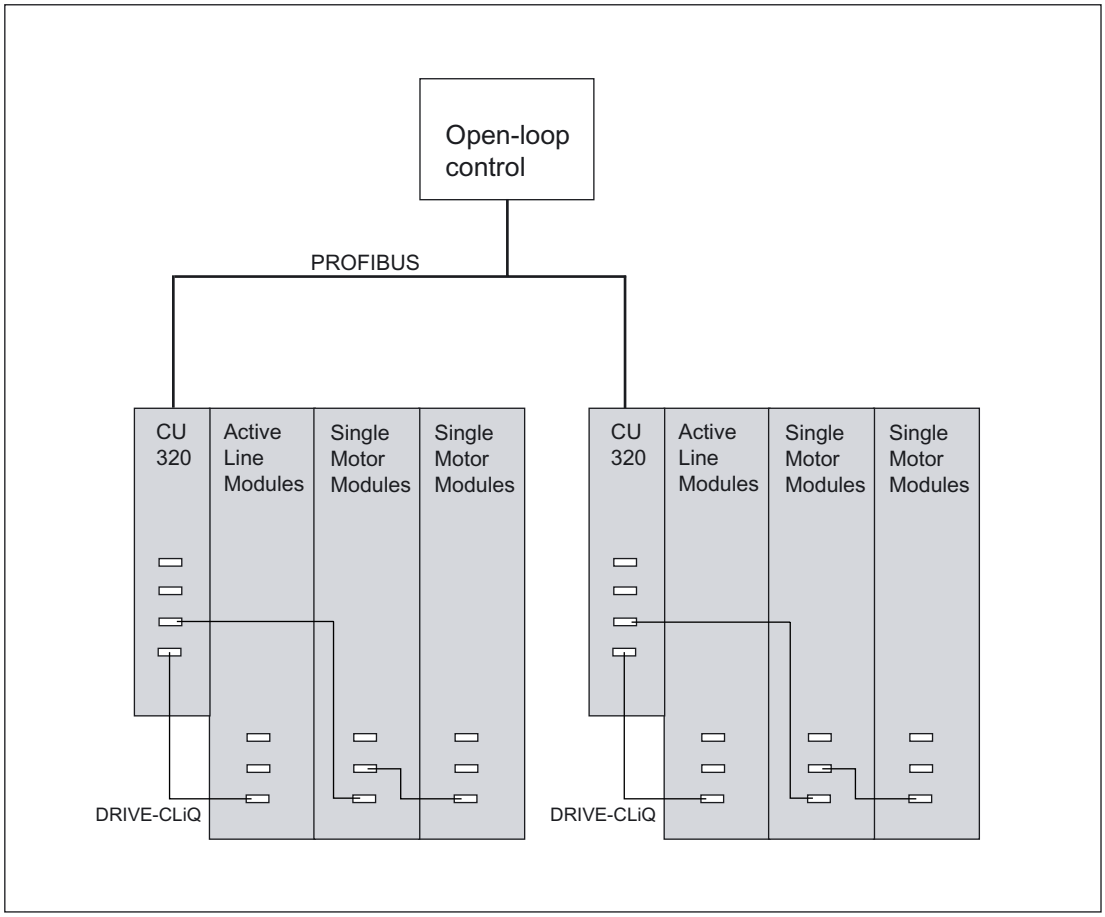



Figure 2-2 Sample configuration

# 2.2 Control Unit 320 (CU320)

## 2.2.1 Description

The Control Unit 320 (CU320) is a central control module in which the closed-loop and open-loop functions are implemented for one or more Active Line and/or Motor Modules.

The CU320 contains the following interfaces:

Table 2-1 Overview of the CU320 interfaces

| Type | Number |
|---|---|
| Digital inputs | 8 |
| Digital inputs/outputs | 8 |
| DRIVE-CLiQ interfaces | 4 |
| PROFIBUS interface | 1 |
| Serial interface (RS232) | 1 |
| Option slot | 1 |

## 2.2.2 Safety Information

**Caution**

The Option Board may only be inserted and removed when the Control Unit and Option Board are disconnected from the power supply.

**Notice**

The 80 mm clearances above and below the components must be observed.

**Note**

The CompactFlash card may only be inserted and removed when the Control Unit is disconnected from the power supply.

## 2.2.3 Interface description

### 2.2.3.1 Overview

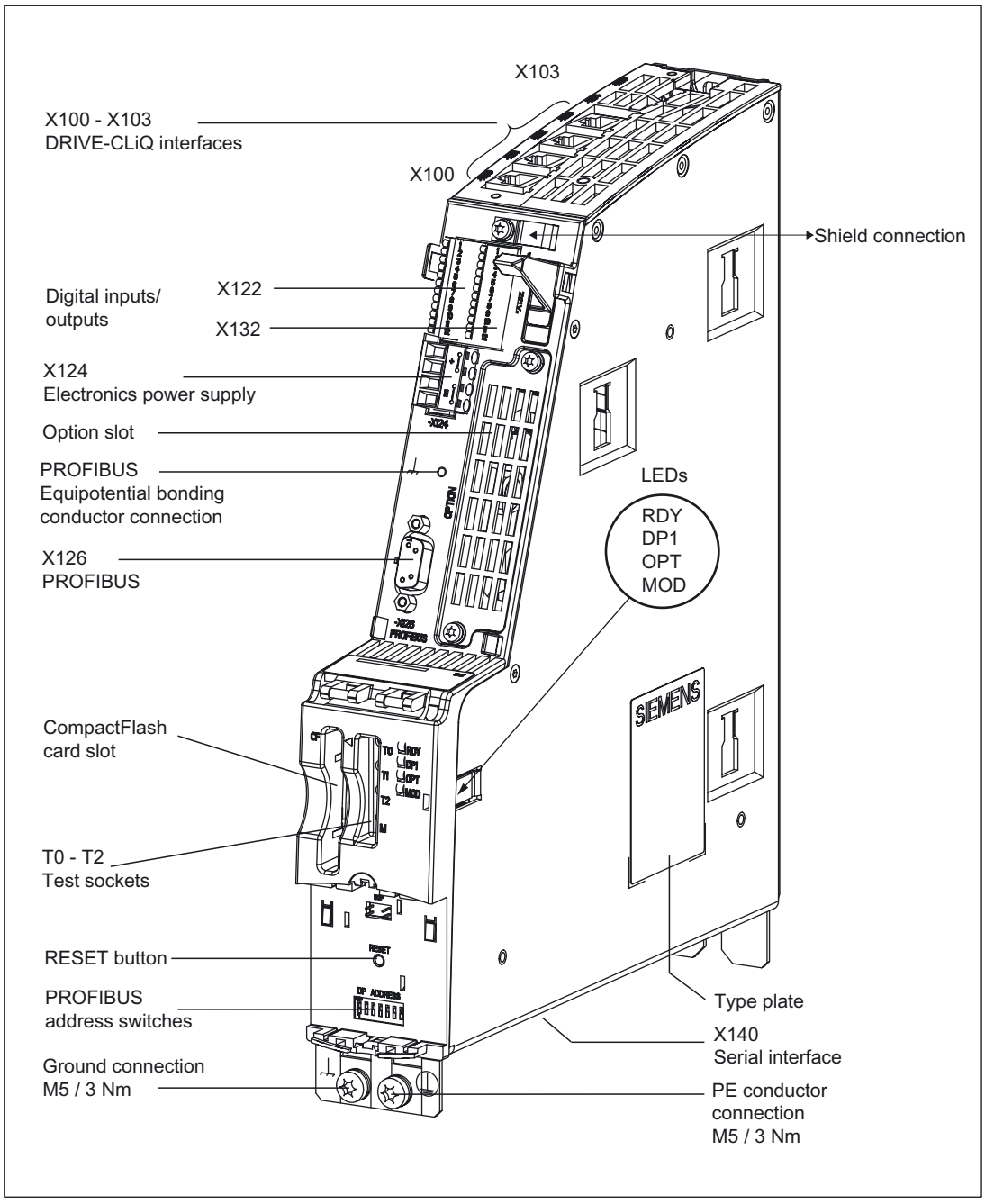



Figure 2-3 Interface description of the CU320 (covers removed)

### 2.2.3.2 Connection example

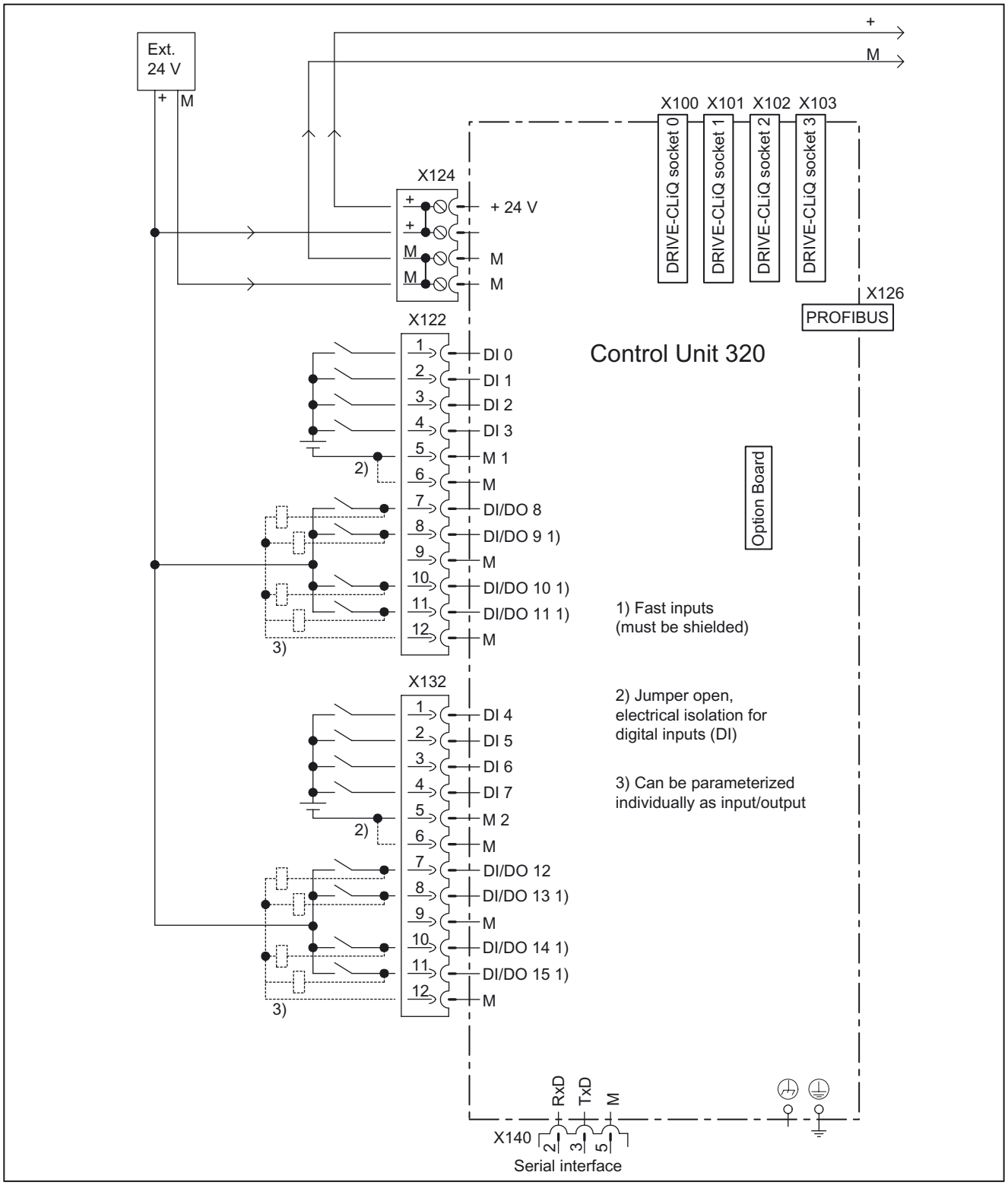
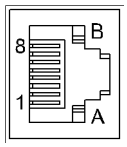



Figure 2-4 Example connection of CU320

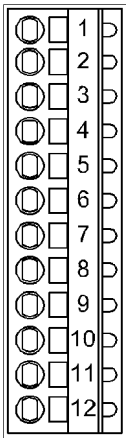
### 2.2.3.3 X200 - X202 DRIVE-CLiQ interface

Table 2-2 DRIVE-CLiQ interface

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255<br>The maximum DRIVE-CLiQ cable length is 50 m. | | | |

### 2.2.3.4 X122: Digital Inputs/Outputs

Table 2-3 Terminal block X122

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | DI 0 | Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Isolation: The reference potential is terminal M1<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V<br>Signal propagation times:<br>L → H approx. 50 µs<br>H → L: approx. 100 µs |
| | 2 | DI 1 | |
| | 3 | DI 2 | |
| | 4 | DI 3 | |
| | 5 | M1 | |
| | 6 | M | |
| | 7 | DI/DO 8 | As input:<br>Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V<br>Terminal numbers 8, 10, and 11 are "fast inputs"<br>Signal propagation times for inputs/"fast inputs":<br>L → H: approx. 50 µs/5 µs<br>H → L: approx. 100 µs/50 µs<br>As output:<br>Voltage: 24 V DC<br>Max. load current per output: 500 mA<br>Continued-short-circuit-proof |
| | 8 | DI/DO 9 | |
| | 9 | M | |
| | 10 | DI/DO 10 | |
| | 11 | DI/DO 11 | |
| | 12 | M | |
| Max. connectable cross-section: 0.5mm$^2$<br>Type: Spring-loaded terminal 1 (see Appendix A) | | | |

1) DI: digital input; DI/DO: bidirectional digital input/output; M: electronic ground M1: ground reference

**Note**

An open input is interpreted as "low".

The "fast inputs" can be used in conjunction with a measuring system for position sensing.

To enable digital inputs (DI) 0 to 3 to function, terminal M1 must be connected. This can be done as follows:

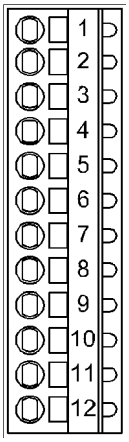
Connect the reference mass of the digital inputs, or a jumper to terminal M **(Notice this removes isolation for these digital inputs).**

**Note**

If a momentary interruption in the voltage occurs in the 24 V supply, the digital outputs will be deactivated until the interruption has been rectified.

### 2.2.3.5 X132: Digital Inputs/Outputs

Table 2-4 Terminal block X132

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | DI 4 | Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Isolation: The reference potential is terminal M2<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V<br>Signal propagation times for digital inputs:<br>L → H approx. 50 µs<br>H → L: approx. 100 µs |
| | 2 | DI 5 | |
| | 3 | DI 6 | |
| | 4 | DI 7 | |
| | 5 | M2 | |
| | 6 | M | |
| | 7 | DI/DO 12 | As input:<br>Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V Terminal numbers 8, 10, and 11 are "fast inputs"<br>Signal propagation times ”fast inputs”:<br>L → H: approx. 5 µs<br>H → L: approx. 50 µs<br>As output:<br>Voltage: 24 V DC<br>Max. load current per output: 500 mA<br>Continued-short-circuit-proof |
| | 8 | DI/DO 13 | |
| | 9 | M | |
| | 10 | DI/DO 14 | |
| | 11 | DI/DO 15 | |
| | 12 | M | |
| Max. connectable cross-section: 0.5 mm² | | | |
| Type: Spring-loaded terminal 1 (see Appendix A) | | | |

1) DI: digital input; DI/DO: digital input/output; M: electronic ground; M2: ground reference

**Note**

An open input is interpreted as "low".

The "fast inputs" can be used for position sensing.

To enable digital inputs (DI) 4 to 7 to function, terminal M2 must be connected. This can be done as follows:

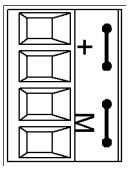
Connect the reference mass of the digital inputs, or a jumper to terminal M **(Notice this removes isolation for these digital inputs).**

**Note**

If a momentary interruption in the voltage occurs in the 24 V supply, the digital outputs will be deactivated until the interruption has been rectified.

### 2.2.3.6 Electronics power supply X124

Table 2-5 Terminal block X124

| | Terminal | Function | Technical specifications |
|---|---|---|---|
|  | + | Electronics power supply | Voltage: 24 V DC (20.4 V - 28.8 V)<br>Current consumption: max. 0.8 A (without DRIVE-CLiQ or digital outputs)<br>Max. current via jumper in connector:<br>20 A at 55 °C |
| | + | Electronics power supply | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2.5 mm$^2$<br>Type: Screw terminal 2 (see Appendix A) | | | |

**Note**

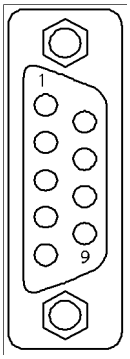
The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ node.

### 2.2.3.7 PROFIBUS X126

The PROFIBUS interface is a standard interface on every Control Unit.

Table 2-6 PROFIBUS interface X126

| | Pin | Signal name | Meaning | Range |
|---|---|---|---|---|
|  | 1 | - | Do not use | |
| | 2 | M24_SERV | Power supply for teleservice, ground | 0 V |
| | 3 | RxD/TxD–P | Receive/transmit data P (B) | RS485 |
| | 4 | CNTR–P | Control signal | TTL |
| | 5 | DGND | PROFIBUS data reference potential | |
| | 6 | VP | Supply voltage plus | 5 V + -10 % |
| | 7 | P24_SERV | Power supply for teleservice, + (24 V) | 24 V (20.4 V – 28.8 V) |
| | 8 | RxD/TxD–N | Receive/transmit data N (A) | RS485 |
| | 9 | - | Do not use | |
| Type: 9-pin SUB-D female | | | | |

**Note**

A teleservice adapter can be connected to the PROFIBUS interface (X126) for remote diagnosis purposes.
The power supply for the teleservice terminals 2 and 7 can have a max. load of 150 mA.

**Caution**

No CAN cables must be connected to interface X126. If CAN cables are connected, the CU320 and other CAN bus nodes may be destroyed.

### PROFIBUS connectors

The first and last nodes in a bus must contain terminating resistors. Otherwise data transmission will not function correctly.

The terminating resistors are activated in the connector.

The cable shield must be connected at both ends over large-surface area contacts.

## 2.2.3.8 PROFIBUS address switches

Table 2-7 PROFIBUS address switches

| Technical specifications | Switch | Significance |
|---|---|---|
| Significance: $2^0$ $2^1$ $2^2$ $2^3$ $2^4$ $2^5$ $2^6$ = 1 2 4 8 16 32 64; ON / OFF; S1 S2 S3 S4 S5 S6 S7 | S1 | $2^0 = 1$ |
| | S2 | $2^1 = 2$ |
| | S3 | $2^2 = 4$ |
| | S4 | $2^3 = 8$ |
| | S5 | $2^4 = 16$ |
| | S6 | $2^5 = 32$ |
| Example: 1 + 4 + 32 = 37; PROFIBUS address = 37 | S7 | $2^6 = 64$ |

**Note**

The PROFIBUS address switches are defaulted to 0 or 127. In these two settings, addresses are assigned via parameters.

The address switch is behind the blanking plate. The blanking plate is part of the scope of supply.

### 2.2.3.9 Reference

#### Setting the PROFIBUS address

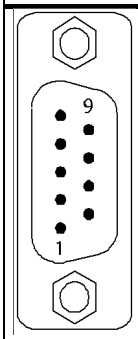
The following reference contains further information about setting the PROFIBUS address:

Reference: /IH1/ SINAMICS S120 Commissioning Manual

### 2.2.3.10 Serial interface (RS232) X140

An external display and operator device for operator control/parameterization can be connected via the serial interface. The interface is located on the underside of the CU.

Table 2-8 Serial interface (RS-232-C) X140

| | Pin | Name | Technical Specifications |
|---|---|---|---|
|  | 2 | RxD | Receive data |
| | 3 | TxD | Transmit data |
| | 5 | Ground | Ground reference |

### 2.2.3.11 Measurement sockets T0, T1, and T2

Table 2-9 Measurement sockets T0, T1, and T2

| Socket | Function | Technical specifications |
|---|---|---|
| T0 | Measurement socket 0 | Voltage: 0 V to 5 V<br>Resolution: 8 bits<br>Load current: max. 3 mA<br>Continued-short-circuit-proof<br>The reference potential is terminal M |
| T1 | Measurement socket 1 | |
| T2 | Measurement socket 2 | |
| M | Ground | |
| The measurement sockets are only suitable for bunch pin plugs with a diameter of 2 mm. | | |

### 2.2.3.12 Slot for the CompactFlash card

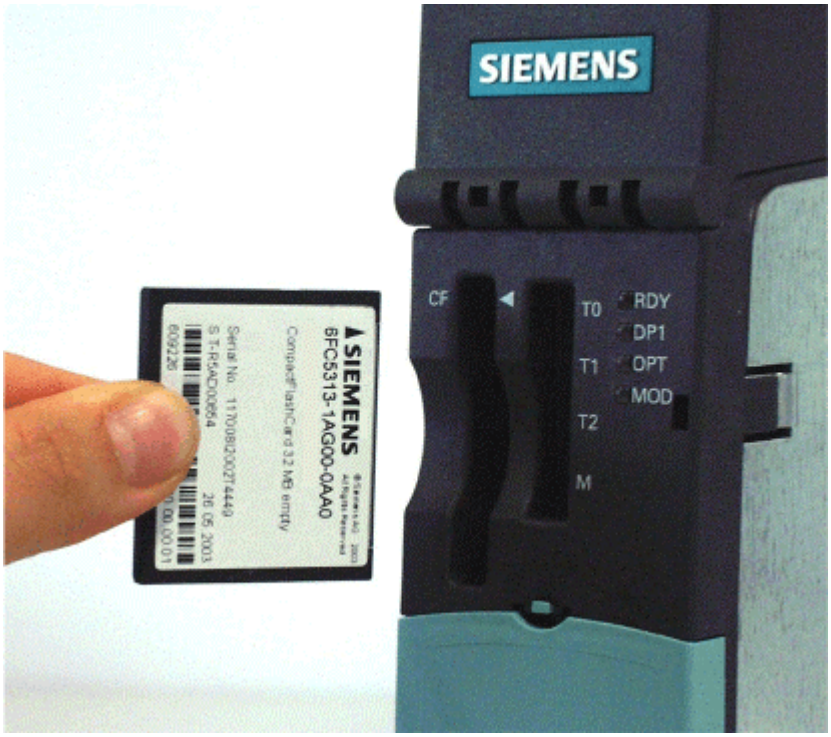



Figure 2-5 CompactFlash card slot

**Caution**

The CompactFlash card may only be inserted as shown in the figure (arrow top right).

The CompactFlash card may only be inserted or removed when the Control Unit is disconnected from the power supply.

When returning a defective Control Unit, remove the CompactFlash card and keep it for insertion in the replacement unit. This is important otherwise the data on the CompactFlash card (parameters, firmware, licenses, and so on) may be lost.

### 2.2.3.13 Description of the LEDs on the control unit

Table 2-10 Description of the LEDs on the Control Unit

| LED | Color | State | Description |
|---|---|---|---|
| RDY (READY) | - | OFF | The electronics power supply is missing or lies outside permissible tolerance range. |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | | Flashing 2 Hz | Writing to CompactFlash card |
| | Red | Continuous | At least one fault is present in this component. |
| | | Flashing 0.5 Hz | Boot error |
| | Green/ Red | Flashing 0.5 Hz | Control Unit 320 is ready for operation.<br>However there are no software licenses. |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. |
| | | Flashing 0.5 Hz | Unable to load firmware to RAM |
| | | Flashing 2 Hz | Firmware checksum error, CRC error. |
| DP1 (PROFIBUS cyclic operation) | - | OFF | Cyclic communication is not (yet) running.<br>Note:<br>PROFIdrive is ready for communication when the Control Unit is ready for operation (see RDY LED). |
| | Green | Continuous | Cyclic communication is running. |
| | | Flashing 0.5 Hz | Cyclic communication is not yet running fully.<br>Possible reasons:<br>• The controller is not transmitting any setpoints.<br>• During isochronous (clock synchronous) operation, no Global Control (GC) or a faulty Global Control (GC) is transferred by the controller. |
| | Red | Continuous | Cyclic communication has been interrupted. |
| OPT (OPTION) | – | Off | Electronics power supply is missing or outside permissible tolerance range.<br>Component is not ready.<br>Option Board not installed or no associated drive object has been created. |
| | Green | Continuous | Option Board is ready. |
| | | 0.5 Hz flashing light | Depends on the Option Board used |
| | Red | Continuous | At least one fault is pending in this component.<br>The Option Board is not ready (e.g. after power ON). |
| MOD | - | OFF | Reserved |

### Cause and rectification of faults

The following reference contains further information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S120 Commissioning Manual.

### RESET button

The RESET button is located behind the blanking plate.

## 2.2.4 Dimension Drawing

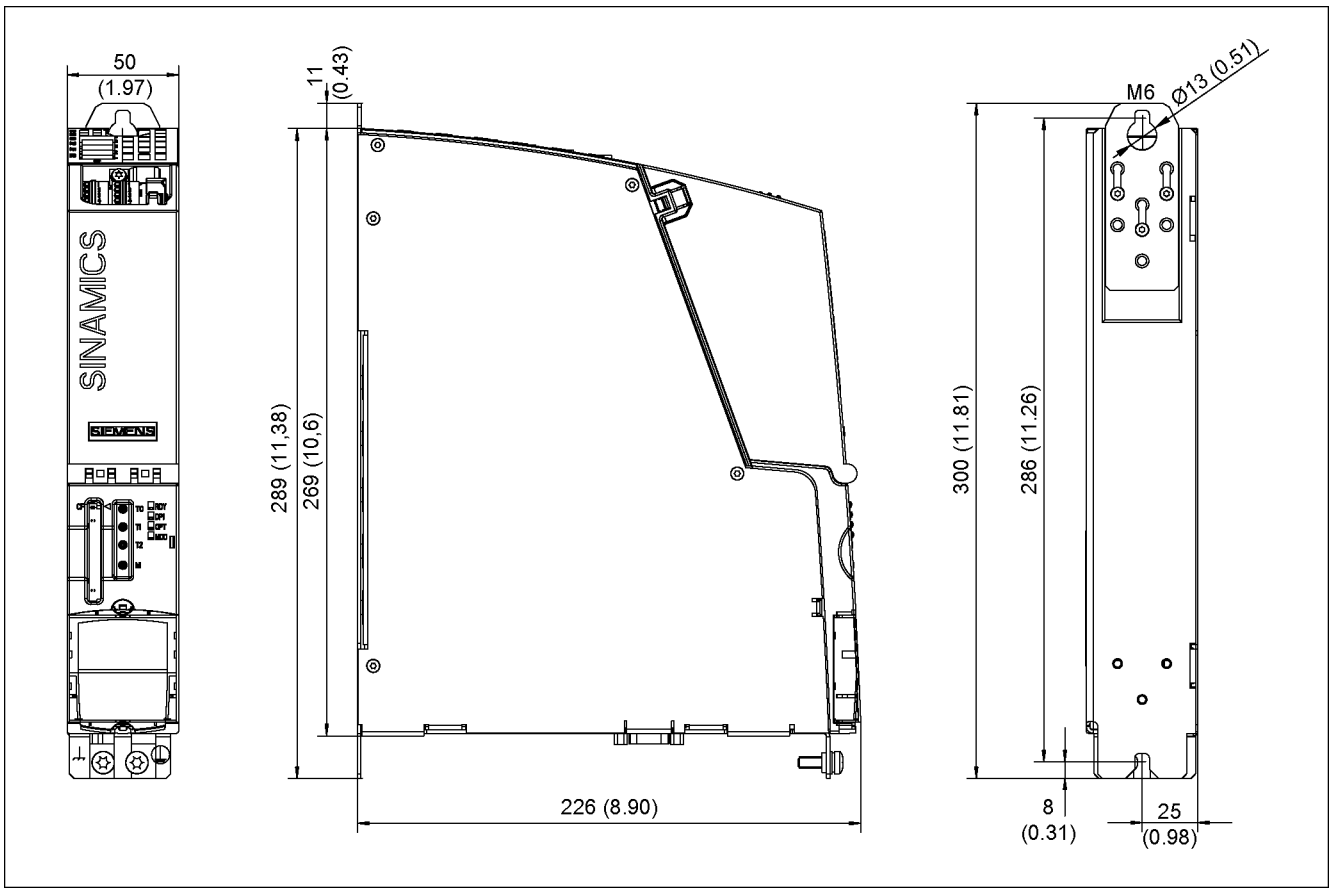



Figure 2-6 Dimension drawing: CU320

## 2.2.5 Installation

### Mounting the CU320 directly on a line module booksize

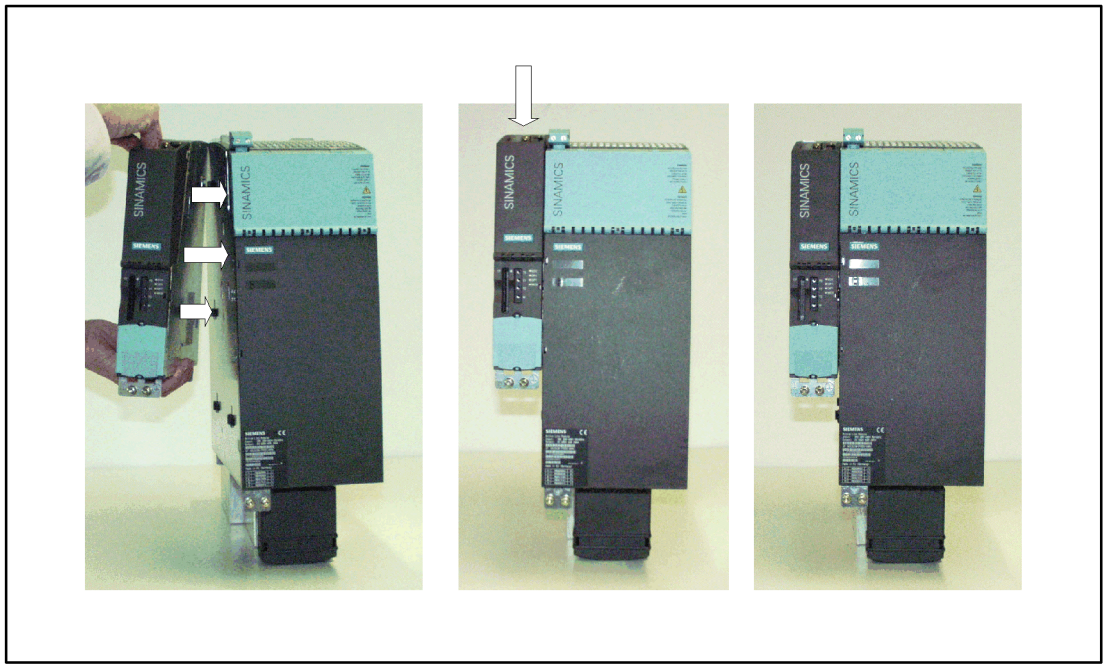



Figure 2-7 Mounting the CU320 directly on a line module booksize

## Installing the CU320 directly on a mounting surface

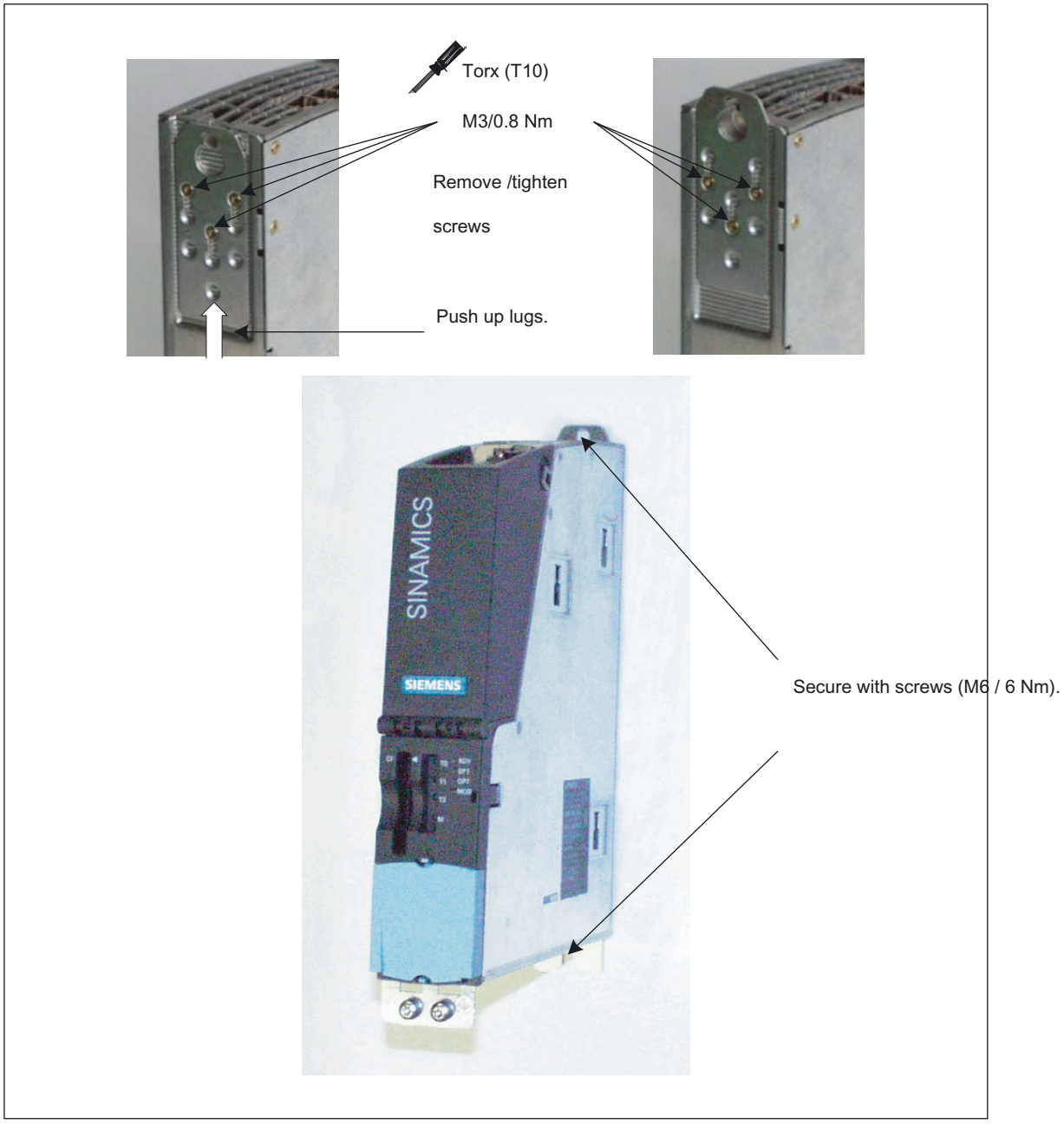



Figure 2-8 Installing the CU320 directly on a mounting surface

## Installing the CU320 on a mounting surface using spacer elements

To provide the correct mounting depth for a booksize line-up with internal air cooling, you can use spacer elements (2 elements: 6SL3064-1BB00-0AA0) can be mounted.

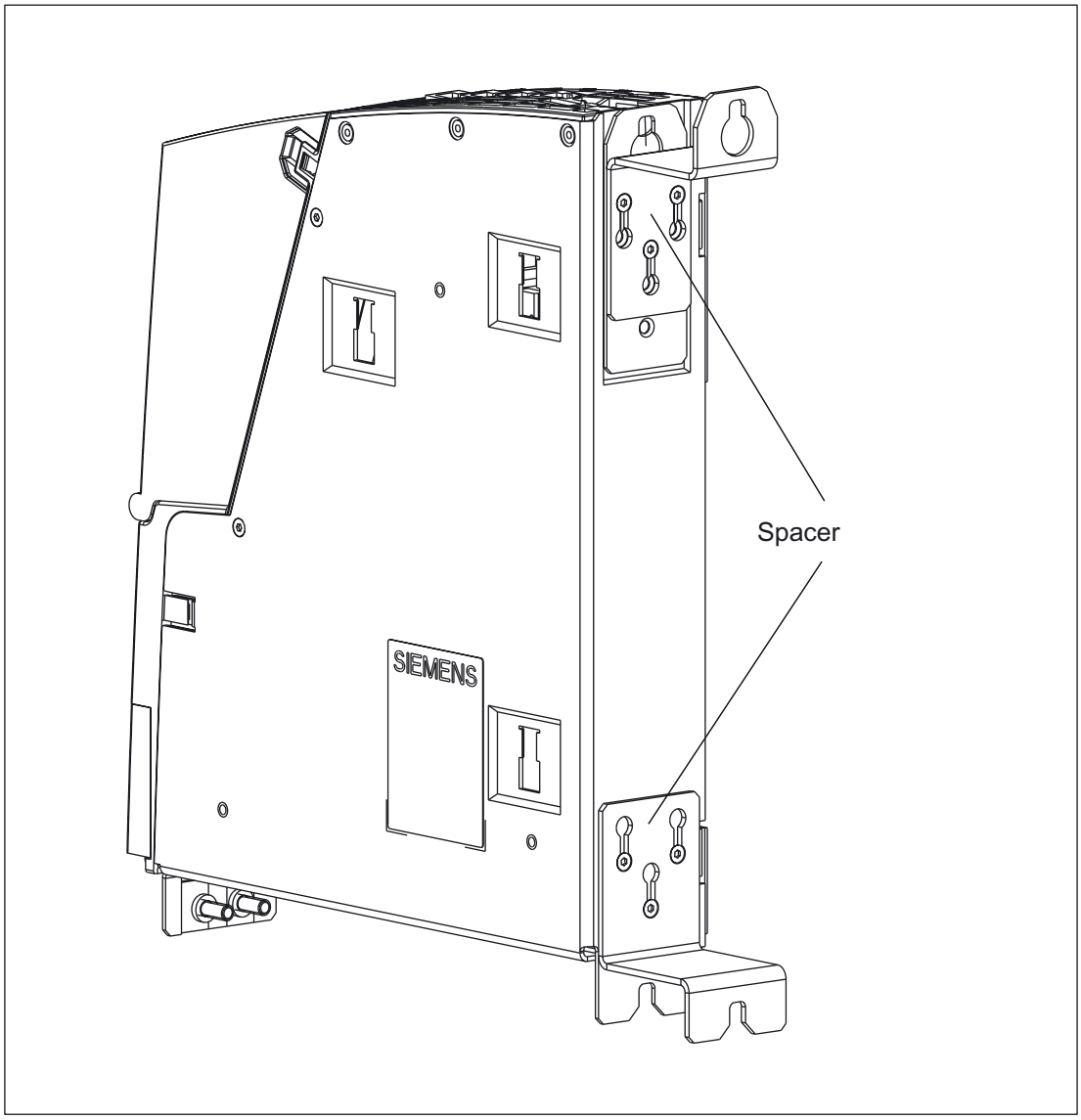



Figure 2-9 Installing the CU320 on a mounting surface using spacer elements

## Removing/opening the cover of the CU320

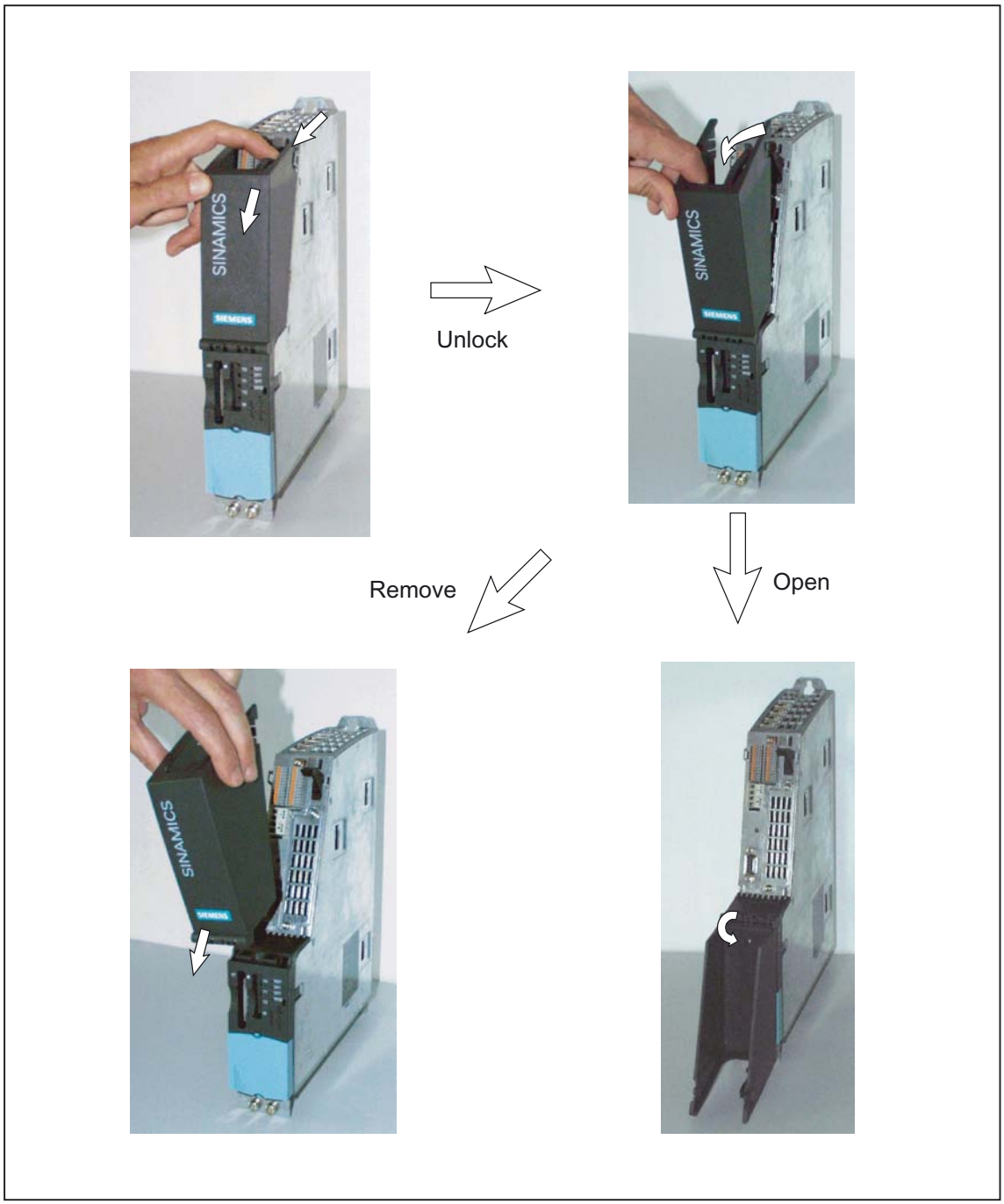



Figure 2-10 Removing/opening the cover of the CU320

## 2.2.6 Technical Specifications

Table 2-11 Technical specifications

| | Unit | Value |
|---|---|---|
| Electronics power supply | | |
| Voltage | $V_{DC}$ | 24 DC (20.4 – 28.8) |
| Current (without DRIVE-CLiQ or digital outputs) | $A_{DC}$ | 0.8 |
| Power loss | W | 20 |
| PE/ground connection | On housing with M5/3 Nm screw | |
| Response time | The response time of digital inputs/outputs depends on the evaluation (refer to the function chart).<br>**Reference:** /LH1/ SINAMICS S List Manual, Chapter "Function diagrams". | |
| Weight | kg | 1.5 |

# Additional system components

# 3

## 3.1 Basic Operator Panel 20 (BOP20)

### 3.1.1 Description

The Basic Operator Panel 20 (BOP20) is a basic operator panel with six keys and a display unit with background lighting. The BOP20 can be plugged onto the SINAMICS Control Unit CU320 and operated. Operation is only possible from SINAMICS V2.4 onwards.

**The following functions are possible with the BOP:**

- Input of parameters and activation of functions
- Display of operating modes, parameters, alarms and faults

### 3.1.2 Interface description


Figure 3-1 Basic Operator Panel (BOP20)

## Overview of displays and keys

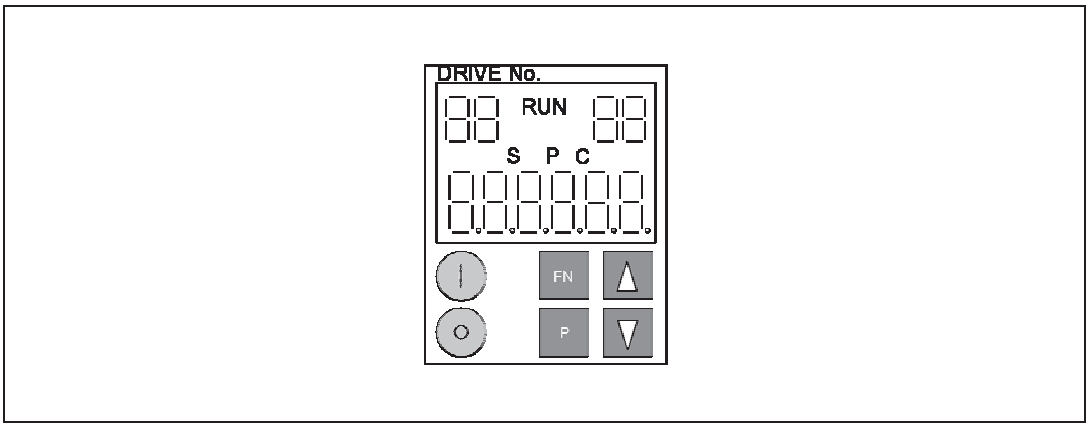



Figure 3-2 Overview of displays and keys

Table 3-1 Displays

| Display | Meaning |
|---|---|
| top left<br>2 positions | The active drive object of the BOP is displayed here.<br>The displays and key operations always refer to this drive object. |
| RUN | Is lit (bright) if the displayed drive is in the RUN state (in operation). |
| top right<br>2 positions | The following is displayed in this field:<br>• More than 6 digits: Characters that are present but cannot be seen (e.g. “r2” —> 2 characters to the right are invisible, “L1” —> 1 character to the left is invisible)<br>• Faults: Selects/displays other drives with faults<br>• Designation of BICO inputs (bi, ci)<br>• Designation of BICO outputs (bo, co)<br>Source object of a BICO interconnection to a drive object different than the active one. |
| S | Is (bright) if at least one parameter was changed and the value was not transferred into the non-volatile memory. |
| P | Is lit (bright) if, for a parameter, the value only becomes effective after pressing the P key. |
| C | Is light (bright) if at least one parameter was changed and the calculation for consistent data management has still not been initiated. |
| Below, 6 position | Displays, e.g. parameters, indices, faults and alarms. |

## BOP20 keyboard

Table 3-2 Assignment of the BOP20 keyboard

| Key | Name | Meaning |
|---|---|---|
|  | ON | Powers-up the drive - the "ON/OFF1", "OFF2" or "OFF3" commands for this purpose should come from the BOP. |
|  | OFF | Powers-down the drive - the "ON/OFF1", "OFF2" or "OFF3" commands for this purpose should come from the BOP. |
| | | **Note:**<br>The effectiveness of these keys can be defined using the appropriate BICO parameterization (e.g. using these keys, it is possible to simultaneously control all of the axes that have been configured).<br>The structure of the BOP control word corresponds to the structure of the PROFIBUS control word. |
|  | Functions | The significance of these keys depends on the actual display.<br>**Note:**<br>The effectiveness of this key to acknowledge faults can be defined using the appropriate BiCo parameterization. |
|  | Parameter | The significance of these keys depends on the actual display. |
|  | Raise | The keys are dependent on the actual display and are used to raise or lower values. |
|  | Lower | |

## Displays and operating the BOP20

Information about the displays and using the BOP20 is provided in the following reference:

Reference: /IH1/ SINAMICS S120 Commissioning Manual

## 3.1.3 Installation

Table 3-3 Installation

| | |
|---|---|
|  |  |
| 1. CU320 and BOP20 | 2. Press the bars of the cover together |
|  |  |
| 3. Remove the cover | 4. Locate the BOP20 |

## 3.1.4 Technical data

Table 3-4 Technical data

| **Basic Operator Panel 20 (BOP20)** | | |
|---|---|---|
| Weight, approx. | kg | 0.02 |

# 3.2 Option Board: Communication Board CAN (CBC10)

## 3.2.1 Description

The Communication Board CAN 10 (CBC10) is a communication board for linking to CAN.

## 3.2.2 Safety Information

**Caution**

The Option Board may only be inserted and removed when the Control Unit and Option Board are disconnected from the power supply.

**Caution**

The CBC10 must only be operated by qualified personnel. The ESC notices must be observed.

## 3.2.3 Interface description

### 3.2.3.1 Overview

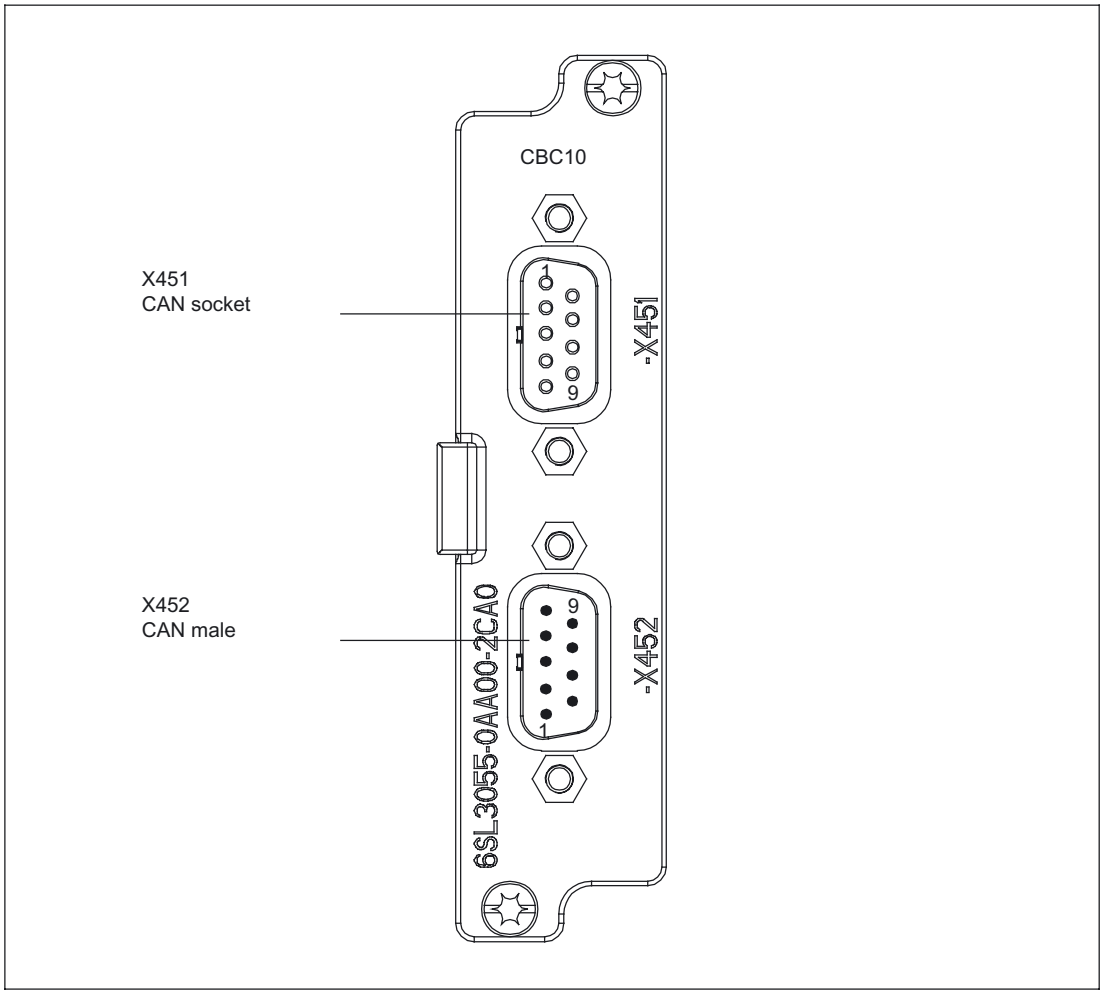
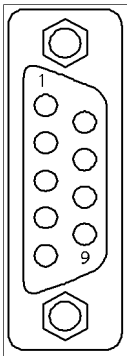



Figure 3-3 Interface description of the CBC10

### 3.2.3.2 CAN bus interface X451

Table 3-5 CAN bus interface X451

| | Pin | Name | Technical specifications |
|---|---|---|---|
|  | 1 | Reserved, do not use | |
| | 2 | CAN_L | CAN signal (dominant low) |
| | 3 | CAN_GND | CAN ground |
| | 4 | Reserved, do not use | |
| | 5 | CAN_SHLD | Optional shield |
| | 6 | GND | CAN ground |
| | 7 | CAN_H | CAN signal |
| | 8 | Reserved, do not use | |
| | 9 | Reserved, do not use | |
| Type: 9-pin SUB-D female | | | |

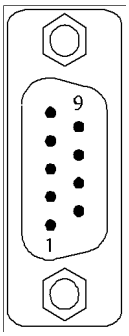


**Caution**

If the CAN connector is mistakenly plugged into the PROFIBUS connector, this can destroy the CAN master.

### 3.2.3.3 CAN bus interface X452

Table 3-6 CAN bus interface X452

| | Pin | Name | Technical specifications |
|---|---|---|---|
|  | 1 | Reserved, do not use | |
| | 2 | CAN_L | CAN signal (dominant low) |
| | 3 | CAN_GND | CAN ground |
| | 4 | Reserved, do not use | |
| | 5 | CAN_SHLD | Optional shield |
| | 6 | GND | CAN ground |
| | 7 | CAN_H | CAN signal |
| | 8 | Reserved, do not use | |
| | 9 | Reserved, do not use | |
| Type: 9-pin SUB-D male | | | |

### 3.2.3.4 2-pin SMD DIL switch

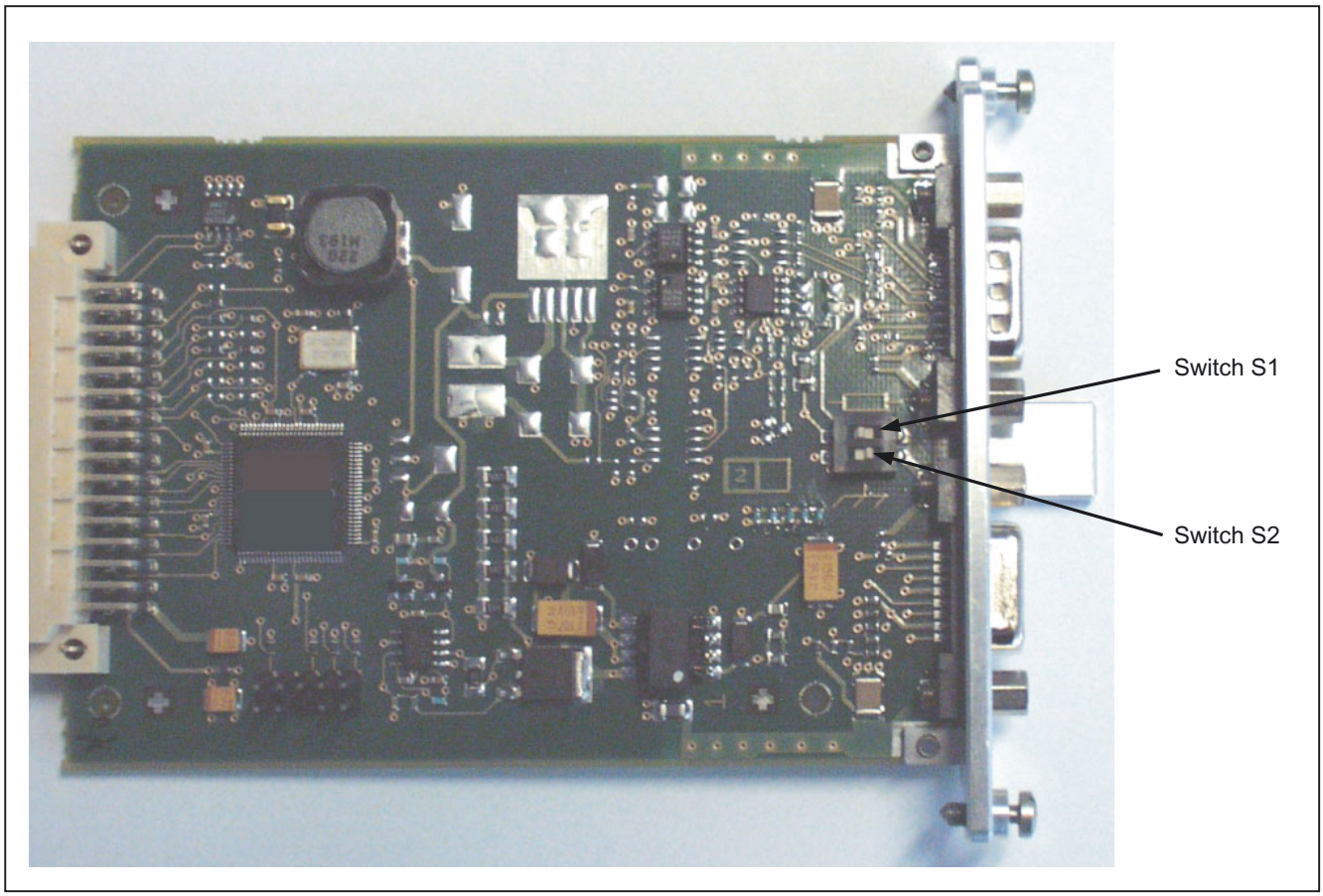
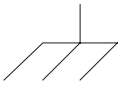



Figure 3-4 Switch S1/S2

Table 3-7 2-pin SMD DIL switch

| ID on the component | Switch | Function | Switch position | | Default |
|---|---|---|---|---|---|
|  | S1 | Bus terminating resistor 120 Ohm | OFF | Inactive | OFF |
| | | | ON | Active | |
|  | S2 | Operation with/without ground | OFF | Ground-free operation | OFF |
| | | | ON | Operation with ground | |

## 3.2.4 Installation

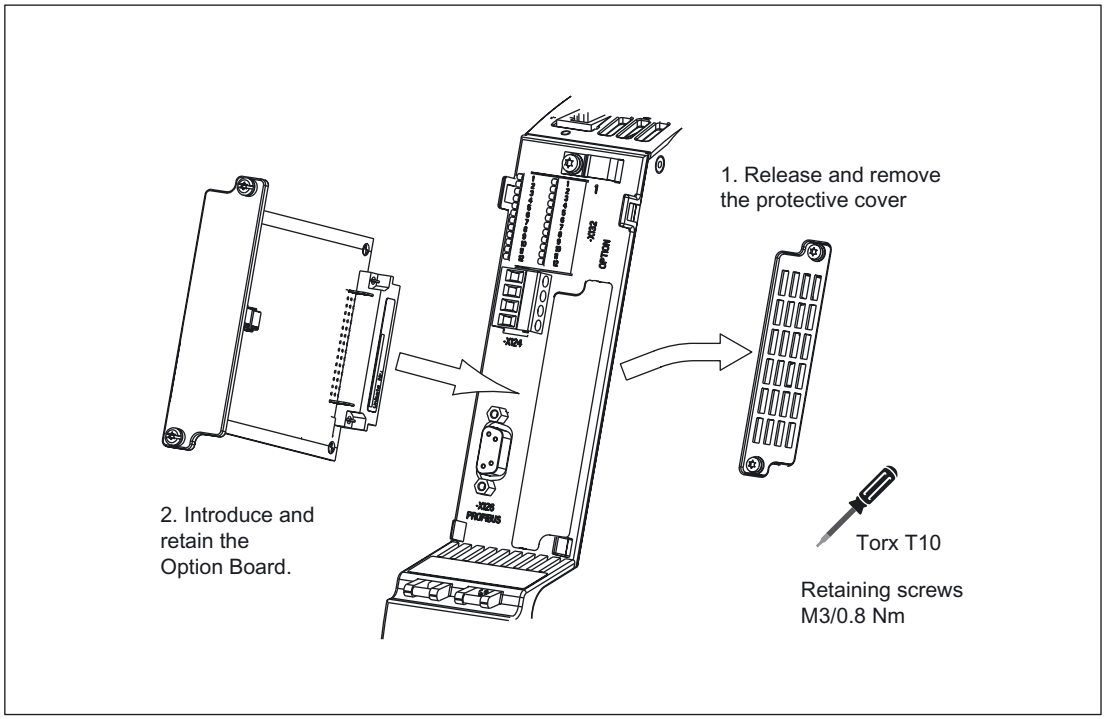



Figure 3-5 Installing the Option Board

## 3.2.5 Technical Specifications

Table 3-8 Technical Specifications

| **Communication Board CAN (CBC10)** | | |
|---|---|---|
| Max. current requirements (at 24 V DC) | $A_{DC}$ | 0.1 |
| Power loss | W | <10 |
| Weight, approx. | kg | 0.1 |

# 3.3 Communication Board Ethernet (CBE20)

## 3.3.1 Description

The Communication Board Ethernet interface for SINAMICS S120 (CBE20) is used to connect the SINAMICS S120 system to PROFINET. The CBE20 permits PROFINET IO with IRT support and PROFINET IO with RT support. Mixed operation is not permissible! PROFINET CBA is not supported.

## 3.3.2 Safety information

**Caution**

The Option Board may only be inserted and removed when the Control Unit and Option Board are disconnected from the power supply.

**Caution**

The CBE20 must only be operated by qualified personnel. The ESC notices must be observed.

## 3.3.3 Interface description

### 3.3.3.1 Overview

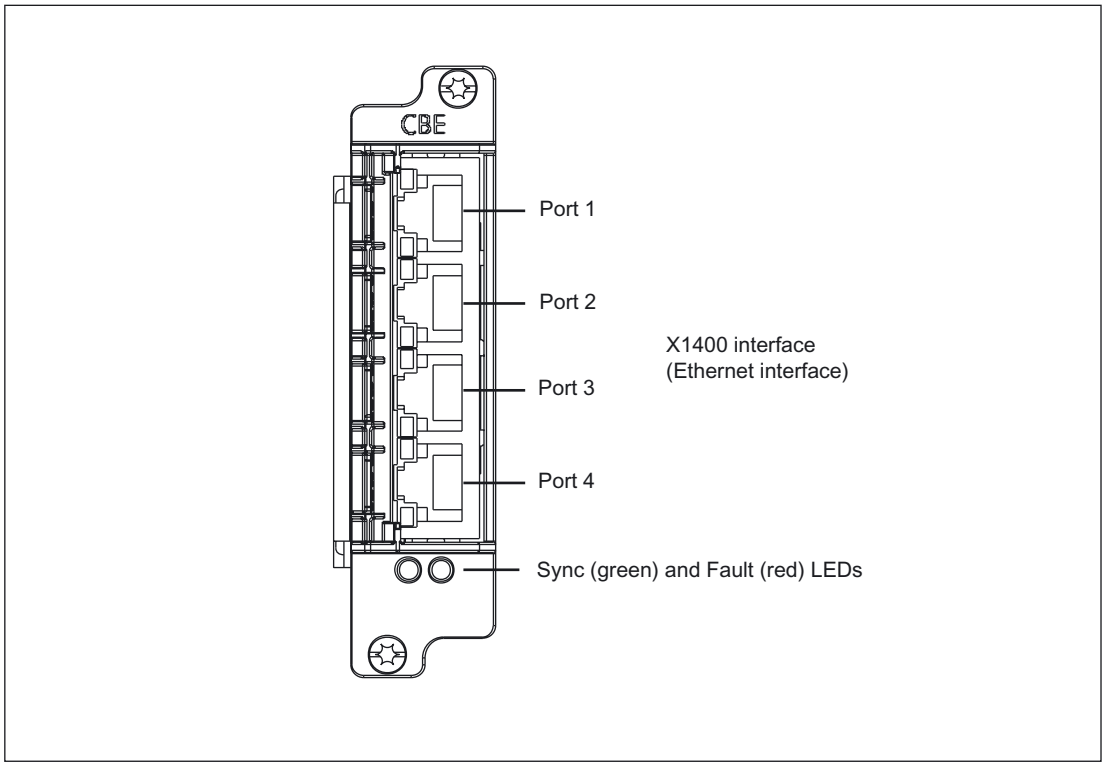



Figure 3-6 Interface description CBE20

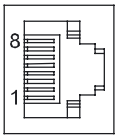
### MAC address

The MAC address of the Ethernet interface is indicated on the upper side of the board.

The label is only visible when the Option Board has been removed.

### 3.3.3.2 X1400 Ethernet interface

Table 3-9 X1400 Port 1-4

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | RX+ | Receive data + |
| | 2 | RX- | Receive data - |
| | 3 | TX+ | Transmit data + |
| | 4 | --- | Reserved, do not use |
| | 5 | --- | Reserved, do not use |
| | 6 | TX- | Transmit data - |
| | 7 | --- | Reserved, do not use |
| | 8 | --- | Reserved, do not use |
| | Screened backshell | M_EXT | Screen, permanently connected |

## PROFINET

### Cable and connector types

Information on PROFINET cables and connectors can be found in the following catalog:

Catalog IKPI, edition 2005

Industrial Communication for Automation and Drives

Order No. E86060-K6710-A101-B4

### 3.3.3.3 Description of the LEDs on the CBE20

The Ethernet interfaces are equipped with LEDs for indicating the statuses Link and Activity. The front panel of the board is fitted with two LEDs (Fault and Sync) which indicate the bus status.

Table 3-10 Description of the LEDs on the CBE20

| LED | Color | State | Description |
|---|---|---|---|
| Link Port (4x) | - | Off | Electronics power supply is missing or outside permissible tolerance range. |
| | Green | Continuous | A different device is connected to port x and a physical connection exists. |
| Activity Port (4x) | - | Off | Electronics power supply is missing or outside permissible tolerance range. |
| | Yellow | Continuous | Component active (DC link discharge via braking resistor in progress). |

| LED | Color | State | Description |
|---|---|---|---|
| Fault | - | Off | If the Link Port LED is green:<br>The CBE20 is operating normally, data is being exchanged with the configured IO Controller. |
| | Red | Flashing | • The response monitoring time has expired.<br>• Communications is interrupted.<br>• The IP address is incorrect.<br>• Incorrect or no configuration.<br>• Incorrect parameter settings.<br>• Incorrect or missing device name.<br>• IO Controller not connected/switched off, although an Ethernet connection has been established.<br>• After being powered-up, the LED flashes with 2 Hz until the CBE20 exchanges data with its IO controller. |
| | | Continuous | CBE20 bus error<br>• No physical connection to a subnet/switch.<br>• Incorrect transmission rate.<br>• Full duplex transmission is not activated. |
| Sync | - | Off | CBE20 is not synchronized to the IRT clock cycle. |
| | Green | Flashing | The Control Unit task system has synchronized with the IRT clock cycle and data is being exchanged. |
| | | Steady light | CBE20 is synchronized to the IRT clock cycle. |
| OPT<br>(on the CU320) | - | Off | The state appears if the CBe20 is not detected, because<br>• it is not inserted,<br>• it is defect,<br>• or because its electronics power supply is not OK. |
| | Green | Continuous | CBE20 is ready and cyclic communications has been established via PROFINET. |
| | | Flashing<br>0,5 Hz | CBE20 is ready but cyclic communications have not been established via PROFINET.<br>Possible causes:<br>• There is at least one SINAMICS fault, that prevents cyclic communications being established LED "RDY" is in the red/steady light state)<br>• SINAMICS is still not in clock synchronism |
| | Red | Steady light | Still no cyclic communications via PROFINET. However, non-cyclic communications are possible. SINAMICS waits for a parameterizing/configuring telegram. |
| | | Flashing<br>0.5 Hz | The firmware download into the CBE20 has been completed with an error.<br>Possible causes:<br>• CBE20 is defective<br>• CF is defective<br>In this state, CBE20 cannot be used. |
| | | Flashing<br>2.5 Hz | Communications error between SINAMICS and CBE20. Possible causes:<br>• Board was withdrawn after booting<br>• or a fatal exceptional error has occurred on the board |
| | Orange | Flashing<br>2.5 Hz | Firmware download into the CBE20 running. |

### Cause and rectification of faults

The following reference contains further information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S120 Commissioning Manual

## 3.3.4 Installation

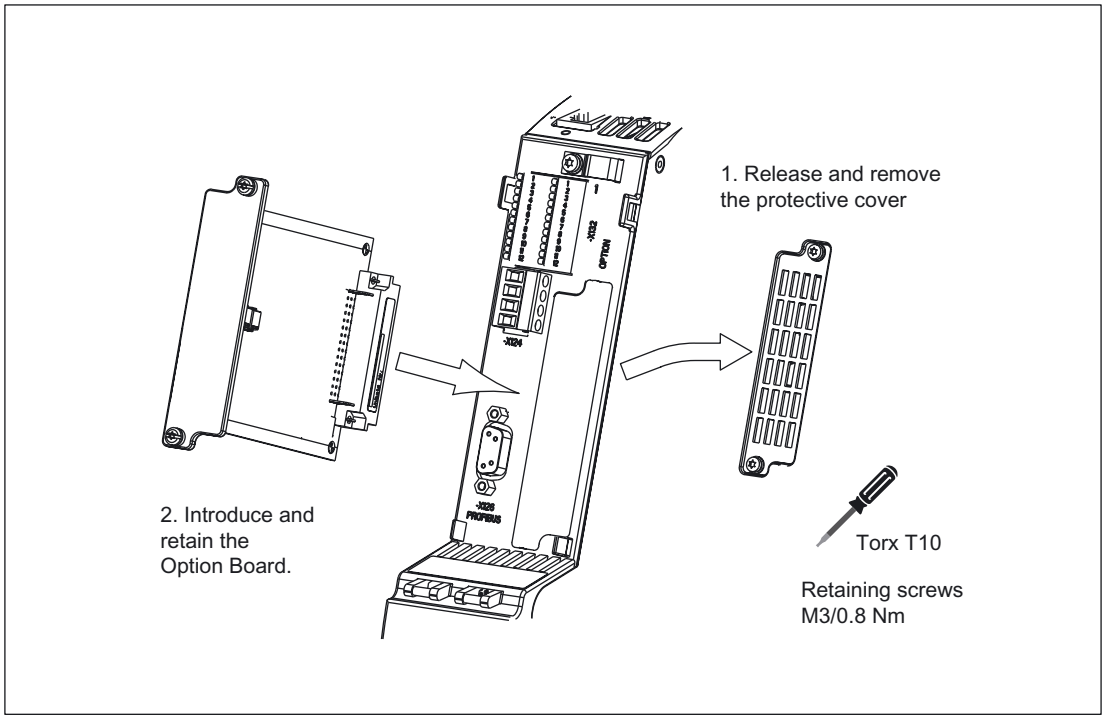



Figure 3-7 Installing the CBE20

## 3.3.5 Technical specifications

Table 3-11 Technical specifications

| Communication Board Ethernet (CBE20)<br>6SL3055-0AA00-2EBx | Unit | Value |
|---|---|---|
| Max. current requirements (at 24 V DC) | $A_{DC}$ | 0.1 |
| Power loss | W | 3 |
| Weight | kg | <0.1 |

# 3.4 Option Board: Terminal Board 30 (TB30)

## 3.4.1 Description

The Terminal Board 30 (TB30) is a terminal expansion board for plugging in to the control unit.

The TB30 contains the following terminals:

Table 3-12 Interface overview of the TB30

| Type | Number |
|---|---|
| Digital inputs | 4 |
| Digital outputs | 4 |
| Analog inputs | 2 |
| Analog outputs | 2 |

## 3.4.2 Safety Information

**Caution**

The option board may only be inserted and removed when the control unit and option board are disconnected from the power supply.

**Caution**

The TB30 must only be operated by qualified personnel. The ESC notices must be observed.

## 3.4.3 Interface description

### 3.4.3.1 Overview

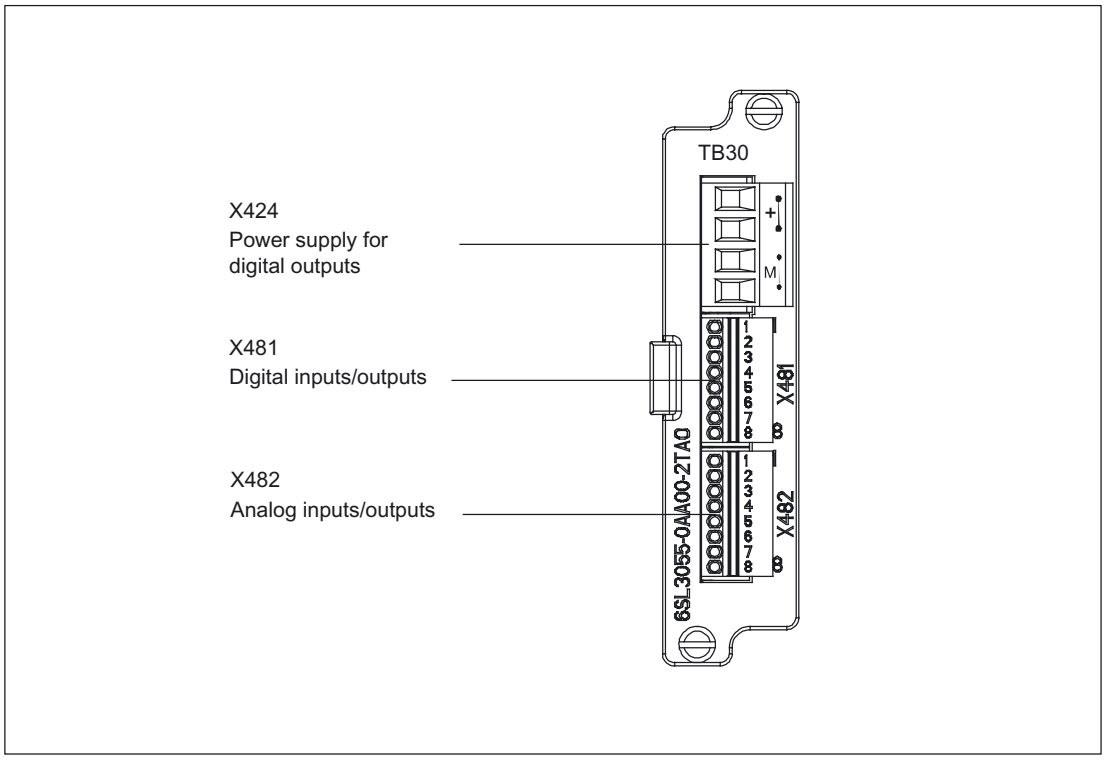



Figure 3-8 Interface description of the TB30

### 3.4.3.2 Connection example

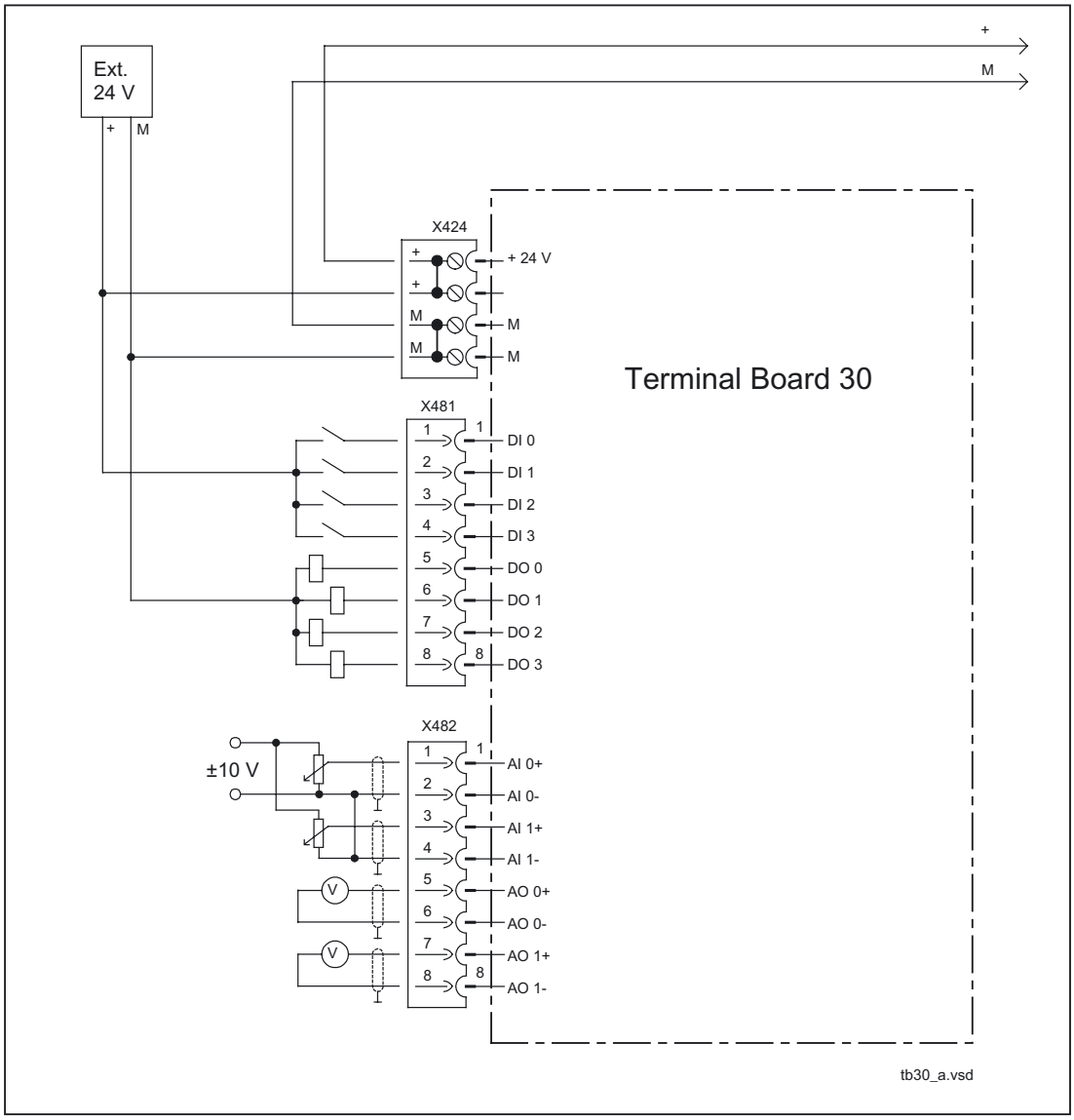
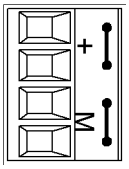



Figure 3-9 Example connection of TB30

### 3.4.3.3 X424 power supply, digital outputs

Table 3-13 Terminal block X424

| | Terminal | Function | Technical specifications |
|---|---|---|---|
|  | + | Power supply | Voltage: 24 V DC (20.4 V – 28.8 V)<br>Current consumption: max. 4 A (per digital output max. 0.5 A)<br><br>Max. current via jumper in connector:<br>20 A at 55 °C |
| | + | Power supply | |
| | M | Ground | |
| | M | Ground | |
| Max. connectable cross-section: 2.5 mm$^2$<br>Type: Screw terminal 2 (see Appendix A) | | | |



**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

This power supply is required for the digital outputs only. The electronics power supply and the power supply for the analog inputs/outputs are drawn via the option slot of the Control Unit.

**Note**

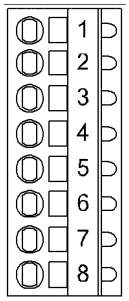
The power supply of the digital outputs and the electronics power supply of the Control Unit are isolated.

**Note**

If a the 24 V power supply voltage is briefly interrupted, then the digital outputs are de-activated during this time.

### 3.4.3.4 Digital inputs/outputs X481

Table 3-14 Terminal block X481

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | DI 0 | Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Ground reference: X424. M<br>Signal propagation times:<br>L → H approx. 50 µs<br>H → L: approx. 100 µs<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V |
| | 2 | DI 1 | |
| | 3 | DI 2 | |
| | 4 | DI 3 | |
| | 5 | DO 0 | Voltage: 24 V DC<br>Max. load current per output: 500 mA<br>Ground reference: X424.M<br>Continued-short-circuit-proof |
| | 6 | DO 1 | |
| | 7 | DO 2 | |
| | 8 | DO 3 | |
| Max. connectable cross-section: 0.5 mm$^2$<br>Type: Spring-loaded terminal 1 (see Appendix A) | | | |

1) DI: digital input, DO: Digital output

**Note**

An open input is interpreted as "low".

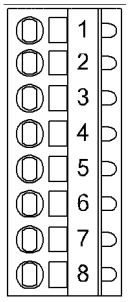
The power supply and the digital inputs/outputs are isolated from the Control Unit.

**Note**

If a momentary interruption in the voltage occurs in the 24 V supply, the digital outputs will be deactivated until the interruption has been rectified.

### 3.4.3.5 Analog inputs/outputs X482

Table 3-15 Terminal block X482

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | AI 0+ | Analog inputs (AI)<br>Voltage: -10 V to +10 V<br>Internal resistance: 65 kΩ<br>Resolution: 13 bits + sign |
| | 2 | AI 0- | |
| | 3 | AI 1+ | |
| | 4 | AI 1- | |
| | 5 | AO 0+ | Analog outputs (AO)<br>Voltage range: -10 V to +10 V<br>Load current: max. -3 mA to +3 mA<br>Resolution: 11 bit + sign<br>Continuously short-circuit proof |
| | 6 | AO 0- | |
| | 7 | AO 1+ | |
| | 8 | AO 1- | |
| Max. connectable cross-section: 0.5 mm$^2$<br>Type: Spring-loaded terminal 1 (see Appendix A) | | | |

1) AI: analog input, AO: Analog output

**Note**

An open input is interpreted as approximately "0V".

The power supply of the analog inputs/outputs is drawn via the option slot of the Control Unit and not via X424.

The shield is connected to the Control Unit (refer to Chapter "Electrical Connection").

**Caution**

The common-mode range must not be infringed.
The analog differential voltage signals can have a maximum offset voltage of +/-30 V with respect to the ground potential. If the range is infringed, incorrect results may occur during analog/digital conversion.

## Handling analog inputs

The following reference contains more information about analog inputs:

Reference: /IH1/ SINAMICS S120 Commissioning Manual

## 3.4.4 Installation/Mounting

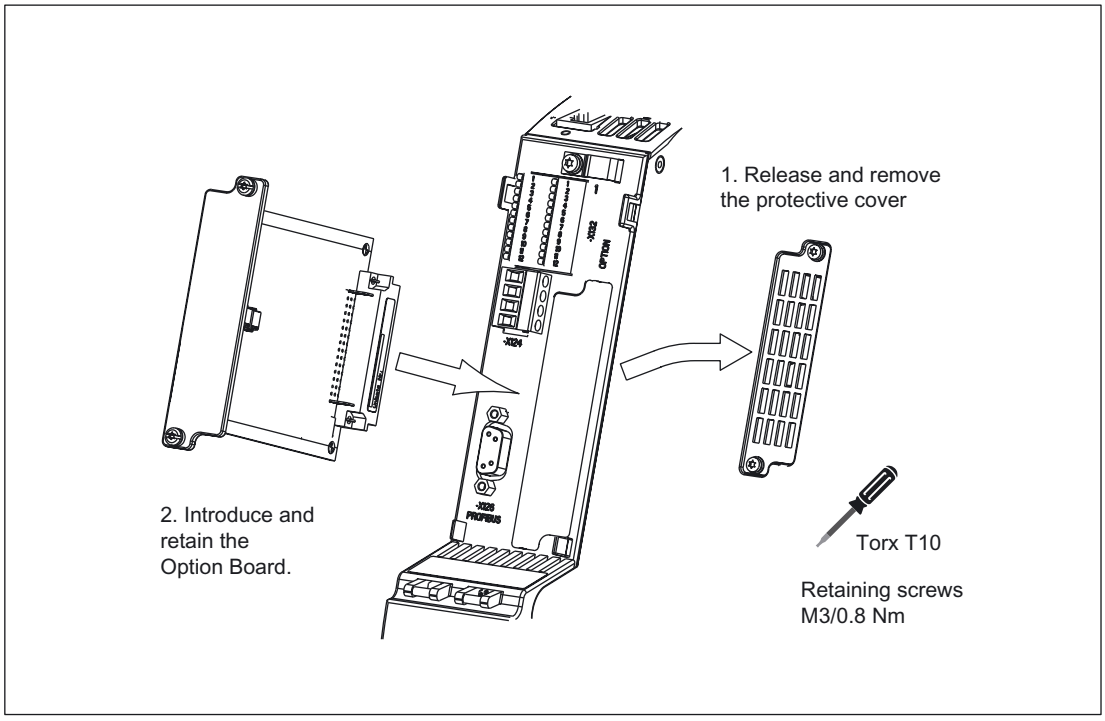



Figure 3-10 Installing the Option Board

## 3.4.5 Electrical Connection

### Shield connection of the TB30 on the control unit

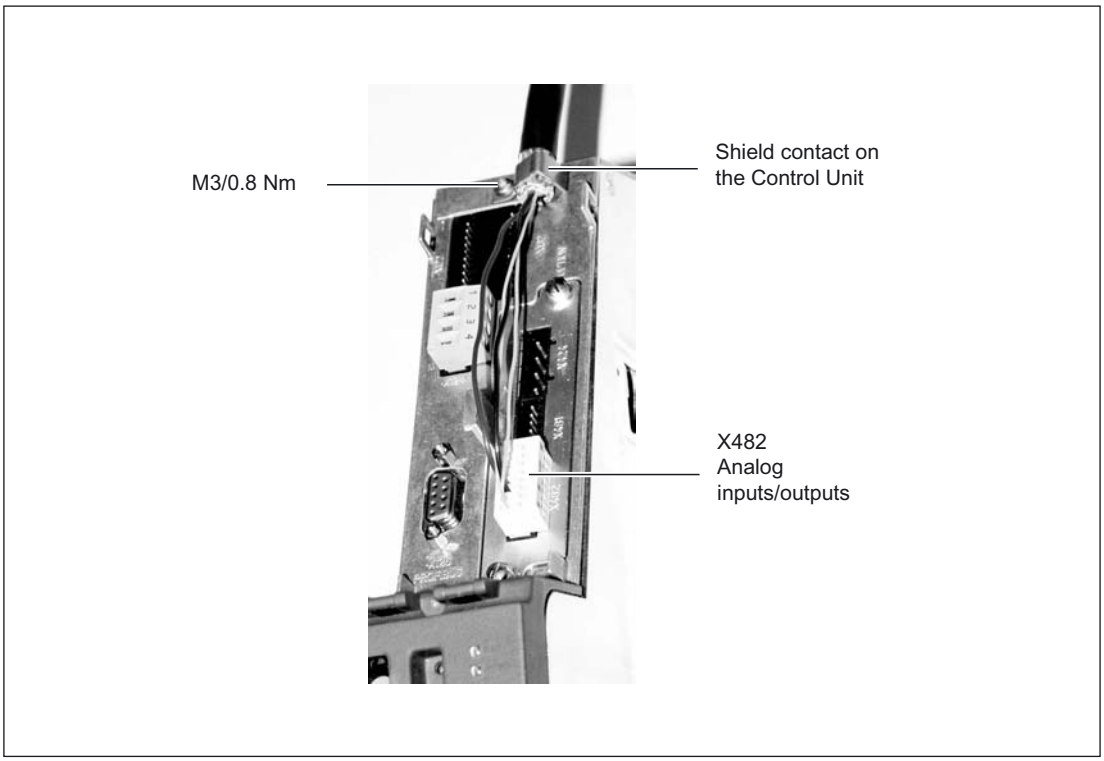



Figure 3-11 Shield contact for the TB30

The permissible bending radii for the cables must not be exceeded when the cables are being installed.

## 3.4.6 Technical Specifications

Table 3-16 Technical Specifications

| | Unit | Value |
|---|---|---|
| Electronics power supply | | |
| Voltage | $V_{DC}$ | 24 DC (20.4 – 28.8) |
| Current via the option slot of the CU (without digital outputs) | $A_{DC}$ | 0.05 |
| Power loss | W | <3 |
| Response time | The response time of digital inputs/outputs and analog inputs/outputs depends on the evaluation on the control unit (see function diagram).<br>**Reference:**SINAMICS S List Manual – "Function diagrams" chapter | |
| Weight | kg | 0.1 |

# 3.5 Terminal Module 15 (TM15)

## 3.5.1 Description

The Terminal Module 15 (TM15) is a terminal expansion module for snapping on to a DIN 50022 mounting rail. The TM15 can be used to increase the number of available digital inputs/outputs within a drive system.

Table 3-17 Interface overview of the TM15

| Type | Number |
|---|---|
| Digital inputs/outputs | 24 (isolation in 3 groups each with 8 DI/O) |

## 3.5.2 Safety Information

**Danger**

The 50 mm clearances above and below the components must be observed.

## 3.5.3 Interface description

### 3.5.3.1 Overview

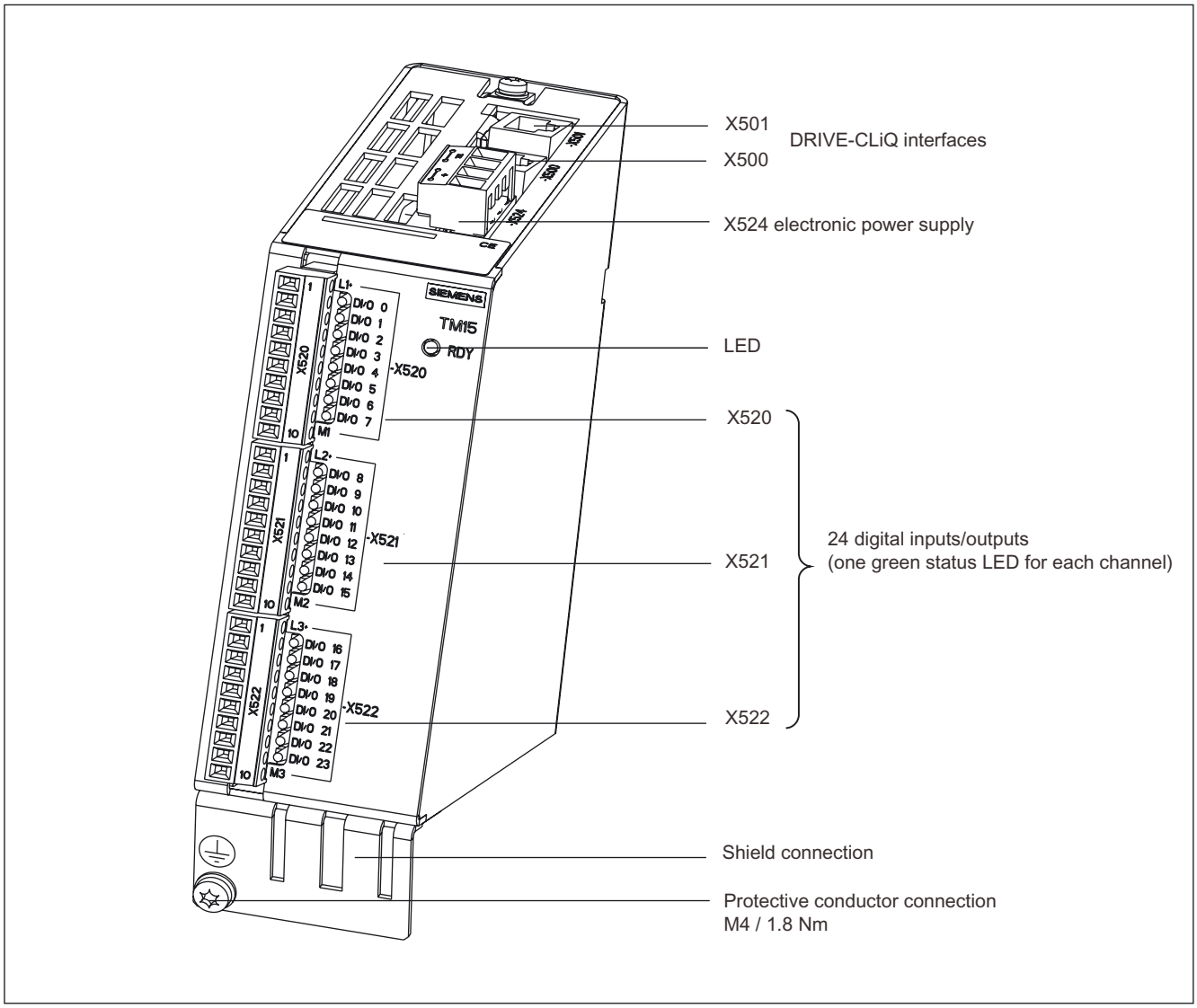



Figure 3-12 Interface description TM15

### 3.5.3.2 Connection example

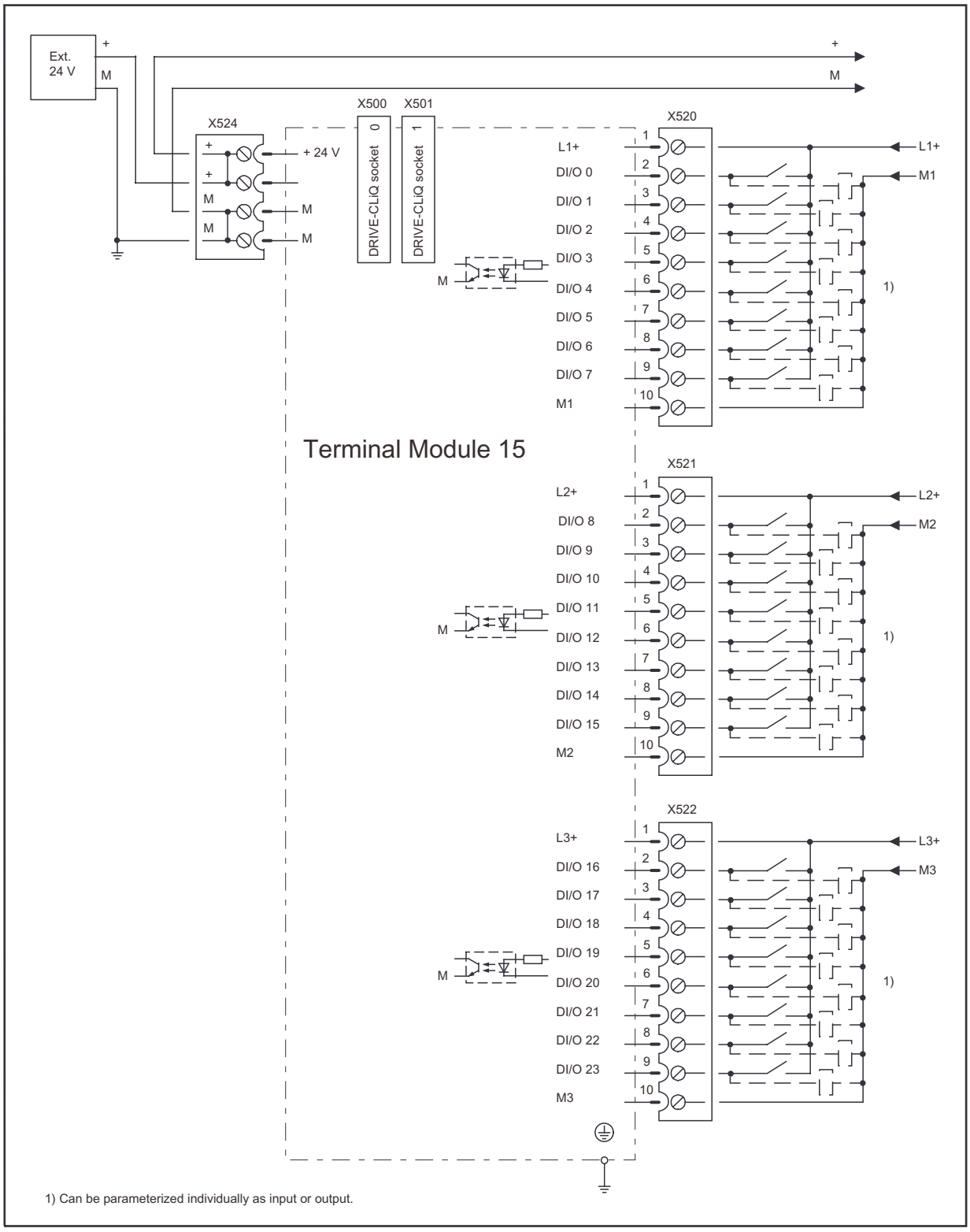
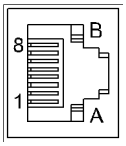



Figure 3-13 Example connection of TM15

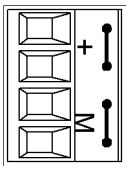
### 3.5.3.3 X500 and X501 DRIVE-CLiQ interface

Table 3-18 DRIVE-CLiQ interface X500

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255 | | | |

### 3.5.3.4 X524 Electronic power supply

Table 3-19 Terminals for the electronics power supply

| | Terminal | Name | Technical specifications |
|---|---|---|---|
|  | + | Electronics power supply | Voltage: 24 V DC (20.4 V – 28.8 V)<br>Current consumption: max. 0.15 A<br><br>Max. current via jumper in connector:<br>20 A at 60 °C |
| | + | Electronics power supply | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2.5 mm²<br>Type: Screw terminal 2 (see Appendix A) | | | |

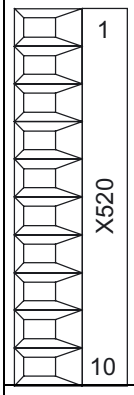
**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ node. The digital outputs are supplied via terminals X520, X521 and X522.

### 3.5.3.5 X520 digital inputs/outputs

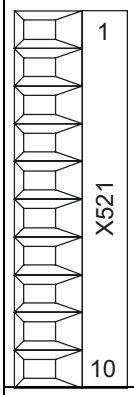
Table 3-20 Screw terminal X520

| | Terminal | Designation[1] | Technical specifications |
|---|---|---|---|
|  | 1 | L1+ | See "Technical specifications" |
| | 2 | DI/O 0 | |
| | 3 | DI/O 1 | |
| | 4 | DI/O 2 | |
| | 5 | DI/O 3 | |
| | 6 | DI/O 4 | |
| | 7 | DI/O 5 | |
| | 8 | DI/O 6 | |
| | 9 | DI/O 7 | |
| | 10 | M1 (GND) | |
| Max. connectable cross-section: 1.5 mm$^2$<br>Type: Screw terminal 1 (see Appendix A) | | | |

[1] L1+: A 24 V DC power supply for DI/O 0 to 7 (first potential group) must always be connected if at least one DI/O of the potential group is used as output.
M1: A reference ground for DI/O 0 to 7 (first potential group) must always be connected if at least one DI/O of the potential group is used as either input or output.
DI/O: Digital input/output

### 3.5.3.6 X521 digital inputs/outputs

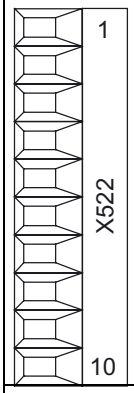
Table 3-21 Screw terminal X521

| | Terminal | Designation[1] | Technical specifications |
|---|---|---|---|
|  | 1 | L2+ | See "Technical specifications" |
| | 2 | DI/O 8 | |
| | 3 | DI/O 9 | |
| | 4 | DI/O 10 | |
| | 5 | DI/O 11 | |
| | 6 | DI/O 12 | |
| | 7 | DI/O 13 | |
| | 8 | DI/O 14 | |
| | 9 | DI/O 15 | |
| | 10 | M2 (GND) | |
| Max. connectable cross-section: 1.5 mm$^2$<br>Type: Screw terminal 1 (see Appendix A) | | | |

[1] L2+: A 24 V DC power supply for DI/O 8 to 15 (second potential group) must always be connected if at least one DI/O of the potential group is used as output.
M2: A reference ground for DI/O 8 to 15 (second potential group) must always be connected if at least one DI/O of the potential group is used as either input or output.
DI/O: Digital input/output

### 3.5.3.7 X522 digital inputs/outputs

Table 3-22 Screw terminal X522

| | Terminal | Designation[1] | Technical specifications |
|---|---|---|---|
|  | 1 | L3+ | See "Technical specifications" |
| | 2 | DI/O 16 | |
| | 3 | DI/O 17 | |
| | 4 | DI/O 18 | |
| | 5 | DI/O 19 | |
| | 6 | DI/O 20 | |
| | 7 | DI/O 21 | |
| | 8 | DI/O 22 | |
| | 9 | DI/O 23 | |
| | 10 | M3 (GND) | |
| Max. connectable cross-section: 1.5 mm$^2$<br>Type: Screw terminal 1 (see Appendix A) | | | |

[1] L3+: A 24 V DC power supply for DI/O 16 to 23 (third potential group) must always be connected if at least one DI/O of the potential group is used as output.
M3: A reference ground for DI/O 16 to 23 (third potential group) must always be connected if at least one DI/O of the potential group is used as either input or output.
DI/O: Digital input/output

### 3.5.3.8 Description of the LEDs on the Terminal Module 15 (TM15)

Table 3-23 Description of the LED

| LED | Color | State | Description |
|---|---|---|---|
| READY | - | OFF | Electronics power supply outside permissible tolerance range. |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. |
| | Red | Continuous | At least one fault is present in this component. |
| | Green/red | Flashing 2 Hz | Firmware is being downloaded. |
| | Green/ orange | Flashing 2 Hz | Component detected: no fault present |
| | Red/orange | Flashing 2 Hz | Component detected: Fault(s) present |

### Cause of faults and resolving them

The following reference contains further information about the cause of faults and resolving them:

Reference: /IH1/ SINAMICS S, Commissioning Manual

## 3.5.4 Dimension drawing

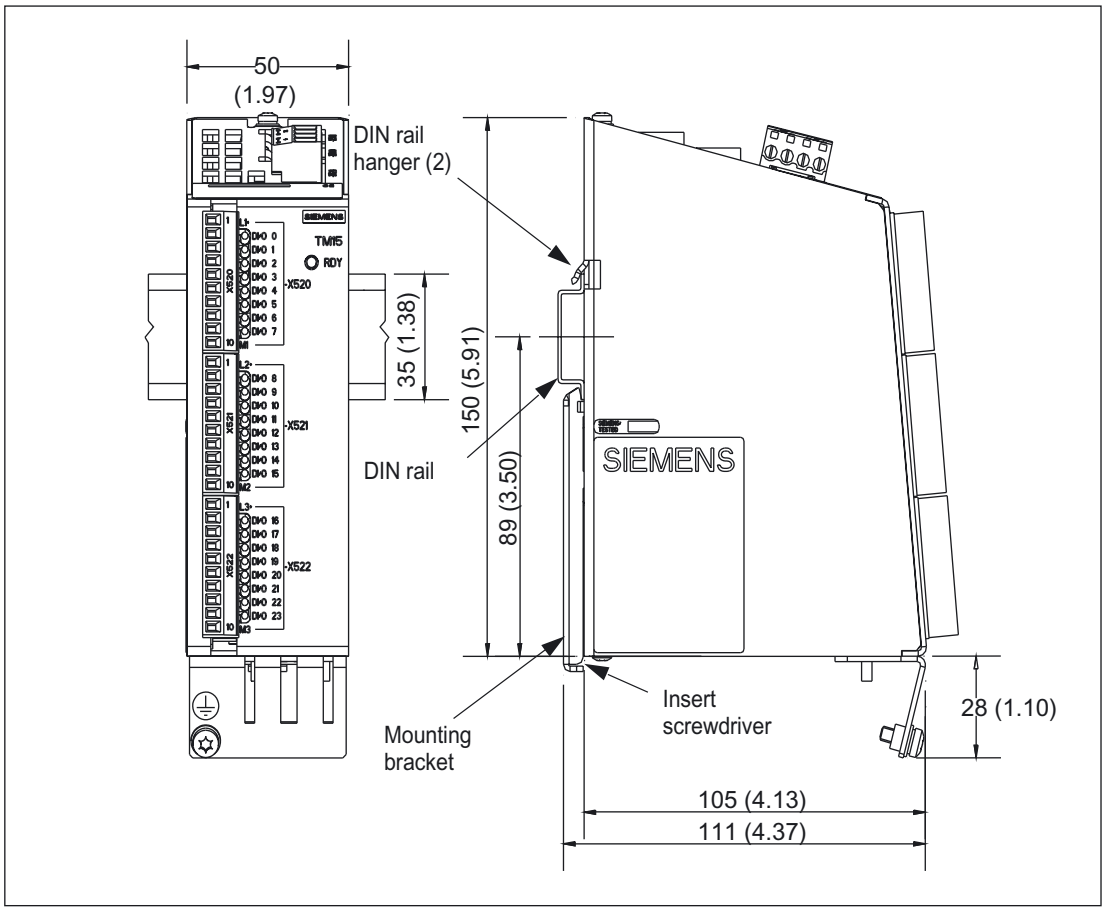



Figure 3-14 Dimension drawing of the TM15

## 3.5.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

## Removal

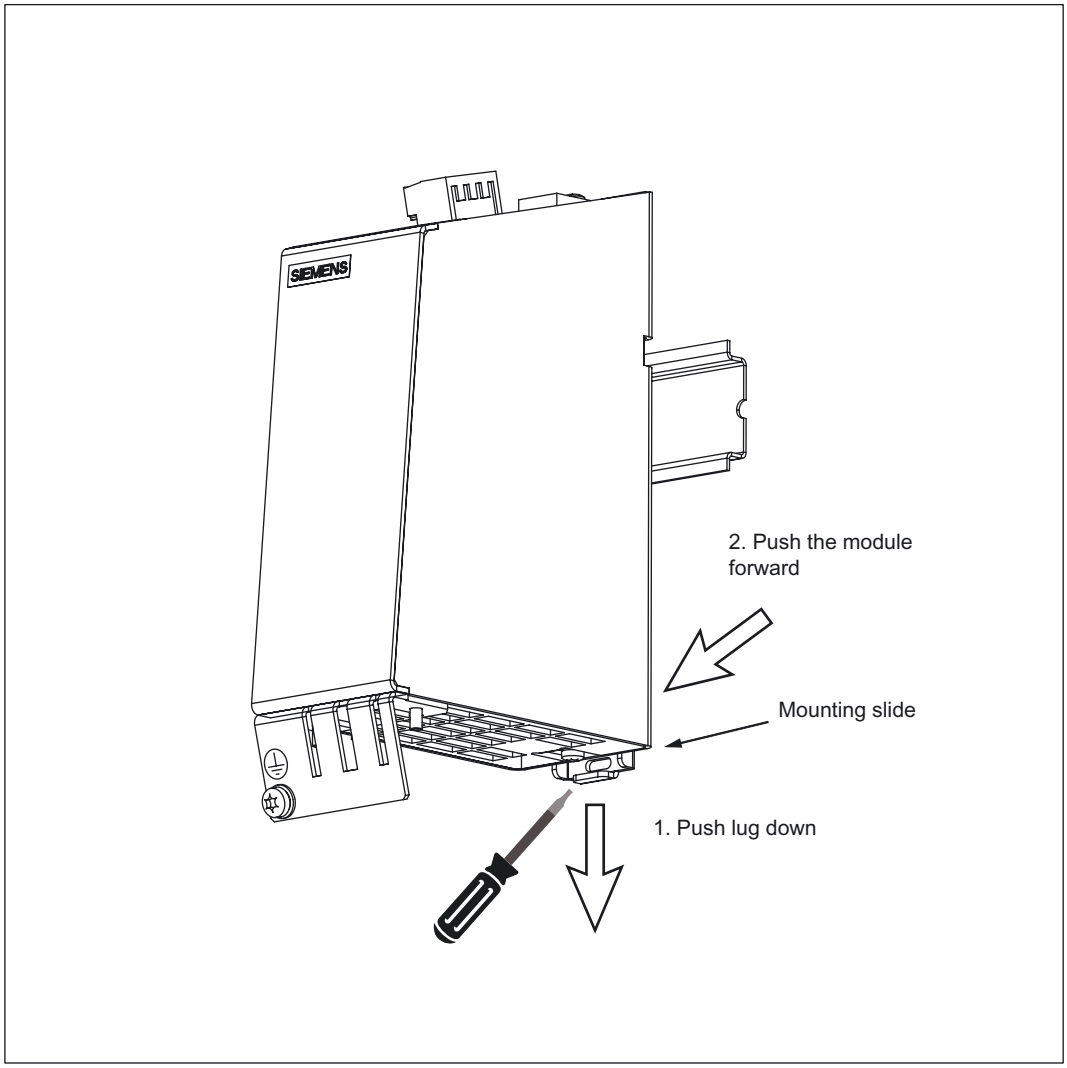



Figure 3-15 Releasing the component from a DIN rail

## 3.5.6 Electrical Connection

It is always advisable to shield the digital inputs/outputs.

The following pictures show two typical shield contacts from Weidmüller.

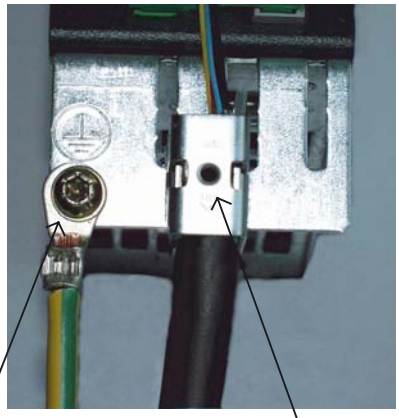



Figure 3-16 Shield contacts

### Internet address of the company:

Weidmüller: http://www.weidmueller.com/

**Danger**

If the shielding procedures described and the specified cable lengths are not observed, the machine may not operate properly.

The TM15 housing is connected to the ground terminal of the module supply (terminal X524). If the ground terminal is actually grounded, then the housing is also grounded. An additional ground connection using the M4 screw is especially necessary if high potential bonding currents can flow (e.g. through the cable shield).

## Connector codes

Siemens supplies a series of profiled coding keys (coding sliders) with each Terminal Module 15. To encode a connector, you must insert at least one coding slider and cut off a coding lug on the connector:

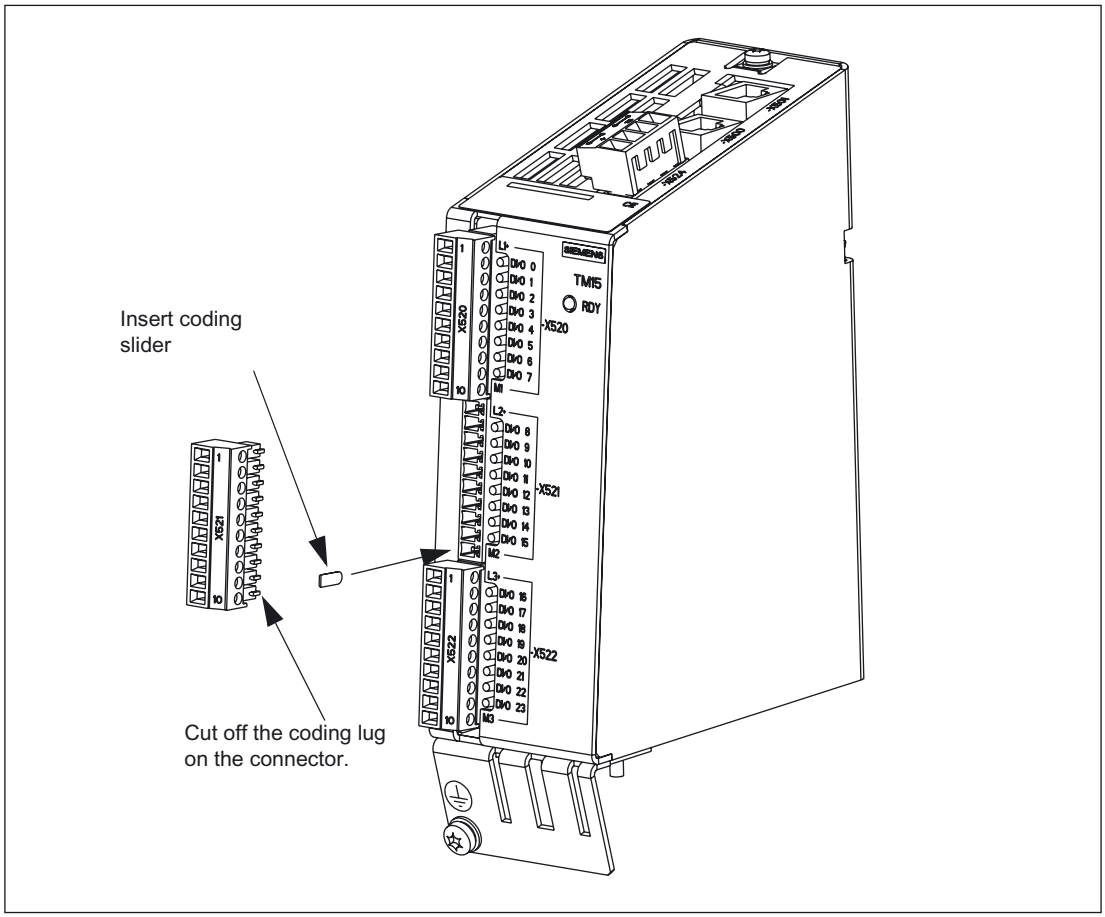



Figure 3-17 Procedure for encoding a connector

To avoid wiring errors, unique coding patterns can be defined for the connectors X520, X521 and X522. Examples of possible patterns:

- 3 connectors on one component are encoded differently (i.e. X520, X521 and X522).
- Different component types are encoded differently.
- Identical components on the same machine are encoded differently (e.g. several TM15-type components).

## 3.5.7 Technical specifications

Table 3-24 Technical Specifications

| **Terminal Module 15**<br>**6SL3055-0AA00-3FAx** | **Unit** | **Value** |
|---|---|---|
| Electronics power supply<br>Voltage<br>Current (without DRIVE-CLiQ or digital outputs)<br>Power loss | <br>$V_{DC}$<br>$A_{DC}$<br>W | <br>24 DC (20.4 – 28.8)<br>0.15<br><3 |
| Ambient temperature up to an altitude of 2000 m | °C | 0 - 60 |
| Storage temperature | °C | -40 to +85 |
| Relative humidity | 5 % to 95 %, no moisture condensation | |
| I/O | | |
| • Digital inputs/outputs | Can either be parameterized as DI or DO | |
| • Number of digital inputs/outputs | 24 | |
| • Isolation | Yes, in groups up to 8<br>(insulation strength between the groups: 100 $V_{DC}$) | |
| • Max. cable length | m | 30 |
| Digital inputs | | |
| • Voltage | $V_{DC}$ | -30 to +30 |
| • Low level (an open digital input is interpreted as "low") | $V_{DC}$ | -30 to +5 |
| • High level | $V_{DC}$ | 15 to 30 |
| • Input Impedance | kΩ | 2.8 |
| • Current consumption (at 24 VDC) | mA | 11 |
| • Max. voltage in OFF state | $V_{DC}$ | 5 |
| • Current in OFF state | mA | 0.0 to 1.0 (per channel) |
| • Signal run times[1)] of digital inputs through the firmware, typical | µs | L → H: 50<br>H → L: 100 |
| Digital outputs (continued-short-circuit-proof) | | |
| • Voltage | $V_{DC}$ | 24 |
| • Max. load current per digital output | $A_{DC}$ | 0.5 |
| • Output delay (ohmic load) | | |
| • Typical | µs | L → H: 50<br>H → L: 150 |
| • Maximum | µs | L → H: 100<br>H → L: 225 |
| • Min. output pulse<br>(100% amplitude, 0.5 A with resistive load) | µs | 125 (typ.)<br>350 (max.) |
| • Max. switching frequency<br>(100% amplitude, 50%/50% duty cycle, with 0.5 A and a resistive load) | kHz | 1 (typ.) |

| **Terminal Module 15**<br>**6SL3055-0AA00-3FAx** | **Unit** | **Value** |
|---|---|---|
| • Voltage drop in ON state | $V_{DC}$ | 0.75 (max.) for maximum load in all circuits |
| • Leakage current in OFF state | µA | max. 10 per channel |
| • Voltage drop, output<br>(I/O power supply to the output) | $V_{DC}$ | 0.5 |
| • Max. total current of outputs (per group)<br>up to 60 °C<br>up to 50 °C<br>up to 40 °C | <br>$A_{DC}$<br>$A_{DC}$<br>$A_{DC}$ | <br>2<br>3<br>4 |
| IEC enclosure specification | IP20 degree of protection | |
| Protective ground conductor | On housing with M4/1.8 Nm screw | |
| Response time | The response time for the digital inputs/outputs (TM 15DI/DO) consists of the following elements:<br>• Response time on the component itself (approx. 1/2 DRIVE-CLiQ cycle).<br>• Response transmit time via the DRIVE-CLiQ connection (approx. 1 DRIVE-CLiQ cycle).<br>• Evaluation on the control unit (see function diagram)<br>**Literature:** SINAMICS S List Manual – "Function diagrams" chapter | |
| Weight | kg | 0.86 |
| Approbation | UL and cULus<br>http://www.ul.com<br>File: E164110, Vol. 2, Sec. 9 | |

[1] The actual processing speed depends on the signal run-time through the firmware in which the corresponding signal from the control unit is processed.

# 3.6 Terminal Module 31 (TM31)

## 3.6.1 Description

The Terminal Module 31 (TM31) is a terminal expansion board that can be attached to a DIN 50022 mounting rail. The Terminal Module TM31 can be used to increase the number of available digital inputs/outputs and analog inputs/outputs within a drive system.

The TM31 contains the following terminals:

Table 3-25 Interface overview of the TM31

| Type | Number |
|---|---|
| Digital inputs | 8 |
| Digital inputs/outputs | 4 |
| Analog inputs | 2 |
| Analog outputs | 2 |
| Relay outputs | 2 |
| Temperature sensor input | 1 |

## 3.6.2 Safety Information

**Danger**

The 50 mm clearances above and below the components must be observed.

**Caution**

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

## 3.6.3 Interface description

### 3.6.3.1 Overview

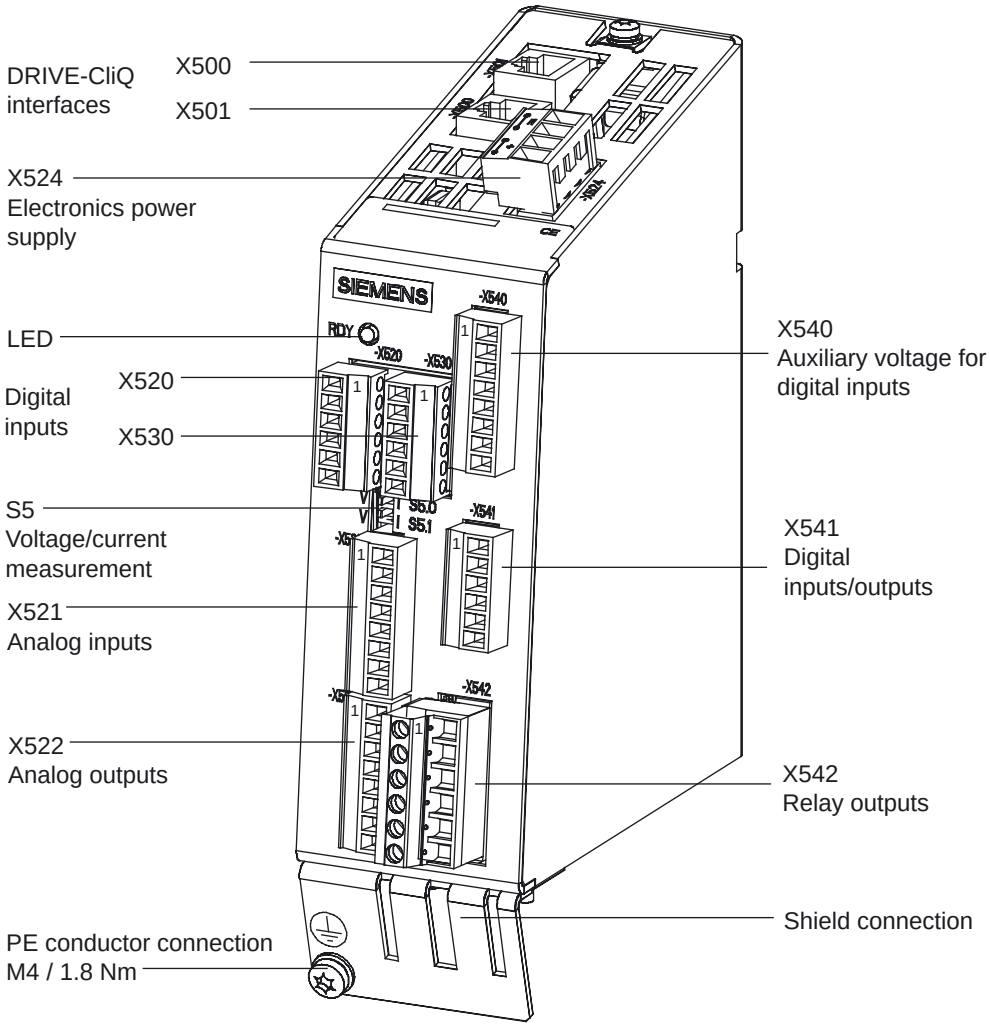



Figure 3-18 Interface description TM31

### 3.6.3.2 Connection example

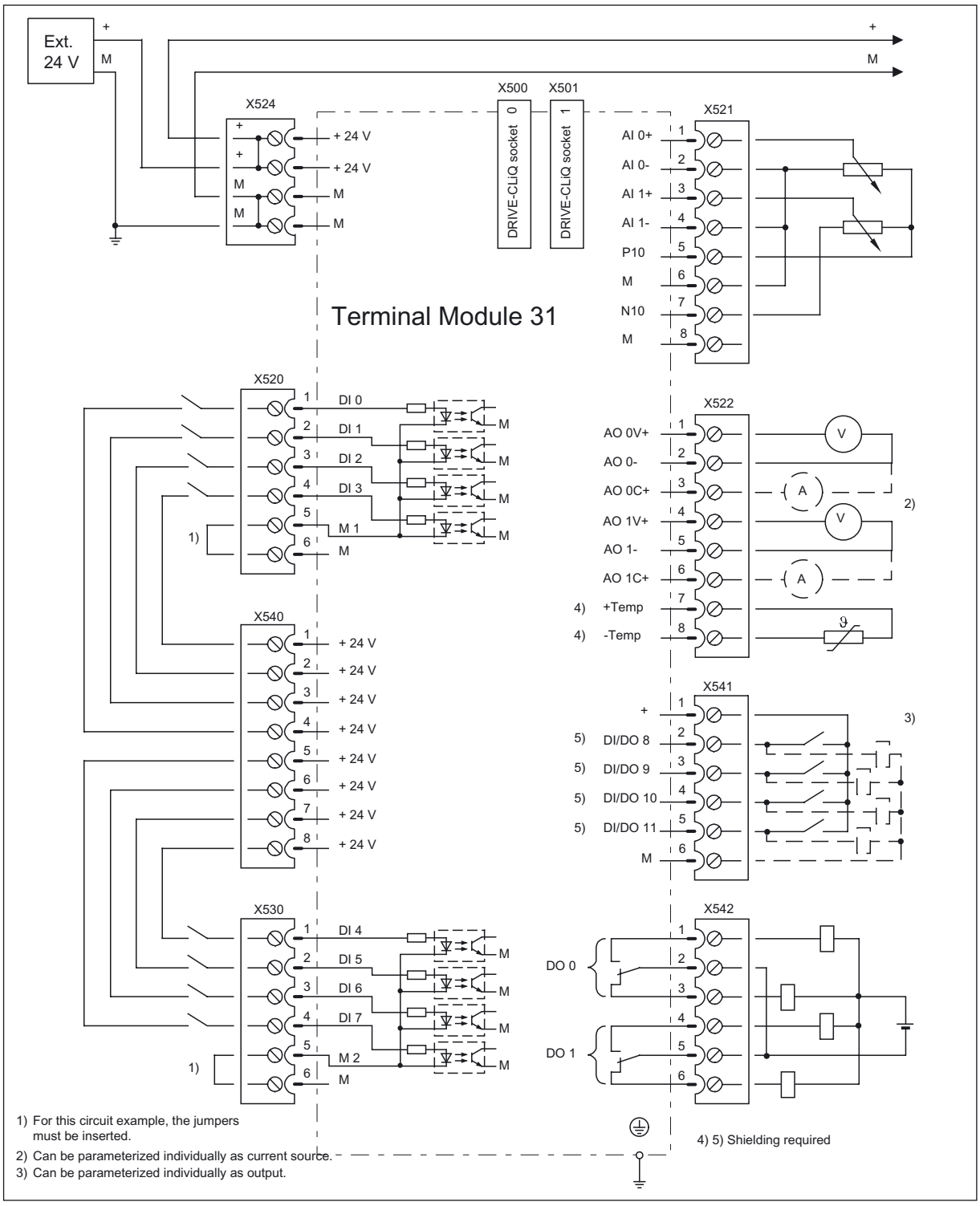
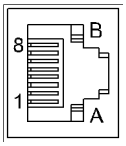



Figure 3-19 Example connection of TM31

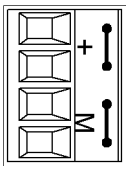
### 3.6.3.3 X500 and X501 DRIVE-CLiQ interface

Table 3-26 DRIVE-CLiQ interface X500

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255 | | | |

### 3.6.3.4 Electronics power supply X524

Table 3-27 Terminals for the electronics power supply

| | Terminal | Name | Technical specifications |
|---|---|---|---|
|  | + | Electronics power supply | Voltage: 24 V DC (20.4 V – 28.8 V)<br>Current consumption: max. 0.5 A<br><br>Max. current via jumper in connector:<br>20 A at 55 °C |
| | + | Electronics power supply | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2.5 mm²<br>Type: Screw terminal 2 (see Appendix A) | | | |

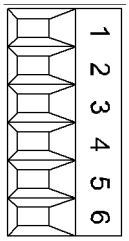
**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ node and digital outputs.

### 3.6.3.5 Digital inputs X520

Table 3-28 Screw terminal X520

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | DI 0 | Voltage: - 3 V to +30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Isolation: The reference potential is terminal M1<br>Signal propagation times:<br>L → H approx. 50 µs<br>H → L: approx. 100 µs<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V |
| | 2 | DI 1 | |
| | 3 | DI 2 | |
| | 4 | DI 3 | |
| | 5 | M1 | |
| | 6 | M | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

1) DI: digital input; M: electronic ground M1: Reference ground

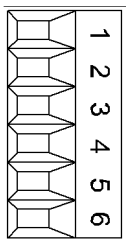
**Note**

To enable the digital inputs to function, terminal M1 must be connected. This can be done as follows:

1) Connect the reference ground of the digital inputs, or
2) a jumper to terminal M
**(Notice: this removes isolation for these digital inputs).**

### 3.6.3.6 Digital inputs X530

Table 3-29 Screw terminal X530

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | DI 4 | Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Isolation: The reference potential is terminal M2<br>Signal propagation times:<br>L → H approx. 50 µs<br>H → L: approx. 100 µs<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V |
| | 2 | DI 5 | |
| | 3 | DI 6 | |
| | 4 | DI 7 | |
| | 5 | M2 | |
| | 6 | M | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

1) DI: digital input; M: electronic ground; M2: ground reference

**Notice**

An open input is interpreted as "low".

To enable the digital inputs to work, terminal M2 must be connected. This can be done as follows:

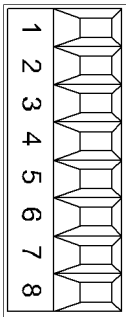
1) Route the reference ground of the digital inputs (with the other cable) and connect it to M2.

2) Jumper terminal M and M2 directly

(the electrical isolation for these digital inputs is therefore removed).

### 3.6.3.7 Auxiliary voltage for the digital inputs X540

Table 3-30 Screw terminal X540

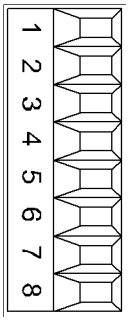
| | Terminal | Name | Technical specifications |
|---|---|---|---|
|  | 1 | +24 V | Voltage: +24 V DC<br>Max. total load current: 150 mA |
| | 2 | +24 V | |
| | 3 | +24 V | |
| | 4 | +24 V | |
| | 5 | +24 V | |
| | 6 | +24 V | |
| | 7 | +24 V | |
| | 8 | +24 V | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

**Note**

This voltage supply is only for powering the digital inputs.

### 3.6.3.8 Analog inputs X521

Table 3-31 Terminal block X521

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | AI 0+ | You can set the following input signals using the appropriate parameters:<br>Voltage: -10 V to 10 V; $R_i$ = 100 kΩ<br>Current 1: 4 mA to 20 mA; $R_i$ = 250 Ω<br>Current 2: -20 mA to 20 mA; $R_i$ = 250 Ω<br>Current 3: 0 mA to 20 mA; $R_i$ = 250 Ω<br>Resolution: 12 bits |
| | 2 | AI 0- | |
| | 3 | AI 1+ | |
| | 4 | AI 1- | |
| | 5 | P10 | Auxiliary voltage:<br>P10 = 10 V<br>N10 = -10 V<br>Continued-short-circuit-proof |
| | 6 | M | |
| | 7 | N10 | |
| | 8 | M | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

1) AI: analog inputs; P10/N10: auxiliary voltage; M or GND: ground reference

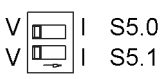
**Caution**

If more than 40 mA flows through the analog current input, then the component could be destroyed.

The common mode range may not be violated. This means that the analog differential voltage signals can have a maximum offset voltage of +/- 30 V DC with respect to the ground potential. If the range is infringed, incorrect results may occur during analog/digital conversion.

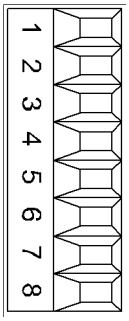
### 3.6.3.9 S5 current/voltage changeover switch for analog inputs

Table 3-32 Current/voltage selector S5

| | Switch | Function |
|---|---|---|
|  | S5.0 | Selector voltage (V)/current (I) AI0 |
| | S5.1 | Selector voltage (V)/current (I) AI1 |

### 3.6.3.10 Analog outputs/temperature sensor connection X522

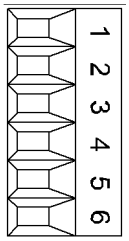
Table 3-33 Terminal block X522

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | AO 0V+ | You can set the following output signals using parameters:<br>Voltage: -10 V to 10 V (max. 3 mA)<br>Current 1: 4 mA to 20 mA (max. load resistance ≤ 500 Ω)<br>Current 2: -20 mA to 20 mA (max. load resistance ≤ 500 Ω)<br>Current 3: 0 mA to 20 mA (max. load resistance ≤ 500 Ω)<br>Resolution: 11 bits + sign<br>Continued-short-circuit-proof |
| | 2 | AO 0- | |
| | 3 | AO 0C+ | |
| | 4 | AO 1V+ | |
| | 5 | AO 1- | |
| | 6 | AO 1C+ | |
| | 7 | +Temp | Temperature sensor connection KTY84-1C130/PTC |
| | 8 | -Temp | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

1) AO xV: analog output voltage; AO xC: Analog output current

### 3.6.3.11 X541 bidirectional digital inputs/outputs

Table 3-34 Terminals for bidirectional digital inputs/outputs

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | + | As input:<br>Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Signal propagation times:<br>L → H approx. 50 µs<br>H → L: approx. 100 µs<br>As output:<br>Voltage: 24 V DC<br>Max. load current per output: 100 mA<br>Max. total current of outputs: 400 mA<br>Continued-short-circuit-proof |
| | 2 | DI/DO 8 | |
| | 3 | DI/DO 9 | |
| | 4 | DI/DO 10 | |
| | 5 | DI/DO 11 | |
| | 6 | M | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

1) DI/DO: bidirectional digital input/output; M or GND: Electronic ground

**Note**

An open input is interpreted as "low".

**Note**

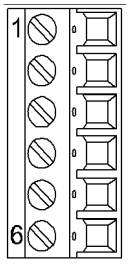
If a momentary interruption in the voltage occurs in the 24 V supply, the digital outputs will be deactivated until the interruption has been rectified.

**Notice**

The digital outputs are only functional if terminals 1 and 6 are supplied with 24 V.

### 3.6.3.12 Relay outputs X542

Table 3-35 Terminal block X542

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | DO 0.NC | Contact type: Two-way contact max. load current: 8 A<br>Max. switching voltage: 250 $V_{AC}$, 30 $V_{DC}$<br>Max. switching power at 250 $V_{AC}$: 2000 VA (cosφ = 1)<br>Max. switching power at 250 $V_{AC}$: 750 VA (cosφ = 0.4)<br>Max. switching power at 30 $V_{DC}$: 240 W (ohmic load)<br>Required minimum current: 100 mA<br>Overvoltage category: Class III to EN 60 664-1 |
| | 2 | DO 0.COM | |
| | 3 | DO 0.NO | |
| | 4 | DO 1.NC | |
| | 5 | DO 1.COM | |
| | 6 | DO 1.NO | |
| Max. connectable cross-section. 2.5 $mm^2$<br>Type: Screw terminal 3 (see Appendix A) | | | |

1) DO: digital output, NO: normally-open contact, NC: normally-closed contact, COM: Mid-position contact

### 3.6.3.13 Description of the LEDs on the Terminal Module 31 (TM31)

Table 3-36 Description of the LEDs on the TM31

| LED | Color | State | Description |
|---|---|---|---|
| RDY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. |
| | Red | Continuous | At least one fault is present in this component. **Note:**<br>LED is driven irrespective of the corresponding messages being reconfigured. |
| | Green/<br>Red | Flashing<br>2 Hz | Firmware is being downloaded. |
| | Green/<br>Orange<br>or<br>Red/Orange | Flashing<br>2 Hz | Detection of the components via LED is activated (p0154).<br>**Note:**<br>Both options depend on the LED status when module recognition is activated via p0154 = 1. |

### 3.6.3.14 Cause of faults and resolving them

#### Cause of faults and resolving them

The following reference contains further information about the cause of faults and resolving them:

Reference: /IH1/ SINAMICS S, Commissioning Manual

## 3.6.4 Dimension Drawing

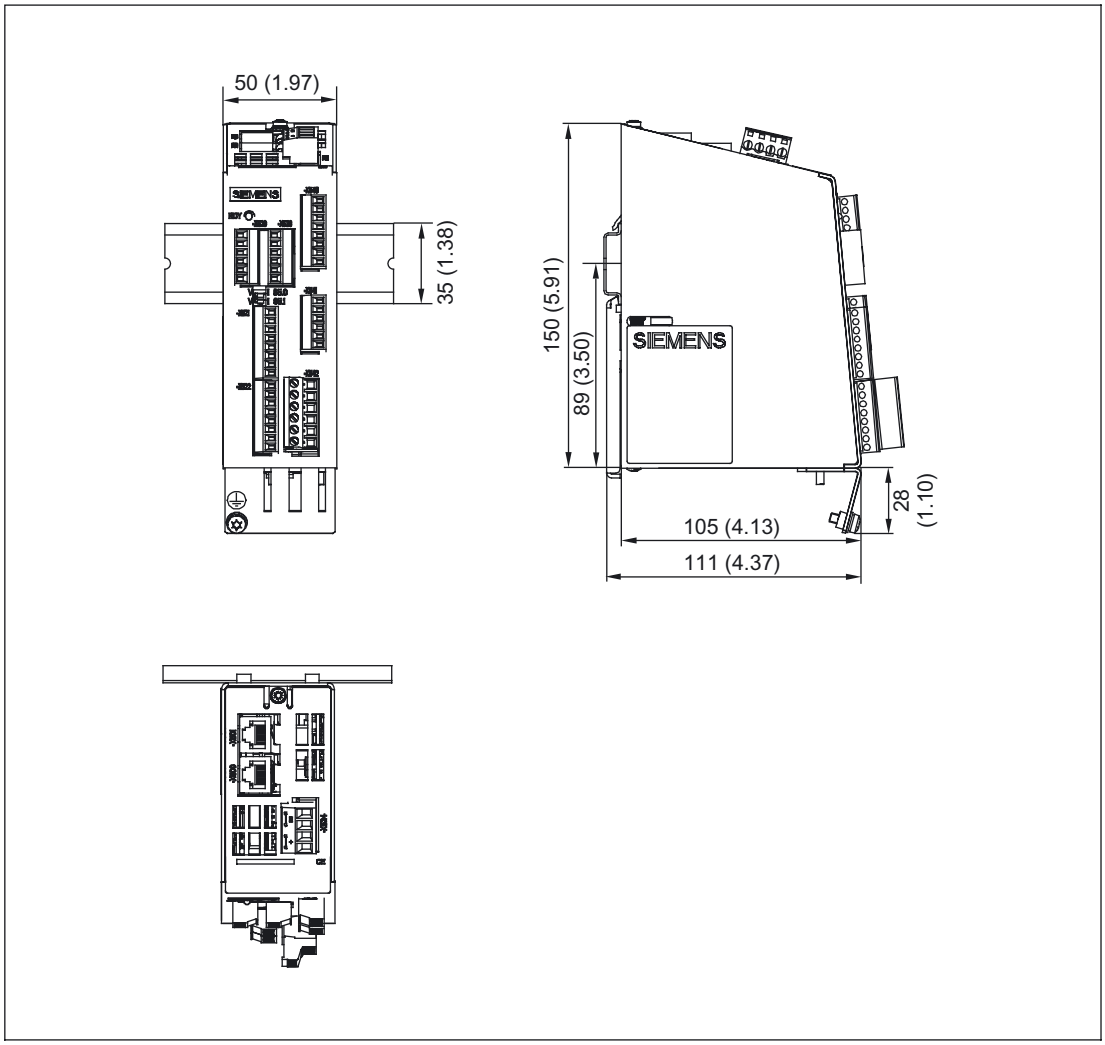



Figure 3-20 Dimension drawing of the TM31

## 3.6.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

## Removal

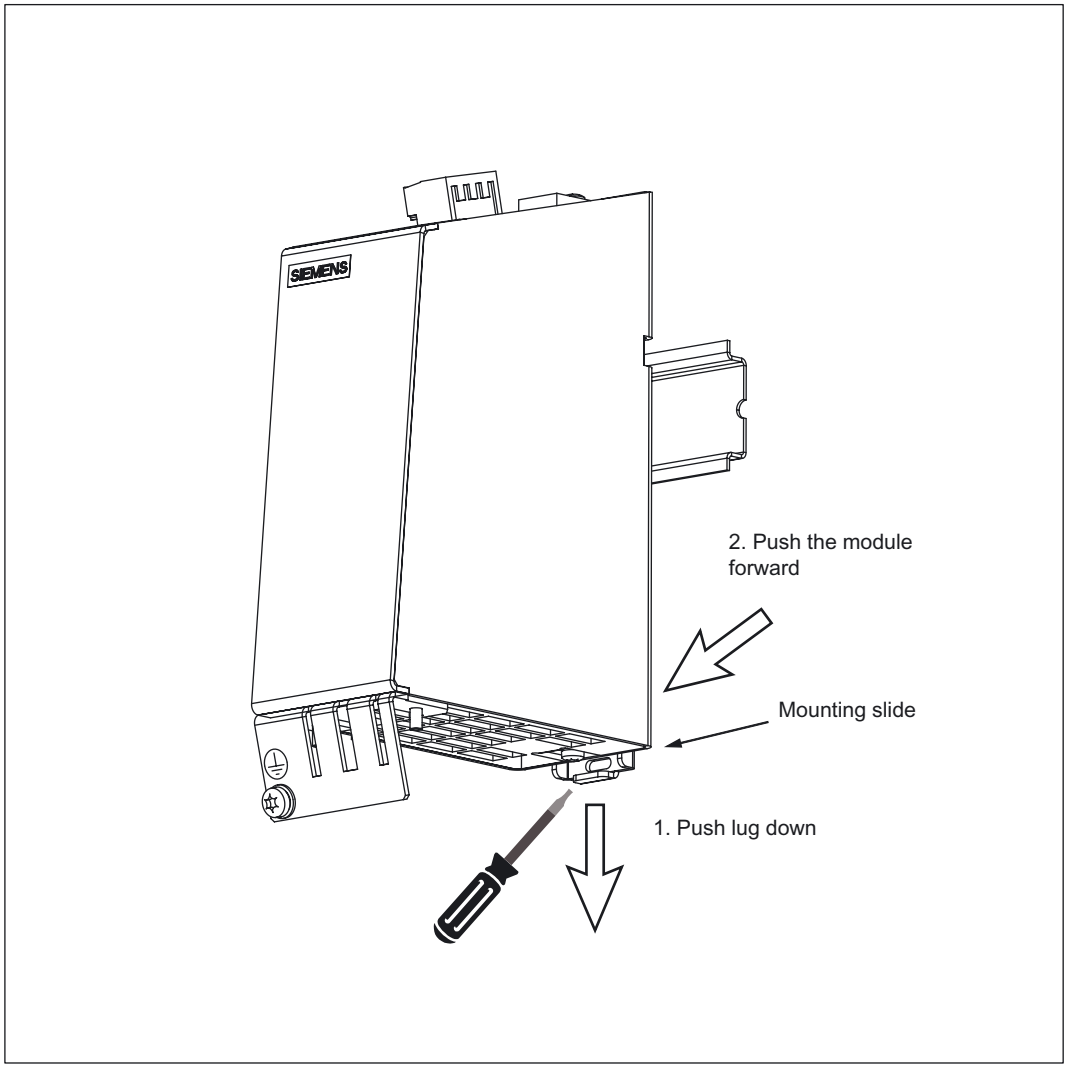



Figure 3-21 Releasing the component from a DIN rail

## 3.6.6 Electrical connection

It is always advisable to shield the digital I/O wiring.

The following pictures show two typical shield contacts from Weidmüller.

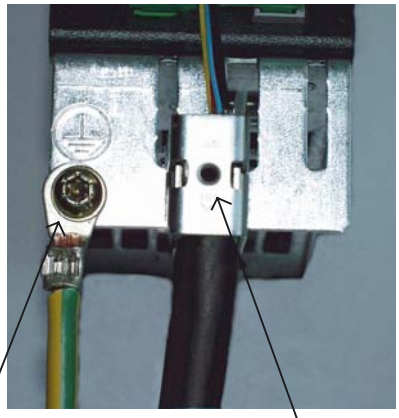



Figure 3-22 Shield contacts

### Internet address of the company:

Weidmüller: http://www.weidmueller.com/

**Danger**

If the shielding procedures described and the specified cable lengths are not observed, the machine may not operate properly.

## Connector codes

To ensure that identical connectors are assigned correctly on the TM31, the connecters are encoded as shown in the following diagram.

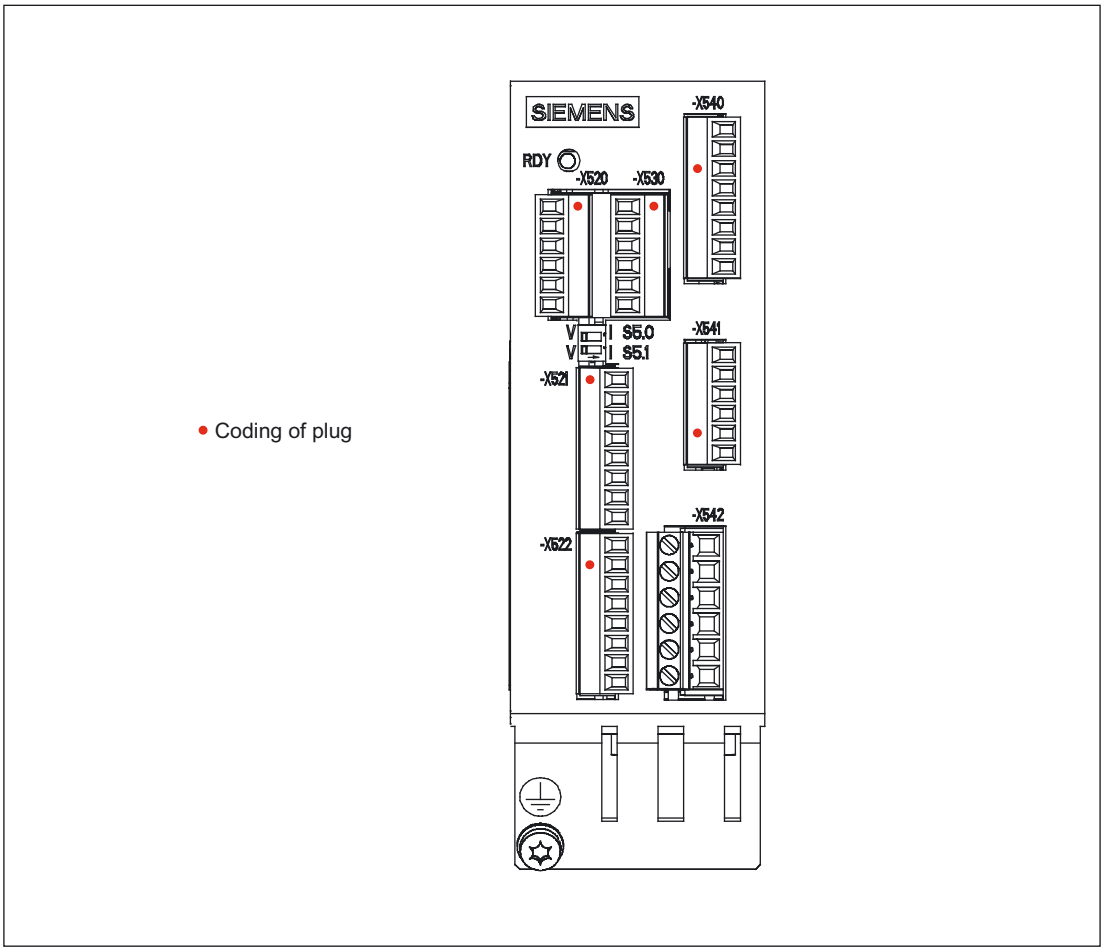



Figure 3-23 Connector codes of the TM31

The bending radii of the cables must be taken into account (see description of MOTION-CONNECT).

## 3.6.7 Technical Specifications

Table 3-37 Technical Specifications

| | Unit | Value |
|---|---|---|
| Electronics power supply | | |
| Voltage | $V_{DC}$ | 24 DC (20.4 – 28.8) |
| Current (without DRIVE-CLiQ or digital outputs) | $A_{DC}$ | 0.5 |
| Power loss | W | <10 |
| PE/ground connection | On housing with M4/1.8 Nm screw | |
| Response time | The response time for the digital inputs/outputs and the analog inputs/outputs consists of the following elements:<br>• Response time on the component itself (approx. 1/2 DRIVE-CLiQ cycle).<br>• Response transmit time via the DRIVE-CLiQ connection (approx. 1 DRIVE-CLiQ cycle).<br>• Evaluation on the control unit (see function diagram).<br>**Reference:**SINAMICS S List Manual – "Function diagrams" chapter | |
| Weight | kg | 1 |

# 3.7 Terminal Module 41 (TM41)

## 3.7.1 Description

The Terminal Module 41 (TM41) is an expansion module that is snapped onto a mounting rail (DIN 50022) in the cabinet.
An incremental encoder can be simulated using the encoder interface of the TM41. The TM41 can also be used to connect analog controls to SINAMICS.

TB41 is equipped with the following terminals:

Table 3-38 Interface overview of the TM41

| Type | Number |
|---|---|
| Digital inputs, floating | 4 |
| Digital inputs/outputs | 4 |
| Analog inputs | 1 |
| TTL encoder output | 1 |

TM41 can be used from firmware 2.4 onwards

## 3.7.2 Safety Information

**Danger**

The 50 mm clearances above and below the components must be observed.

## 3.7.3 Interface description

### 3.7.3.1 Overview

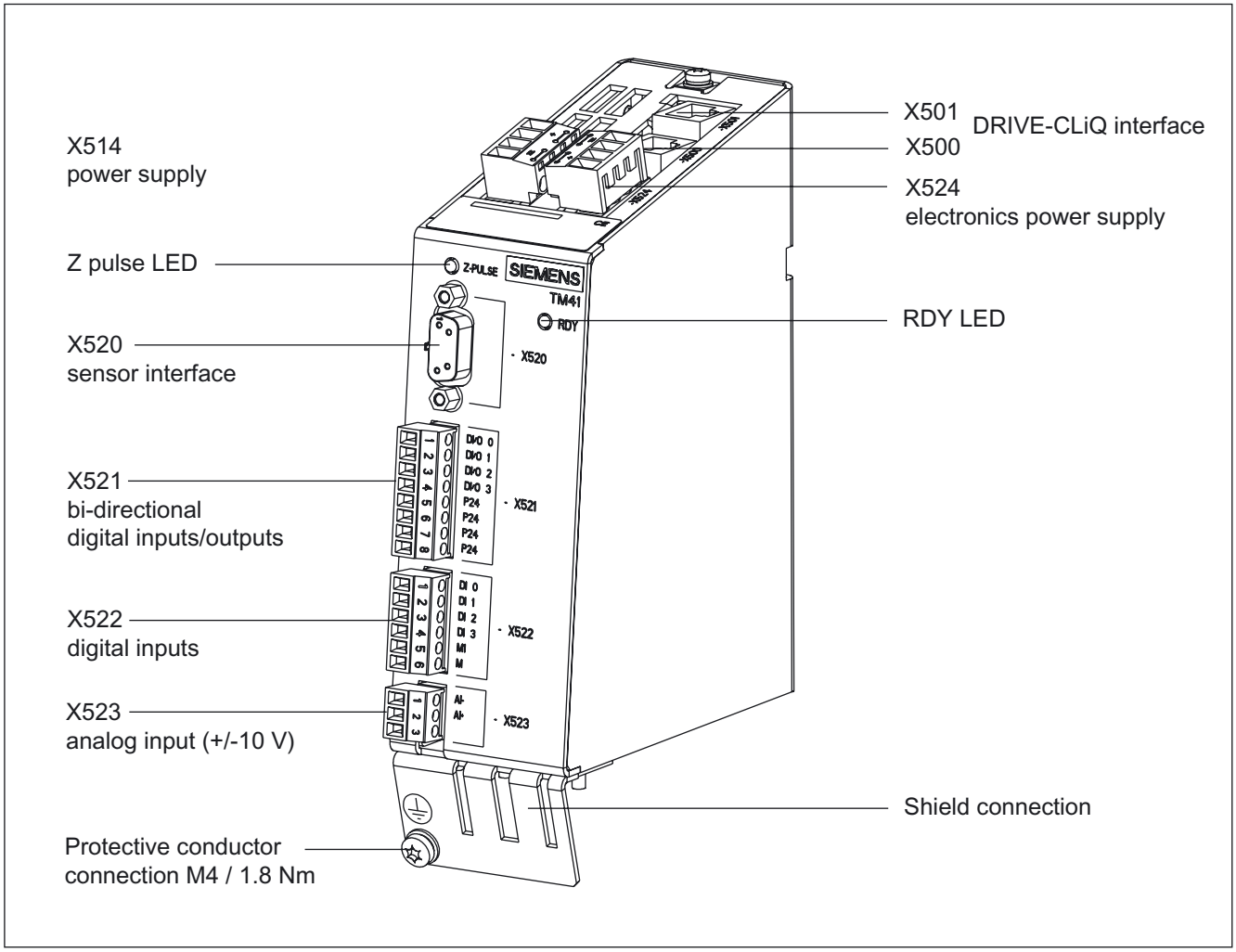



Figure 3-24 Interface description TM41

### 3.7.3.2 Connection example

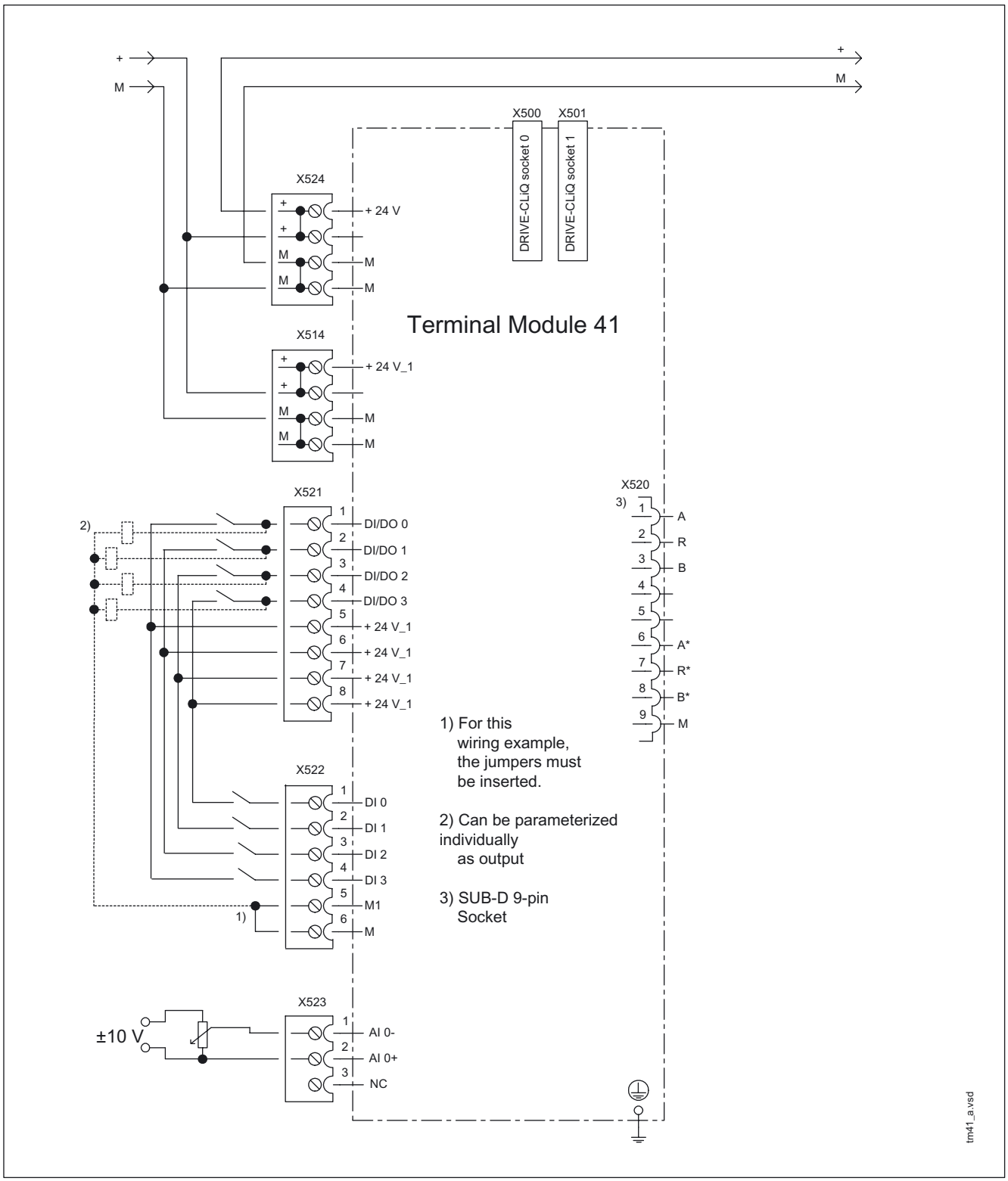
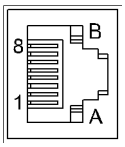



Figure 3-25 Sample connection of TM41

### 3.7.3.3 X500 and X501 DRIVE-CLiQ interface

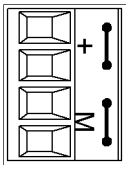
Table 3-39 DRIVE-CLiQ interface X500

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255 | | | |

### 3.7.3.4 X514 and X524 Power Supply

The X514 interface supplies the X521 interface with current.
The X524 provides the electronics power supply.

Table 3-40 Power supply terminals X514 and X524

| | Terminal | Name | Technical specifications |
|---|---|---|---|
|  | + | Power supply | Voltage: 24 V DC (20.4 V – 28.8 V)<br>Current consumption: max. 0.5 A<br><br>Max. current via jumper in connector:<br>20 A at 55 °C |
| | + | Power supply | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2.5 mm²<br>Type: Screw terminal 2 (see Appendix A) | | | |

**Note**

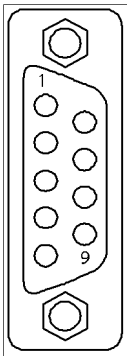
The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

The current drain of X524 increases by the value for the DRIVE-CLiQ node.

The current drain of X514 increases by the value for the digital outputs.

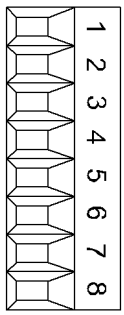
### 3.7.3.5 Sensor interface X520

Table 3-41 X520 interface

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | A | Incremental signal A |
| | 2 | R | Reference signal R |
| | 3 | B | Incremental signal B |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | A* | Inverted incremental signal A |
| | 7 | R* | Inverted reference signal R |
| | 8 | B* | Inverted incremental signal B |
| | 9 | M | Ground |
| TTL encoder<br>100 m max. cable length<br>Type: 9-pin SUB-D female | | | |

### 3.7.3.6 X521 bidirectional digital inputs/outputs

Table 3-42 Screw terminal X521

| | Terminal | Name | Technical specifications |
|---|---|---|---|
|  | 1 | DI/DO 0 | As input:<br>Voltage: -3 V to 30 V<br>Typical current consumption: 10 mA at 24 V DC<br>Level (including ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V<br>As output:<br>Voltage: 24 VDC<br>Max. load current per output: 0.5 mA<br>Max. total current of outputs: 2 A<br>Continued-short-circuit-proof |
| | 2 | DI/DO 1 | |
| | 3 | DI/DO 2 | |
| | 4 | DI/DO 3 | |
| | 5 | +24 V | Voltage: +24 V DC<br>Max. load current per terminal: 500 mA |
| | 6 | +24 V | |
| | 7 | +24 V | |
| | 8 | +24 V | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

**Note**

This voltage supply is only for powering the digital inputs.

**Note**

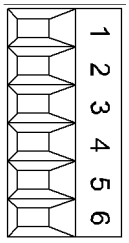
An open input is interpreted as "low".

**Note**

If a momentary interruption in the voltage occurs in the 24 V supply, the digital outputs will be deactivated until the interruption has been rectified.

### 3.7.3.7 X522 digital inputs / floating (isolated)

Table 3-43 Screw terminal X522

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | DI 0 | Voltage: - 3 V to 30 V<br>Typical current consumption: 6.5 mA at 24 V DC<br>Isolation: The reference potential is terminal M1<br>Signal propagation times:<br>L → H approx. 50 µs<br>H → L: approx. 100 µs<br>Level (incl. ripple)<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V |
| | 2 | DI 1 | |
| | 3 | DI 2 | |
| | 4 | DI 3 | |
| | 5 | M1 | |
| | 6 | M | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

1) DI: digital input; M: electronic ground M1: ground reference

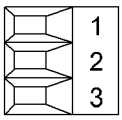
**Note**

To enable the digital inputs to function, terminal M1 must be connected. This can be done as follows:

1) Connect the reference mass of the digital inputs, or
2) a jumper to terminal M **(Notice: this removes isolation for these digital inputs).**

### 3.7.3.8 Analog input X523

Table 3-44 Terminal block X523

| | Terminal | Name[1)] | Technical specifications |
|---|---|---|---|
|  | 1 | AI 0- | Voltage: -10 V to 10 V; $R_i$ = 40 kΩ<br>Resolution: 14 bits (13 bits + sign) |
| | 2 | AI 0+ | |
| | 3 | Reserved, do not use | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

**Caution**

The common mode range may not be violated. This means that the analog differential voltage signals can have a maximum offset voltage of +/- 15 V with respect to the ground potential. If the range is infringed, incorrect results may occur during analog/digital conversion.

### 3.7.3.9 Description of the LEDs on Terminal Module 41 (TM41)

Table 3-45 Description of the LEDs on the TM41

| LED | Color | State | Description |
|---|---|---|---|
| READY | - | OFF | Electronics power supply outside permissible tolerance range. |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. |
| | Red | Continuous | At least one fault is present in this component. |
| | Green<br>Red | Flashing<br>2 Hz | Firmware is being downloaded. |
| | Green/<br>Orange<br>or<br>Red/ Orange | Flashing<br>2 Hz | Component recognition via LED is activated (p0154).<br>Note:<br>both options depend on the LED status when module recognition is activated via p0154 = 1. |
| Z pulses | - | OFF | No zero mark (reference signal) found or component is switched off |
| | Red | Continuous | Encoder output is switched off |
| | Green | Continuous | Stopped at zero mark (reference signal) |
| | | Flashing | Zero mark (reference signal) found |

### 3.7.3.10 Cause of faults and resolving them

#### Cause of faults and resolving them

The following reference contains further information about the cause of faults and resolving them:

Reference: /IH1/ SINAMICS S, Commissioning Manual

## 3.7.4 Dimension Drawing

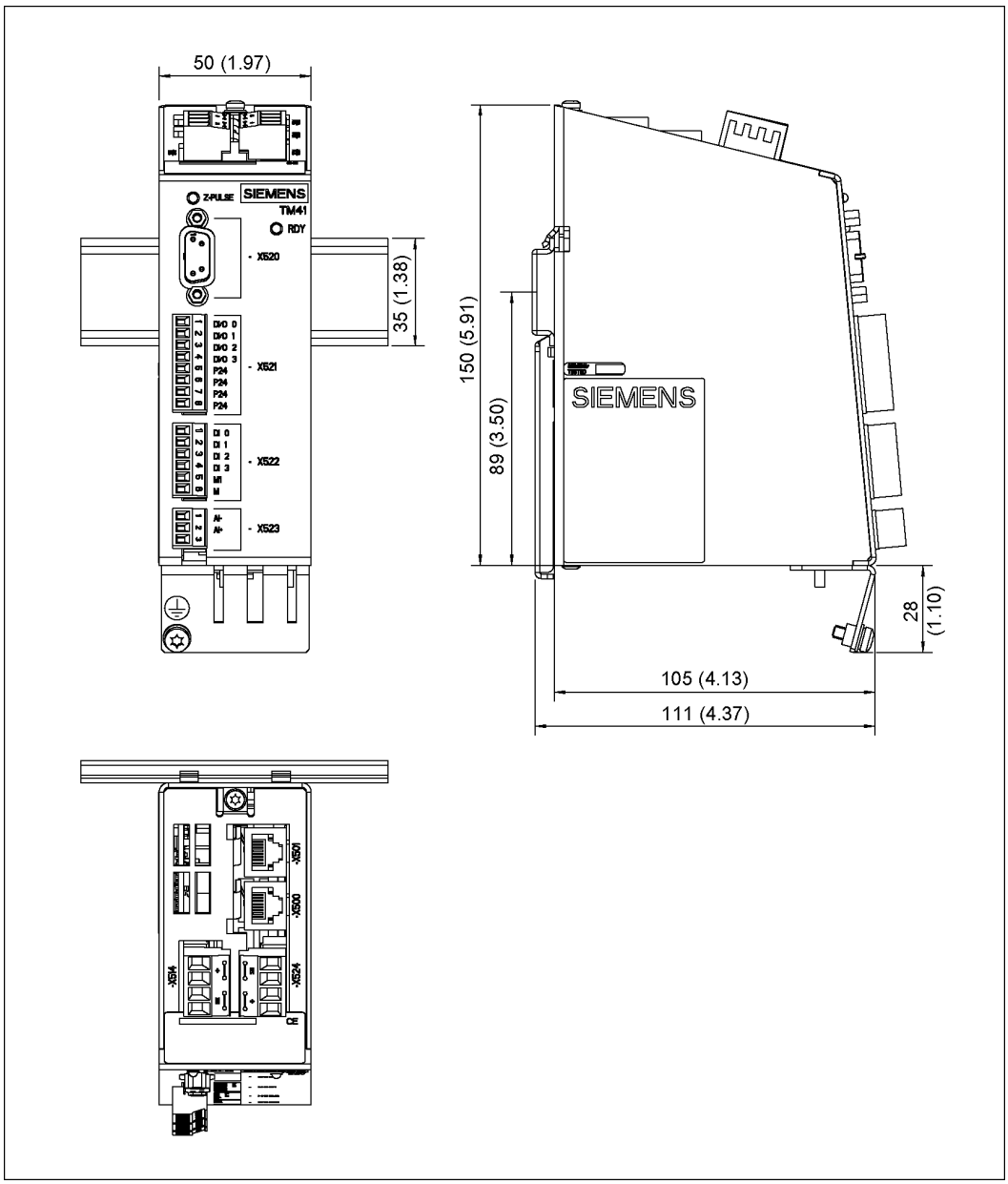



Figure 3-26 Dimension drawing of TM41

## 3.7.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

## Removal

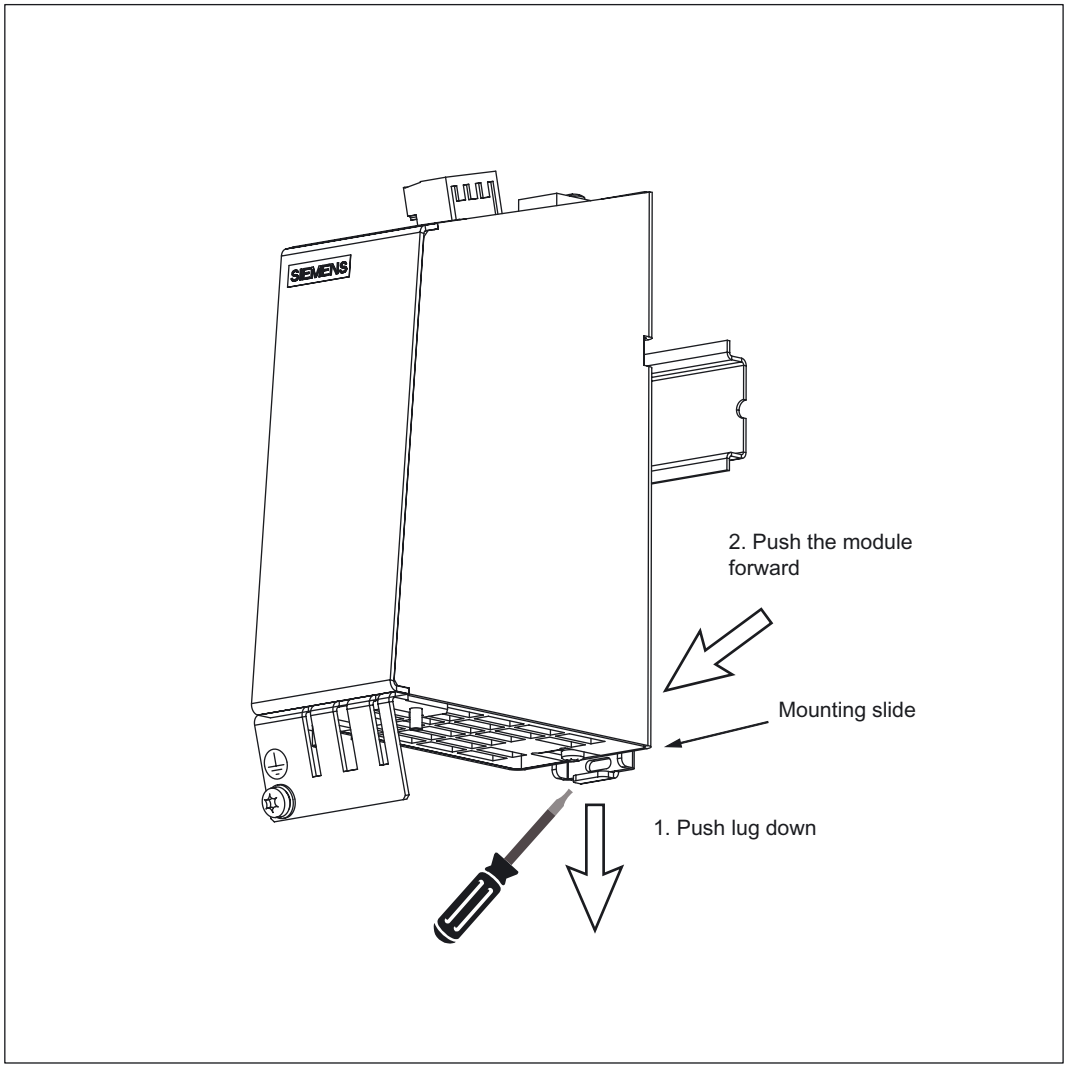



Figure 3-27 Releasing the component from a DIN rail

## 3.7.6 Electrical Connection

### Shield contact for components from Weidmüller

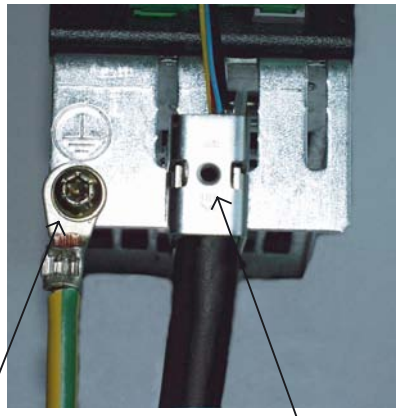



Figure 3-28 Shield contacts

### Internet address of the company:

Weidmüller: http://www.weidmueller.com/

The bending radii of the cables must be taken into account (see description of MOTION-CONNECT).

## 3.7.7 Technical Specifications

Table 3-46 Technical data

| | Unit | Value |
|---|---|---|
| Electronics power supply | | |
| Voltage | $V_{DC}$ | 24 DC (20.4 – 28.8) |
| Current (without DRIVE-CLiQ or digital outputs) | $A_{DC}$ | 0.5 |
| PE/chassis connection | On housing with M4/1.8 Nm screw | |
| Response time | The response time for the digital inputs/outputs and the analog input consists of the following elements:<br>• Response time on the component itself (approx. 1/2 DRIVE-CLiQ cycle).<br>• Response transmit time via the DRIVE-CLiQ connection (approx. 1 DRIVE-CLiQ cycle).<br>• Evaluation on the control unit (see function diagram).<br>**Reference:**SINAMICS S List Manual – "Function diagrams" chapter | |
| Weight | kg | 0.85 |

# 3.8 DRIVE-CLiQ Hub Module Cabinet 20 (DMC20)

## 3.8.1 Description

The DRIVE-CLiQ Hub Module Cabinet 20 (DMC20) is used for the star-shaped distribution of a DRIVE-CLiQ line. With the DMC20, an axis grouping can be expanded with 4 DRIVE-CLiQ sockets for additional subgroups.

The component is especially suitable for applications which require DRIVE-CLiQ nodes to be removed in groups, without interrupting the DRIVE-CLiQ line and therefore the data exchange.

## 3.8.2 Safety information

**Danger**

The 50 mm clearances above and below the components must be observed.

## 3.8.3 Interface description

### 3.8.3.1 Overview

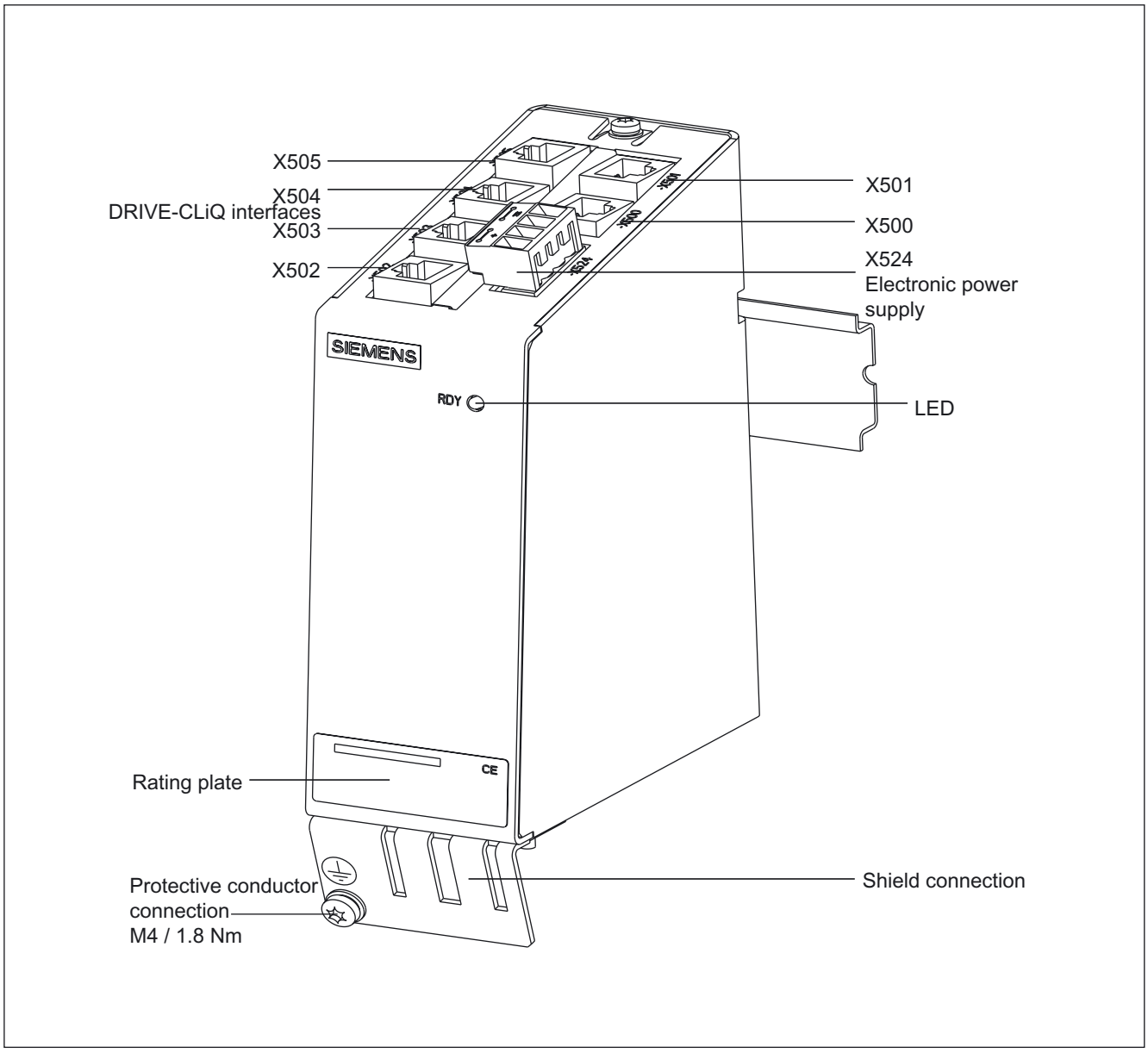
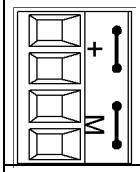



Figure 3-29 Interface description of the DMC20

### 3.8.3.2 Electronics power supply X524

Table 3-47 X524 terminals for the electronics power supply

| | Terminal | Designation | Technical specifications |
|---|---|---|---|
|  | + | Electronic power supply | 24 DC (20.4 – 28.8) |
| | + | N. c. | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2,5 mm$^2$<br>Type: Screw terminal type 2 (see Appendix A) | | | |

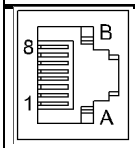
**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ node and digital outputs.

### 3.8.3.3 DRIVE-CLiQ interface

Table 3-48 DRIVE-CLiQ interface X500, X501, X502, X503, X504, X505
Type: RJ45plus socket

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255 | | | |

### 3.8.3.4 Significance of the LED on the DMC20

Table 3-49 Significance of the LED on the DMC20

| LED | Color | Status | Description |
|---|---|---|---|
| READY | - | Off | Electronics power supply outside permissible tolerance range. |
| | Green | Steady light | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Steady light | DRIVE-CLiQ communication is being established. |
| | Red | Steady light | At least one fault is present in this component. |
| | Green<br>Red | Flashing<br>2 Hz | The firmware is being downloaded.<br>Component recognition via LED is activated (po154). |

## 3.8.4 Dimension drawing

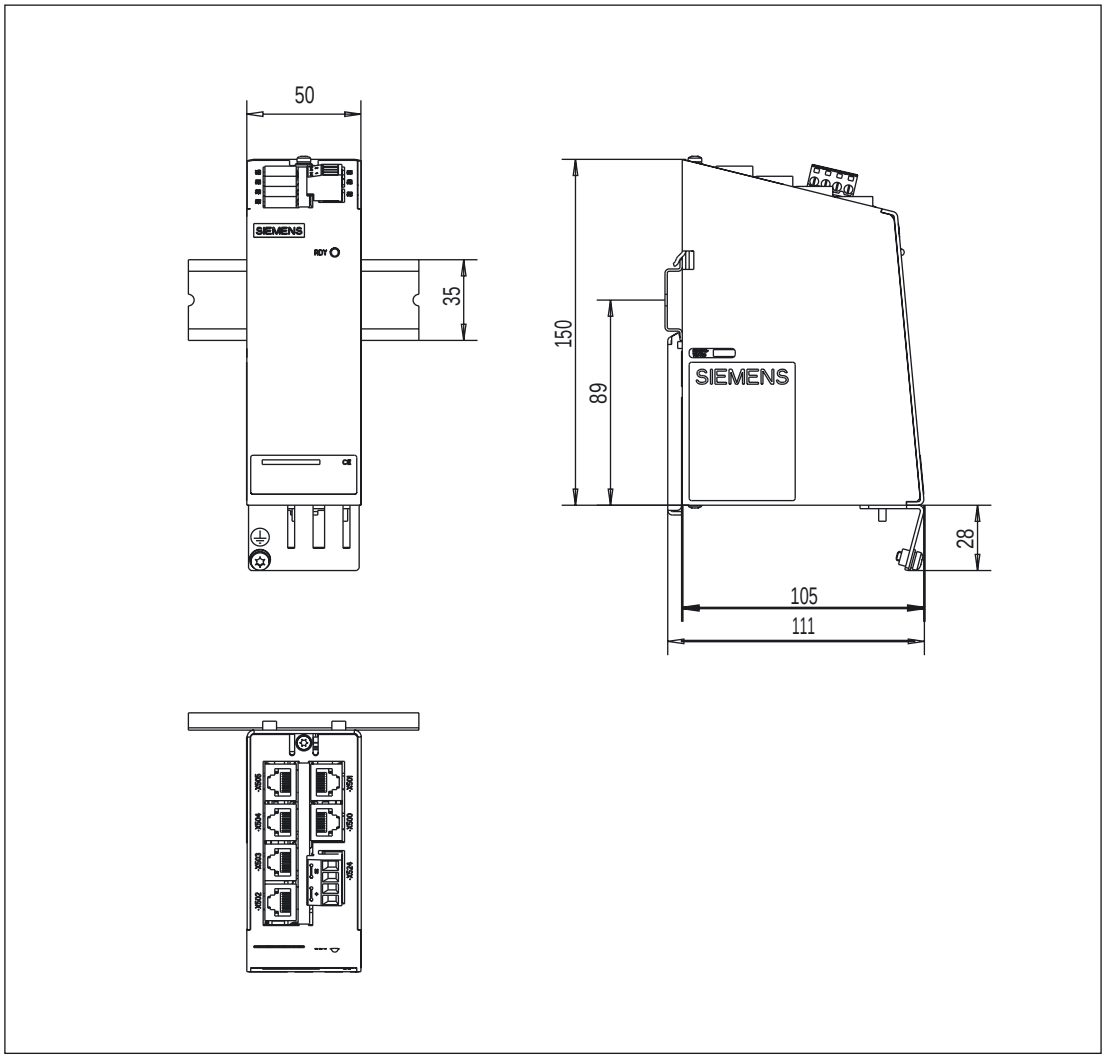



Figure 3-30 Dimension drawing of the DMC20

## 3.8.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

### Removal

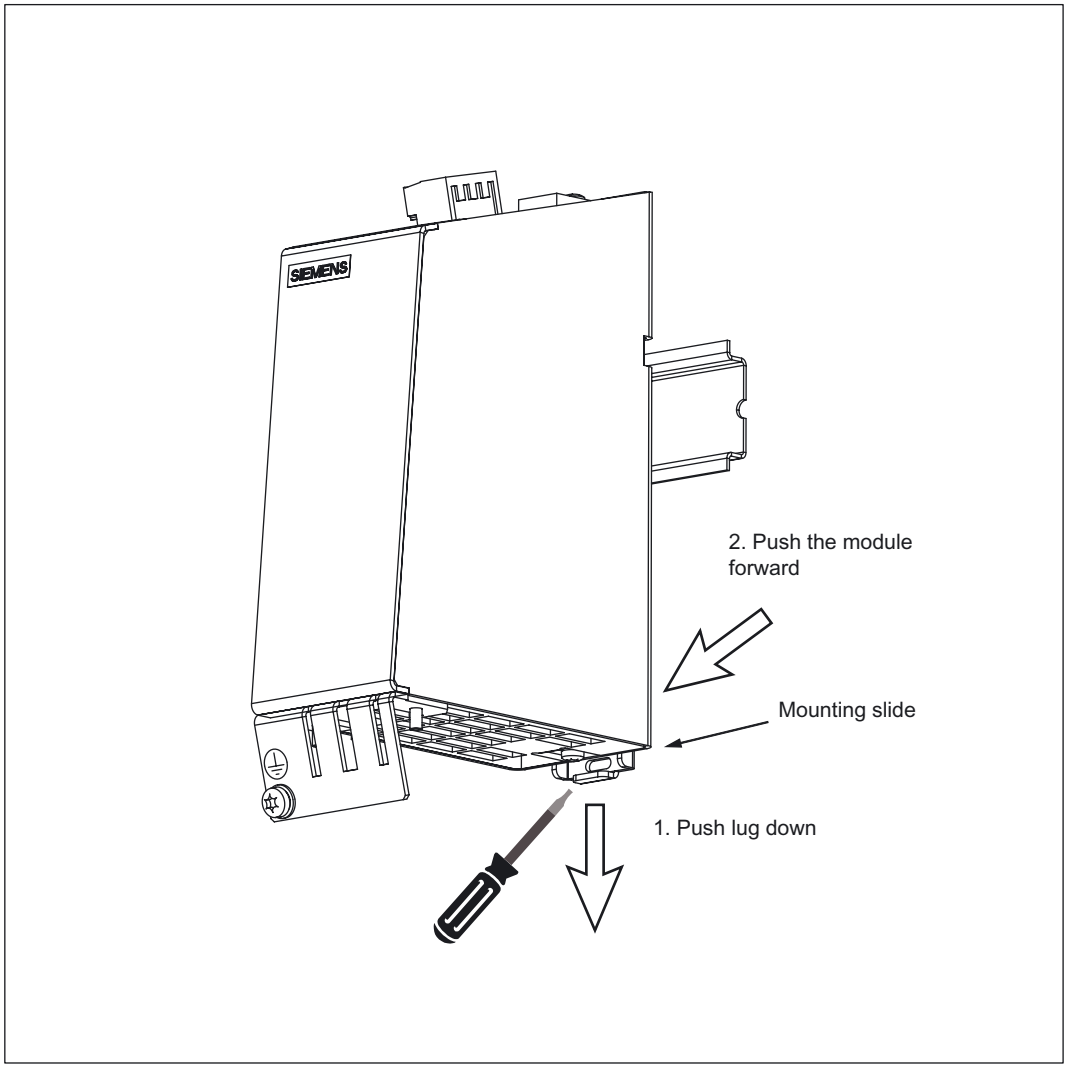



Figure 3-31 Releasing the component from a DIN rail

## 3.8.6 Technical data

Table 3-50 Technical data of the DMC20

| | Units | Value |
|---|---|---|
| Electronic power supply<br>Voltage<br>Current (without DRIVE-CLiQ or digital outputs) | <br>$V_{DC}$<br>$A_{DC}$ | <br>24 DC (20.4 – 28.8)<br>0.5 |
| PE/ground connection | On the housing with M4/1.8 Nm screw | |
| Weight | kg | 0.8 |

# 3.9 Voltage Sensing Module 10 (VSM10)

## 3.9.1 Description

The Voltage Sensing Module 10 (VSM10) is a voltage sensing module that is used to sense the actual value for Active Line Modules and Smart Line Modules from 16 kW and upwards. The Voltage Sensing Module is used to sense the three-phase line supply voltage in front of the line reactor which is then provided to the infeed closed-loop control.

For booksize units, these components can be optionally used to increase the degree of ruggedness against irregularities in the line supply.

In addition to the voltage sensing, a temperature sensor can be connector to the VSM10 to thermally monitor the line reactor. Further, the functionality of the line filter can checked using two analog inputs.

The VSM10 from firmware 2.4 onwards can be used.

Table 3-51 Interface overview of the VSM10

| Type | Number |
|---|---|
| Analog inputs | 2 |
| Line supply voltage connections (690 V) | 3 |
| Line supply voltage connections (100 V) | 3 |
| Temperature sensor input | 1 |

## 3.9.2 Safety information

**Danger**

The 50 mm clearances above and below the components must be observed.

**Notice**

The VSM10 has two terminal strips to sense the three-phase line supply voltage (X521 and X522). The voltage strength of terminal X521 is a maximum of 100 V (phase-to-phase) and is used for voltage sensing via a potential transformer. A maximum voltage to be sensed of up to to 690 V (phase-to-phase) can be directly connected to terminal X522. Only one of the two terminals X521 and X522 may be used. Nothing may be connected to the unused terminal.

**Caution**

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

## 3.9.3 Interface description

### 3.9.3.1 Overview

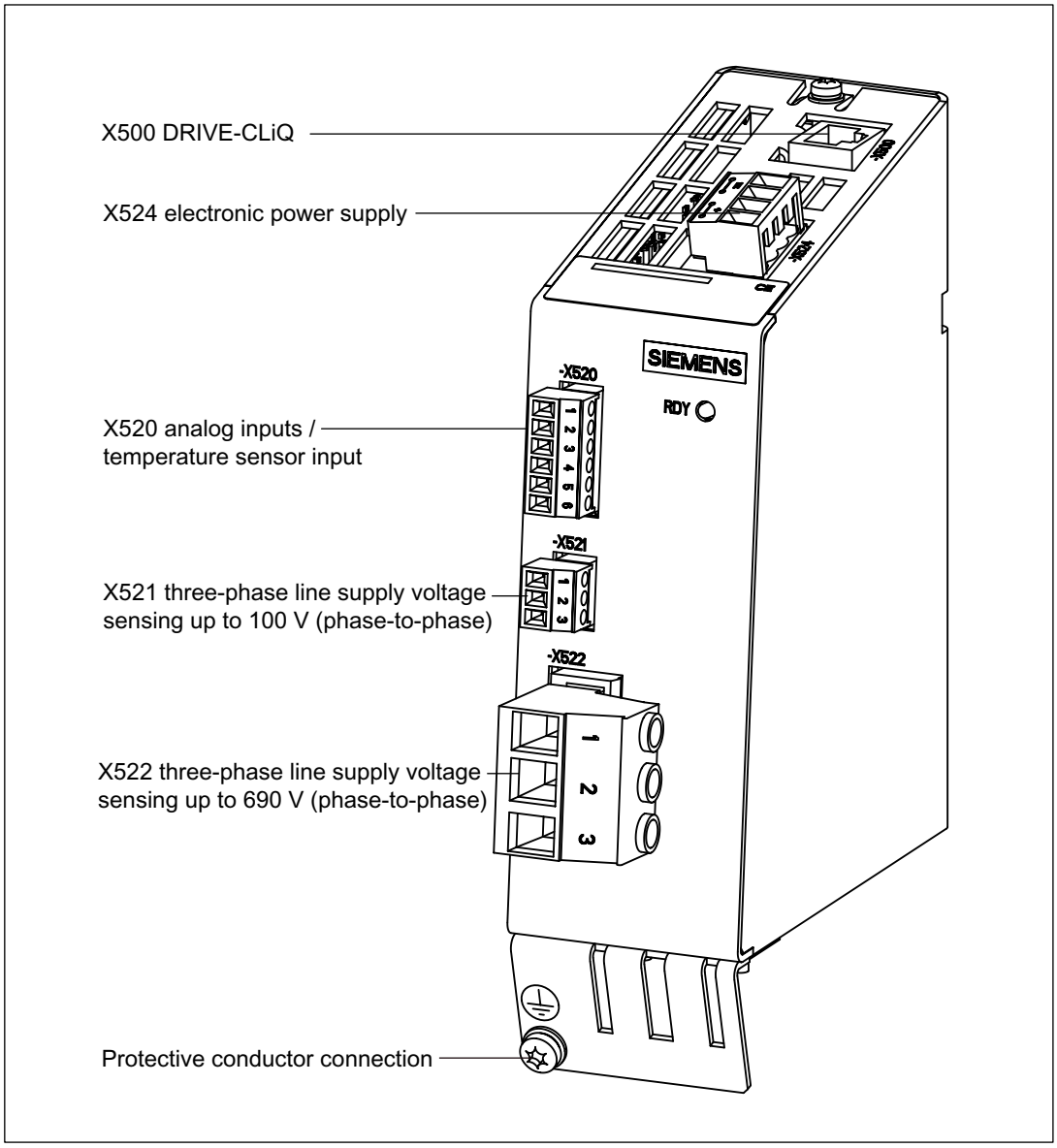



Figure 3-32 Voltage Sensing Module 10 (VSM10)

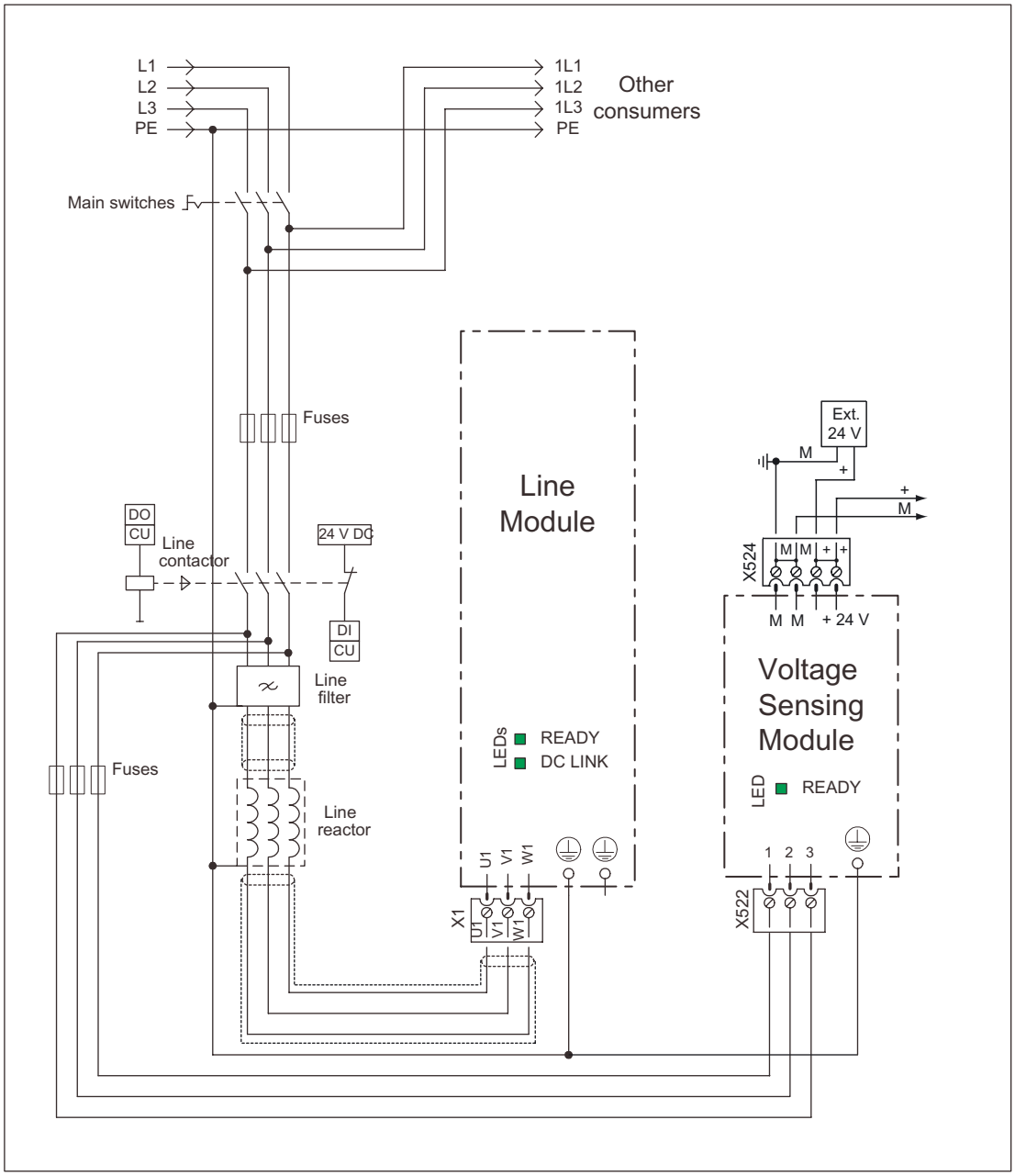
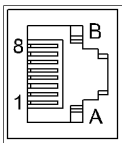



Figure 3-33 Connection example, VSM10

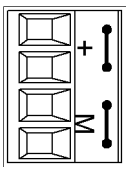
### 3.9.3.2 DRIVE-CLiQ interface X500

Table 3-52 DRIVE-CLiQ interface X500

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255<br>The maximum cable length that can be connected is 50 m. | | | |

### 3.9.3.3 Electronics power supply X524

Table 3-53 Terminals for the electronics power supply

| | Terminal | Designation | Technical specifications |
|---|---|---|---|
|  | + | Electronic power supply | Voltage: 24 V DC (20.4 V – 28.8 V)<br>Current consumption: max. 0,2 A<br><br>Max. current via jumper in connector:<br>20 A at 55 °C |
| | + | Reserved, do not use | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2,5 mm²<br>Type: Screw terminal 2 (see Appendix A)<br>The maximum cable length that can be connected is 10 m. | | | |

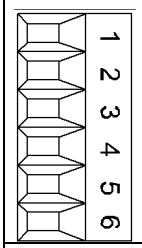
**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

The current consumption increases by the value for the DRIVE-CLiQ node.

### 3.9.3.4 X520 analog inputs/temperature sensor connection

Table 3-54 Terminal block X520

| | Terminal | Designation | Technical specifications |
|---|---|---|---|
|  | 1 | AI 0+ | 2 analog differential inputs +/- 10V to monitor the line filter resonance<br>Resolution: 12 bits |
| | 2 | AI 0- | |
| | 3 | AI 1+ | |
| | 4 | AI 1- | |
| | 5 | +Temp | Temperature sensor connection KTY84-1C130/PTC |
| | 6 | -Temp | |
| Max. connectable cross-section: 1.5 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

**Note**

In order to minimize noise emission, shielded cables should be used.

**Caution**

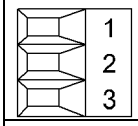
The common mode range may not be violated. This means that the analog differential voltage signals can have a maximum offset voltage of +/-30 V with respect to the ground potential. If the range is infringed, incorrect results may occur during analog/digital conversion.

### 3.9.3.5 X521 three-phase line supply voltage sensing up to 100 V (phase-to-phase)

This interface is not relevant for booksize units.

### 3.9.3.6 X522 three-phase line supply voltage sensing up to 690 V (phase-to-phase)

Table 3-55 Terminal block X522

| | Terminal | Designation | Technical specifications |
|---|---|---|---|
|  | 1 | Phase voltage U | Directly connected to sense the line supply voltage |
| | 2 | Phase voltage V | |
| | 3 | Phase voltage W | |
| Max. connectable cross-section: 6 mm²<br>Type: Screw terminal 1 (see Appendix A) | | | |

**Notice**

Only one of the two terminals X521 and X522 may be used. Nothing may be connected to the unused terminal.

**Notice**

The line phases must be connected to the VSM10 with the same sequence as that of the Line Module. If this is not observed, when the Line Module is enabled, overcurrents can occur.

**Notice**

If the configuration has a line filter, then the phase voltages for the VSM (X522) must be taken from in front of the line filter. If the configuration does not have a line filter, then X522 must be connected to the line side of the line reactor (voltages are taken from in front of the line reactor).

### 3.9.3.7 Significance of the LEDs for the Voltage Sensing Module 10 (VSM10)

Table 3-56 Significance of the LEDs on the VSM10

| LED | Color | Status | Description |
|---|---|---|---|
| RDY | --- | Off | The electronics power supply is missing or lies outside permissible tolerance range. |
| | Green | Steady light | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Steady light | DRIVE-CLiQ communication is being established. |
| | Red | Steady light | At least one fault is present in this component. |
| | Green / red | 2 Hz flashing light | Firmware is being downloaded. |
| | Green orange<br>or<br>red orange | 2 Hz flashing light | Detection of the components via LED is activated (p0144).<br>Note:<br>Both options depend on the LED status when module recognition is activated via p0144 = 1. |

## 3.9.4 Dimension drawing

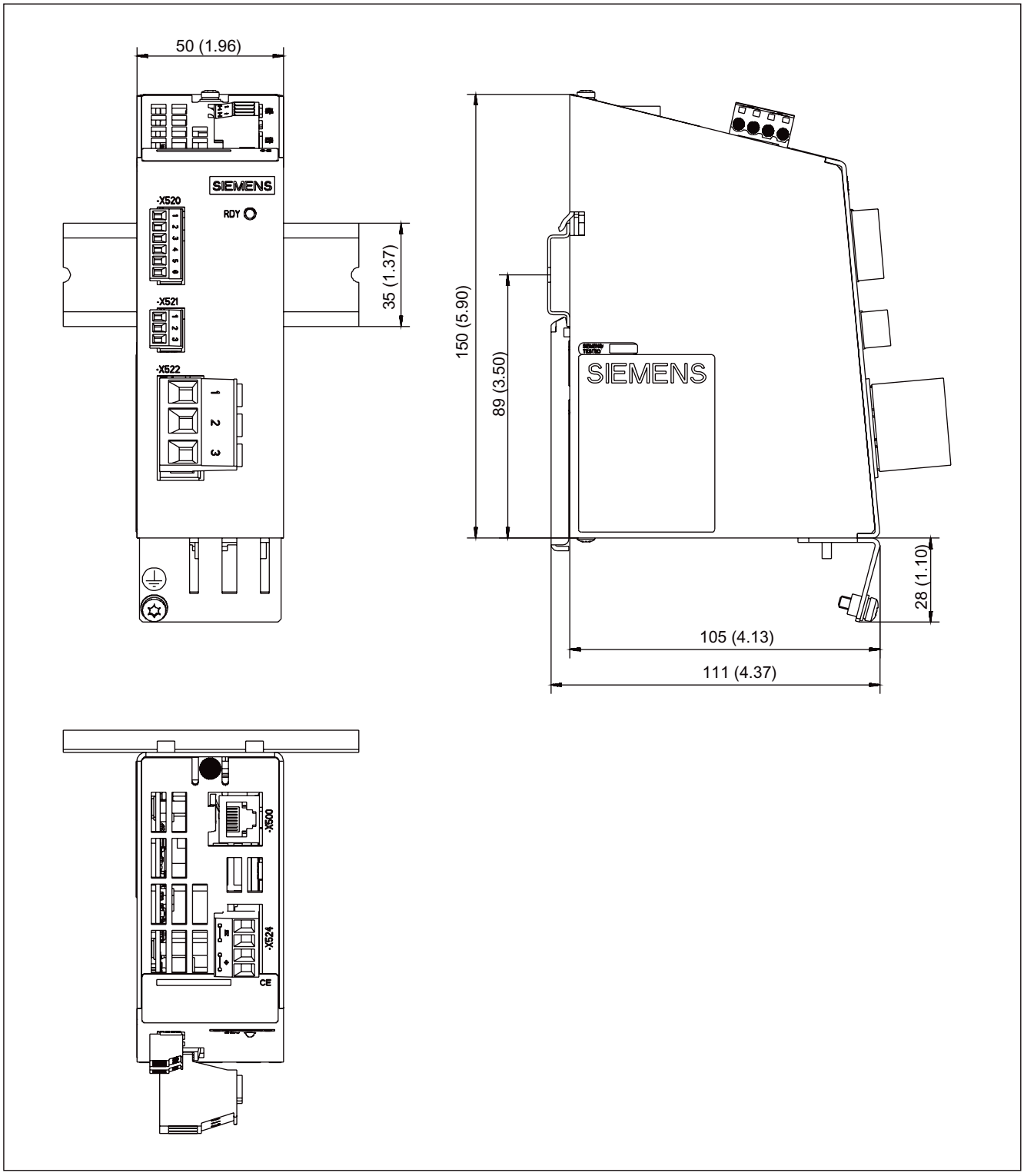



Figure 3-34 Dimension drawing: Voltage Sensing Module

## 3.9.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

### Removal

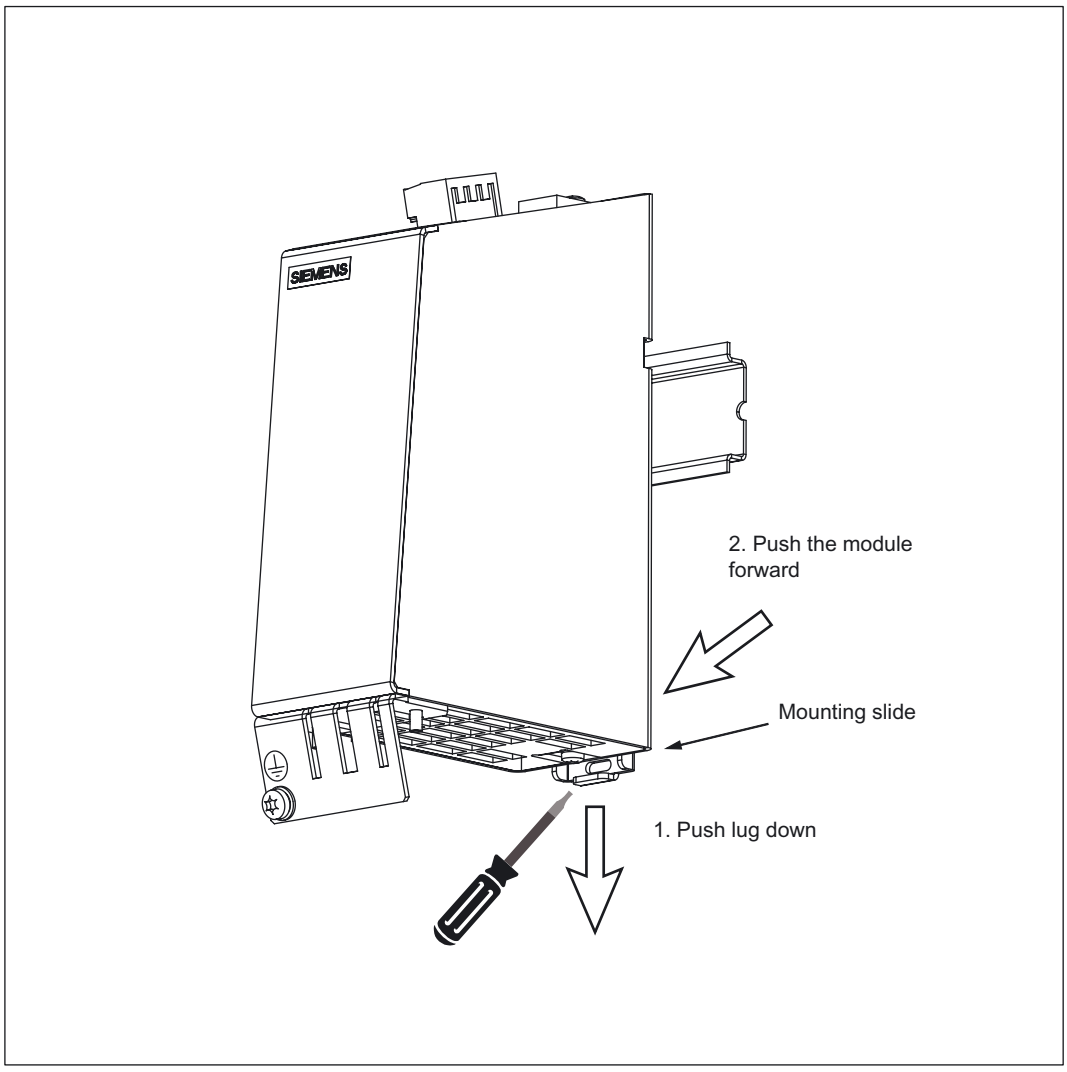



Figure 3-35 Releasing the component from a DIN rail

## 3.9.6 Electrical Connection

### Shield contact for components from Weidmüller

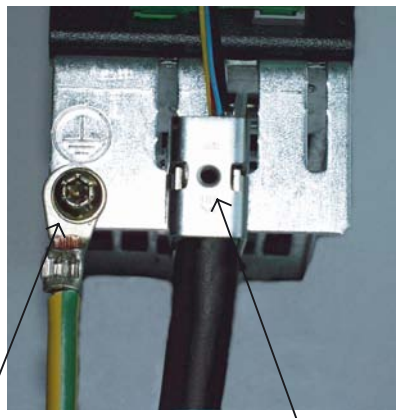



Figure 3-36 Shield contacts

### Internet address of the company:

Weidmüller: http://www.weidmueller.com/

## 3.9.7 Technical data

Table 3-57 Technical data

| | Units | Value |
|---|---|---|
| Electronic power supply | | |
| Voltage | $V_{DC}$ | 24 DC (20.4 – 28.8) |
| Current (without DRIVE-CLiQ or digital outputs) | $A_{DC}$ | 0.3 |
| Power loss | W | <10 |
| PE/ground connection | On the housing with M4, 1.8 Nm screw | |
| Weight | kg | 1 |

# Encoder system connection

# 4

## 4.1 Introduction

The sensor system should be connected to SINAMICS S120 via DRIVE-CLiQ.

Motors with DRIVE-CLiQ interfaces (e.g. synchronous motors 1FK7 and 1FT6, and induction motors 1PH7) are designed for this purpose.

These motors with DRIVE-CLiQ interfaces can be connected to the associated Motor Module via the available MOTION-CONNECT DRIVE-CLiQ cables. In this way, the motor sensor and temperature signals as well as the electronic type plate data, such as the unique identification number, rated data (voltage, current and torque) are transferred directly to the Control Unit. These motors simplify commissioning and diagnosis because the motor and sensor type are identified automatically.

### Motors without DRIVE-CLiQ interfaces

The sensor and temperature signals from motors without DRIVE-CLiQ interfaces, as well as external sensors must be connected via Sensor Modules. Presently, Sensor Modules Cabinet-Mounted are available, which can be directly mounted in the control cabinets and Sensor Modules External for mounting outside the control cabinets.

Only one encoder system can be connected to each Sensor Module.

### Motors with DRIVE-CLiQ interfaces

The encoder systems can be connected to SINAMICS S120 via DRIVE-CLiQ. Motors with DRIVE-CLiQ interface are available for this purposes, e.g. 1FK7 synchronous motor.

Motors with DRIVE-CLiQ interfaces can be directly connected to the associated Motor Module via the available MOTION-CONNECT DRIVE-CLiQ cables. The connection of the MOTION-CONNECT DRIVE-CLiQ cable at the motor has degree of protection IP67.

The DRIVE-CLiQ interface supplies the motor encoder via the integrated 24 V DC supply and transfers the motor encoder and temperature signals and the electronic rating plate data, e.g. a unique identification number, rated data (voltage, current, torque) directly to the Control Unit. This means that for the various encoder types - e.g. resolver or absolute value encoder - different encoder cables are no longer required; just one MOTION-CONNECT DRIVE-CLiQ cable can be used for all types.

### Further information

Motor sensors and temperature signals should preferably be connected to the associated Motor Module, while external sensors should be connected to the Control Unit.

# 4.2 Overview of Sensor Modules

## 4.2.1 Description

### Sensor Modules Cabinet-Mounted (SMC)

Cabinet-mounted Sensor Modules (SMC) can be ordered and configured separately. They are used when a motor with a DRIVE-CLiQ interface is not available and when external sensors in addition to the motor sensor are required. Only one sensor system can be connected to each cabinet-mounted Sensor Module (SMC). Only sensor systems in which the power supply for the sensor system is not grounded may be connected.

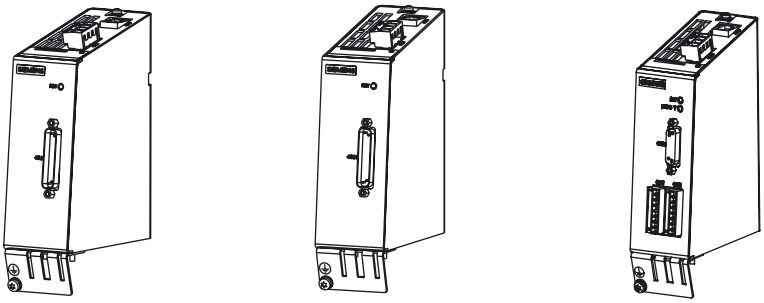



Figure 4-1 Sensor Modules Cabinet-Mounted (SMC)

## Sensor Module External (SME)

Measuring systems outside the cabinet can be connected directly to the Sensor Module External (SME). The SME evaluates these measuring systems and converts the calculated values to DRIVE-CLiQ. No motor or sensor data is stored in the SME.

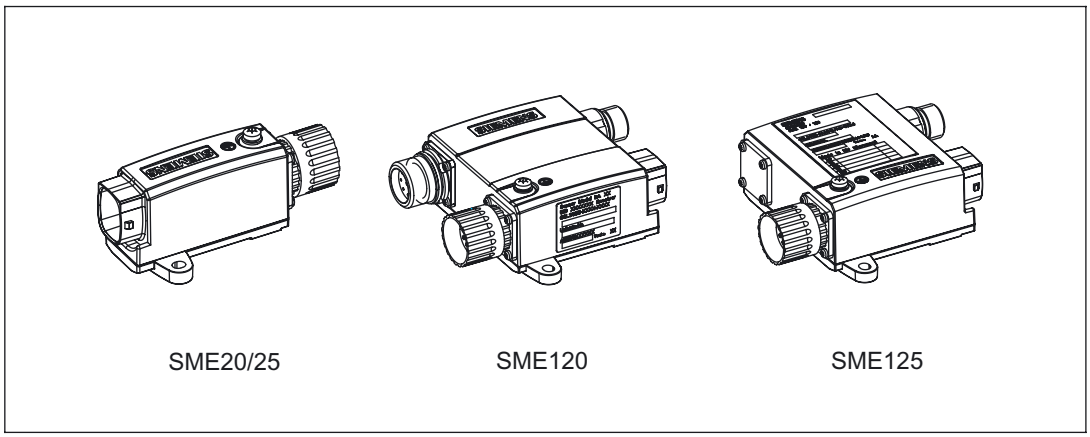



Figure 4-2 Sensor Module External (SME)

## Connectable sensor systems

Table 4-1 Connectable sensor systems

| | SMC | | | SME | | | |
|---|---|---|---|---|---|---|---|
| **Measuring systems** | **SMC10** | **SMC20** | **SMC30** | **SME20** | **SME25** | **SME120** | **SME125** |
| Resolver | Yes | - | - | - | - | - | - |
| Incremental encoder sin/cos (1 Vpp) with reference signal | - | Yes | - | Yes | - | Yes | - |
| Incremental encoder sin/cos (1 Vpp) without reference signal | - | Yes | - | Yes | Yes | Yes | Yes |
| Absolute encoder EnDat | - | Yes | - | - | Yes | - | Yes |
| Incremental encoder TTL/HTL | - | - | Yes | - | - | - | - |
| SSI absolute encoder [1)] | - | Yes | Yes | - | - | - | - |
| Temperature evaluation | Yes | Yes | Yes | - | - | Yes (electrically isolated) | Yes (electrically isolated) |

[1)]As of Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

## 4.2.2 Sensor Connections

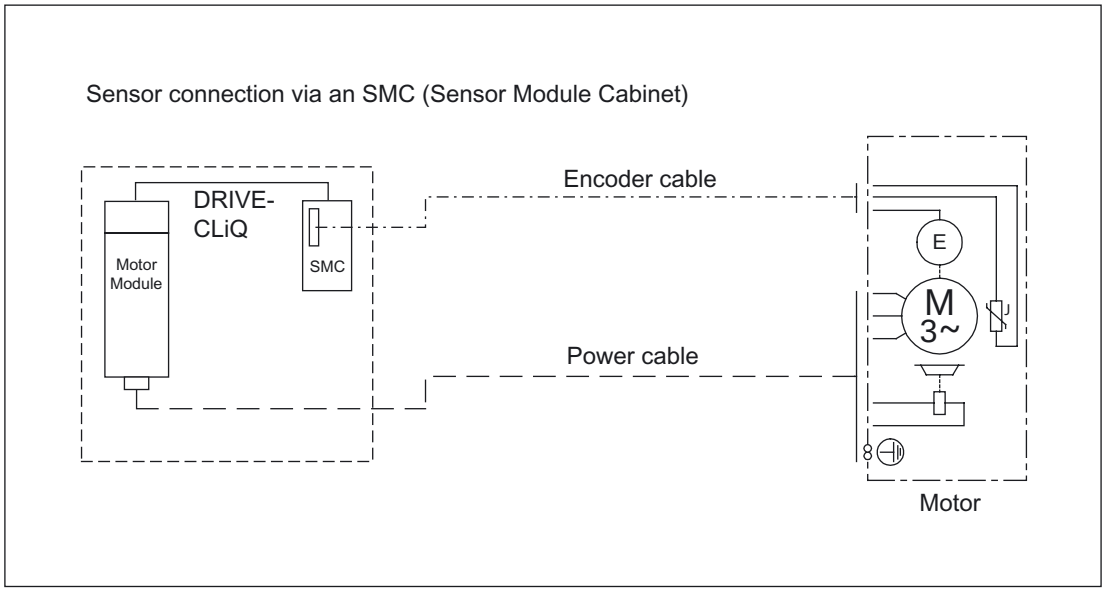



Figure 4-3 Sensor connection via an SMC (Sensor Module Cabinet)

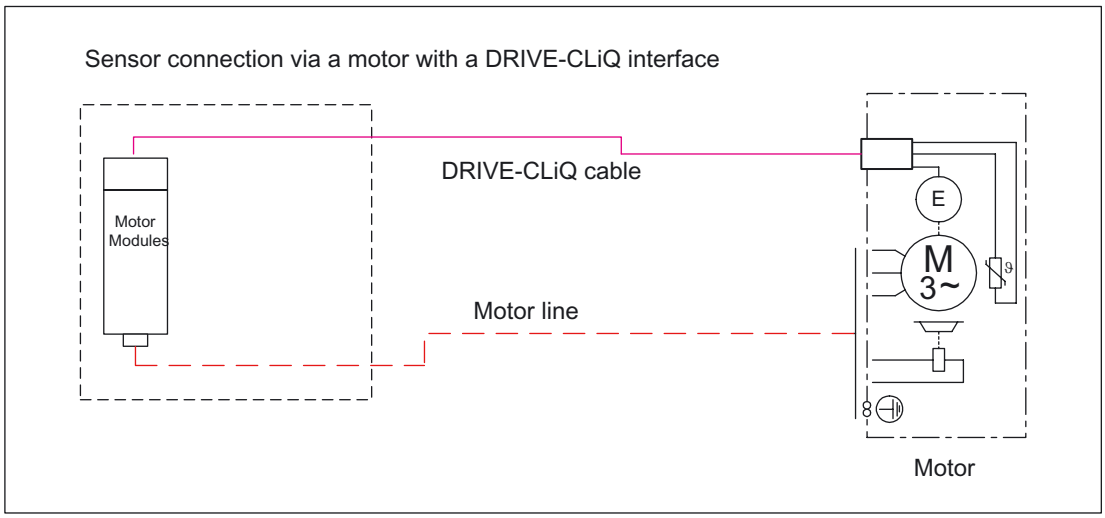



Figure 4-4 Sensor connection via a motor with a DRIVE-CLiQ interface

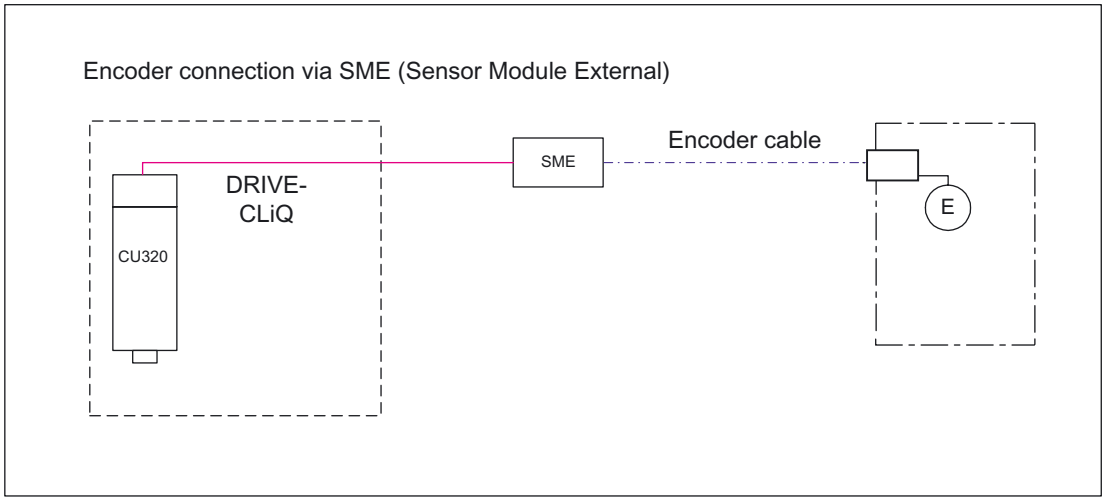



Figure 4-5 Sensor connection via an SME (Sensor Module External)

# 4.3 Sensor Module Cabinet 10 (SMC10)

## 4.3.1 Description

The Sensor Module Cabinet-Mounted 10 (SMC10) evaluates encoder signals and transmits the speed, actual position value, rotor position and, if necessary, the motor temperature via DRIVE-CLiQ to the Control Unit.

The SMC10 can be operated from firmware 2.2 and higher

The SMC10 is used to evaluate sensor signals from resolvers.

Table 4-2 Specification

| | Value |
|---|---|
| Transmission ratio of the resolver | ü = 0.5 |
| Exciting voltage on the SMC10 when ü=0.5 | 4.1 Vrms |
| Amplitude monitoring threshold (secondary tracks) of the SMC10 | 1 Vrms |

The excitation voltage is 4.1 V and cannot be parameterized.

The excitation frequency is synchronized to the current controller clock cycle and lies in the range from 5 kHz to 10 kHz.

The ratio between ohmic resistance R and inductance L determines whether the resolver can be evaluated with the SMC10. See the following diagram:

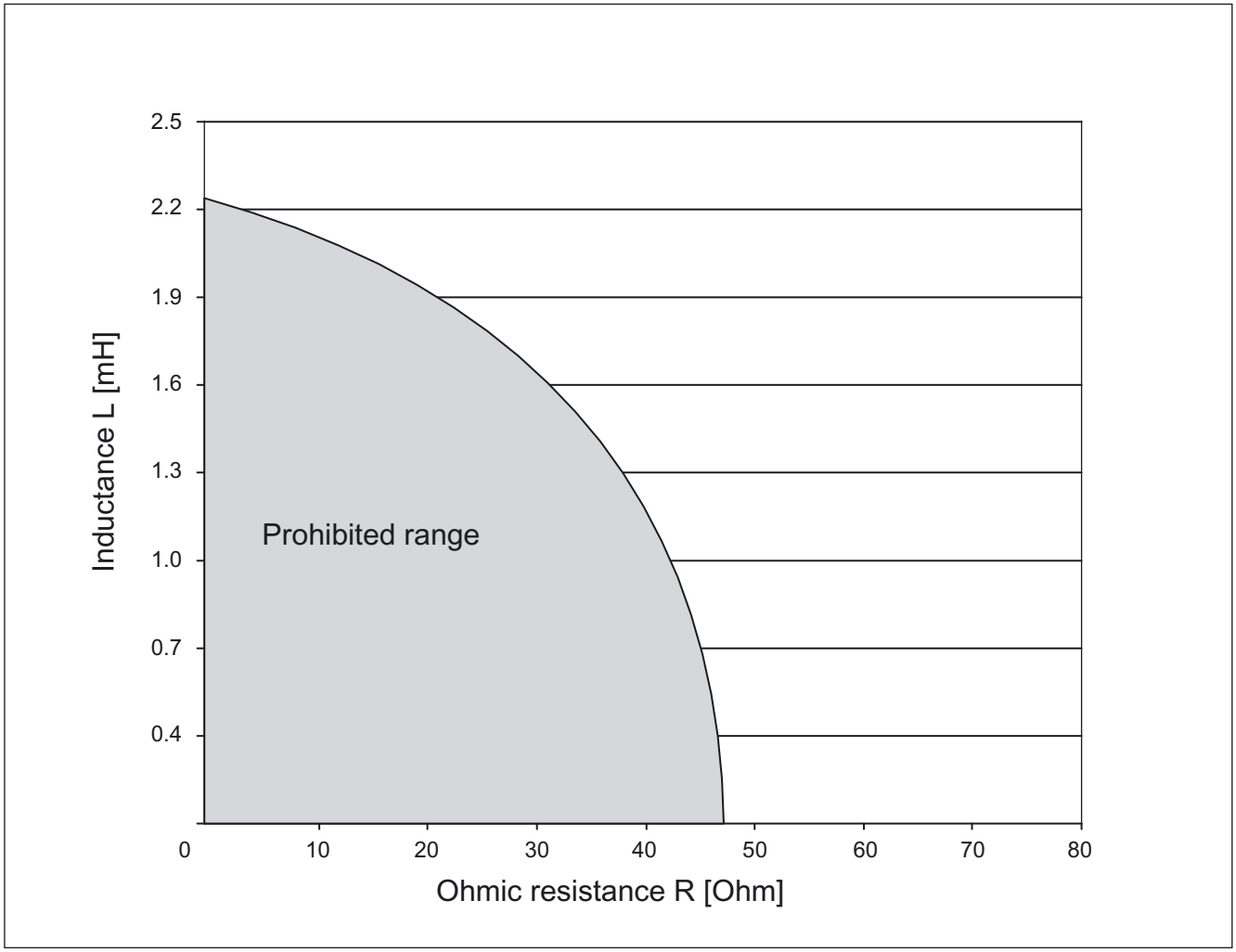



Figure 4-6 Connectable impedances with an exciting frequency f = 5000 Hz

The maximum sensor cable length is 130 m.

The component is snapped on to a mounting rail according to DIN 50022.

## 4.3.2 Safety Information

**Caution**

The 50 mm clearances above and below the components must be observed.

**Notice**

Only one measuring system can be connected to each Sensor Module.

**Note**

It is not permissible that there is an electrical connection between the measuring system housing and the measuring system electronics (most encoder systems fulfill this requirement). If this not carefully taken into consideration under certain circumstances, the system cannot reach the required noise immunity (danger of equalizing currents through the electronics ground).

**Caution**

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

## 4.3.3 Interface description

### 4.3.3.1 Overview

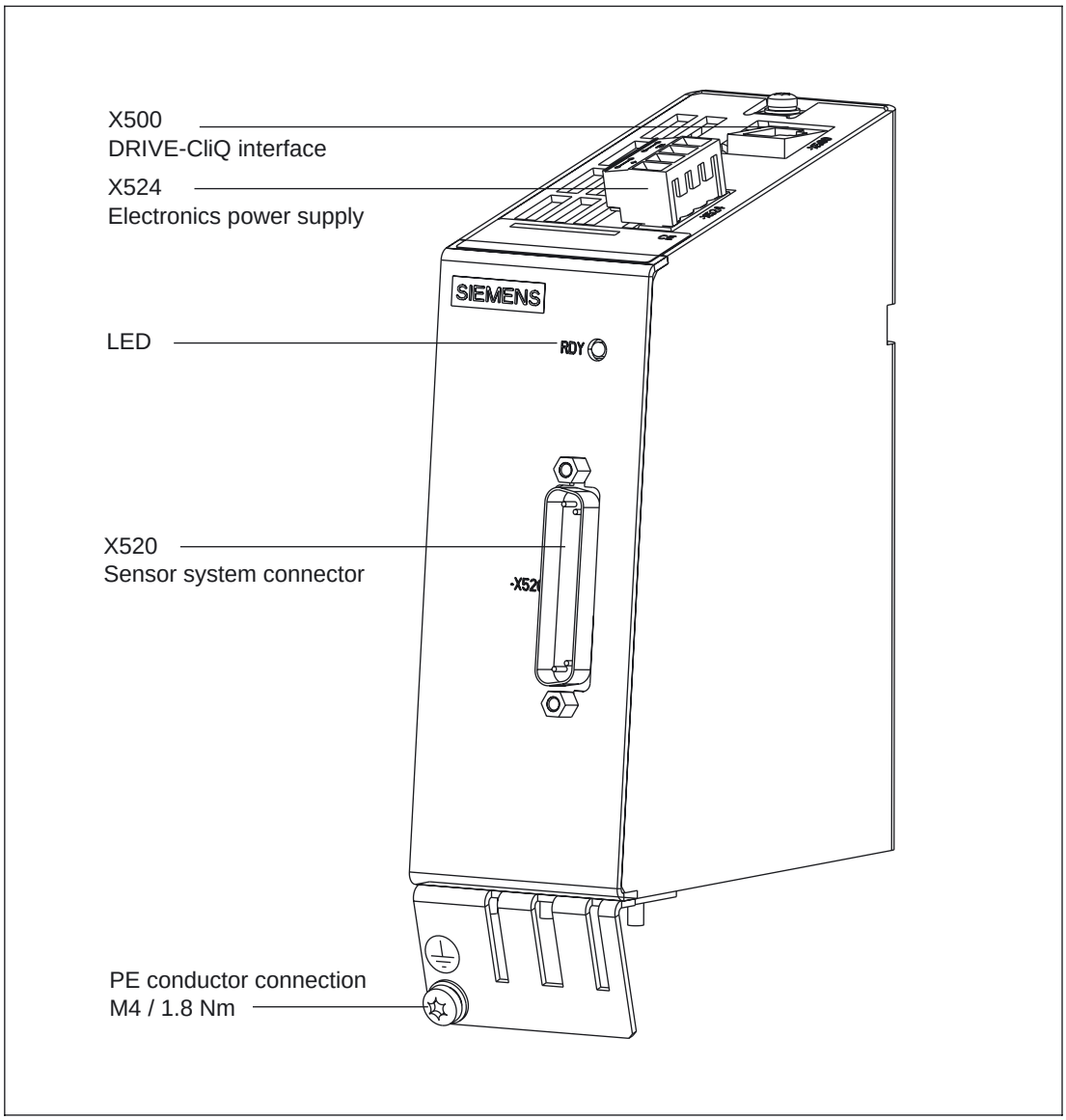
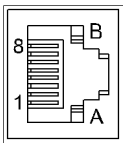



Figure 4-7 Interface description of the SMC10

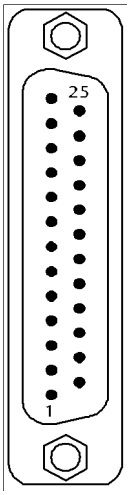
### 4.3.3.2 DRIVE-CLiQ interface X500

Table 4-3 DRIVE-CLiQ interface X500

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | Reserved, do not use | |
| | B | GND (0 V) | Electronic ground |

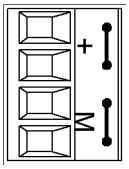
### 4.3.3.3 X520 sensor system

Table 4-4 Sensor interface X520

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | Reserved, do not use | |
| | 2 | Reserved, do not use | |
| | 3 | A (sin+) | Resolver signal A |
| | 4 | A* (sin-) | Inverted resolver signal A |
| | 5 | Ground | Ground (for internal shield) |
| | 6 | B (cos+) | Resolver signal B |
| | 7 | B* (cos-) | Inverted resolver signal B |
| | 8 | Ground | Ground (for internal shield) |
| | 9 | RESP | Resolver excitation positive |
| | 10 | Reserved, do not use | |
| | 11 | RESN | Resolver excitation negative |
| | 12 | Reserved, do not use | |
| | 13 | +Temp | Motor temperature measurement KTY+ |
| | 14 | Reserved, do not use | |
| | 15 | Reserved, do not use | |
| | 16 | Reserved, do not use | |
| | 17 | Reserved, do not use | |
| | 18 | Reserved, do not use | |
| | 19 | Reserved, do not use | |
| | 20 | Reserved, do not use | |
| | 21 | Reserved, do not use | |
| | 22 | Reserved, do not use | |
| | 23 | Reserved, do not use | |
| | 24 | Ground | Ground (for internal shield) |
| | 25 | -Temp | Motor temperature measurement KTY- |

### 4.3.3.4 Electronics power supply X524

Table 4-5 Terminal block X524

| | Terminal | Function | Technical specifications |
|---|---|---|---|
|  | + | Electronics power supply | Voltage: 24 V (20.4 V – 28.8 V)<br>Current consumption: max. 0.35 A<br>Maximum current via jumper in connector: 20 A at 55°C |
| | + | Electronics power supply | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2.5 mm²<br>Type: Screw terminal 2 (see Appendix) | | | |

**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

### 4.3.3.5 Description of the LEDs on the SMC10

Table 4-6 Description of the LEDs on the SMC10

| LED | Color | State | Technical specifications |
|---|---|---|---|
| RDY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Steady light | DRIVE-CLiQ communication is being established. |
| | Red | Steady light | At least one fault is present in this component. **Note:**<br>LED is driven irrespective of the corresponding messages being reconfigured. |
| | Green/<br>Red | Flashing<br>2 Hz | Firmware is being downloaded. |
| | Green/<br>Orange<br>or<br>Red/ Orange | Flashing<br>2 Hz | Component recognition via LED is activated (p0144)<br>**Note:**<br>Both options depend on the LED status when component recognition is activated via p0144 = 1. |

### Cause and rectification of faults

The following reference contains further information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S, Commissioning Manual

## 4.3.4 Dimension Drawing

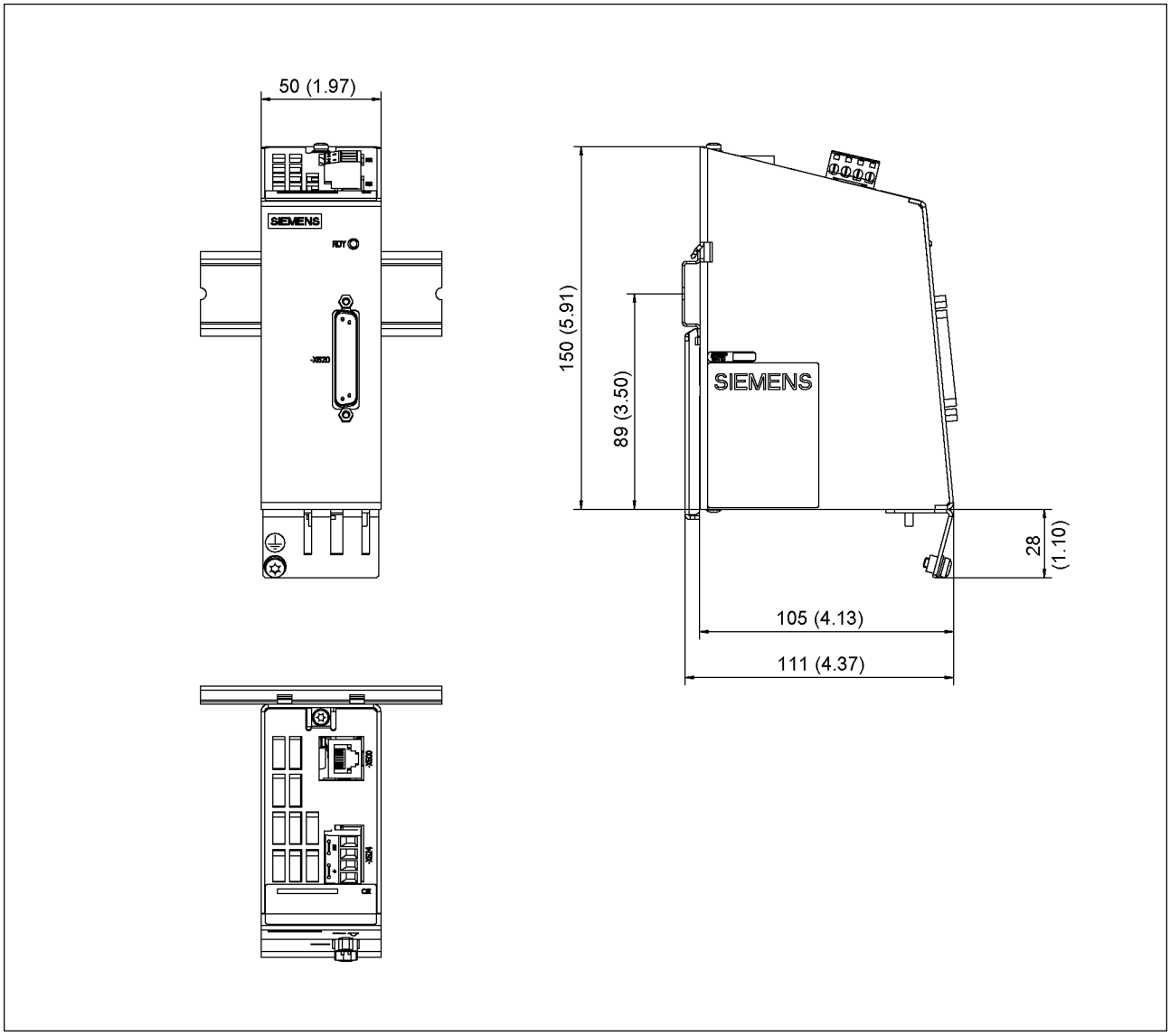



Figure 4-8 Dimension drawing of the SMC10

## 4.3.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

### Removal

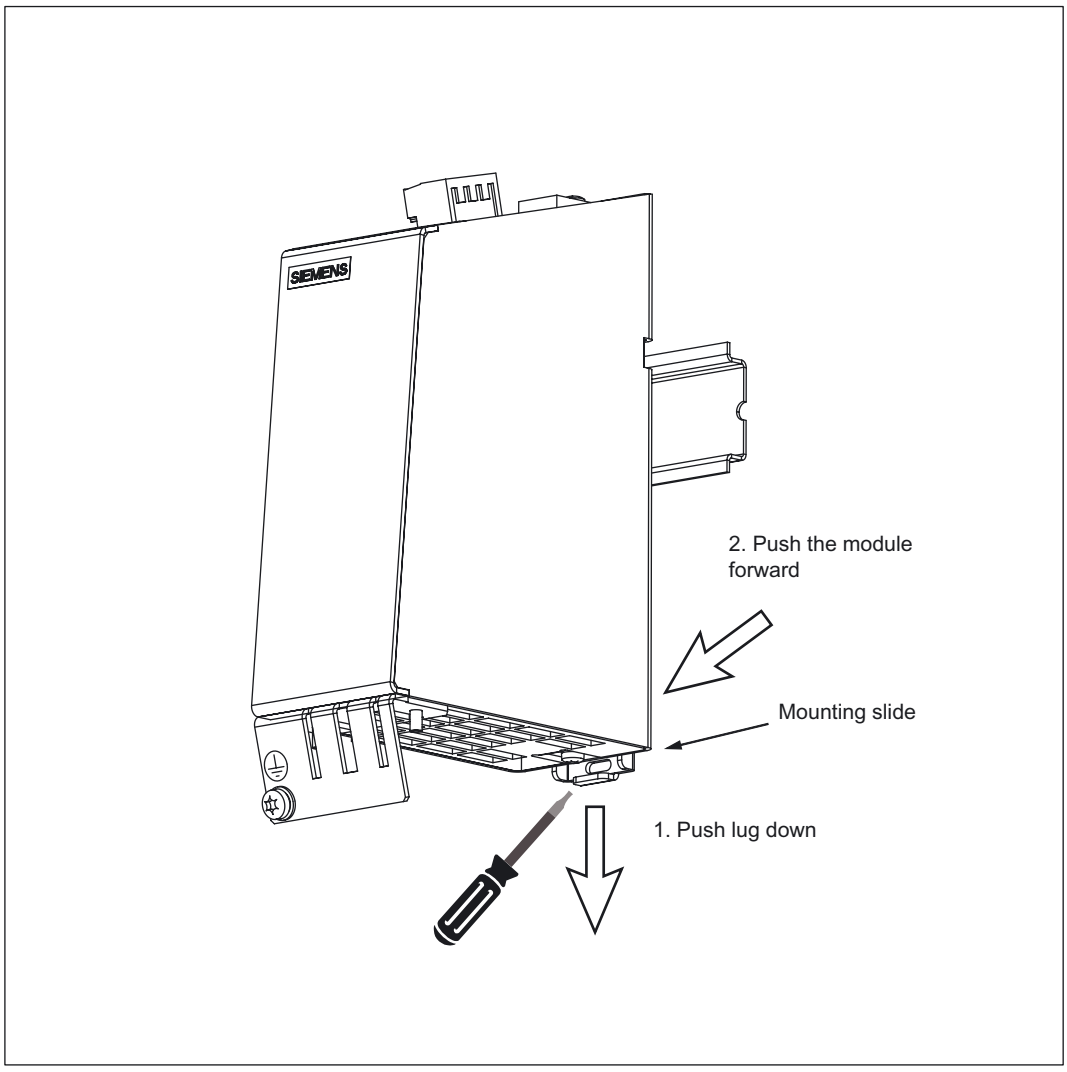



Figure 4-9 Releasing the component from a DIN rail

## 4.3.6 Technical data

Table 4-7 Technical data

| | Unit | Value |
|---|---|---|
| Electronics power supply | | |
| Voltage | $V_{DC}$ | 24 DC (20.4 – 28.8) |
| Current | $A_{DC}$ | max. 0.3 |
| PE/ground connection | At the housing with M4/1.8 Nm screw | |
| Weight | kg | 0.8 |
| Degree of protection | IP20 or IPXXB | |

# 4.4 Sensor Module Cabinet 20 (SMC20)

## 4.4.1 Description

The Sensor Module Cabinet-Mounted 20 (SMC20) evaluates encoder signals and transmits the speed, actual position value, rotor position and, if necessary, the motor temperature and reference point via DRIVE-CLiQ to the Control Unit.

Encoders that can be connected are incremental SIN/COS (1 Vpp) and absolute encoders with EnDat and SSI (with 5 V operating voltage).

The maximum sensor cable length is 100 m.

The component is snapped on to a mounting rail according to DIN 50022.

The SMC20 can be operated from Firmware 2.2 onwards

## 4.4.2 Safety Information

**Caution**

The 50 mm clearances above and below the components must be observed.

**Notice**

Only one measuring system can be connected to each Sensor Module.

**Note**

It is not permissible that there is an electrical connection between the measuring system housing and the measuring system electronics (most encoder systems fulfill this requirement). If this not carefully taken into consideration under certain circumstances, the system cannot reach the required noise immunity (danger of equalizing currents through the electronics ground).

**Caution**

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

## 4.4.3 Interface description

### 4.4.3.1 Overview

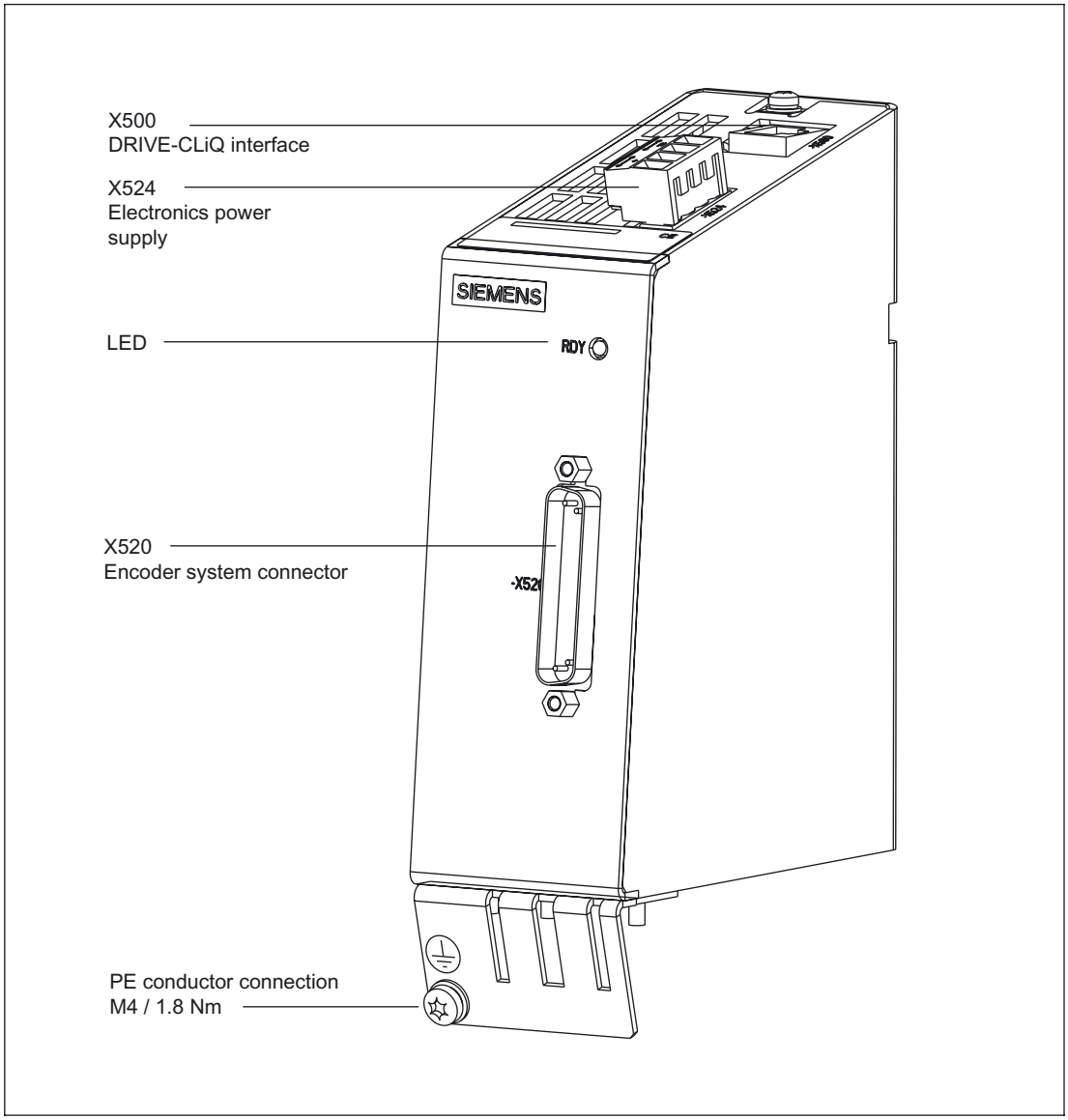
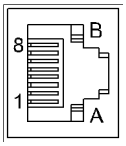



Figure 4-10 Interface description of the SMC20

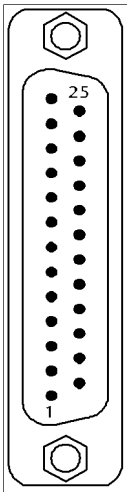
### 4.4.3.2 DRIVE-CLiQ interface X500

Table 4-8 DRIVE-CLiQ interface X500

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | Reserved, do not use | |
| | B | GND (0 V) | Electronic ground |

### 4.4.3.3 X520 sensor system

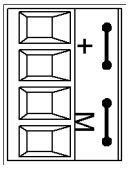
Table 4-9 Sensor interface X520

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | P encoder | Sensor power supply |
| | 2 | M encoder | Ground for sensor power supply |
| | 3 | A | Resolver signal A |
| | 4 | A* | Inverted resolver signal A |
| | 5 | Ground | Ground (for internal shield) |
| | 6 | B | Resolver signal B |
| | 7 | B* | Inverted resolver signal B |
| | 8 | Ground | Ground (for internal shield) |
| | 9 | Reserved, do not use | |
| | 10 | EnDat_Clock,<br>SSI_Clock | Clock, EnDat interface,<br>SSI clock[1)] |
| | 11 | Reserved, do not use | |
| | 12 | EnDat_Clock*,<br>SSI_Clock* | Inverted clock, EnDat interface,<br>Inverted SSI clock[1)] |
| | 13 | +Temp | Motor temperature measurement KTY+/PTC |
| | 14 | 5 V Sense | Sense input sensor power supply |
| | 15 | EnDat_Data,<br>SSI_Data | Data, EnDat interface,<br>SSI data[1)] |
| | 16 | 0 V Sense | Ground sense input sensor power supply |
| | 17 | R | Reference signal R |
| | 18 | R* | Inverted reference signal R |
| | 19 | C | Absolute track signal C |
| | 20 | C* | Inverted absolute value signal C |
| | 21 | D | Absolute track signal D |
| | 22 | D* | Inverted absolute track signal D |
| | 23 | EnDat_Data*,<br>SSI_Data* | Inverted data, EnDat interface,<br>Inverted SSI data |
| | 24 | Ground | Ground (for internal shield) |
| | 25 | -Temp | Motor temperature measurement KTY-/PTC |

[1)] Only from Firmware 2.4 onwards

### 4.4.3.4 Electronics power supply X524

Table 4-10 Terminal block X524

| | Terminal | Function | Technical specifications |
|---|---|---|---|
|  | + | Electronics power supply | Voltage: 24 V (20.4 V – 28.8 V)<br>Current consumption: max. 0,35 A<br>Maximum current via jumper in connector: 20 A at 55°C |
| | + | Electronics power supply | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2.5 mm²<br>Type: Screw terminal 2 (see Appendix A) | | | |



**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

### 4.4.3.5 Description of the LEDs on the SMC20

Table 4-11 Description of the LEDs on the SMC20

| LED | Color | State | Technical specifications |
|---|---|---|---|
| RDY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. |
| | Green | Steady light | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Steady light | DRIVE-CLiQ communication is being established. |
| | Red | Steady light | At least one fault is present in this component. **Note:**<br>LED is driven irrespective of the corresponding messages being reconfigured. |
| | Green/<br>Red | Flashing<br>2 Hz | Firmware is being downloaded. |
| | Green/<br>Orange<br>or<br>Red/ Orange | Flashing<br>2 Hz | Component recognition via LED is activated (p0144)<br>**Note:**<br>Both options depend on the LED status when component recognition is activated via p0144 = 1. |

#### 4.4.3.6 Reference

### Cause and rectification of faults

The following reference contains further information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S, Commissioning Manual

## 4.4.4 Dimension Drawing

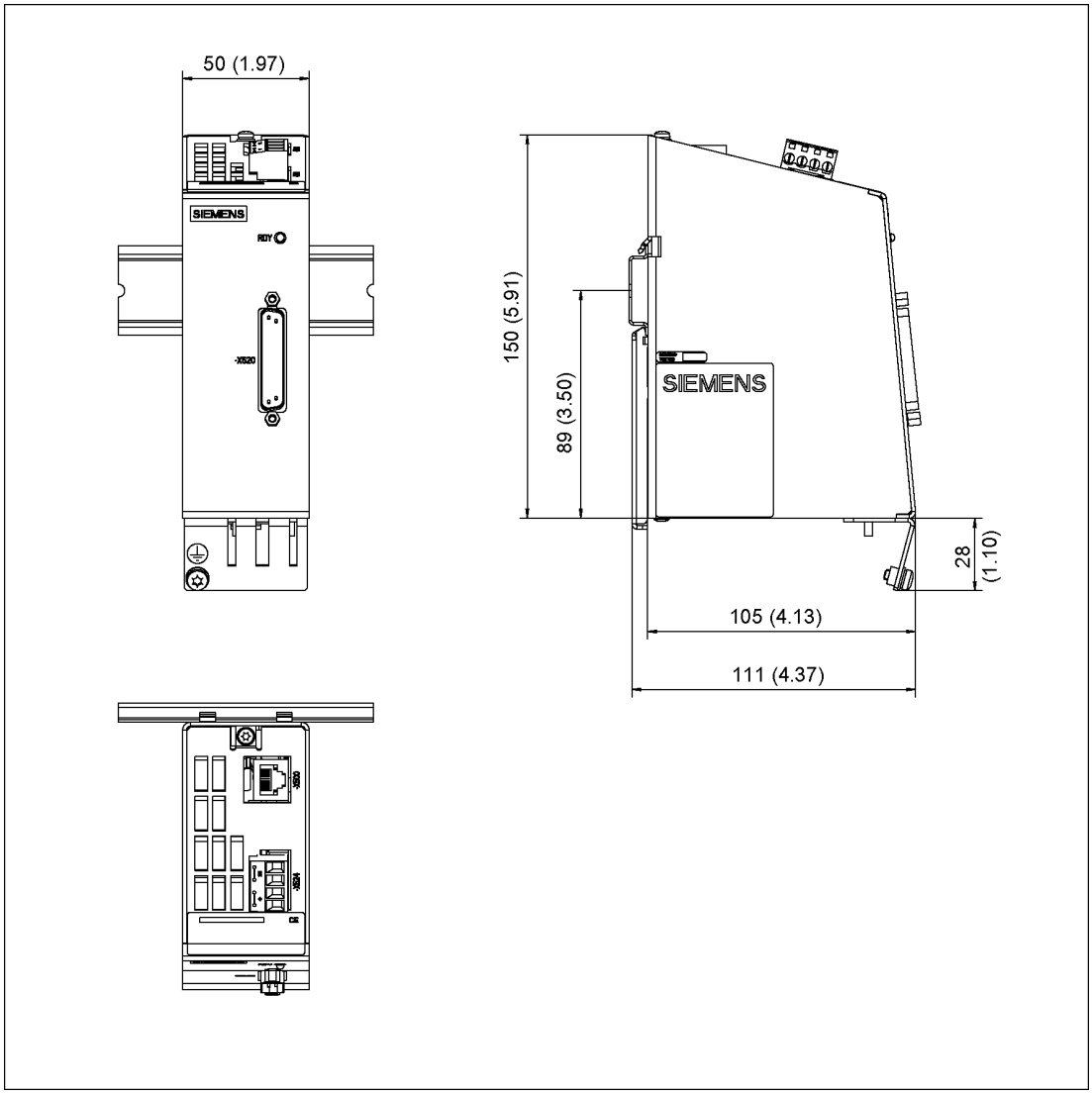



Figure 4-11 Dimension drawing of the SMC20

## 4.4.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

### Removal

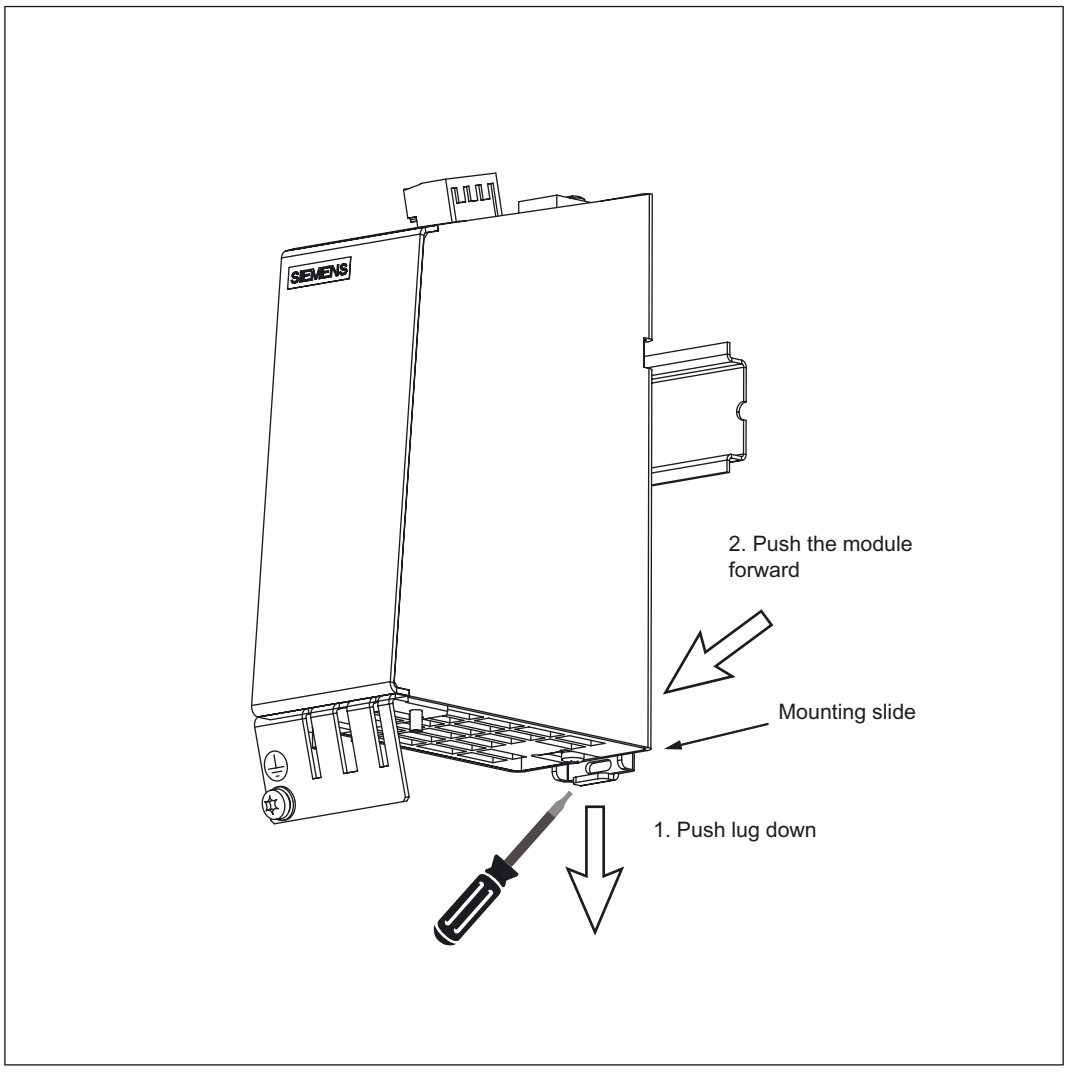



Figure 4-12 Releasing the component from a DIN rail

## 4.4.6 Technical Specifications

Table 4-12 Technical specifications

| | Unit | Value |
|---|---|---|
| Electronics power supply<br>Voltage<br>Current<br>Power loss | <br>$V_{DC}$<br>$A_{DC}$<br>W | <br>24 V DC (20.4 – 28.8)<br>Max. 0.4<br><10 |
| PE/ground connection | At the housing with M4/1.8 Nm screw | |
| Weight | kg | 0.8 |

Table 4-13 Max. frequency that can be evaluated (speed)

| Resolver | | Max. speed resolver / motor | | |
|---|---|---|---|---|
| Number of poles | Number of pole pairs | 8kHz / 125 µsec | 4kHz / 250 µsec | 2kHz / 500 µsec |
| 2-pole | 1 | 120,000 RPM | 60,000 RPM | 30,000 RPM |
| 4-pole | 2 | 60,000 RPM | 30,000 RPM | 15,000 RPM |
| 6-pole | 3 | 40,000 RPM | 20,000 RPM | 10,000 RPM |
| 8-pole | 4 | 30,000 RPM | 15,000 RPM | 7,500 RPM |

# 4.5 Sensor Module Cabinet 30 (SMC30)

## 4.5.1 Description

The Sensor Module Cabinet-Mounted 30 (SMC30) evaluates encoder signals and transmits the speed, actual position value, rotor position and, if necessary, the motor temperature and reference point via DRIVE-CLiQ to the Control Unit.

The measuring systems that can be connected have a TTL, HTL or SSI[1)] interface.

A combination of TTL/HTL signals and SSI absolute signal is possible, if both are derived from the same measured variable.

The SMC30 can be operated from Firmware 2.2 onwards

Table 4-14 Encoders that can be connected

| | X520 (D-Sub) | X521 (terminal) | X531 (terminal) | Interupted cable monitoring | Remote Sense[5)] |
|---|---|---|---|---|---|
| HTL bipolar 24 V | No | Yes | | No | No |
| HTL unipolar 24 V[3)] | No | Yes (however, a bipolar connection is recommended)[3)] | | No | No |
| TTL bipolar 24 V | Yes | Yes[1)] | | Yes[2)] | No |
| TTL bipolar 5 V | Yes | Yes | | Yes[2)] | To X520 |
| SSI 24 V[1)] | Yes | Yes | | No | No |
| TTL unipolar | No | | | | |

Table 4-15 Maximum encoder cable length

| Sensor type | Maximum encoder cable length in m |
|---|---|
| TTL[4)] | 100 |
| HTL unipolar[3)] | 100 |
| HTL bipolar | 300 |
| SSI[1)] | 100 |

[1)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

[2)] For Order No. 6SL3055-0AA00-5CA0 only at X520

[3)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

[4)] For TTL encoders at X520 → Remote Sense → 100 m

[5)] A controller compares the measuring system supply voltage - sensed via the remote sense cables - with the reference supply voltage of the measuring system and adjusts the supply voltage for the measuring system at the output of the drive module until the required supply voltage is obtained directly at the measuring system.

**For encoders with 5 V supply at X521/X531, the cable length (this applies for cables cross-sections of 0.5 mm$^2$ depends on the encoder current:**

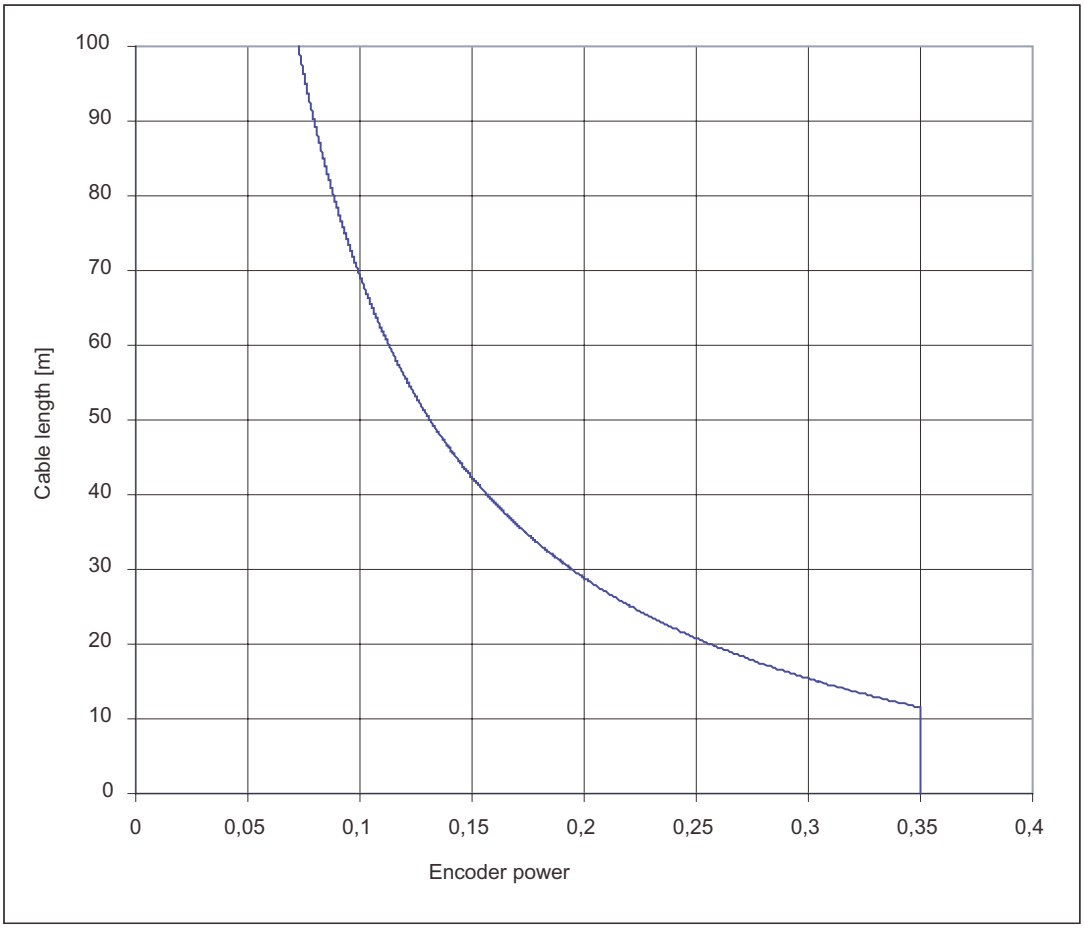



Figure 4-13 Max. cable length as a function of the encoder current drawn

## 4.5.2 Safety Information

**Danger**

The 50 mm clearances above and below the components must be observed.

**Notice**

Only one measuring system can be connected to each sensor module.

**Note**

It is not permissible that there is an electrical connection between the measuring system housing and the measuring system electronics (most encoder systems fulfill this requirement). If this not carefully taken into consideration under certain circumstances, the system cannot reach the required noise immunity (danger of equalizing currents through the electronics ground).

**Caution**

When the measuring system is connected via terminals, make sure that the cable shield is connected at the component.

**Caution**

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

## 4.5.3 Interface description

### 4.5.3.1 Overview

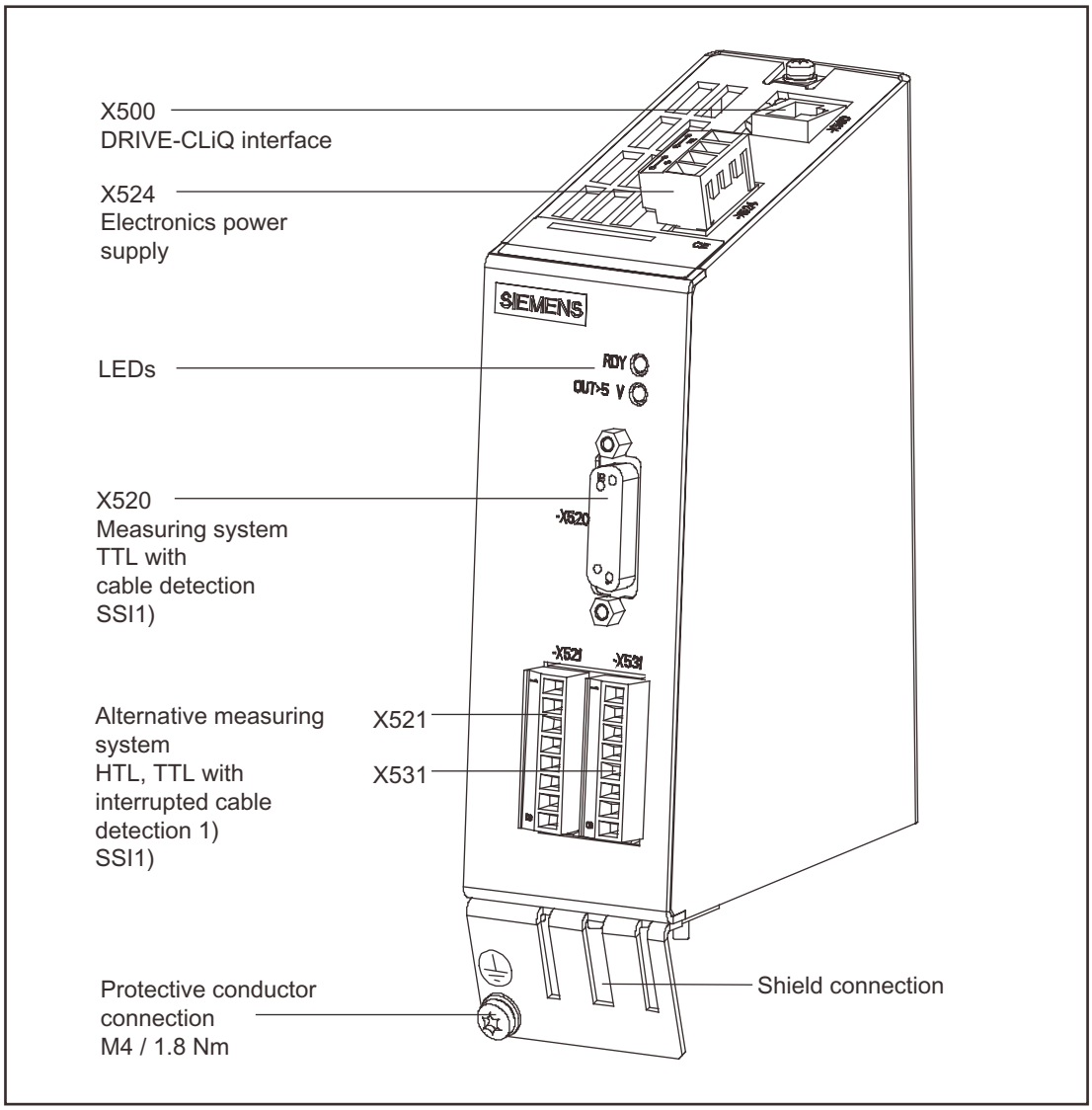



Figure 4-14 Interface description of the SMC30

1) Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

### 4.5.3.2 Connection examples

#### Connection example 1: HTL encoder, bipolar, with reference signal

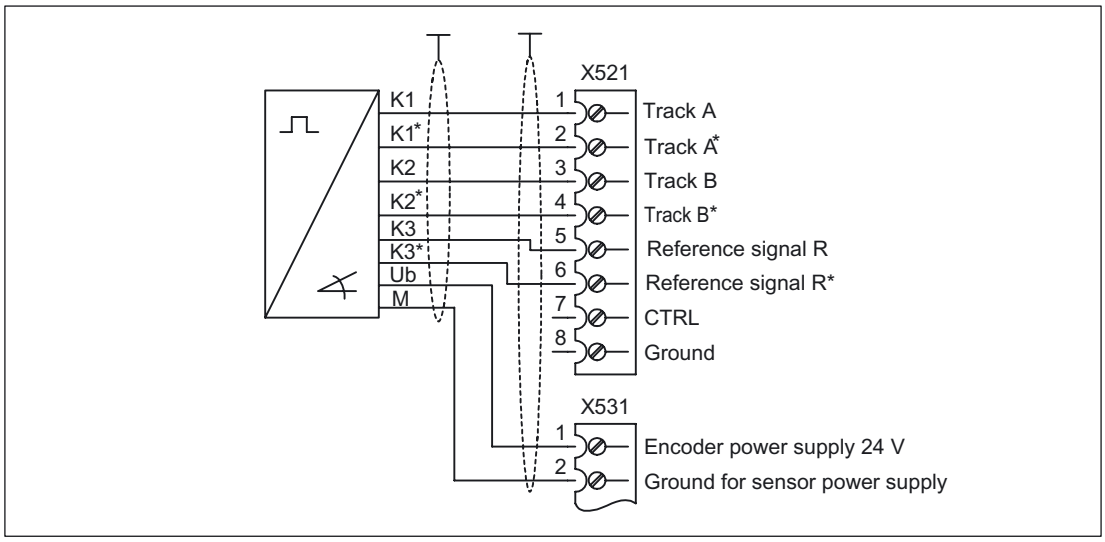



Figure 4-15 Connection example 1: HTL encoder, bipolar, with reference signal

#### Connection example 2: HTL encoder, unipolar, with reference signal

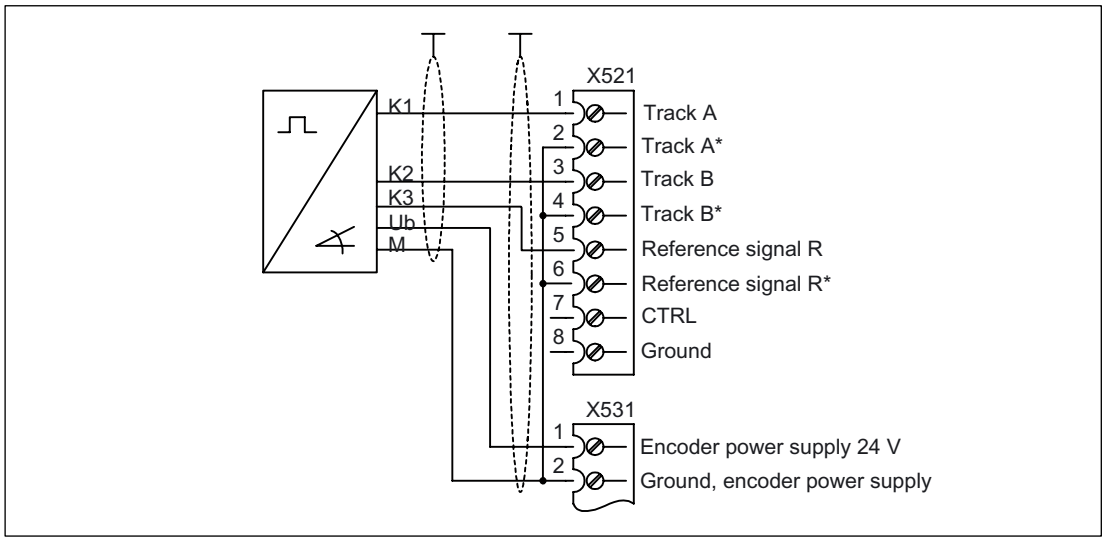
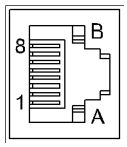



Figure 4-16 Connection example 2: HTL encoder, unipolar, with reference signal[1)]

[1)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

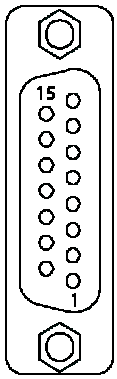
### 4.5.3.3 DRIVE-CLiQ interface X500

Table 4-16 DRIVE-CLiQ interface X500

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | Reserved, do not use | |
| | B | GND (0 V) | Electronic ground |

### 4.5.3.4 X520 measuring system

Table 4-17 Measuring system connection X520

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | Reserved, do not use | |
| | 2 | SSI_CLK | SSI clock[1)] |
| | 3 | SSI_XCLK | Inverted SSI clock[1)] |
| | 4 | P_Encoder 5 V / 24 V | Sensor power supply |
| | 5 | P_Encoder 5 V / 24 V | |
| | 6 | P_Sense | Sense input sensor power supply |
| | 7 | M_Encoder (M) | Ground for sensor power supply |
| | 8 | Reserved, do not use | |
| | 9 | M_Sense | Ground sense input |
| | 10 | R | Reference signal R |
| | 11 | R* | Inverted reference signal R |
| | 12 | B* | Inverted resolver signal B |
| | 13 | B | Resolver signal B |
| | 14 | A*/SSI_XDAT | Inverted resolver signal A / inverted SSI data[1)] |
| | 15 | A/SSI_DAT | Resolver signal A / SSI data[1)] |

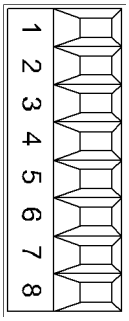
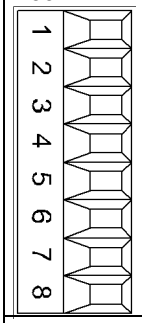
[1)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

**Caution**

The sensor power supply can be parameterized to 5 V or 24 V. The sensor may be destroyed if you enter the wrong parameters.

### 4.5.3.5 X521 / X531 alternative measuring system

Table 4-18 Measuring system connection X521 / X531

| | Pin | Name | Technical specifications |
|---|---|---|---|
| X521<br>  <br> | 1 | A | Resolver signal A |
| | 2 | A* | Inverted resolver signal A |
| | 3 | B | Resolver signal B |
| | 4 | B* | Inverted resolver signal B |
| | 5 | R | Reference signal R |
| | 6 | R* | Inverted reference signal R |
| | 7 | CTRL | Control signal |
| | 8 | M | Ground via inductivity |
| | | | |
| | 1 | P_Encoder 5 V / 24 V | Encoder power supply |
| | 2 | M_Encoder | Ground, encoder power supply |
| | 3 | - Temp | Motor temperature measurement KTY84-1C130<br>Temperature sensor connection KTY84-1C130/PTC |
| | 4 | + Temp | |
| X531<br>  <br> | 5 | SSI_CLK | SSI clock[2)] |
| | 6 | SSI_XCLK | Inverted SSI clock[2)] |
| | 7 | SSI_DAT | SSI data[2)] |
| | 8 | SSI_XDAT | Inverted SSI data[2)] |
| Max. connectable cross-section: 1.5 mm$^2$<br>When using unipolar HTL encoders, at the terminal block A*, B*, R* must be connected to (jumper) M_Encoder (X531)[1)]. | | | |

[1)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

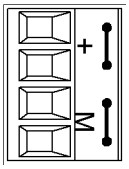
[2)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

**Caution**

When the measuring system is connected via terminals, make sure that the cable shield is connected at the component. Refer to the Chapter "Electrical connection".

### 4.5.3.6 Electronics power supply X524

Table 4-19 Terminal block X524

| | Terminal | Function | Technical specifications |
|---|---|---|---|
|  | + | Electronics power supply | Voltage: 24 V (20.4 V – 28.8 V)<br>Current consumption: max. 0,55 A<br>Max. current across<br>jumper in connector: 20 A at 55 °C |
| | + | Electronics power supply | |
| | M | Electronic ground | |
| | M | Electronic ground | |
| Max. connectable cross-section: 2.5 mm² | | | |

**Note**

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

### 4.5.3.7 Description of the LEDs on the SMC30

Table 4-20 Description of the LEDs on the SMC30

| LED | Color | State | Description |
|---|---|---|---|
| RDY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. |
| | Green | Steady light | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. |
| | Orange | Steady light | DRIVE-CLiQ communications is being established. |
| | Red | Steady light | At least one fault is present in this component.<br>**Note:**<br>The LED is driven irrespective of the corresponding messages being reconfigured. |
| | Green/<br>Red | Flashing light<br>2 Hz | Firmware is being downloaded. |
| | Green/Orange<br>or<br>Red/Orange | Flashing light<br>2 Hz | Component recognition via LED is activated (p0144)<br>**Note:**<br>Both options depend on the LED status when component recognition is activated via p0144 = 1. |
| OUT > 5 V | - | OFF | Electronics power supply is missing or outside permissible tolerance range.<br>Power supply ≤5 V. |
| | Orange | Steady light | Electronics power supply for measuring system available.<br>Power supply >5 V.<br>**Notice**<br>You must ensure that the connected encoder can be operated with a 24 V supply.<br>If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics. |

#### Cause and rectification of faults

The following reference contains further information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S, Commissioning Manual

## 4.5.4 Dimension Drawing

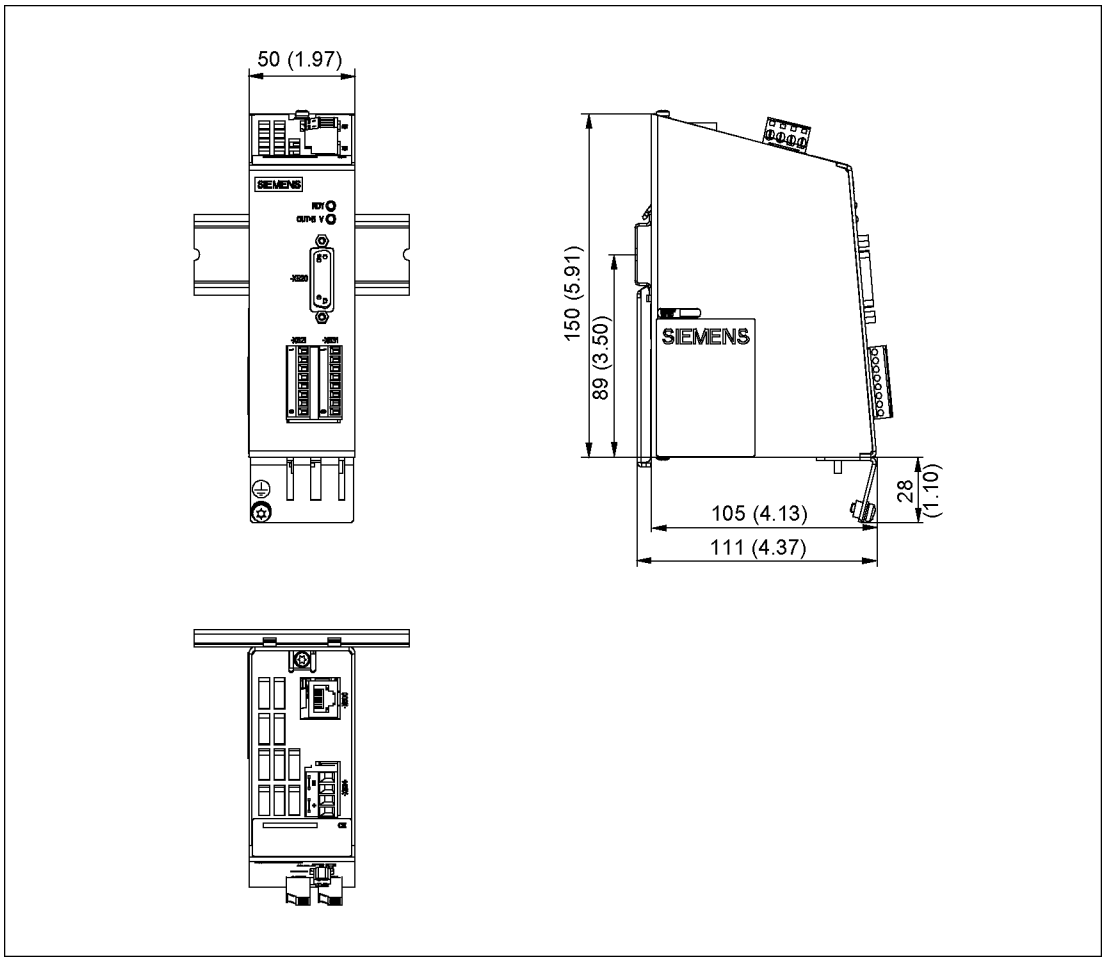



Figure 4-17 Dimension drawing of the SMC30

## 4.5.5 Installation

### Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

## Removal

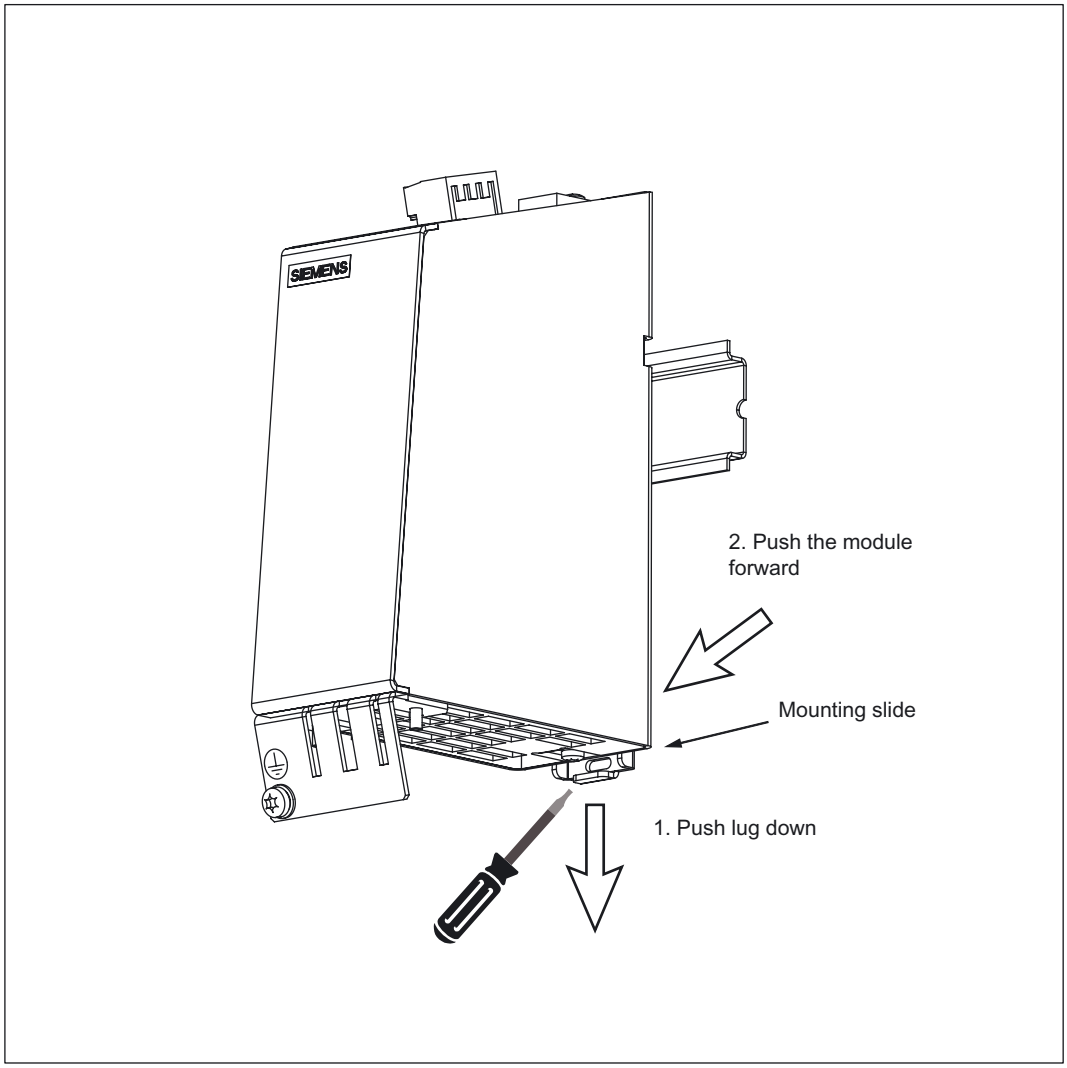



Figure 4-18 Releasing the component from a DIN rail

## 4.5.6 Electrical Connection

Shield contacts are only required if the system is connected to X521/X531.

Shield contact for the SMC30 from Weidmüller

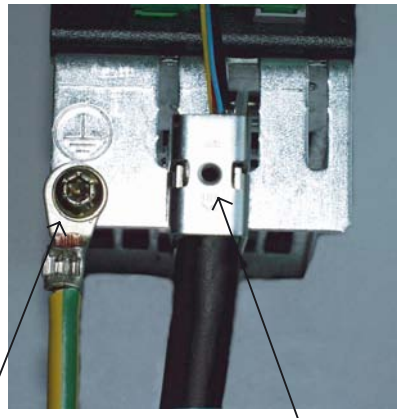



Figure 4-19 Shield contacts for the SMC30

Weidmüller: http://www.weidmueller.com/

The bending radii of the cables must be taken into account (see description of MOTION-CONNECT).

## 4.5.7 Technical Specifications

Table 4-21 Technical data

| Parameters | Designation | Unit | Value |
|---|---|---|---|
| Electronics power supply | | | |
| Voltage | $V_{DC}$ | V | 24 DC (20.4 – 28.8) |
| Current | $A_{DC}$ | A | max. 0.6 |
| Measuring system supply voltage ≥ 5V | $V_{CC}$ | V | $V_{DC}$ -1 V |
| PE/ground connection | | At the housing with M4/1.8 Nm screw | |
| Weight | | kg | 0.8 |
| Degree of protection | | IP20 | |

Table 4-22 Specification, measuring systems that can be connected

| Parameter | Name | Unit | Min. | Max . |
|---|---|---|---|---|
| High signal level (TTL bipolar at X520 or X521/X531)[1)] | $U_{Hdiff}$ | V | 2 | |
| Low signal level (TTL bipolar at X520 or X521/X531)[1)] | $U_{Ldiff}$ | V | | -2 |
| Signal level high (HTL unipolar) | $U_H$ | V | 10 | $V_{CC}$ |
| Signal level low (HTL unipolar) | $U_L$ | V | 0 | 2 |
| High signal level (HTL bipolar)[2)] | $U_{Hdiff}$ | V | 3 | |
| Low signal level (HTL bipolar)[2)] | $U_{Ldiff}$ | V | | -3 |
| High signal level (SSI bipolar at X520 or X521/X531)[1)3)] | $U_{Hdiff}$ | V | 2 | |
| Low signal level (SSI bipolar at X520 or X521/X531)[1)3)] | $U_{Ldiff}$ | V | | -2 |
| Signal frequency | $f_S$ | kHz | | 500 |
| Identification range | α1; α2 | Degrees | 50 | 270 |

[1)] Other signal levels according to the RS422 standard.

[2)] The absolute level of the individual signals varies between 0 V and $V_{CC}$ of the measuring system.

[3)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4.

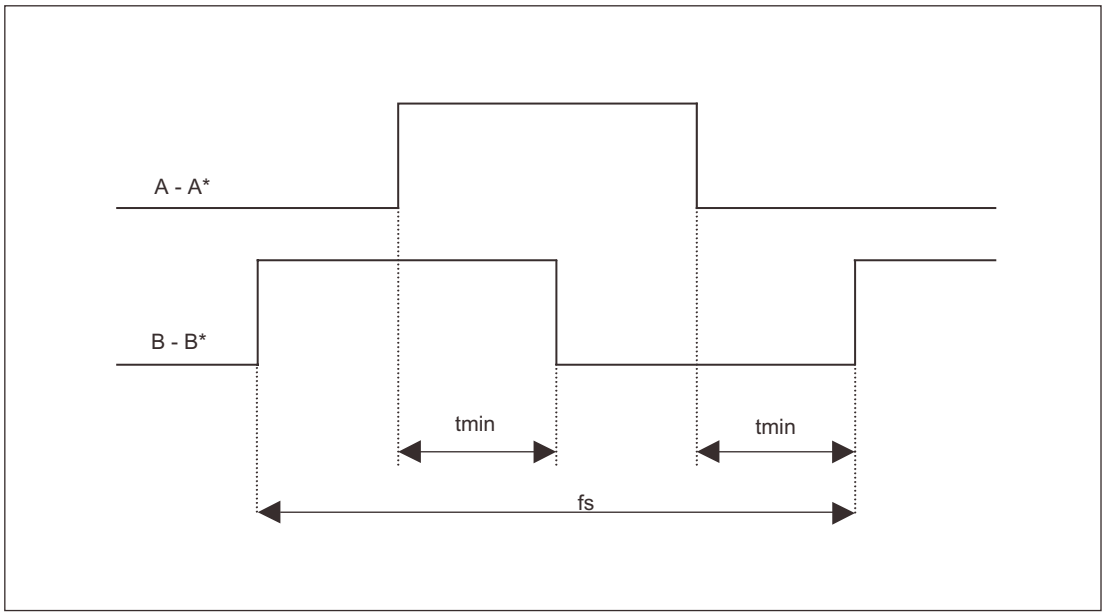



Figure 4-20 Time between two edges with pulse encoders

The minimum interval $t_{min}$ between two edges is 250 ns.

# 4.6 Sensor Module External 20 (SME20)

## 4.6.1 Description

Measuring systems outside the cabinet can be connected directly to the Sensor Module External 20 (SME20). The SME20 evaluates these measuring systems and converts the calculated values to DRIVE-CLiQ.
Neither motor nor encoder data are saved in the SME20.
Incremental direct measuring systems can be connected - SIN/COS (1Vpp).

The maximum DRIVE-CLiQ cable length is 100 m.

The maximum encoder cable length is 3 m.

The SME20 can only be operated from Firmware 2.3 onwards.

## 4.6.2 Safety information

**Notice**

Only measuring systems in which the power supply for the measuring system is not grounded may be connected.

## 4.6.3 Interface description

### 4.6.3.1 Overview

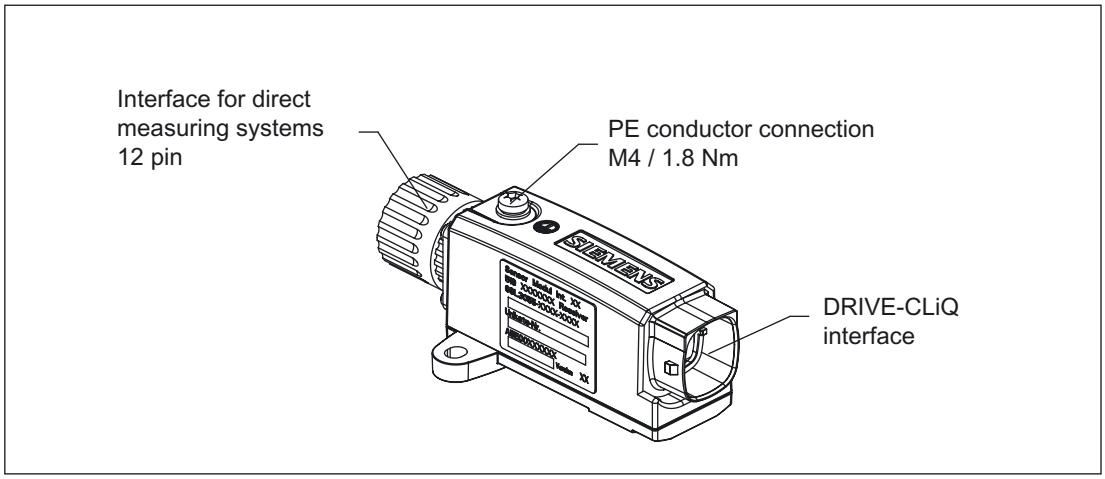
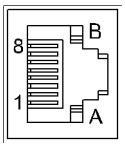



Figure 4-21 Interface description SME20

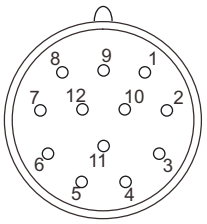
### 4.6.3.2 DRIVE-CLiQ interface

Table 4-23 DRIVE-CLiQ interface

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Cover for the DRIVE-CLiQ interface is included in the scope of supply<br>Current drain: max. 0,19 A | | | |

### 4.6.3.3 Measuring system interface

Table 4-24 Measuring system interface SME20

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | BN | B track negative |
| | 2 | P5 | Encoder power supply +5 V |
| | 3 | RP | Reference signal, positive |
| | 4 | RN | Reference signal, negative |
| | 5 | AP | A track positive |
| | 6 | AN | A track negative |
| | 7 | Reserved, do not use | |
| | 8 | BP | B track positive |
| | 9 | Reserved, do not use | |
| | 10 | M | Encoder power supply M |
| | 11 | M | Encoder power supply M |
| | 12 | P5 | Encoder power supply +5 V |
| Blanking plate for measuring system interface: Pöppelmann GmbH & Co. KG, Lohne,<br>Order No.: GPN 300 F211 | | | |

## 4.6.4 Dimension drawing

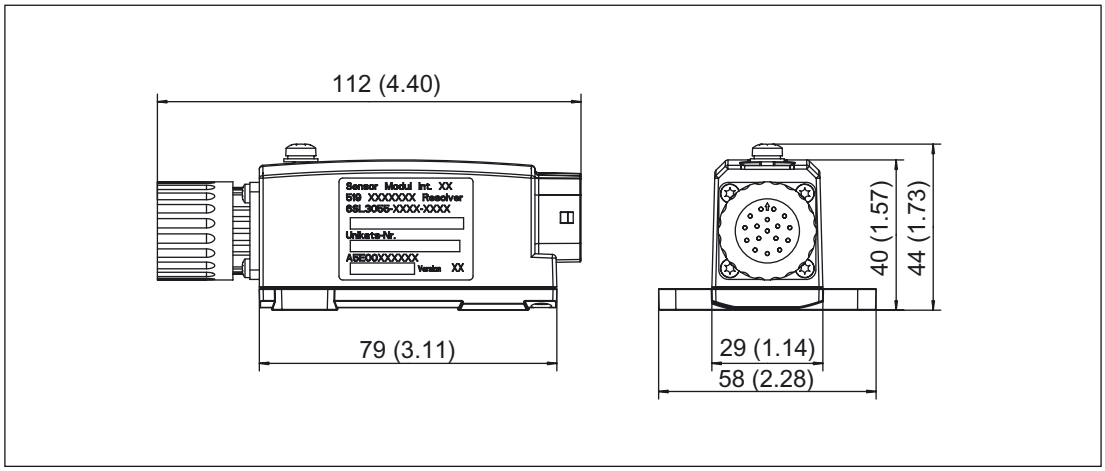
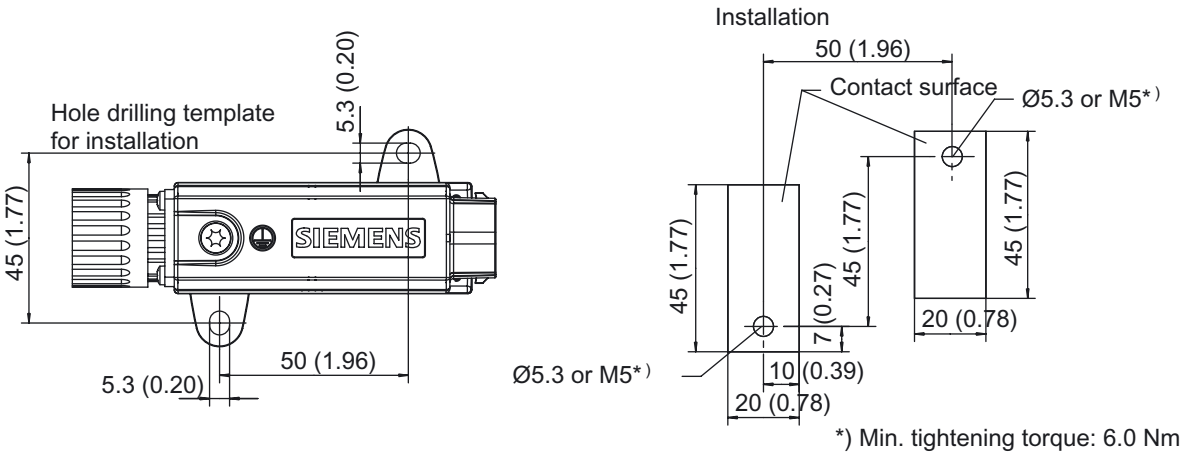



Figure 4-22 Dimension drawing of the SME20

## 4.6.5 Installation




Installation
1. Place the hole drilling template on the contact surface.
2. The contact surfaces must be unpainted metal.
3. Holes Ø5.3 or threads M5
4. Tighten with a min. torque of 6.0 Nm.

Figure 4-23 Installing the SME20/SME25

## 4.6.6 Technical specifications

Table 4-25 Technical specifications

| **Sensor Module External (SME20) 6SL3055-0AA00-5EAx** | **Unit** | **Value** |
|---|---|---|
| Electronic power supply<br>Voltage | $V_{DC}$ | 24 V DC (20.4 – 28.8) |
| PE/ground connection | At the housing with M4/1.8 Nm screw | |
| Weight | kg | 0.18 |
| Degree of protection | IP67 | |

# 4.7 Sensor Module External 25 (SME25)

## 4.7.1 Description

Direct measuring systems can be connected outside the cabinet to the Sensor Module External 25 (SME25). The SME25 evaluates these measuring systems and converts the calculated values to DRIVE-CLiQ.
Neither motor nor encoder data are saved in the SME25.
Incremental direct measuring systems can be connected - SIN/COS (1Vpp) without reference signal and EnDat.

The maximum DRIVE-CLiQ cable length is 100 m.

The maximum encoder cable length is 3 m.

The SME25 can be operated from Firmware 2.3 onwards.

## 4.7.2 Safety information

**Notice**

Only measuring systems in which the power supply for the measuring system is not grounded may be connected.

## 4.7.3 Interface description

### 4.7.3.1 Overview

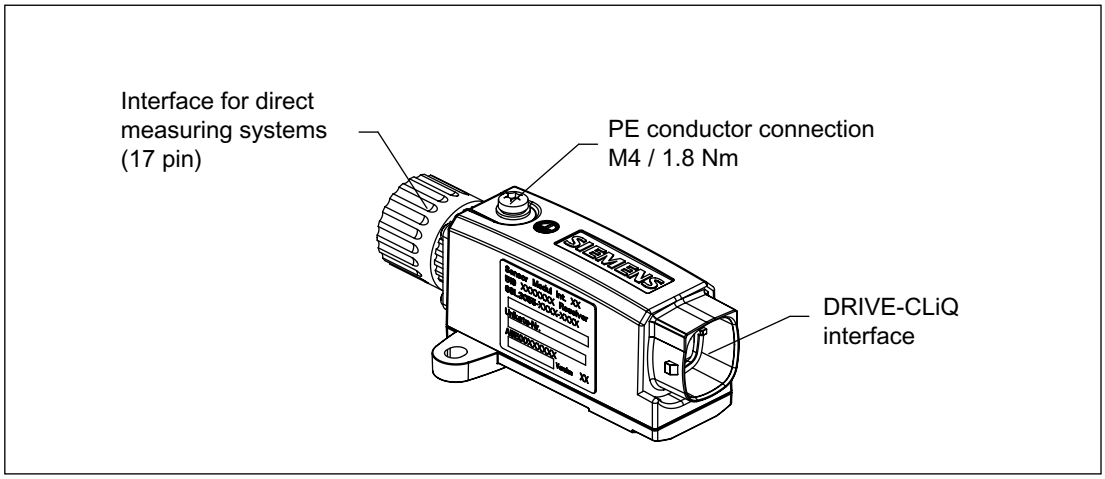
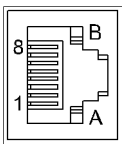



Figure 4-24 Interface description SME25

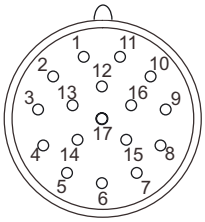
### 4.7.3.2 DRIVE-CLiQ interface

Table 4-26 DRIVE-CLiQ interface

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Cover for the DRIVE-CLiQ interface is included in the scope of supply<br>Current drain: max. 0,19 A | | | |

### 4.7.3.3 Measuring system interface

Table 4-27 Measuring system interface SME25

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | P5 | Encoder power supply +5 V |
| | 2 | Reserved, do not use | |
| | 3 | Reserved, do not use | |
| | 4 | M | Encoder power supply M |
| | 5 | Reserved, do not use | |
| | 6 | Reserved, do not use | |
| | 7 | P5 | Encoder power supply +5 V |
| | 8 | CLK | EnDat V2.1 clock positive |
| | 9 | CLK* | EnDat V2.1 clock negative |
| | 10 | M | Encoder power supply M |
| | 11 | M | Encoder power supply M |
| | 12 | BP | B track positive |
| | 13 | BN | B track negative |
| | 14 | DATA | EnDat V2.1 data positive |
| | 15 | AP | A track positive |
| | 16 | AN | A track negative |
| | 17 | DATA* | EnDat V2.1 data negative |
| Blanking plate for measuring system interface: Pöppelmann GmbH & Co. KG, Lohne,<br>Order No.: GPN 300 F211 | | | |

## 4.7.4 Dimension drawing

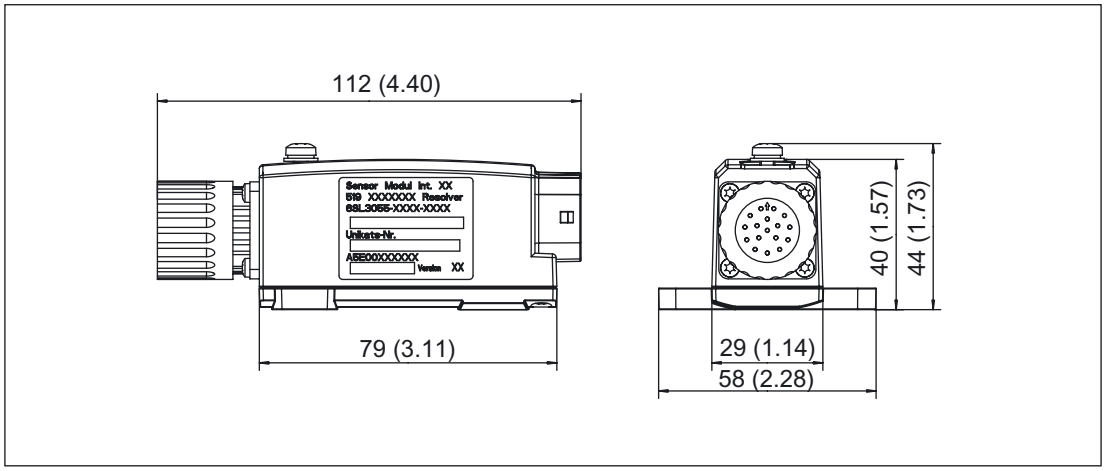
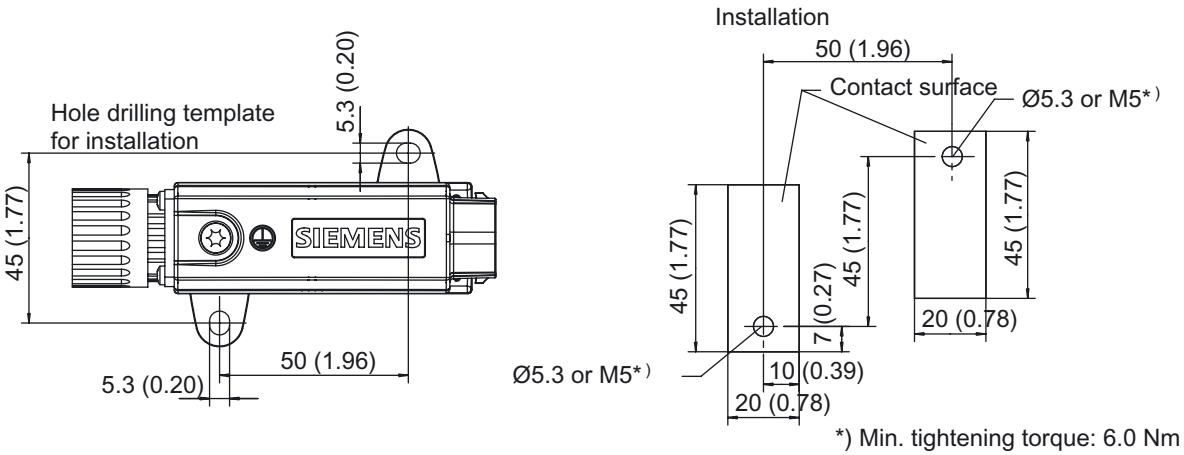



Figure 4-25 Dimension drawing of the SME25

## 4.7.5 Installation




Installation
1. Place the hole drilling template on the contact surface.
2. The contact surfaces must be unpainted metal.
3. Holes Ø5.3 or threads M5
4. Tighten with a min. torque of 6.0 Nm.

Figure 4-26 Installing the SME20/SME25

## 4.7.6 Technical specifications

Table 4-28 Technical specifications

| **Sensor Module External (SME25) 6SL3055-0AA00-5HAx** | **Unit** | **Value** |
|---|---|---|
| Electronic power supply<br>Voltage | $V_{DC}$ | 24 V DC (20.4 – 28.8) |
| PE/ground connection | At the housing with M4/1.8 Nm screw | |
| Weight | kg | 0.18 |
| Degree of protection | IP67 | |

# 4.8 Sensor Module External 120 (SME120)

## 4.8.1 Description

Direct measuring systems outside the cabinet can be connected to the Sensor Module External 120 (SME120). The SME120 evaluates these measuring systems and converts the calculated value to DRIVE-CLiQ.

The components are always used when the temperature signals of the motors do not have protective separation or where this separation is not possible for certain reasons. A Hall sensor box can be connected to determine the commutation position of a linear motor. SME120 is mainly used in linear motor applications.

Neither motor nor encoder data are saved in the SME120.

Incremental direct SIN/COS (1 Vpp) measuring systems can be connected.

The maximum DRIVE-CLiQ cable length is 100 m.

The SME120 can be operated from Firmware 2.4 onwards.

## 4.8.2 Safety information

**Notice**

Only measuring systems in which the power supply for the measuring system is not grounded may be connected.

**Danger**

It may only be used industrial environments.

Only appropriately trained personnel may install and service it.

All connectors at the unit must be correctly latched and screwed into place.

The cover must be screwed to cover all connectors that are not used.

It is only permissible to withdrawn and insert when in a no-voltage state (powered-down).

The unit may not be operated if the housing or the connector is damaged.

If this is not ensured, then this can result in death or severe bodily injury.

## 4.8.3 Interface description

### 4.8.3.1 Overview

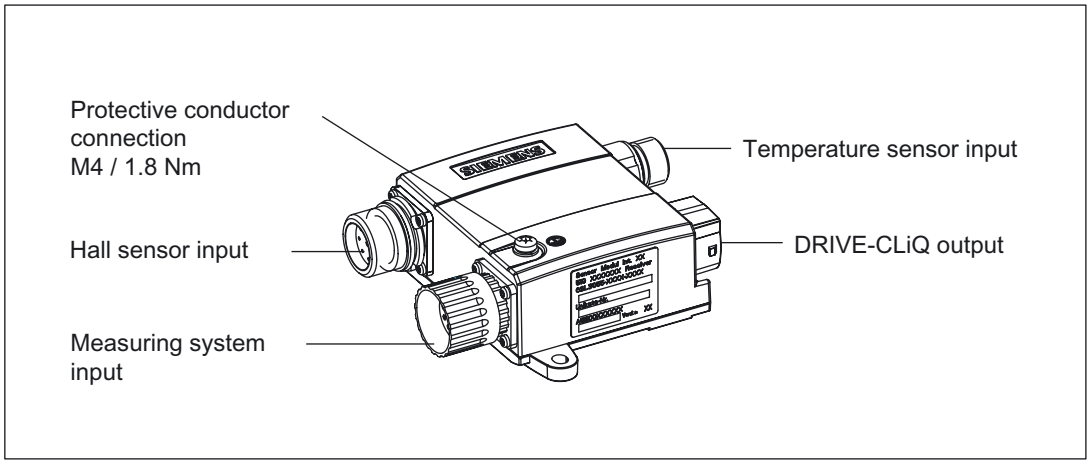



Figure 4-27 Interface description, SME120

### 4.8.3.2 Connection example

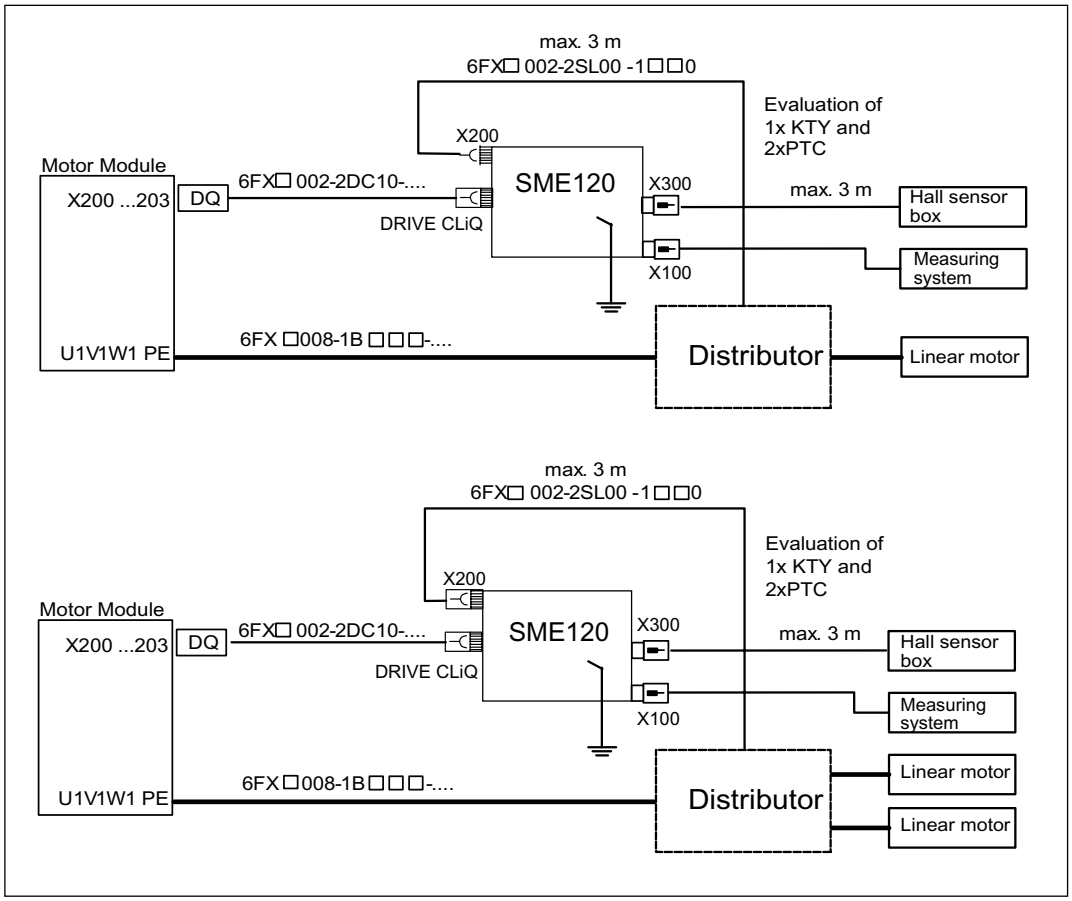
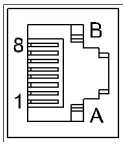



Figure 4-28 Connection example, SME120

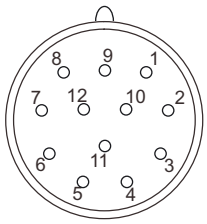
### 4.8.3.3 DRIVE-CLiQ interface

Table 4-29 DRIVE-CLiQ interface

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Cover for the DRIVE-CLiQ interface is included in the scope of supply<br>Current drain: max. 0.24 A | | | |

### 4.8.3.4 X100 measuring system interface

Table 4-30 Measuring system interface, SME120

| | Pin | Signal name | Technical data |
|---|---|---|---|
|  | 1 | BN | B track negative |
| | 2 | P5 | Encoder power supply +5 V |
| | 3 | RP | Zero pulse positive |
| | 4 | RN | Zero pulse negative |
| | 5 | AP | A track positive |
| | 6 | AN | A track negative |
| | 7 | Reserved, do not use | |
| | 8 | BP | B track positive |
| | 9 | Reserved, do not use | |
| | 10 | M | Encoder power supply M |
| | 11 | M | Encoder power supply M |
| | 12 | P5 | Encoder power supply +5 V |
| Blanking plate for measuring system interface: Pöppelmann GmbH & Co. KG, Lohne,<br>Order No.: GPN 300 F211 | | | |

### 4.8.3.5 X200 Temperature sensor

Table 4-31 Temperature sensor X200

| Terminal | Function | Technical data |
|---|---|---|
| 1 | -Temp | Temperature sensor connection KTY84–1C130 |
| 2 | +Temp | |
| 3 | PTC connection | Connection, PTC triplet 1 or bimetal 1 |
| 4 | PTC connection | |
| 5 | PTC connection | Connection, PTC triplet 2 |
| 6 | PTC connection | |

### 4.8.3.6 X300 Hall sensor input

Table 4-32 Hall sensor input X300

| Pin | Signal name | Meaning |
|---|---|---|
| 1 | CP | C track, positive |
| 2 | CN | C track, negative |
| 3 | P5 | Power supply voltage, +5V |
| 4 | M | Power supply voltage, ground |
| 5 | DP | D track, positive |
| 6 | DN | D track, negative |
| 7 | Not assigned | |
| 8 | Not assigned | |
| 9 | Inner shield | Inner shield |

## 4.8.4 Dimension drawing

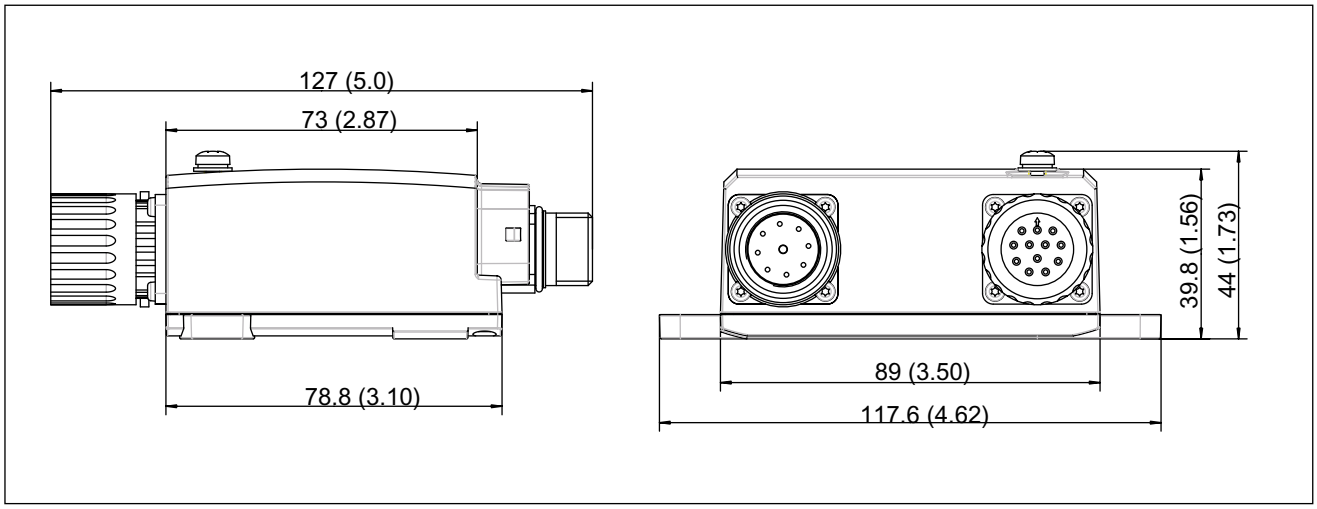



Figure 4-29 Dimension drawing, SME120

## 4.8.5 Mounting

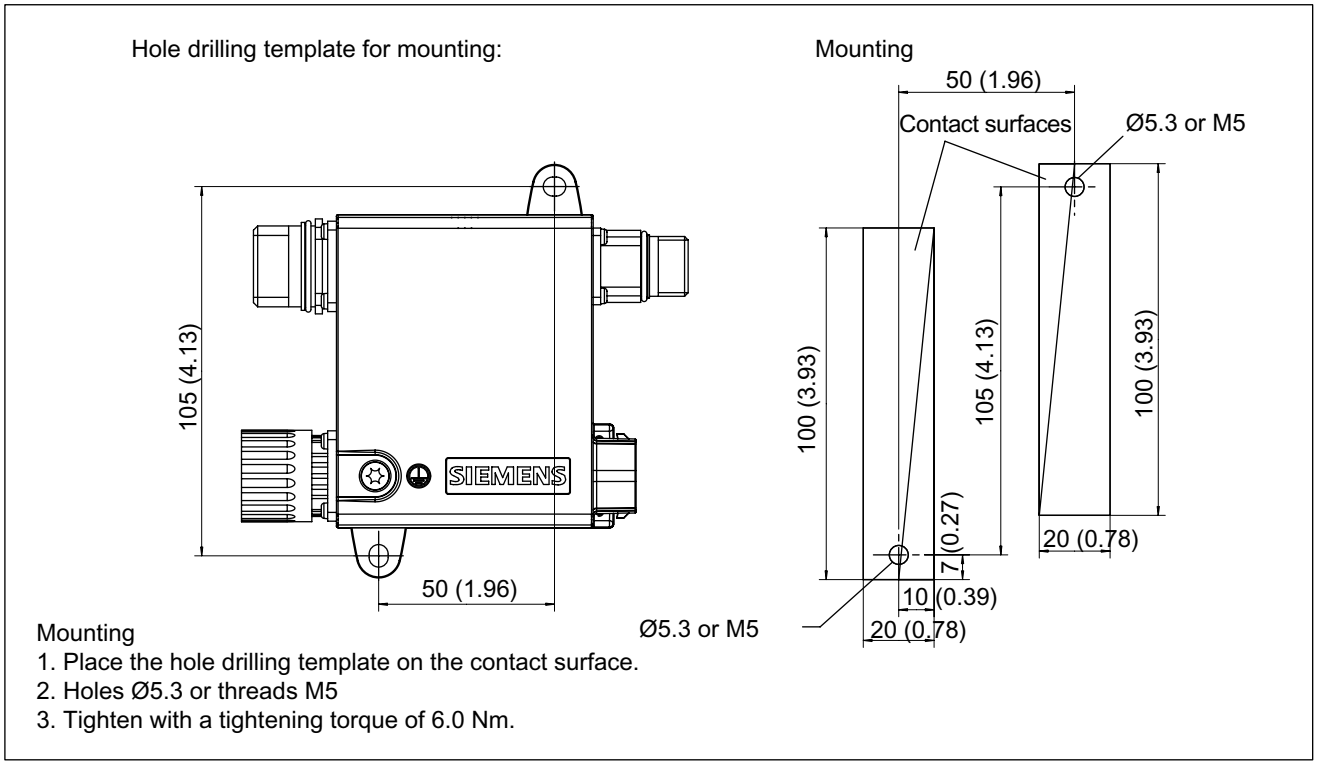



Figure 4-30 Mounting, SME120

## 4.8.6 Technical data

Table 4-33 Technical data

| Sensor Module External (SME120) 6SL3055-0AA00-5JAx | Units | Value |
|---|---|---|
| Electronic power supply Voltage | $V_{DC}$ | 24 V DC (20.4 – 28.8) |
| Load capability of the encoder power supply for the measuring system and, where relevant, the Hall sensor box. | mA | 350 |
| PE/ground connection | At the housing with M4/1.8 Nm screw | |
| Weight | kg | 0.4 |
| Degree of protection | IP67 | |

**Notice**

In order to guarantee the degree of protection, all of the plug connectors must be correctly screwed into place and appropriately locked.

# 4.9 Sensor Module External 125 (SME125)

## 4.9.1 Description

Direct measuring systems outside the cabinet can be connected to the Sensor Module External 125 (SME125). The SME125 evaluates these measuring systems and converts the calculated values to DRIVE-CLiQ.

The components are always used when the temperature signals of the motors do not have protective separation or where this separation is not possible for certain reasons. SME125 is mainly used in linear motor applications.

Neither motor nor encoder data are saved in the SME125.

Incremental direct SIN/COS (1 Vpp) measuring systems without zero pulse and EnDat can be connected.

The maximum DRIVE-CLiQ cable length is 100 m.

The SME125 can be operated from Firmware 2.4 onwards.

## 4.9.2 Safety information

**Notice**

Only measuring systems in which the power supply for the measuring system is not grounded may be connected.

**Danger**

It may only be used industrial environments.

Only appropriately trained personnel may install and service it.

All connectors at the unit must be correctly latched and screwed into place.

The cover must be screwed to cover all connectors that are not used.

It is only permissible to withdrawn and insert when in a no-voltage state (powered-down).

The unit may not be operated if the housing or the connector is damaged.

If this is not ensured, then this can result in death or severe bodily injury.

## 4.9.3 Interface description

### 4.9.3.1 Overview

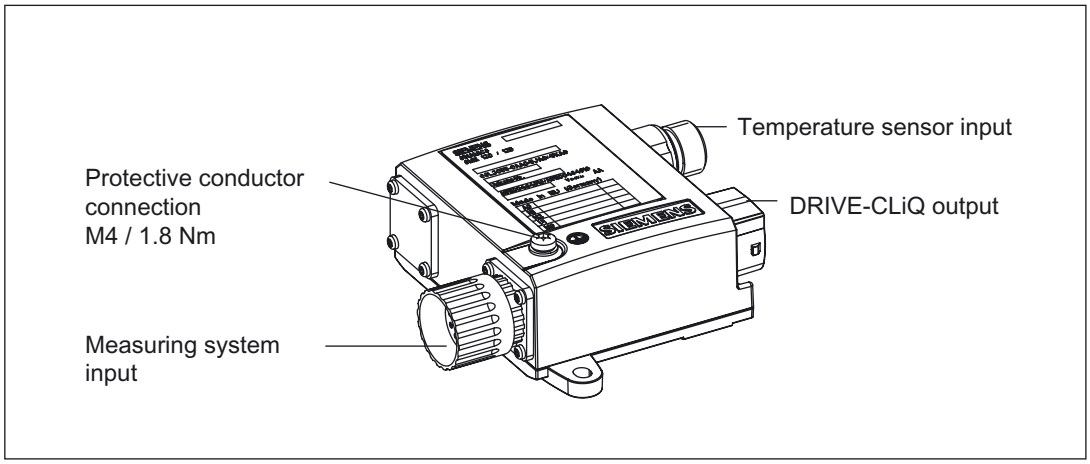



Figure 4-31 Interface description, SME125

### 4.9.3.2 Connection example

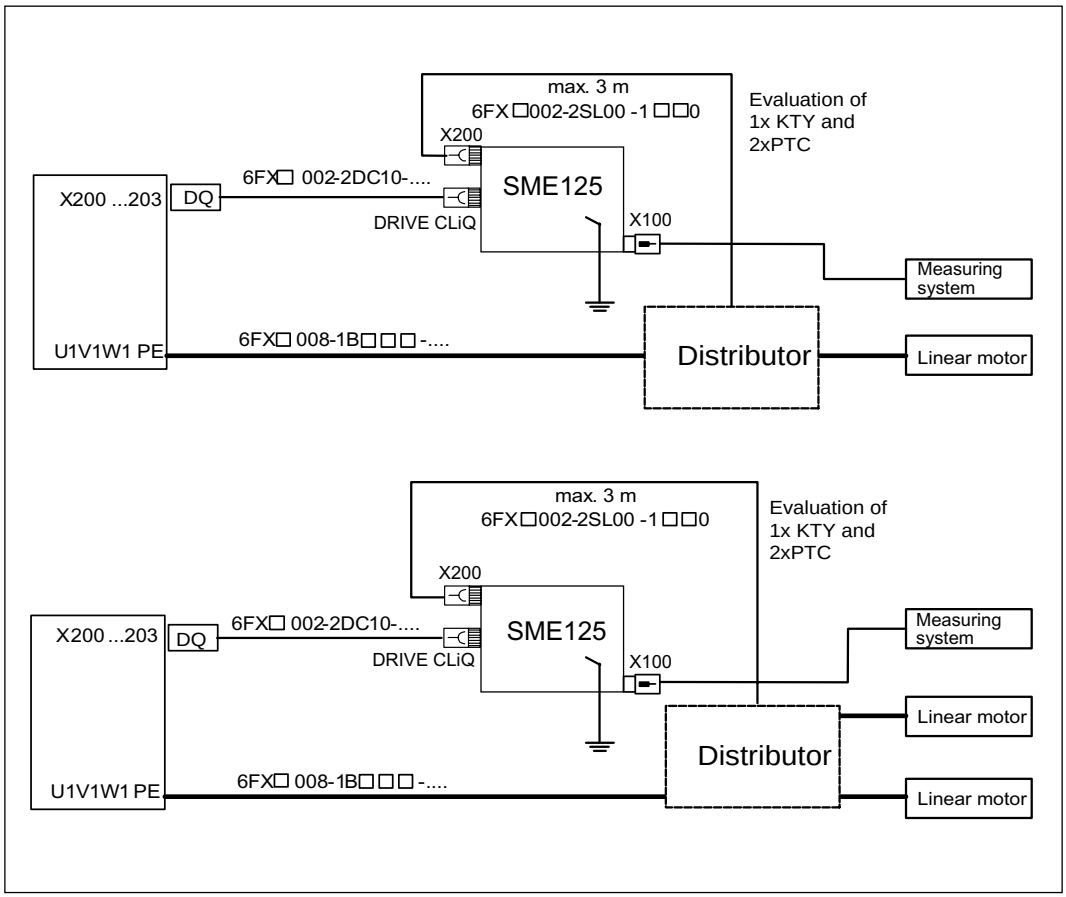
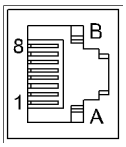



Figure 4-32 Connection example, SME125

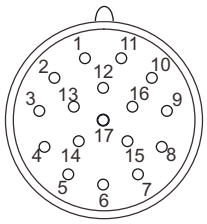
### 4.9.3.3 DRIVE-CLiQ interface

Table 4-34 DRIVE-CLiQ interface

| | Pin | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | TXP | Transmit data + |
| | 2 | TXN | Transmit data - |
| | 3 | RXP | Receive data + |
| | 4 | Reserved, do not use | |
| | 5 | Reserved, do not use | |
| | 6 | RXN | Receive data - |
| | 7 | Reserved, do not use | |
| | 8 | Reserved, do not use | |
| | A | + (24 V) | Power supply |
| | B | GND (0 V) | Electronic ground |
| Cover for the DRIVE-CLiQ interface is included in the scope of supply<br>Current drain: max. 0.24 A | | | |

### 4.9.3.4 X100 measuring system interface

Table 4-35 Measuring system interface, SME125

| | Pin | Signal name | Technical data |
|---|---|---|---|
|  | 1 | P5 | Encoder power supply +5 V |
| | 2 | Reserved, do not use | |
| | 3 | Reserved, do not use | |
| | 4 | M | Encoder power supply M |
| | 5 | Reserved, do not use | |
| | 6 | Reserved, do not use | |
| | 7 | P5 | Encoder power supply +5 V |
| | 8 | CLK | EnDat V2.1 clock positive |
| | 9 | CLK* | EnDat V2.1 clock negative |
| | 10 | M | Encoder power supply M |
| | 11 | M | Encoder power supply M |
| | 12 | BP | B track positive |
| | 13 | BN | B track negative |
| | 14 | DATA | EnDat V2.1 data positive |
| | 15 | AP | A track positive |
| | 16 | AN | A track negative |
| | 17 | DATA* | EnDat V2.1 data negative |
| Blanking plate for measuring system interface: Pöppelmann GmbH & Co. KG, Lohne,<br>Order No.: GPN 300 F211 | | | |

* These connections do not have safe separation!

### 4.9.3.5 X200 Temperature sensor

Table 4-36 Temperature sensor X200

| Terminal | Function | Technical data |
|---|---|---|
| 1 | -Temp | Temperature sensor connection KTY84–1C130 |
| 2 | +Temp | |
| 3 | PTC connection | Connection, PTC triplet 1 or bimetal 1 |
| 4 | PTC connection | |
| 5 | PTC connection | Connection, PTC triplet 2 |
| 6 | PTC connection | |

## 4.9.4 Dimension drawing

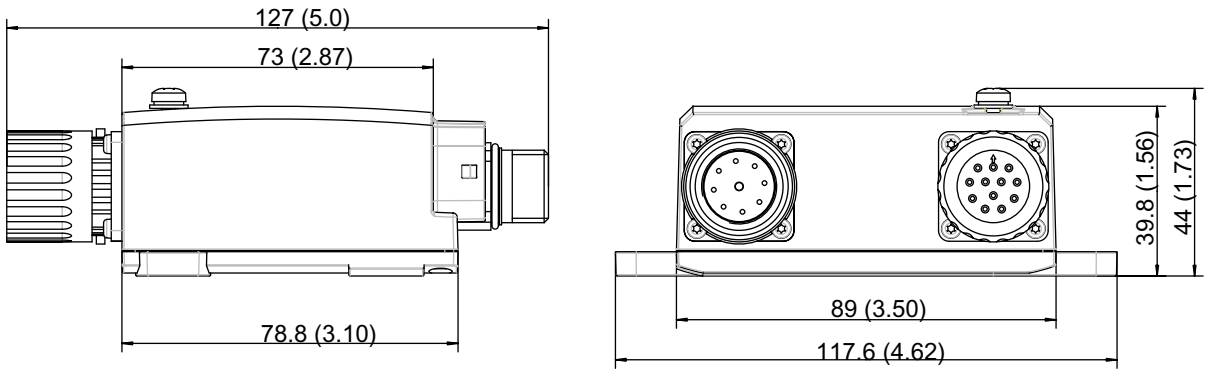
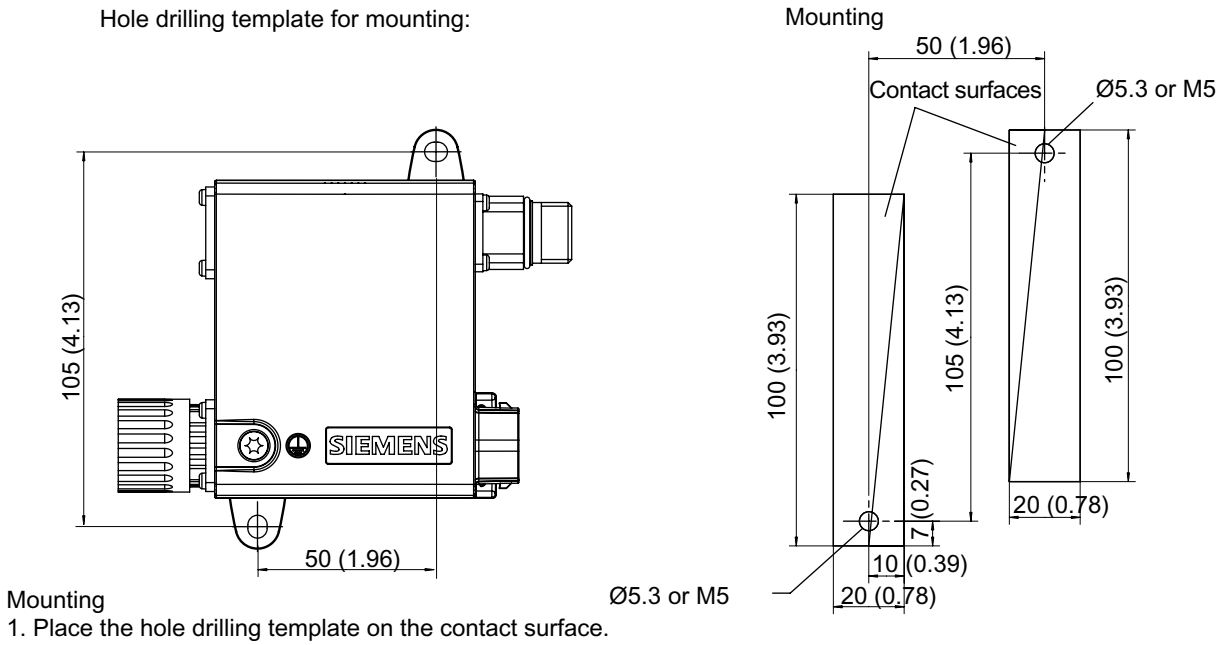



Figure 4-33 Dimension drawing, SME125

## 4.9.5 Mounting




Mounting
1. Place the hole drilling template on the contact surface.
2. Holes Ø5.3 or threads M5
3. Tighten with a tightening torque of 6.0 Nm.

Figure 4-34 Mounting, SME125

## 4.9.6 Technical data

Table 4-37 Technical data

| Sensor Module External (SME125) 6SL3055-0AA00-5KAx | Units | Value |
|---|---|---|
| Electronic power supply<br>Voltage | $V_{DC}$ | 24 V DC (20.4 – 28.8) |
| Load capability of the encoder power supply for measuring systems | mA | 350 |
| PE/ground connection | At the housing with M4/1.8 Nm screw | |
| Weight | kg | 0.4 |
| Degree of protection | IP67 | |

**Notice**

In order to guarantee the degree of protection, all of the plug connectors must be correctly screwed into place and appropriately locked.

# Electromagnetic Compatibility (EMC) 5

## 5.1 Cabinet design and EMC: booksize

Information on cabinet design and electromagnetic compatibility (EMC) can be found in:

/GH2/ SINAMICS S120

Equipment Manual for Booksize Power Sections

Order No.: 6SL3097-2AC00-0AP3, Edition: 03.2006

# Spring-Loaded Terminals/Screw Terminals

A

## A.1 Spring-Loaded Terminals/Screw Terminals

### Connectable conductor cross-sections of spring-loaded terminals

Table A-1 Spring-loaded terminals

| Spring-loaded terminal type | | | |
|---|---|---|---|
| 1 | Connectable conductor cross-sections | Flexible<br>With wire end ferrule, without plastic sleeve<br>With wire end ferrule, with plastic sleeve | 0.14 $mm^2$ to 1.5 $mm^2$<br>0.25 $mm^2$ to 1.5 $mm^2$<br>0.25 $mm^2$ to 0.5 $mm^2$ |
| | Insulation stripping length | 7 mm | |
| | Tool | Screwdriver 0.4 x 2.0 mm | |
| 2 | Connectable conductor cross-sections | Flexible | 0.08 $mm^2$ to 2.5 $mm^2$ |
| | Insulation stripping length | 8 to 9 mm | |
| | Tool | Screwdriver 0.4 x 2.0 mm | |

### Connectable conductor cross-sections of screw terminals

Table A-2 Screw terminals

| Screw terminal type | | | |
|---|---|---|---|
| 1 | Connectable conductor cross-sections | Flexible<br>With wire end ferrule, without plastic sleeve<br>With wire end ferrule, with plastic sleeve | 0.14 $mm^2$ to 1.5 $mm^2$<br>0.25 $mm^2$ to 1.5 $mm^2$<br>0.25 $mm^2$ to 0.5 $mm^2$ |
| | Insulation stripping length | 7 mm | |
| | Tool | Screwdriver 0.4 x 2.0 mm | |
| | Tightening torque | 0.22 to 0.25 Nm | |
| 2 | Connectable conductor cross-sections | Flexible<br>With wire end ferrule, without plastic sleeve<br>With wire end ferrule, with plastic sleeve | 0.2 $mm^2$ to 2.5 $mm^2$<br>0.25 $mm^2$ to 1 $mm^2$<br>0.5 $mm^2$ to 1 $mm^2$ |
| | Insulation stripping length | 7 mm | |
| | Tool | Screwdriver 0.6 x 3.5 mm | |
| | Tightening torque | 0.5 to 0.6 Nm | |

| **Screw terminal type** | | | |
|---|---|---|---|
| 3 | Connectable conductor cross-sections | Flexible<br>With wire end ferrule, without plastic sleeve<br>With wire end ferrule, with plastic sleeve | 0.2 $mm^2$ to 2.5 $mm^2$<br>0.25 $mm^2$ to 1 $mm^2$<br>0.25 $mm^2$ to 1 $mm^2$ |
| | Insulation stripping length | 9 mm | |
| | Tool | Screwdriver 0.6 x 3.5 mm | |
| | Tightening torque | 0.5 to 0.6 Nm | |
| 4 | Connectable conductor cross-sections | Flexible<br>With wire end ferrule, without plastic sleeve<br>With wire end ferrule, with plastic sleeve | 0.2 $mm^2$ to 4 $mm^2$<br>0.25 $mm^2$ to 4 $mm^2$<br>0.25 $mm^2$ to 4 $mm^2$ |
| | Insulation stripping length | 7 mm | |
| | Tool | Screwdriver 0.6 x 3.5 mm | |
| | Tightening torque | 0.5 to 0.6 Nm | |
| 5 | Connectable conductor cross-sections | Flexible<br>With wire end ferrule, without plastic sleeve<br>With wire end ferrule, with plastic sleeve | 0.5 $mm^2$ to 6 $mm^2$<br>0.5 $mm^2$ to 6 $mm^2$<br>0.5 $mm^2$ to 6 $mm^2$ |
| | Insulation stripping length | 12 mm | |
| | Tool | Screwdriver 1.0 x 4.0 mm | |
| | Tightening torque | 1.2 to 1.5 Nm | |
| 6 | Connectable conductor cross-sections | Flexible<br>With wire end ferrule, without plastic sleeve<br>With wire end ferrule, with plastic sleeve | 0.5 $mm^2$ to 10 $mm^2$<br>0.5 $mm^2$ to 10 $mm^2$<br>0.5 $mm^2$ to 10 $mm^2$ |
| | Insulation stripping length | 11 mm | |
| | Tool | Screwdriver 1.0 x 4.0 mm | |
| | Tightening torque | 1.5 to 1.8 Nm | |

# List of Abbreviations

B

## B.1 List of Abbreviations

Table B-1 List of abbreviations

| Abbreviation | English |
|---|---|
| **A** | |
| A... | Alarm |
| AC | Alternating Current |
| ADC | Analog Digital Converter |
| AI | Analog Input |
| ALM | Active Line Module |
| AO | Analog Output |
| AOP | Advanced Operator Panel |
| ASC | Armature Short-Circuit |
| ASCII | American Standard Code for Information Interchange |
| **B** | |
| OC | Operating Condition |
| BERO | Tradename for a type of proximity switch |
| BI | Binector Input |
| BGIA | Berufsgenossenschaftliches Institut für Arbeitssicherheit (German Institute for Occupational Safety) |
| BICO | Binector Connector Technology |
| BLM | Basic Line Module |
| BOP | Basic Operator Panel |
| **C** | |
| C | Capacitance |
| C... | Safety message |
| CAN | Controller Area Network |
| CBC | Communication Board CAN |
| CBP | Communications Board PROFIBUS |
| CD | Compact Disc |
| CDS | Command Data Set |

| Abbreviation | English |
|---|---|
| CI | Connector Input |
| CNC | Computer Numerical Control |
| CO | Connector Output |
| CO/BO | Connector Output/Binector Output |
| COB-ID | CAN object identification |
| COM | Mid-position contact of a changeover contact |
| CP | Communications Processor |
| CPU | Central Processing Unit |
| CRC | Cyclic Redundancy Check |
| CU | Control Unit |
| **D** | |
| DAC | Digital Analog Converter |
| DC | Direct Current |
| DCN | Direct Current Negative |
| DCP | Direct Current Positive |
| DDS | Drive Data Set |
| DI | Digital Input |
| DI/DO | Bidirectional Digital Input/Output |
| DMC | DRIVE-CLiQ Module Cabinet (Hub) |
| DO | Digital Output |
| DO | Drive Object |
| DPRAM | Dual-Port Random Access Memory |
| DRAM | Dynamic Random Access Memory |
| DRIVE CLiQ | Drive Component Link with IQ |
| DSC | Dynamic servo control |
| **I** | |
| EDS | Encoder Data Set |
| EGB | Electrostatic Sensitive Devices |
| EMK | Electromagnetic force |
| EMC | Electromagnetic Compatibility |
| EN | European Standard |
| EnDat | Encoder-Data-Interface |
| EP | Enable Pulses |
| ES | Engineering System |
| ESR | Extended Stop and Retract |
| **F** | |
| F... | Fault |
| FAQ | Frequently Asked Questions |

| Abbreviation | English |
|---|---|
| FCC | Function Control Chart |
| FCC | Flux Current Control |
| FEPROM | Flash-EPROM |
| FG | Function Generator |
| FI | Residual Current |
| FP | Function diagram |
| FW | Firmware |
| **G** | |
| GC | Global Control Telegram (broadcast telegram) |
| GSD | Device master file: describes the features of a PROFIBUS slave |
| GSV | Gate Supply Voltage |
| **H** | |
| HF | High Frequency |
| HFD | High frequency reactor |
| HLG | Ramp-Function Generator |
| HMI | Human Machine Interface |
| HTL | High threshold logic |
| HW | Hardware |
| **I** | |
| In preparation: | In preparation: this feature is currently not available |
| IBN | Commissioning |
| I/O | Input/Output |
| ID | Identifier |
| IEC | International Electrotechnical Commission |
| IGBT | Insulated Gate Bipolar Transistor |
| IL | Pulse cancellation |
| IT | Insulated three-phase line supply |
| **J** | |
| JOG | Jogging |
| **K** | |
| KDV | Data cross-checking |
| KIP | Kinetic buffering |
| Kp | Proportional gain |
| KTY | Positive temperature coefficient temperature sensor |
| **L** | |
| L | Inductance |

| Abbreviation | English |
|---|---|
| LED | Light Emitting Diode |
| LSB | Least Significant Bit |
| LSS | Line Side Switch |
| **M** | |
| M | Reference potential, zero potential |
| MB | Megabyte |
| MCC | Motion Control Chart |
| MDS | Motor Data Set |
| MLFB | Machine-readable product designation |
| MMC | Man Machine Communication |
| MSB | Most Significant Bit |
| MSCY_C1 | Master Slave Cycle Class 1 |
| **N** | |
| N. C. | Not Connected |
| N... | No Report |
| NAMUR | Standardization association for instrumentation and control in the chemical industry |
| NC | Normally Closed contact |
| NC | Numerical Control |
| NEMA | National Electrical Manufacturers Association |
| NM | Zero mark |
| NO | Normally Open contact |
| **O** | |
| OEM | Original Equipment Manufacturer |
| OLP | Optical Link Plug |
| OMI | Option Module Interface |
| **P** | |
| p... | Adjustable parameter |
| PcCtrl | Master Control |
| PDS | Power unit Data Set |
| PE | Protective Earth |
| PELV | Protective Extra Low Voltage |
| PG | Programming device |
| PI | Proportional Integral |
| PID | Proportional Integral Differential |
| PLC | Programmable Logic Controller |

| Abbreviation | English |
|---|---|
| PLL | Phase Locked Loop |
| PNO | PROFIBUS user organisation |
| PRBS | Pseudo Random Binary Signal |
| PROFIBUS | Process Field Bus |
| PS | Power Supply |
| PTC | Positive Temperature Coefficient |
| PTP | Point To Point |
| PWM | Pulse Width Modulation |
| PZD | PROFIBUS process data |
| **Q** | |
| **R** | |
| r … | Display parameter (read only) |
| RAM | Random Access Memory |
| RCCB | Residual-Current Circuit-Breaker |
| RCD | Residual Current Device |
| RJ45 | Standard Describes an 8-pole plug connector with twisted pair Ethernet. |
| RKA | Cooling system |
| RO | Read Only |
| RPDO | Receive Process Data Object |
| RS232 | Standard. Describes the physical characteristics of a serial interface. |
| RS485 | Standard Describes the physical characteristics of a digital serial interface. |
| **S** | |
| S1 | Continuous duty |
| S3 | Periodic duty |
| SBC | Safe Brake Control |
| SOS | Safe Operational Stop |
| SSR | Safe Stop Ramp |
| SE | Safe software limit switch |
| SLS | Safely Limited Speed |
| SGA | Safety-relevant output |
| SGE | Safe input signal |
| SH | Safe standstill |
| SI | Safety Integrated |
| SIL | Safety Integrity Level |

| Abbreviation | English |
|---|---|
| SLM | Smart Line Module |
| SLVC | Sensorless Vector Control |
| SM | Sensor Module |
| SMC | Sensor Module Cabinet |
| SCA | Safe Cam |
| SPC | Setpoint Channel |
| SPS | Programmable Logic Controller (PLC) |
| STW | PROFIBUS Control Word |
| **T** | |
| TB | Terminal Board |
| TIA | Totally Integrated Automation |
| TM | Terminal Module |
| TN | Grounded three-phase line supply |
| Tn | Integral time |
| TPDO | Transmit Process Data Object |
| TT | Grounded three-phase line supply |
| TTL | Transistor Transistor Logic |
| **U** | |
| UL | Underwriters Laboratories Inc. |
| UPS | Uninterruptible Power Supply |
| **V** | |
| VC | Vector control |
| Vdc | DC link voltage |
| VDE | Association of German Electrical Engineers |
| VDI | Association of German Electrical Engineers |
| Vpp | Volt peak to peak |
| VSM | Voltage sensing module |
| **W** | |
| WEA | Automatic restart |

| Abbreviation | English |
|---|---|
| WZM | Machine tool |
| **X** | |
| XML | Extensible Markup Language |
| **Y** | |
| **Z** | |
| ZK | DC Link |
| ZSW | PROFIBUS status word |

# References

C

## C.1 References

### SINAMICS Documentation

#### Catalogs

**/D11.1/ SINAMICS G110 Inverter Chassis Units 0.12 kW to 3 kW**
Order no.: E86060-K5511-A111-A2, 10.2005 edition

**/D11/ SINAMICS G130 Drive Converter Chassis Units, SINAMICS G150 Drive Converter Cabinet Units**
Order no.: E86060-K5511-A101-A2, 07.2004 edition

**/D21.1/ SINAMICS S120 Vector Control Drive System**
Order no.: E86060-K5521-A111-A1, 04.2005 edition

**/D21.3/ SINAMICS S150 Drive Converter Cabinet Units**
75 kW to 1200 kW
Order no.: E86060-K5521-A131-A1, 05.2004 edition

#### Related catalogs

**/ST70/ SIMATIC Components for Totally Integrated Automation**
Ordering information
Order no.: E86060-K4670-A111-A9, 10.2004 edition

**/PM10/ Motion Control System SIMOTION**
Ordering information
Order no.: E86060-K4910-A101-A5, 07.2005 edition

**/NC61/ SINUMERIK & SINAMICS, Automation Systems for Machine Tools**
Ordering information
Order no.: E86060-K4461-A101-A1, 07.2005 edition

#### Interactive catalogs

**/CA01/ The Offline Mall of Automation and Drives**
CD-ROM
Order no.: E86060-D4001-A100-C3, 10.2004 edition

**/Mall/ A&D Mall, Catalog and Online Ordering System**
http://www.siemens.com/automation/mall

## Electronic documentation

**/CD2/ SINAMICS**
The SINAMICS System
Order no.: 6SL3097-2CA00-0YG2, 07.2005 edition

## User Documentation

**/BA1/ SINAMICS G150**
Operating Manual
Order no.: On request, 03.2006 edition

**/BA2/ SINAMICS G130**
Operating Manual
Order no.: On request, 03.2006 edition

**/BA3/ SINAMICS S150**
Operating Manual
Order no.: On request, 03.2006 edition

**/GH1/ SINAMICS S120**
Equipment Manual for Control Units and Additional System Components
Order no.: 6SL3097-2AH00-0BP3, 03.2006 edition

**/GH2/ SINAMICS S120**
Equipment Manual for Booksize Power Sections
Order no: 6SL3097-2AC00-0BP3, 03.2006 edition

**/GH3/ SINAMICS S120**
Equipment Manual for Chassis Power Sections
Order no.: 6SL3097-2AE00-0BP1, 03.2006 edition

**/GH4/ SINAMICS S120**
Equipment Manual for Booksize Cold-Plate Power Sections
Order no.: 6SL3097-2AJ00-0BP3, 03.2006 edition

**/GH5/ SINAMICS S120**
Equipment Manual for Cabinet Modules
Order no.: on request, 03.2006 edition

**/GH6/ SINAMICS S120**
Equipment Manual for AC DRIVE
Order no.: 6SL3097-2AL00-0BP0, 03.2006 edition

**/GS1/ SINAMICS S120**
Getting Started
Order no.: 6SL3097-2AG00-0BP2, 03.2006 edition

**/IH1/ SINAMICS S120**
Commissioning Manual
Order no.: 6SL3097-2AF00-0BP3, 03.2006 edition

**/IH2/ SINAMICS S120**
CANopen Commissioning Manual
Order no.: 6SL3097-2AA00-0BP2, 03.2006 edition

**/FH1/ SINAMICS S120**
Functional Manual
Order no.: 6SL3097-2AB00-0BP2, 03.2006 edition

/LH1/ SINAMICS S
List Manual
Order no.: 6SL3097-2AP00-0BP4, 03.2006 edition

/PFK7S/ SINAMICS Synchronous Motors 1FK7
Planning Guide
Order no.: 6SN1197-0AD16-0BP0, edition: 12.2004

/PFT6S/ SINAMICS Synchronous Motors 1FT6
Planning Guide
Order no.: 6SN1197-0AD12-0BP0, edition: 12.2004

## PROFIBUS Documentation

/P1/ PROFIBUS-DP/DPV1 IEC 61158
Basic Information, Tips and Tricks for Users
Hüthig; Manfred Popp; 2nd edition
ISBN 3-7785-2781-9

/P2/ PROFIBUS-DP, Getting Started
PROFIBUS User Organization; Manfred Popp
Order no.: 4.071

/P3/ Decentralization with PROFIBUS-DP
Architecture and Fundamentals, Configuration and Use of PROFIBUS-DP with SIMATIC S7
SIEMENS; Publicis MCD Verlag; Josef Weigmann, Gerhard Kilian
Order no.: A19100-L531-B714
ISBN 3-89578-074-X

/P4/ Manual for PROFIBUS Networks, SIEMENS
Order no.: 6GK1970-5CA20-0AA0

/P5/ PROFIBUS Profile PROFIdrive Profile Drive Technology
PROFIBUS User Organization
Haid- und Neu-Straße 7, D-76131 Karlsruhe
Order no.: 3.172 Version 3.1 November 2002

/IKPI/ SIMATIC NET, Industrial Communication and Field Devices
Catalog
Order no.: E86060-K6710-A101-B4, edition: 2005

/PDP/ PROFIBUS Installation Guidelines
Installation Guideline for PROFIBUS-FMS/DP
Installation and Wiring Recommendation for RS 485 Transmission
Order no. 2.111 (German), Version 1.0
Order no. 2.112 (English), Version 1.0

## Documentation for Safety Equipment

**Note**

For more information about technical documentation for Safety Integrated, visit the following address:

http://www.siemens.de/safety

The following list contains some of the safety-related documentation available.

**/LVP/ Low-Voltage Switchgear SIRIUS-SENTRON-SIVACON**
Catalog
Order no.: E86060-K1002-P101-A5, edition: 2006

**/MRL/ Directive 98/37/EG of the European Parliament and Council**
Machinery Directive
Bundesanzeiger-Verlags GmbH, edition: 22.06.1998

**/SIAH/ Safety Integrated**
Application Manual
Order no.: 6ZB5000-0AA01-0BA1, 5th Edition

**/SICD/ Safety Integrated**
CD-ROM
Order no.: E20001-D10-M103-X-7400, edition: 09.2004

# Index

## M



## O



## P



## R



## S



## T



## V

To

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**Recommendation**

**Corrections**

for document:

SINAMICS S120

Equipment Manual (GH1)

Manufacturer / Service Documentation

**From**

Name

Your company address/dept.

Address

Postal code: City:

Phone: /

Fax: /

Equipment Manual

Order no.: 6SL3097-2AH00-0BP3

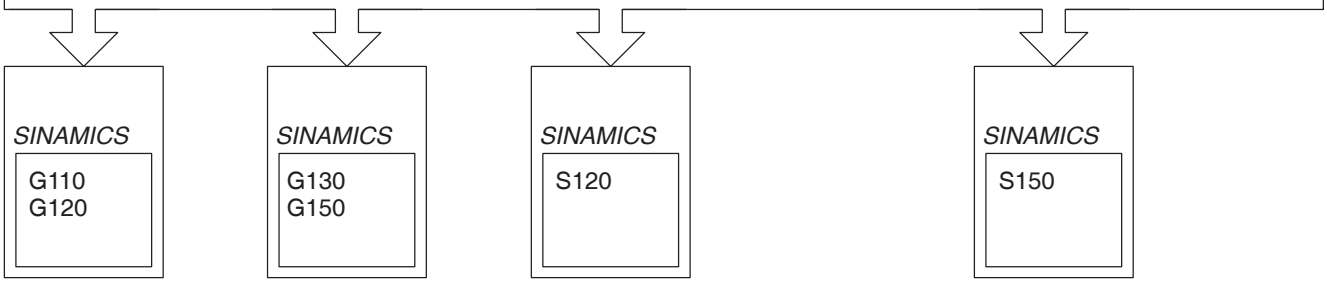
Edition: 03.2006

Should you come across any printing errors when reading this publication, please notify us on this sheet. Suggestions for improvement are also welcome.

**Recommendations and/or suggestions**

# **Overview of SINAMICS Documentation** (03/2006)

## General Documentation/Catalogs



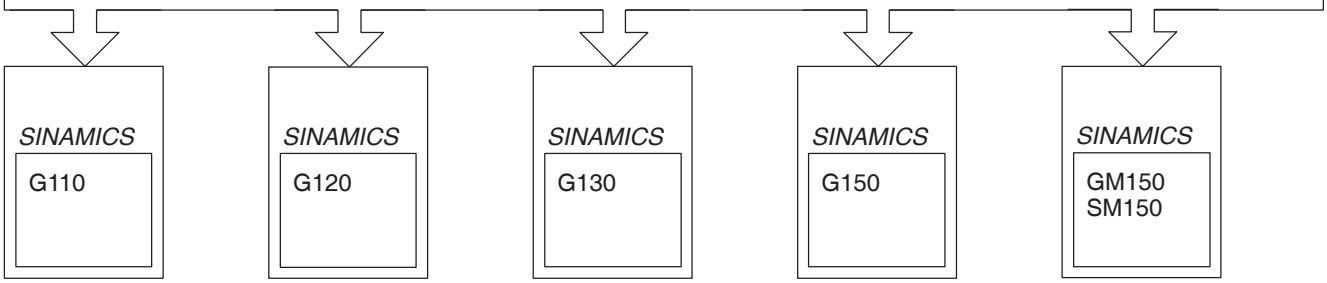

D11.1
Converter Chassis Units
0.12 – 3 kW

D11
Converter Chassis Units
Converter Cabinet Units

D21.1
Chassis Units

D21.3
Vector Control Cabinet Units
75 – 1200 kW

## Manufacturer/Service Documentation




– Getting Started
– Operating Instructions
– List Manual

– Operating Instructions (Compact)
– Operating Instructions
– List Manual

– Operating Instructions
– List Manual

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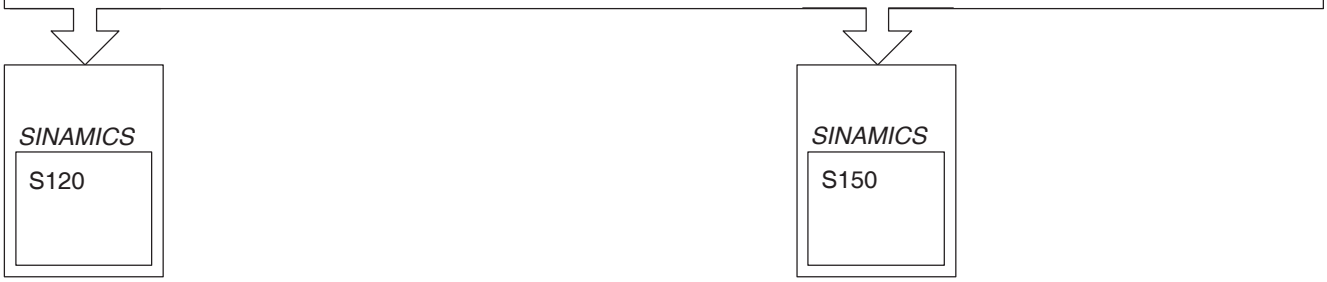
– List Manual

– Operating Instructions
– List Manual

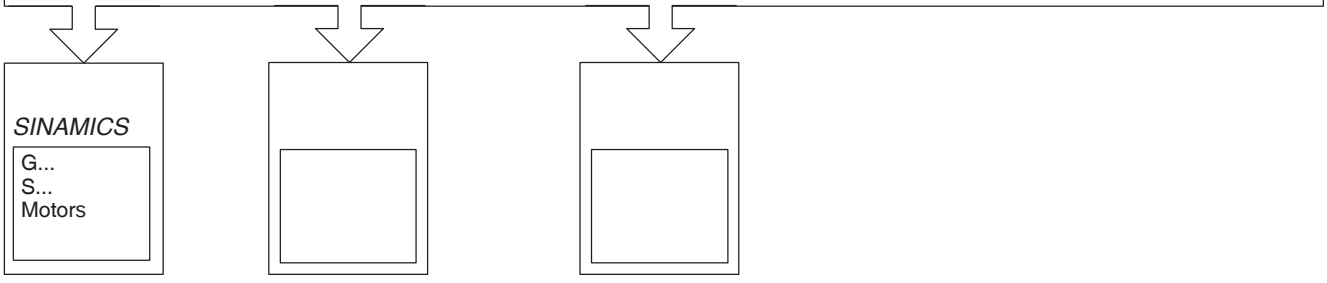
## Manufacturer/Service Documentation




– Getting Started
– Equipment Manual for Control Units and Additional System Components
– Equipment Manual for Booksize Power Modules
– Equipment Manual Booksize Cold-Plate Power Sections
– Chassis Power Sections
– Equipment Manual AC DRIVE
– Commissioning Manual – Commissioning Manual CANopen
– Function Manual – Function Manual Free Function Blocks
– List Manual

– Operating Instructions
– List Manual

## Manufacturer/Service Documentation




DOCONCD

Configuration Manual
Motors

EMC
Installation Guideline