SINAMICS S120

Control Units and additional system components

Equipment Manual · 10/2008

SINAMICS

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SINAMICS

S120
Control Units and additional system components

Manual

(GH1), 10.2008 Edition
6SL3097-2AH00-0BP5

Legal information

Warning notice system

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

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

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

⚠CAUTION
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.

Proper use of Siemens products

Note the following:

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

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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Ordernumber: 6SL3097-2AH00-0BP5
℗ 11/2008

Foreword

SINAMICS documentation

The SINAMICS documentation is sub-divided into 2 parts:

- General documentation/catalogs
- Manufacturer/service documentation

At http://www.siemens.com/motioncontrol/docu information is available on the following topics:

- Ordering documentation

Here you will find the current overview of publications

- Downloading documentation

Links to more information for downloading files from Service & Support

- Researching documentation online

Information on DoconCD and direct access to the publications in DoconWeb.

- Individually compiling documentation on the basis of Siemens contents with the My Documentation Manager (MDM), refer to

http://www.siemens.com/mdm

The My Documentation Manager offers you a number of features for compiling your own machine documenation

- Training and FAQs

Information on the range of training courses and FAQs (frequently asked questions) are available via the page navigation.

Phases of use

Table Preface-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 • SINAMICS S120 Equipment Manual for Booksize Power Units • SINAMICS S120 Equipment Manual for Chassis Power Units • SINAMICS S150 Operating Instructions

Phases of use	Tools
Commissioning	• STARTER Parameterizing and Commissioning Tool • SINAMICS S120 Getting Started • SINAMICS S120 Commissioning Manual • SINAMICS S120 Commissioning Manual CANopen • SINAMICS S List Manual • SINAMICS S150 Operating Instructions
Using/operating	• SINAMICS S120 Commissioning Manual • SINAMICS S List Manual • SINAMICS S150 Operating Instructions
Maintenance/Service	• SINAMICS S120 Commissioning Manual • SINAMICS S List Manual • 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:

	Europe/Africa
Telephone	+49 180 5050 - 222
Fax	+49 180 5050 - 223
0.14 €/min. from German landlines, mobile phone prices may differ)	
Internet	http://www.siemens.de/automation/support-request

	America
Telephone	+1 423 262 2522
Fax	+1 423 262 2200
E-mail	mailto:techsupport.sea@siemens.com

	Asia/Pacific
Telephone	+86 1064 757575
Fax	+86 1064 747474
E-mail	mailto:support.asia.automation@siemens.com

Note

You will find telephone numbers for other countries for technical support in the Internet: http://www.automation.siemens.com/partner

Spare parts

Spare parts are available on the Internet at:
http://support.automation.siemens.com/WW/view/de/16612315

Questions about the documentation

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

Fax	+49 9131 98 2176
E-mail	mailto:docu.motioncontrol@siemens.com

A fax form is available in the appendix of this document.

Internet address for SINAMICS

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

EC Declarations of Conformity

The EC Declaration of Conformity for the EMC Directive can be found/obtained:

- in the Internet:
  http://support.automation.siemens.com
  under the Product/Order No. 15257461
- at the relevant regional office of the I DT MC Business Unit of Siemens AG

The EC Declaration of Conformity for the EMC Directive can be found/obtained

- in the Internet:
  http://support.automation.siemens.com
  under the Product/Order No. 22383669

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).

Electronic components may not be placed near display units, monitors or televisions (minimum distance from the screen > 10 cm).

Measurements may 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).

⚠ DANGER

Electrical, magnetic, and electromagnetic fields (EMF) occurring during operation can pose a danger to people in the direct vicinity of the product, especially people with pacemakers, implants, or similar.

The relevant directives and standards must be observed by the machine/plant operators and people present in the vicinity of the product. These are, for example, EMF Directive 2004/40/EEC and standards EN 12198-1 to -3 applying to the European Economic Area (EEA) and in Germany the accident prevention regulation BGV 11 and the associated rule BGR 11 "Electromagnetic fields" from the German employer's liability accident insurance association.

These state that a hazard analysis must drawn up for every workplace, from which measures for reducing dangers and their impact on people are derived and applied, and exposure and danger zones are defined and observed.

The relevant safety notes in each chapter must be observed.

Safety information

⚠ DANGER

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

Only appropriately qualified personnel may mount/install, commission and service SINAMICS S drive units.

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.

Operational electrical equipment and motors have parts and components which are at hazardous voltage levels, that when touched can result in severe bodily injury or death.

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.

To ensure compliance with EN61800-5-1 and UL 508, only safety extra-low voltages from the electronics modules may be connected to connections and terminals.

⚠ DANGER
Using protection against direct contact via DVC A (PELV) is only permissible in areas with equipotential bonding and in dry rooms indoors. If these conditions are not fulfilled, then other protective measures against electric shock must be used (e.g. protection using protective impedances or limited voltage or using protective classes I and II).

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.

Explanation of the symbols

The symbols corresponds to IEC 617-2.

Table Preface-2 Symbols

Symbol	Meaning
	Protective ground (PE)
	Ground (e.g. M 24 V)
	Functional ground Equipotential bonding

Residual risks of power drive systems

When carrying out a risk assessment of the machine in accordance with the EU Machinery Directive, the machine manufacturer must consider the following residual risks associated with the control and drive components of a power drive system (PDS).

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions not within the scope of the specification
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices / cellular phones in the immediate vicinity of the controller
   - External influences / damage
2. Exceptional temperatures as well as emissions of light, noise, particles, or gas caused by, for example:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions not within the scope of the specification
   - External influences / damage
3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions not within the scope of the specification
   - Condensation / conductive contamination
   - External influences / damage
4. Operational electrical, magnetic, and electromagnetic fields that can pose a risk to people with a pacemaker and/or implants or metallic objects if they are too close.
5. Release of environmentally hazardous materials and emissions during improper operation and / or improper disposal of components.

For more information about residual risks of the power drive system components, see the relevant chapters in the technical user documentation.

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 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 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.

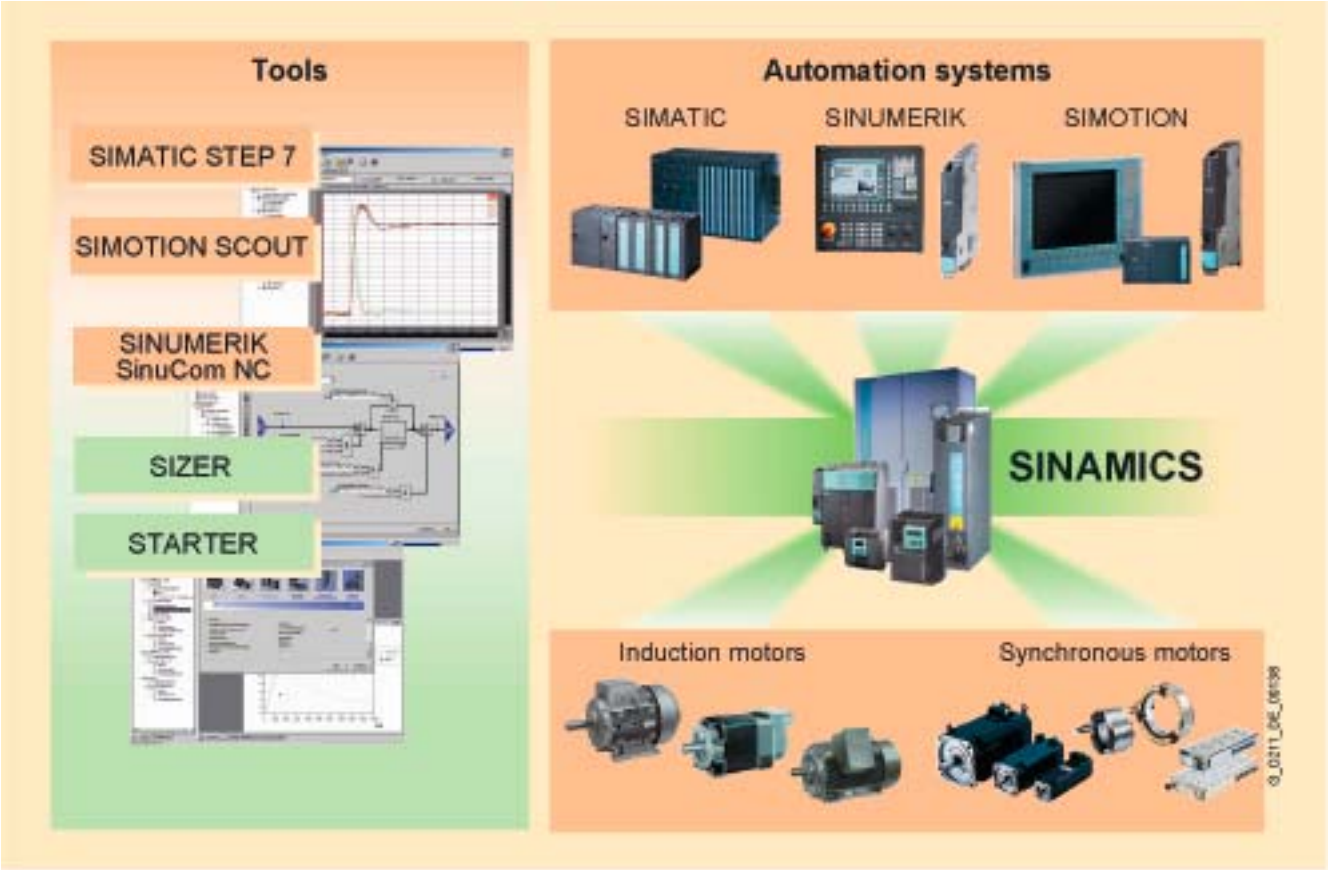


Figure 1-2 SINAMICS as part of the Siemens modular automation system

1.3 Introduction

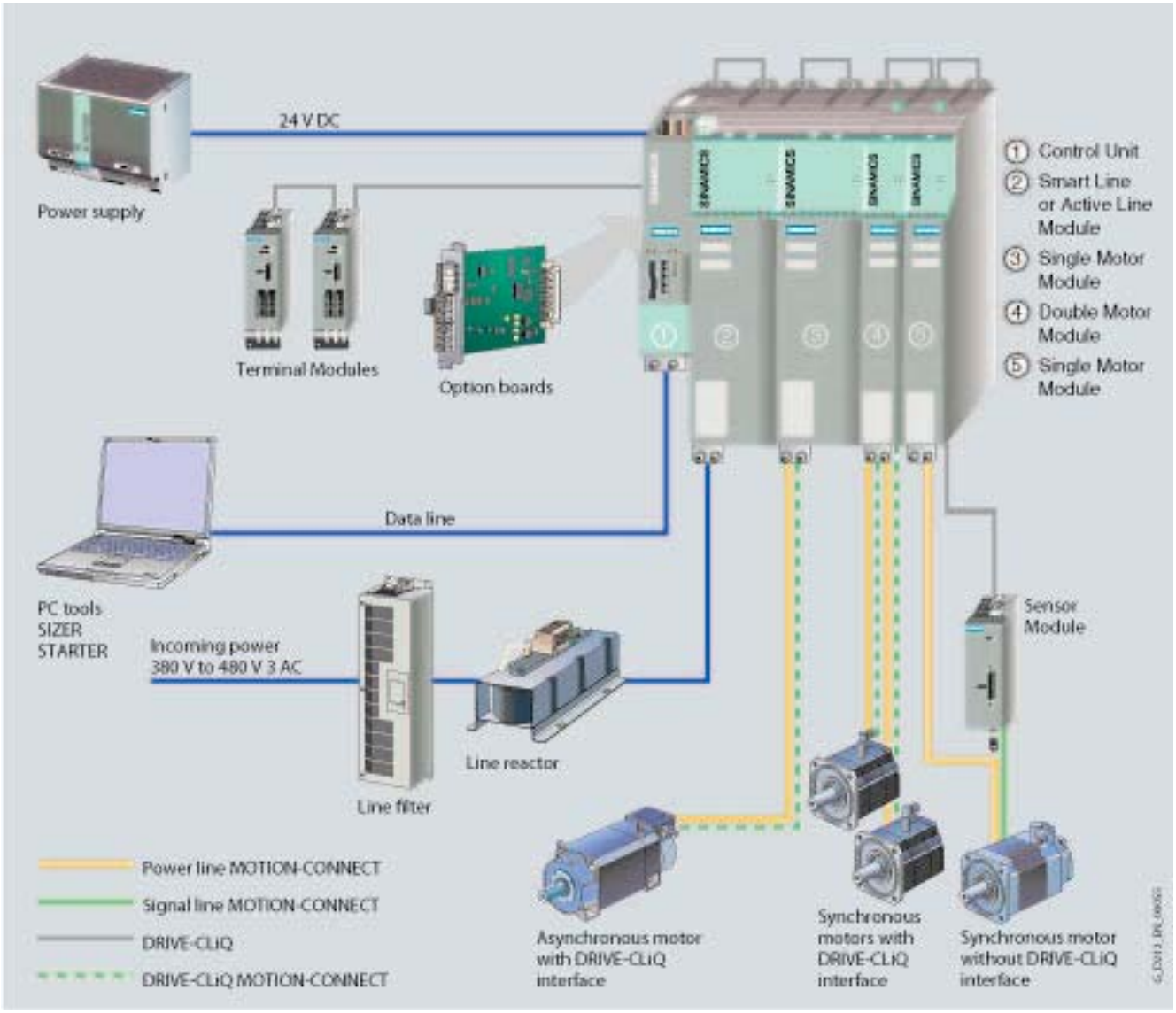


Figure 1-3 SINAMICS S120 system overview

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.

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

Electronic rating plates in all components

All SINAMICS S120 components have an electronic rating plate. This electronic rating 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 rating 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.

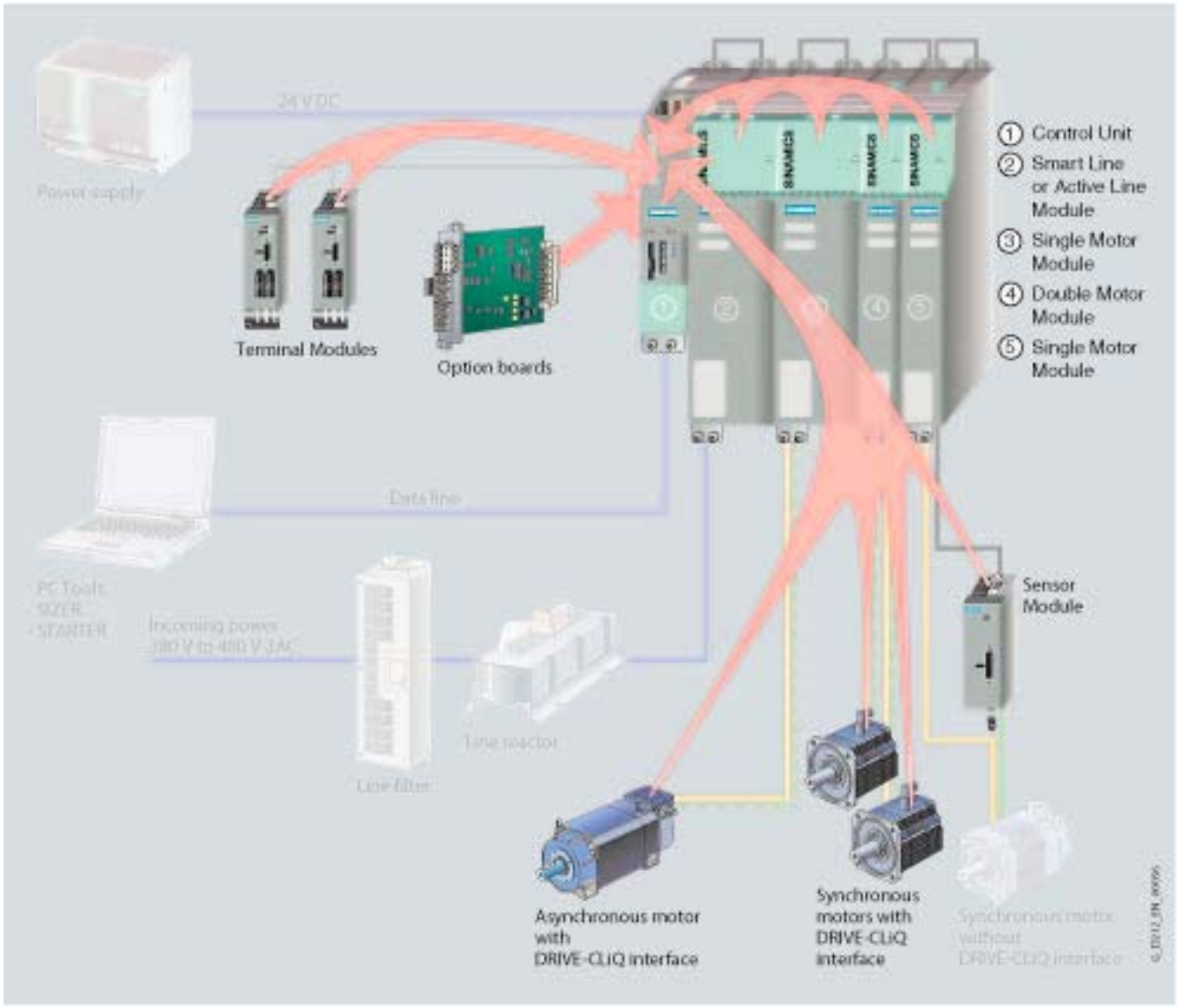


Figure 1-4 The electronic rating plate for SINAMICS S120

1.4 SINAMICS S120 Components

The following system 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.
- Supplementary system components that enhance functionality and offer different interfaces for encoders and process signals.

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

Booksize format

Booksize format units are optimized for multi-axis applications and are mounted adjacent to one another. The connection for the shared voltage-source DC link is an integral feature.

The booksize format offers various cooling options:

- Internal air cooling
- External air cooling
- Cold plate cooling

Booksize compact format

The booksize compact format combines all benefits of the booksize format and provides the same performance with an even smaller overall height and an extended overload capability. The booksize compact format is thus particularly well suited for integration into machines with high dynamic requirements and confined installation conditions.

The booksize format offers the following cooling options:

- Internal air cooling
- Cold plate cooling

Power units

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-regulated DC link voltage and are capable of regenerative feedback.

- Active Line Modules

  The Active Line Modules generate a regulated DC link voltage and are capable of regenerative feedback.

- Basic Line Modules
  Basic Line Modules generate a non-regulated DC link voltage and are not capable of regenerative feedback.

Motor Modules

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

1.5 System data

Technical data

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

Electrical specifications	
Electronics power supply	24 V DC -15/+20%, protective extra-low voltage DVC A (PELV)
Line connection voltage	3-ph. 380 V to 480 V AC ±10 % (-15 % < 1 min)
Line frequency	47 Hz to 63 Hz
Radio interference suppression acc. to EN 61800-3	Category C3 (standard) Category C2 (option) for systems implemented in conformance with the EC Declaration of Conformity for EMC and with the EMC Installation Guidelines, Order No.: 6FC5297-□AD30-0AP□
Overvoltage category	III acc. to EN 60664-1
Degree of contamination	2 acc. to EN 60664-1

Environmental conditions	
The Safety Integrated safety function: The components must be protected against conductive pollution (e.g. by installing them in a cabinet with degree of protection IP54B acc. to EN 60529). Provided that conductive pollution can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.	
Degree of protection Degree of protection for SME20/25/120/125 and DME20	IP20 or IPXXB acc. to EN 60529, open type acc. to UL 508 IP67, with mounted connectors or protective caps.
Protective class, line supply circuits Protective class, electronic circuits	I (with protective conductor connection) III (safety extra-low voltage DVC A /PELV) acc. to EN 61800-5-1
Permissible ambient temperature in the cabinet during operation	0 °C to +55 °C up to 2000 m above sea level. Above an altitude of 2000 m, the max. ambient temperature decreases by 3.5 K every 500 m. Installation altitude: max. 4000 m above sea level
Chemically active substances • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1C2 acc. to EN 60721-3-1 Class 2C2 acc. to EN 60721-3-2 Class 3C2 acc. to EN 60721-3-3
Biological environmental conditions • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1B1 acc. to EN 60721-3-1 Class 2B1 acc. to EN 60721-3-2 Class 3B1 acc. to EN 60721-3-3

Environmental conditions	
Vibratory load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation (except SME20/25/120/125) Test values for SME20/25/120/125 and DME20 • Operation	 Class 1M2 acc. to EN 60721-3-1 Class 2M3 acc. to EN 60721-3-2 Test values: Frequency range: 10 Hz to 58 Hz With constant deflection = 0.075 mm Frequency range: 58 Hz to 200 Hz With constant acceleration 1 g Frequency range: 10 Hz to 58 Hz With constant deflection = 0.37 mm Frequency range: 58 Hz to 200 Hz With constant acceleration 5 g
Shock stressing • Long-term storage in the transport packaging • Transport in the transport packaging • Operation (except SME20/25/120/125) Test values for SME20/25/120/125 and DME20 • Operation	 Class 1M2 acc. to EN 60721-3-1 Class 2M3 acc. to EN 60721-3-2 Test values: 15 g / 11 ms Test values: 25 g / 6 ms
Climatic ambient conditions • Long-term storage in the transport packaging • Transport in the transport packaging • Operation SME20/25/120/125 and DME20 • Operation	 Class 1K4 acc. to EN 60721-3-1 Temperature -25 °C to +55 °C Class 2K4 acc. to EN 60721-3-2 Temperature -40 °C to +70 °C Class 3K3 acc. to EN 60721-3-3 Temperature +0 °C to +40 °C Relative / absolute air humidity 5 % to 90 % / ≤ 25 g/m^3 Oil mist, salt mist, formation of ice, moisture condensation, dripping, spray, splashing and water jets not permissible Temperature +0 °C to +55 °C Air humidity: ≥ 5 % to ≤ 65 % annual average ≤ 85 % for max. 2 months / year moisture condensation and the formation of ice not permissible

Certificates	
Declarations of Conformity	CE (Low-Voltage and EMC Directives)
Approbation	cULus

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).

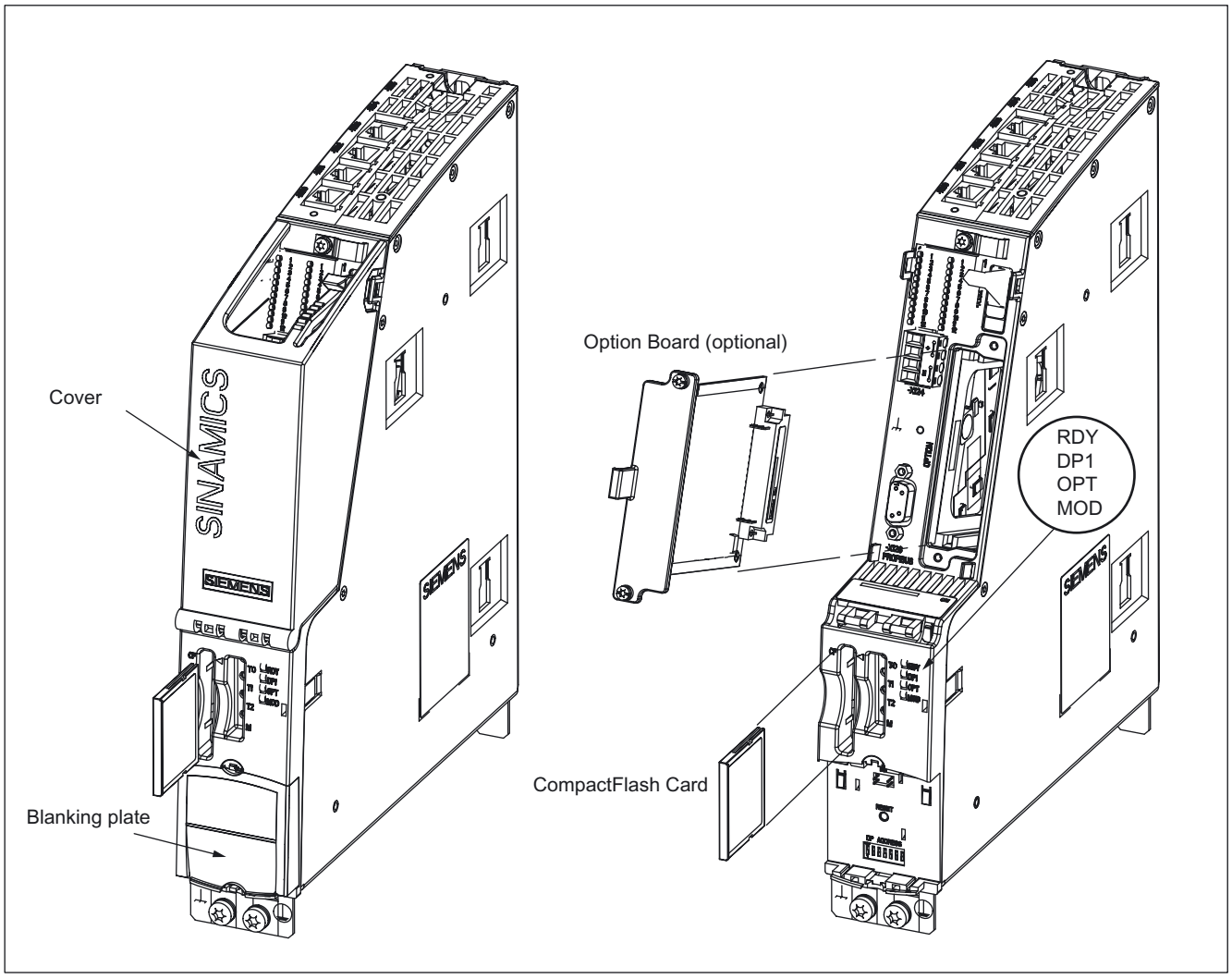


Figure 2-1 Overview Control Unit 320 (CU320)

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.

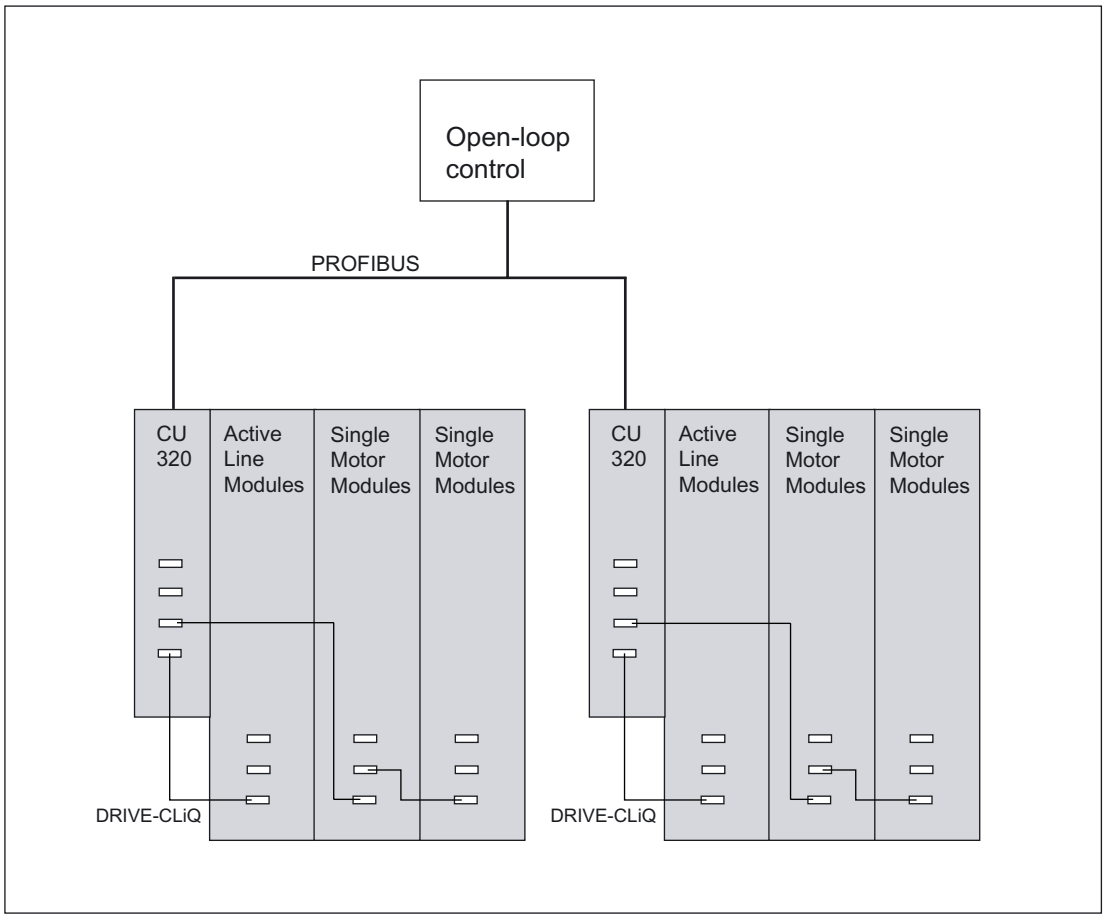


Figure 2-2 Sample configuration

2.2 Control Unit CU320

2.2.1 Description

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

The CU320 contains the following interfaces:

Table 2-1 Overview of the CU320 interfaces

Type	Quantity
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 should only be inserted and removed when both the Control Unit and option board are disconnected from the power supply.

⚠ WARNING

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

Note

The CompactFlash card may only be inserted and removed from the Control Unit when in the no-voltage condition.

2.2.3 Interface description

2.2.3.1 Overview

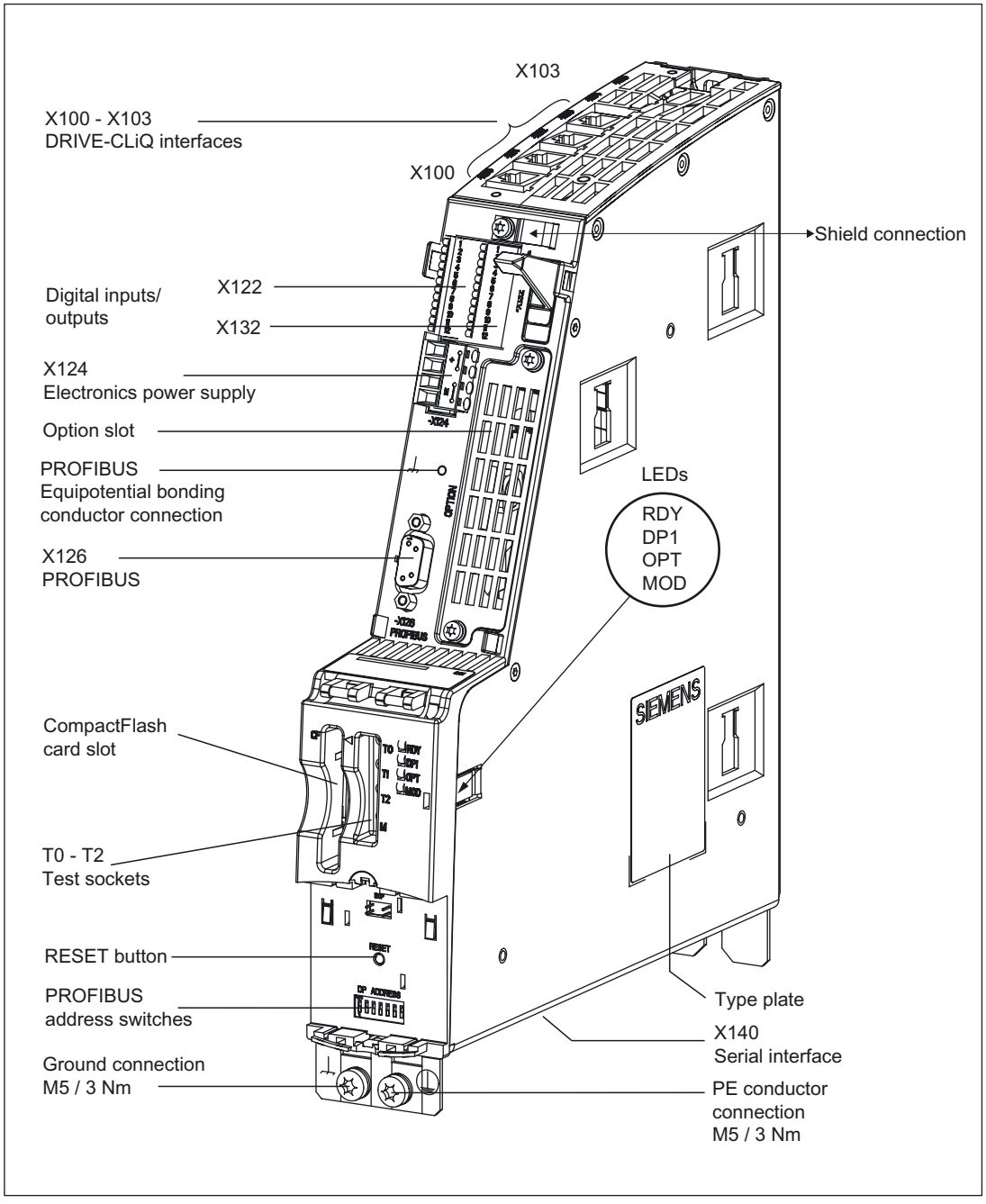


Figure 2-3 Interface description of the CU320 (covers removed)

2.2.3.2 Connection example

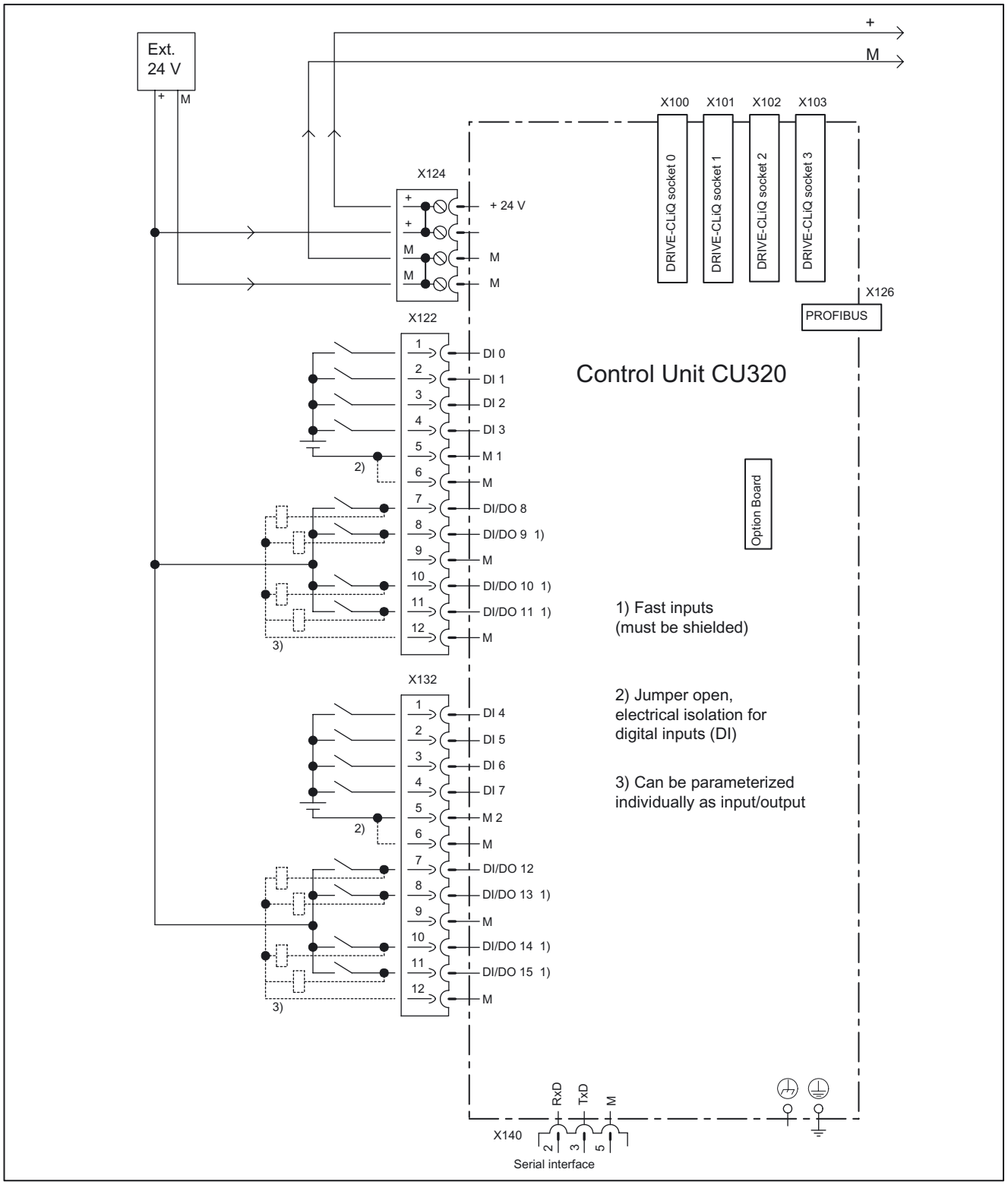


Figure 2-4 Example connection of CU320

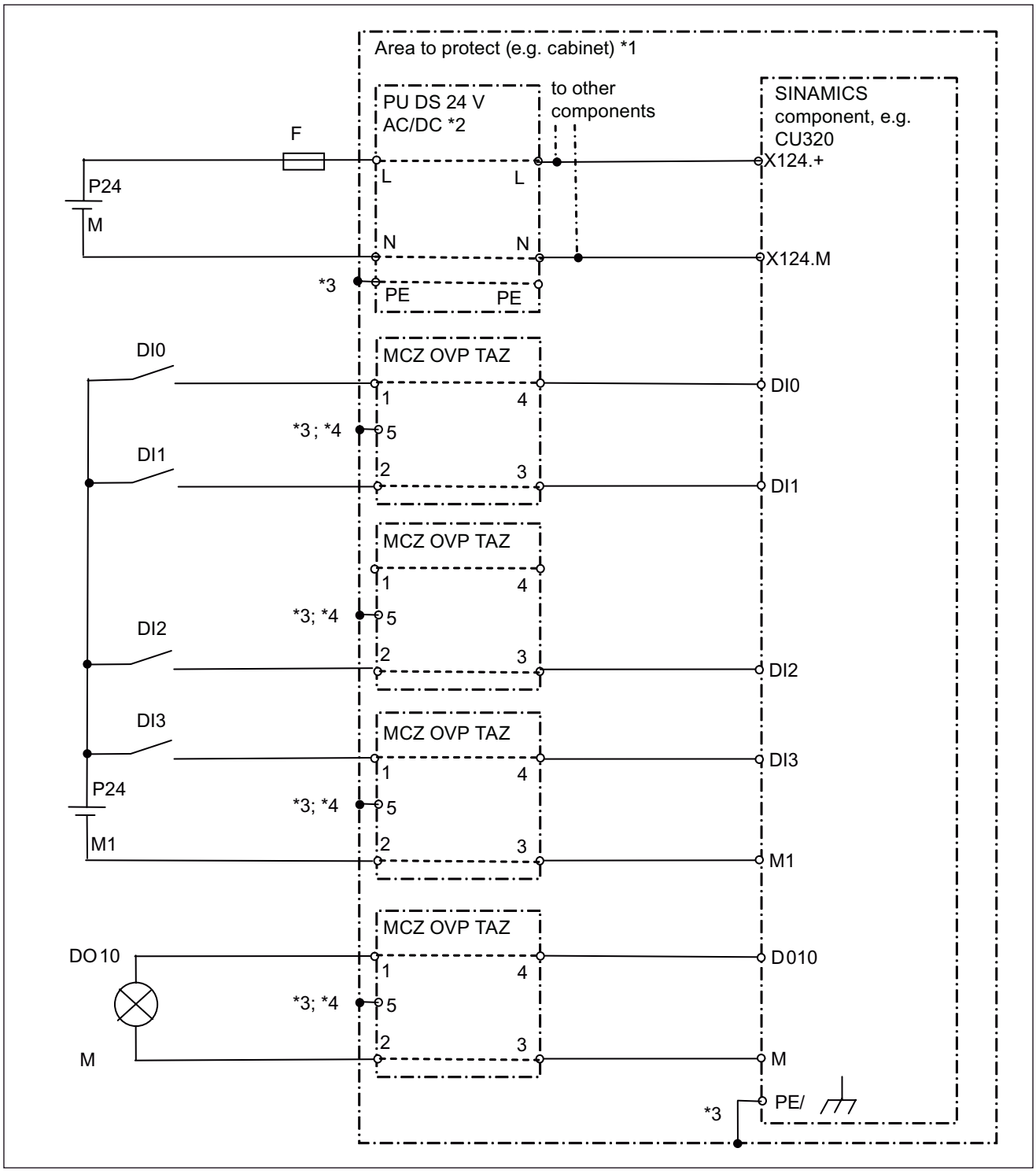


Figure 2-5 Connection example: Overvoltage protection components from Weidmüller to SINAMICS components

Designation	Part No.
PU DS 24V AC/DC	868210 0000
Weidmüller MCZ OVP TAZ	844915 0000

*1 The overvoltage protectors must be placed next to the area to be protected, e.g. entry point to the cabinet.

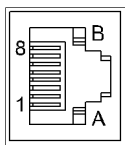
*2 Terminals 11, 12, 14 of the "PU DS 24V AC/DC" are isolated monitoring contacts (11 C, 12 NC, 14 NO). In the case of a thermal overload of the varistor installed, contacts 11-12 are opened and contacts 11-14 are closed.

*3 The metallic enclosure of the SINAMICS components and the PE connection of the overvoltage protector must be interconnected in a manner that ensures good conductivity (equipotential bonding). This can be achieved by installing the SINAMICS components on a metallic mounting plate and connecting the PE connections of the overvoltage protectors as directly as possible to the mounting plate.

*4 Snap the overvoltage protector (MCZ OVP TAZ) onto the metallic DIN rail to make the PE connection (terminal 5) to the rail. It is then sufficient to make a good conductive interconnection between the DIN rail and the metallic enclosure of the SINAMICS component (equipotential bonding). This is the case when both the DIN rail and the SINAMICS component are mounted on a common metallic mounting plate.

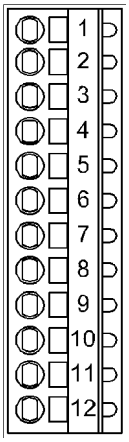
2.2.3.3 X100 - X103 DRIVE-CLiQ interface

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	M (0 V)	Electronics ground
Blanking plate on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13			

2.2.3.4 X122: Digital Inputs/Outputs

Table 2-3 Terminal block X122

	Terminal	Designation[1)]	Technical specifications
	1	DI 0	Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Isolation: The reference potential is terminal M1 Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V Input delay: for "0" → "1": approx. 50 µs for "1" → "0": approx. 100 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	M1	
	6	M	
	7	DI/DO 8	As input: Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V Terminal numbers 7, 8, 10, and 11 are "fast inputs" Input delay: for "0" → "1": approx. 50 µs / 5 µs for "1" → "0": approx. 100 µs/50 µs As output: Voltage: 24 V DC Max. load current per output: 500 mA continuous short-circuit proof output delay: for "0" → "1": approx. 400 µs for "1" → "0": approx. 100 µs
	8	DI/DO 9	
	9	M	
	10	DI/DO 10	
	11	DI/DO 11	
	12	M	
Max. connectable cross-section: 0.5 mm^2 Type: Spring-loaded terminal 1 (see Appendix A)			

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

NOTICE

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 achieved as follows:

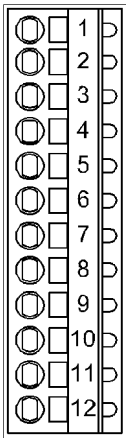
Connect the reference ground of the digital inputs, or a jumper to terminal M (Notice! This removes electrical isolation for these digital inputs).

Note

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

2.2.3.5 X132: Digital Inputs/Outputs

Table 2-4 Terminal block X132

	Terminal	Designation[1)]	Technical specifications
	1	DI 4	Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Isolation: The reference potential is terminal M2 Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V Input delay: for "0" to "1": approx. 50 µs for "1" to "0": approx. 100 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	M2	
	6	M	
	7	DI/DO 12	As input: Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V Terminal numbers 7, 8, 10, and 11 are "fast inputs" Input delay: for "0" to "1": approx. 5 µs for "1" to "0": approx. 50 µs As output: Voltage: 24 V DC Max. load current per output: 500 mA continuous short-circuit proof output delay: for "0" to "1": 400 µs for "1" to "0": 100 µs
	8	DI/DO 13	
	9	M	
	10	DI/DO 14	
	11	DI/DO 15	
	12	M	
Max. connectable cross-section: 0.5 mm^2 Type: Spring-loaded terminal 1 (see Appendix A)			

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

NOTICE

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 achieved as follows:

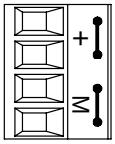
Connect the reference ground of the digital inputs, or a jumper to terminal M (Notice! This removes electrical isolation for these digital inputs).

Note

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

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) Current consumption: max. 0.8 A (without DRIVE-CLiQ or digital outputs) Max. 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 mm^2 Type: Screw terminal 2 (see Appendix A)			

Note

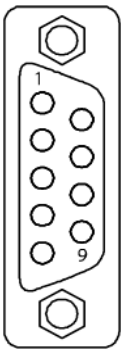
The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

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	-	Not assigned	
	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	-	Not assigned	
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.

⚠ CAUTION

A potential bonding conductor with a minimum cross-section of 25 mm² must be used between parts of a plant or system that are separated from one another. If this is not carefully complied with, then significant discharge (leakage) currents can flow through the PROFIBUS cable that will destroy the Control Unit or other devices connecting to PROFIBUS.

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 Example: 1 + 4 + 32 = 37 PROFIBUS address = 37	S1	$2^0 = 1$
	S2	$2^1 = 2$
	S3	$2^2 = 4$
	S4	$2^3 = 8$
	S5	$2^4 = 16$
	S6	$2^5 = 32$
	S7	$2^6 = 64$

Note

The factory setting of the DIP switch is 0 or 127. Parameter p0918 can be used to set the bus address for PROFIBUS to values between 1 and 126. The address can also be set manually to values between 1 and 126 using the DIP switch. Then, it is only possible to read the address with p0918.

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

Setting the PROFIBUS address

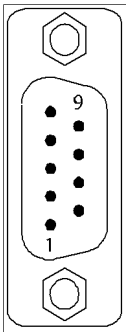
The following reference contains further information about setting the PROFIBUS address:

Reference: /IH1/ SINAMICS S120 Commissioning Manual

2.2.3.9 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

2.2.3.10 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 Resolution: 8 bits Load current: max. 3 mA Continued-short-circuit-proof 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.		

Note

The test sockets are provided as a support to commissioning and diagnostics; they must not be connected for normal operation.

2.2.3.11 Slot for the CompactFlash card

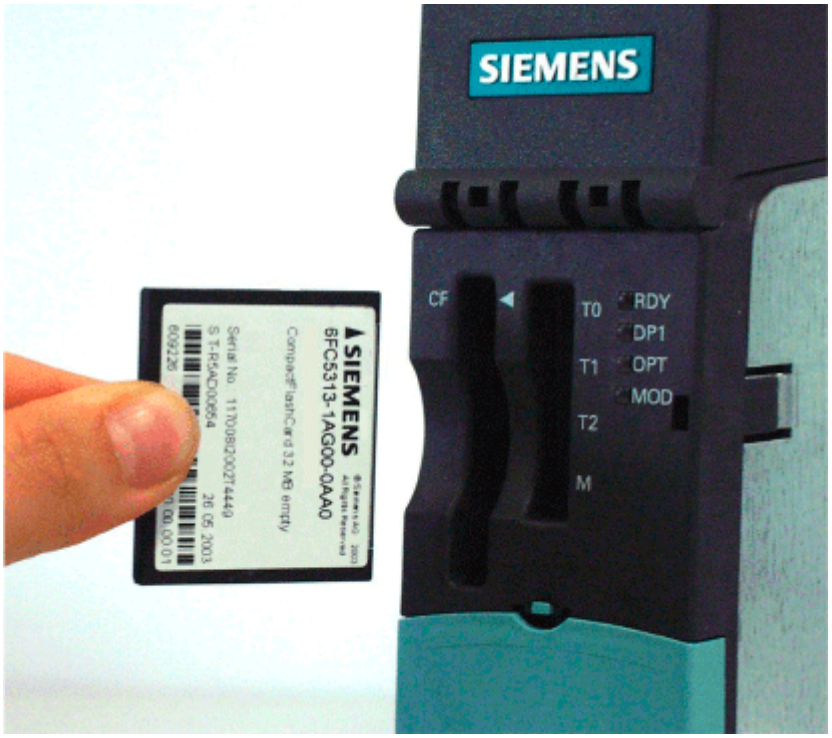


Figure 2-6 CompactFlash card slot

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 in a no-voltage condition. 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.

2.2.3.12 Description of the LEDs on the Control Unit

The individual statuses during booting are indicated via the LEDs on the Control Unit (CU320, CU310).

- The duration of the individual statuses varies.
- If an error occurs, booting is aborted and the cause of the error is indicated via the LEDs. **Remedy:** Insert the appropriate CompactFlash card with the correct software and parameters.
- Once the unit has been successfully booted, all the LEDs are switched off briefly.
- Once the unit has been booted, the LEDs are driven via the loaded software.

  The description of the LEDs after booting applies.

Control Unit 310/320 – behavior of the LEDs during booting

Table 2-10 Load software 1

LED				Status	Comment
RDY	DP1	OPT	MOD		
red	red	red	off	Reset	–
red 2 Hz	red	red	off	error	• CompactFlash card not inserted or • Load software 2 has not been installed on the CompactFlash card or is defective.

Table 2-11 Load software 2

LED				Status	Comment
RDY	DP1	OPT	MOD		
off	red	red	off	Loaded	–
off	Orange	red	off	Running	–
off	red 2 Hz	red	off	error file	Software on the CompactFlash card is incomplete or defective.
off	red 0.5 Hz	red	off	error crc	CRC invalid.
off	off	red	off	Firmware loaded	–

Table 2-12 Firmware

LED				Status	Comment
RDY	DP1	OPT	MOD		
off	off	off	off	initializing	–
alternating				Running	refer to the following table

Behavior of the LEDs after booting

Table 2- 13 Control Unit 320 - description of the LEDs after booting

LED	Color	State	Description, cause	Remedy
RDY (READY)	-	OFF	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous	The component is ready and cyclic DRIVE-CLiQ communication takes place or the Control Unit waits for initial commissioning.	–
		Flashing 0.5 Hz	Commissioning/reset	
		Flashing 2 Hz	Writing to the memory card.	–
	Red	Continuous	At least one fault is present in this component.	Remedy and acknowledge fault
		Flashing 0.5 Hz	Firmware update complete, wait for PowerOn	
		Flashing 2 Hz	Boot error	Check whether CompactFlash card is plugged in correctly Replace CompactFlash card Replace Control Unit Carry out a POWER ON
		Flashing 2 Hz	General error bus error	
	Green/ red	Flashing 0.5 Hz	Control Unit 320 is ready for operation. However there are no software licenses.	Obtain licenses
	Orange	Continuous	System booting and DRIVE-CLiQ communication is being established.	–
		Flashing 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components	-
		Flashing 2 Hz	Firmware update is complete for components. Wait for POWER ON for the components in question.	Turn POWER ON for the components in question
	Green/ orange or red/ orange	Flashing 1 Hz	Component detection via LED is activated (p0124[0]). **Note:** Both options depend on the LED status when component recognition is activated via p0124[0] = 1.	-
DP1 PROFIdrive cyclic operation	-	OFF	Cyclic communication has not (yet) taken place. **Note:** The PROFIdrive is ready to communicate when the Control Unit is ready to operate (see LED RDY).	–
	Green	Continuous	Cyclic communication is taking place.	–

LED	Color	State	Description, cause	Remedy
		Flashing 0.5 Hz	Full cyclic communication has not yet taken place. Possible causes: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller.	–
	Red	Continuous	Cyclic communication has been interrupted.	Remedy fault
	Orange	Flashing 2 Hz	Firmware CRC error.	Check whether CompactFlash card is plugged in correctly Replace CompactFlash card Replace Control Unit Carry out a POWER ON
OPT (OPTION)	–	OFF	Electronics power supply missing, is outside permissible tolerance range, component is not ready for operation, Option Board is not available, no associated drive object has been created,	–
	Green	Continuous	Option board is ready.	–
		Flashing 0.5 Hz	Depends on the option board used.	–
	Red	Continuous	At least one fault is present in this component. Option board not ready (e.g. after power-on).	Remedy and acknowledge fault
MOD	–	OFF	Reserved	–

2.2.4 Dimension Drawing

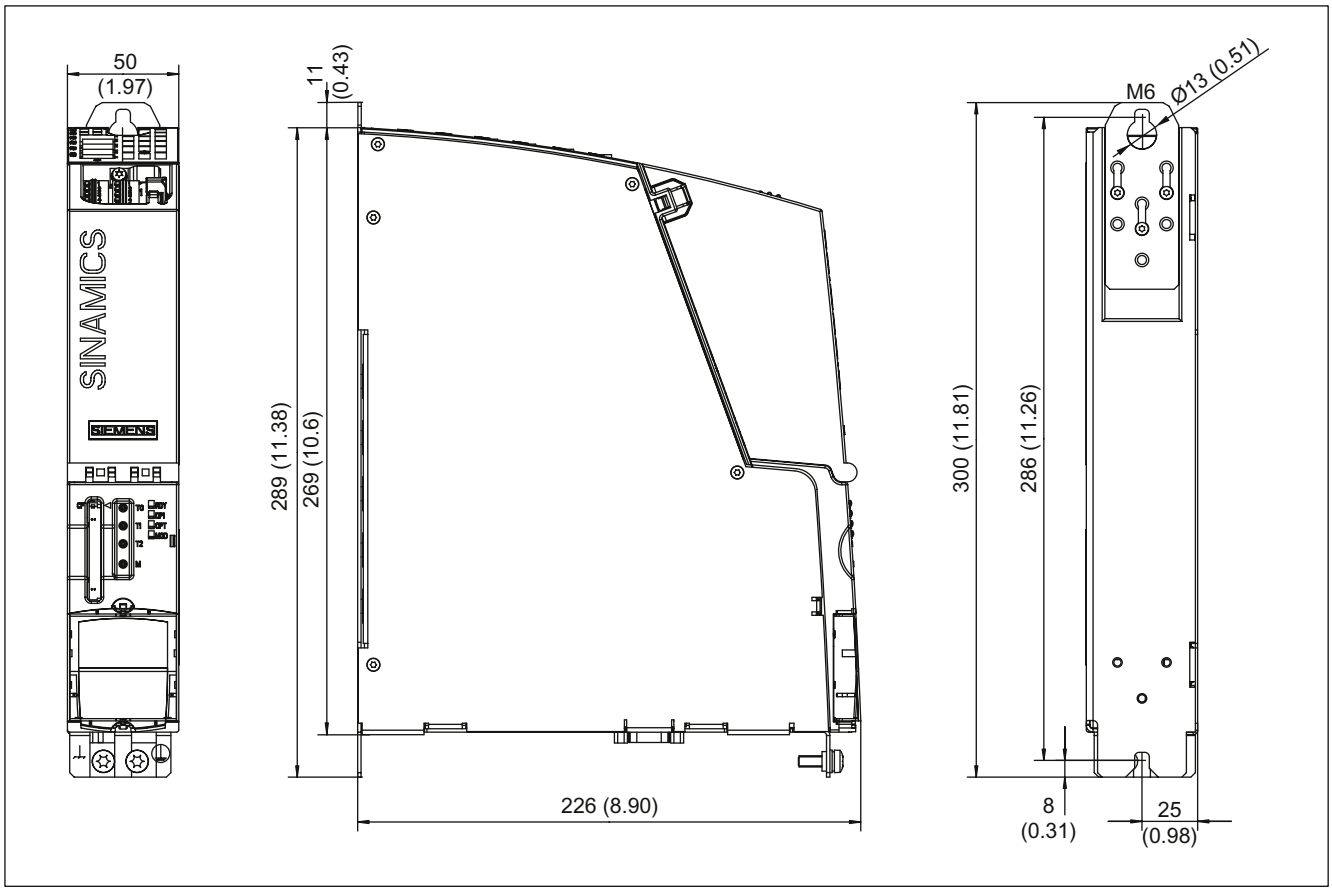


Figure 2-7 Dimension drawing: CU320

2.2.5 Installation

Mounting the CU320 directly on a Line Module booksize

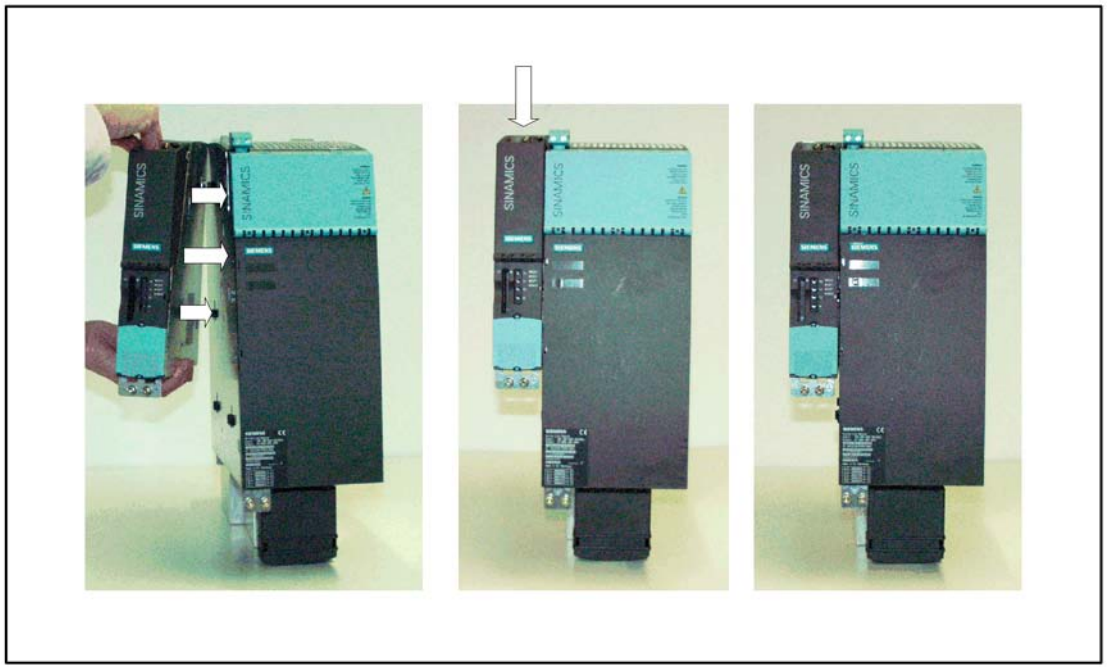


Figure 2-8 Mounting the CU320 directly on a Line Module in booksize format

Installing the CU320 directly on a mounting surface

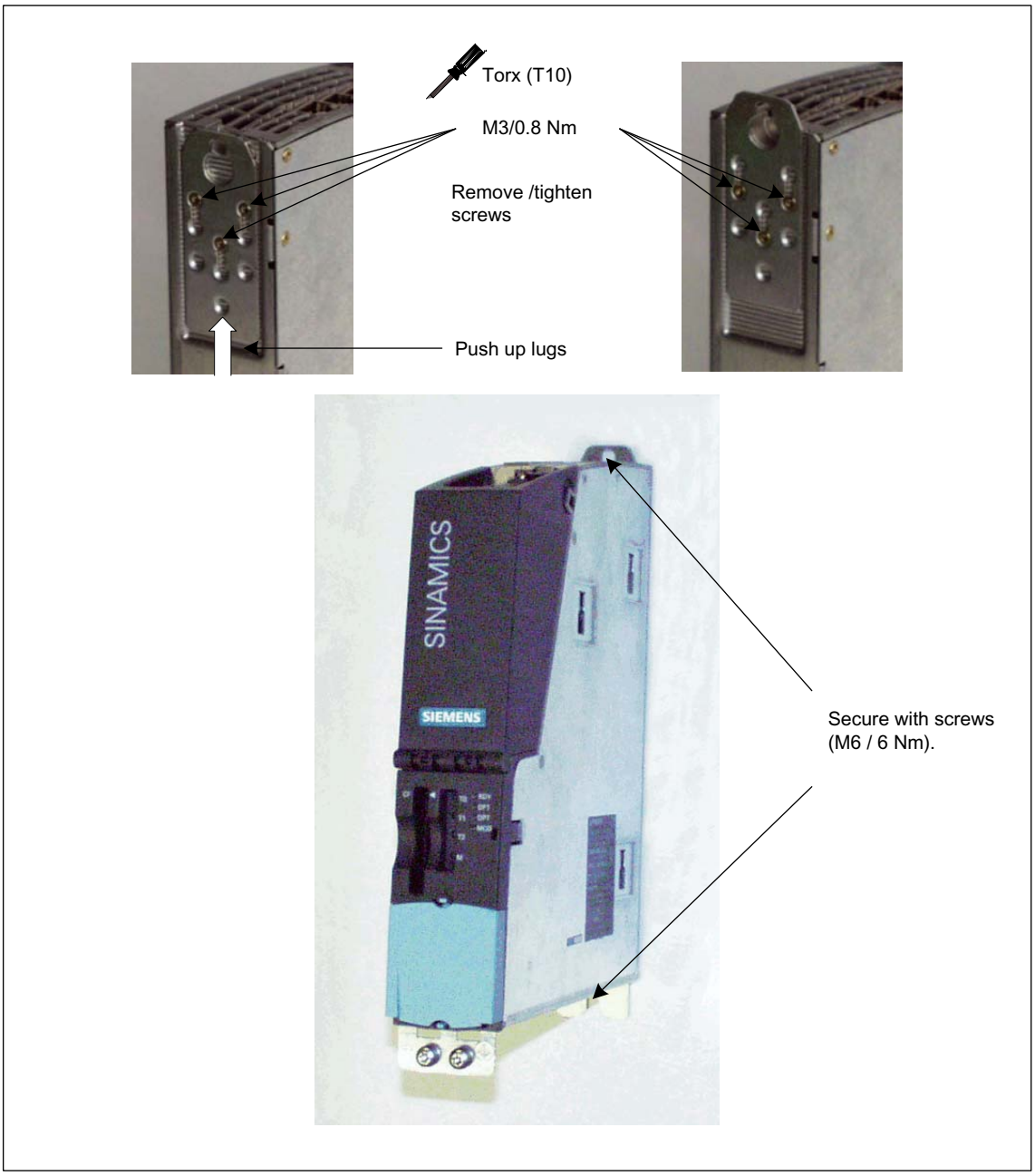


Figure 2-9 Installing the CU320 directly on a mounting surface

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.

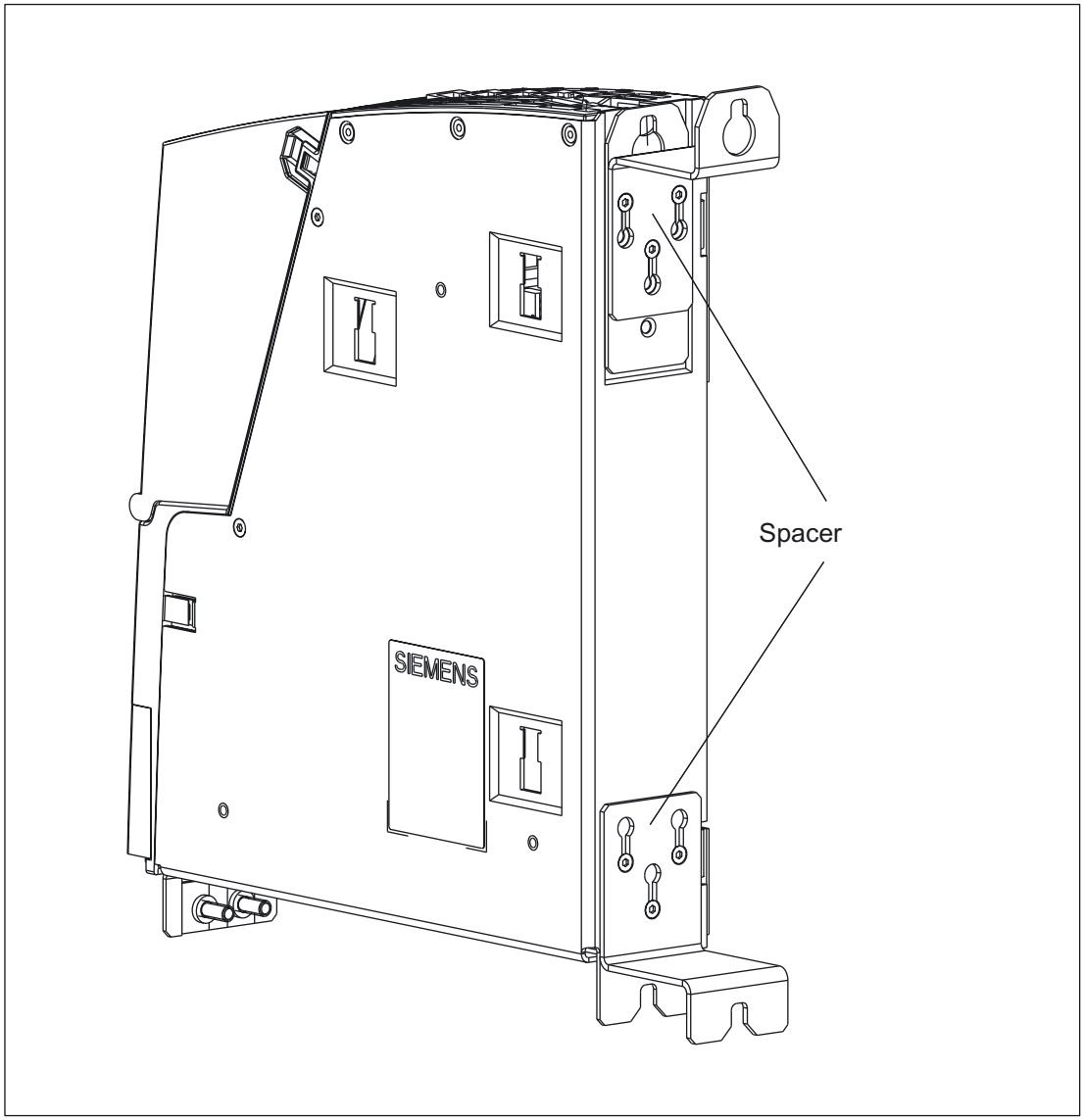


Figure 2-10 Installing the CU320 on a mounting surface using spacer elements

Removing/opening the cover of the CU320

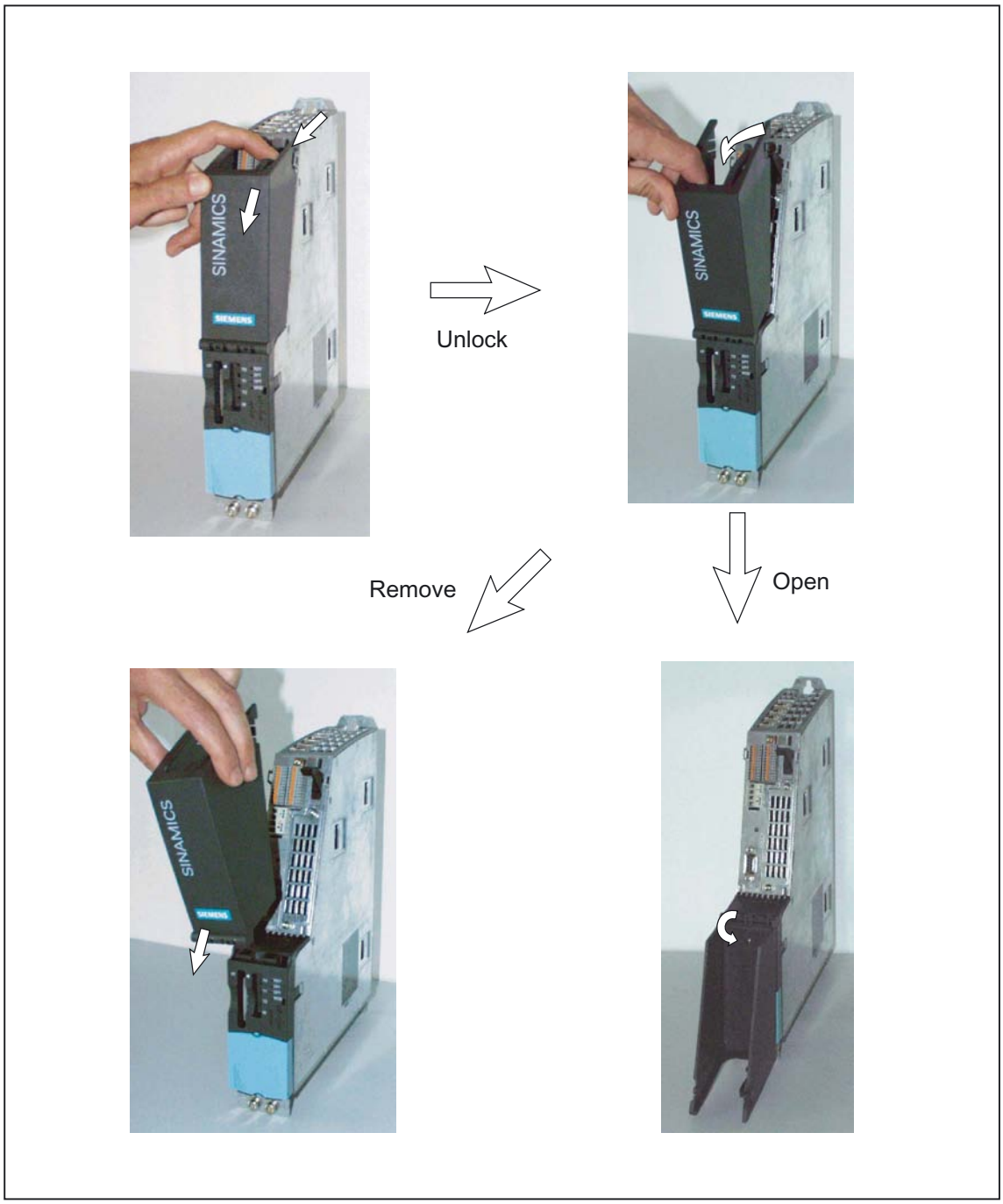


Figure 2-11 Removing/opening the cover of the CU320

2.2.6 Technical Specifications

Table 2-14 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}	0.8
Power loss	W	20
Maximum DRIVE-CLiQ cable length	m	100
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 diagram). **References:** / LH1/ SINAMICS S List Manual, Chapter "Function diagrams".	
Weight	kg	1.5

Additional system components

3

3.1 Basic Operator Panel BOP20

3.1.1 Description

The Basic Operator Panel BOP20 contains six keys and a backlit display unit. The BOP20 can be plugged onto the SINAMICS Control Unit 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

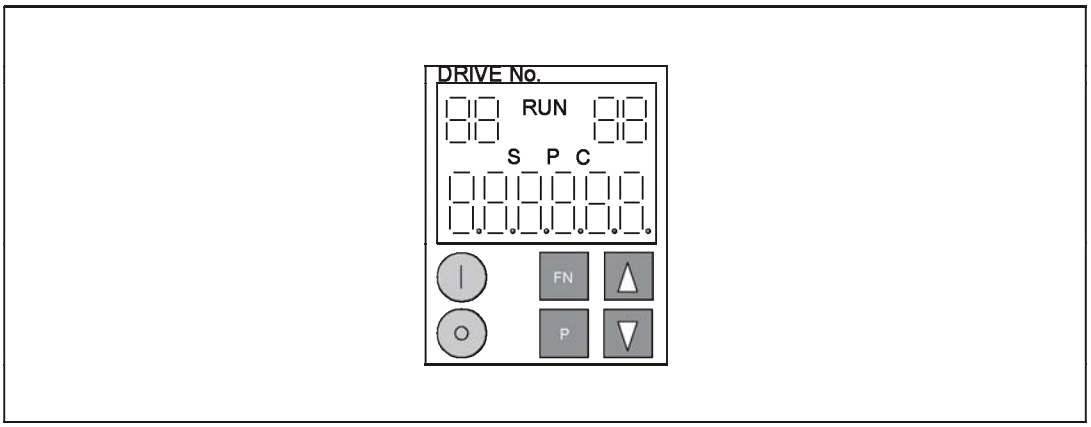


Figure 3-2 Overview of displays and keys

Table 3-1 Displays

Display	Meaning
top left 2 positions	The active drive object of the BOP is displayed here. 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 2 positions	The following is displayed in this field: • 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) • Faults: Selects/displays other drives with faults • Designation of BICO inputs (bi, ci) • Designation of BICO outputs (bo, co) Source object of a BICO interconnection to a drive object different than the active one.
S	Is lit (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 lit (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	Powering-up the drives for which the command "ON/OFF1", "OFF2" or "OFF3" should come from the BOP.
	OFF	Powering-down the drives for which the commands "ON/OFF1", "OFF2" or "OFF3" should come from the BOP.
		Note: 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). 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. **Note:** 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 latching cams of the cover together
	
3. Remove the cover	4. Locate the BOP20

3.2 Option Board: Communication Board CBC10

3.2.1 Description

The Communication Board 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

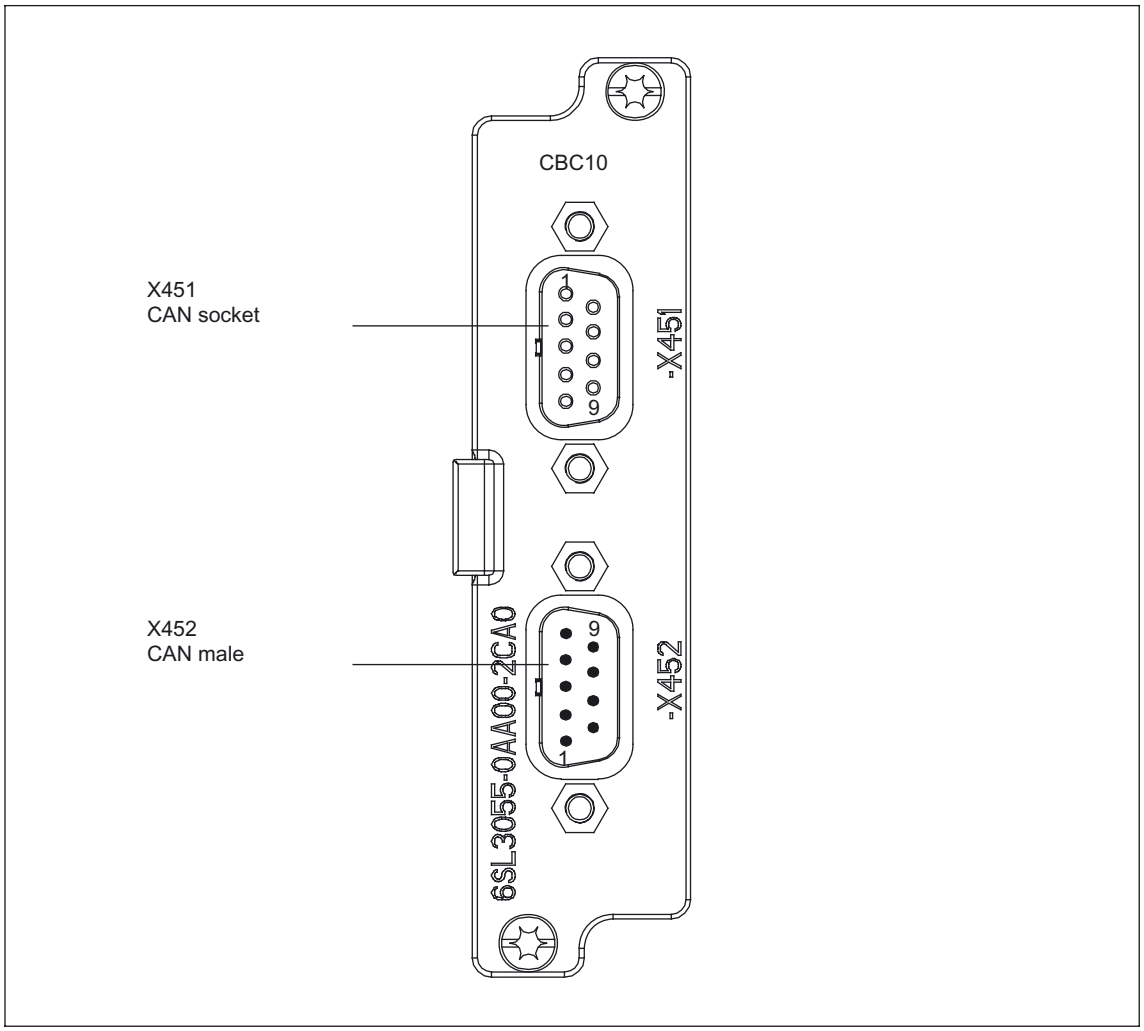
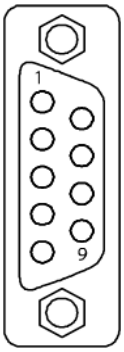


Figure 3-3 Interface description of the CBC10

3.2.3.2 CAN bus interface X451

Table 3-4 CAN bus interface X451

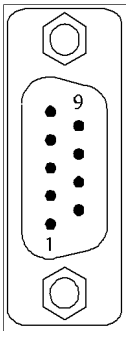
	Pin	Designation	Technical data
	1	Reserved, do not use	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved, do not use	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved, do not use	
	9	Reserved, do not use	
Type: 9-pin SUB-D female			

⚠ CAUTION

If the CAN bus interface is connected to the PROFIBUS connector, then this can destroy the CAN interface.

3.2.3.3 CAN bus interface X452

Table 3-5 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

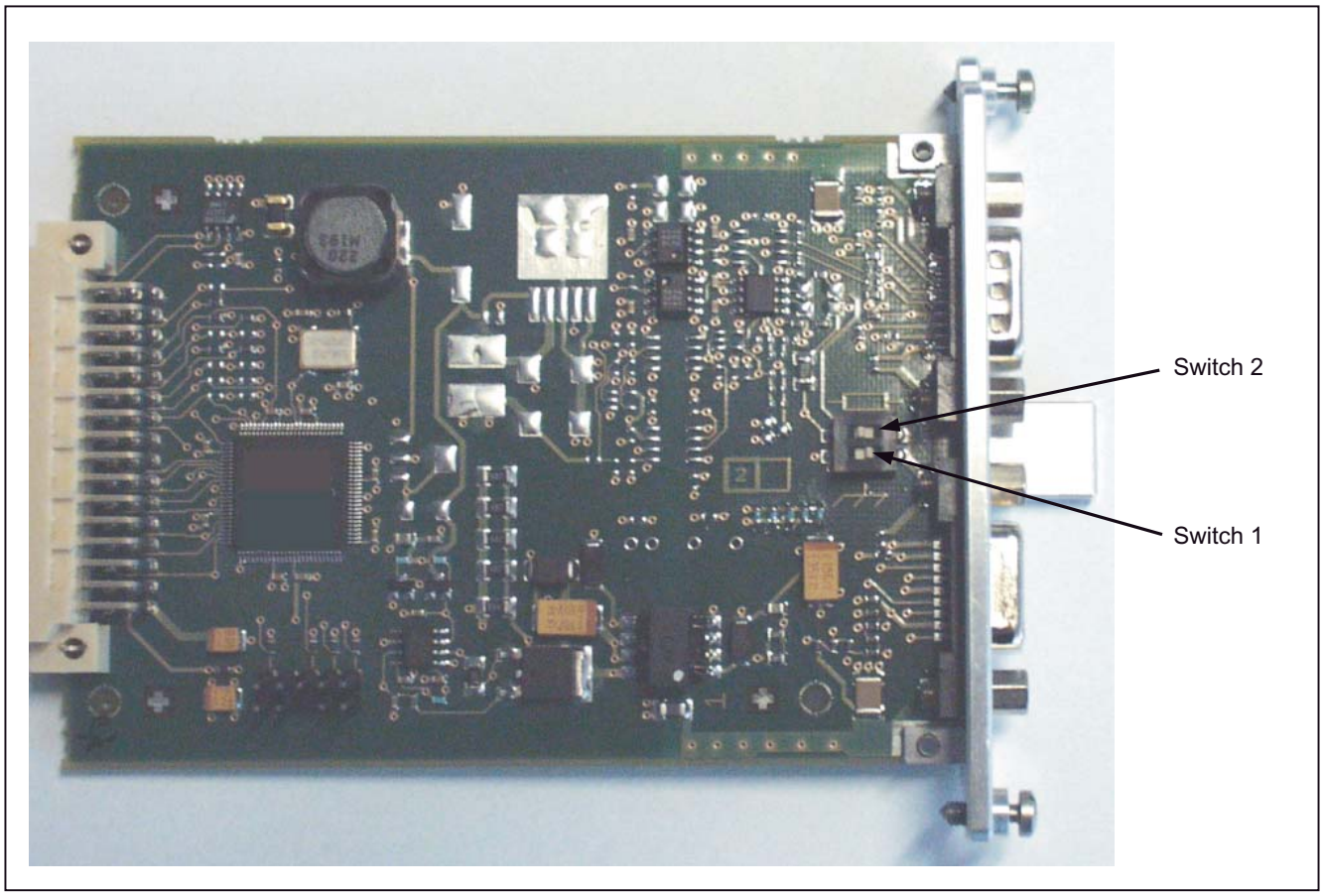
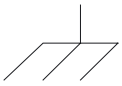


Figure 3-4 Switch 2/1

Table 3-6 2-pin SMD DIL switch

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

3.2.3.5 Meaning of the LED

Table 3-7 Communication Board CAN 10 (CBC10) – description of the LEDs

LED	Color	State	Description, cause	Remedy
OPT on the Control Unit	–	OFF	Electronics power supply is missing or outside permissible tolerance range. Communication Board either defective or not inserted.	–
	Green	Continuous	OPERATIONAL	–
		Flashing	PREOPERATIONAL No PDO communication possible	–
		Single flash	STOPPED Only NMT communication possible	
	Red	Continuous	BUS OFF	Check baud rate Check cabling
		Single flash	ERROR PASSIVE MODE The error counter for "error passive" has reached the value 127. After the SINAMICS drive system was booted no further active CAN component was on the bus.	Check baud rate Check cabling
		Double flash	Error Control Event, a Guard Event has occurred	Check connection to CANopen master

3.2.4 Installation/Mounting

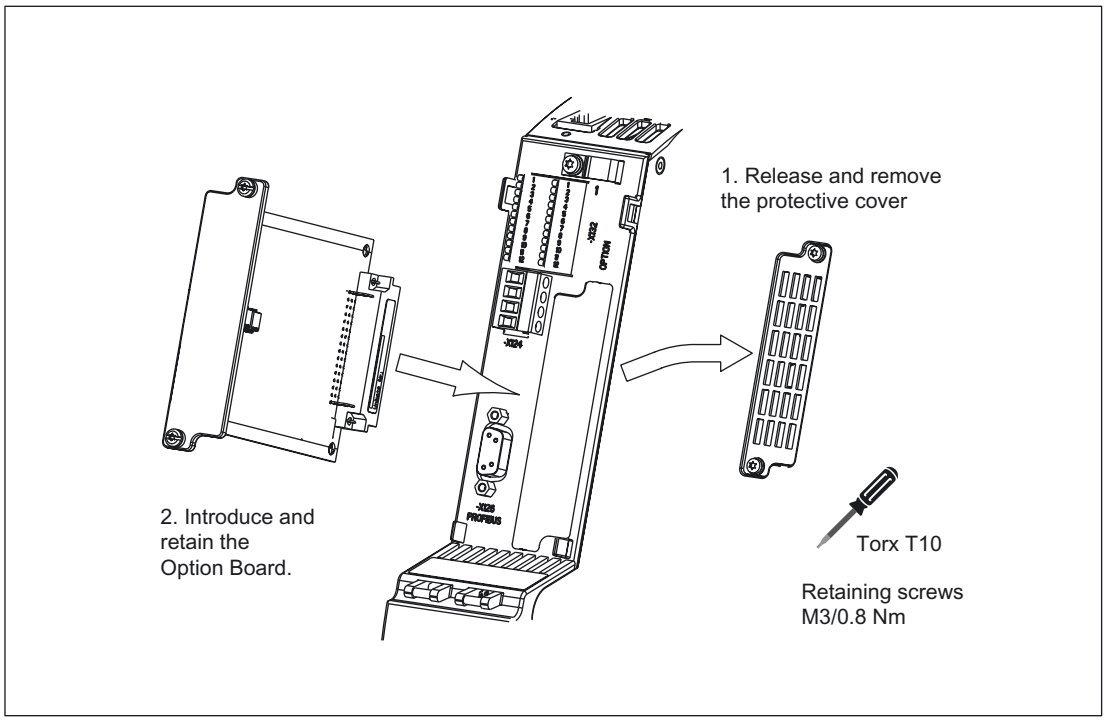


Figure 3-5 Installation of an option board in a CU320

3.2.5 Technical Specifications

Table 3-8 Technical specifications

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

3.3 Option board: Communication Board CBE20

3.3.1 Description

The SINAMICS S120 system can be connected to PROFINET using the Communication Board CBE20 interface board. 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

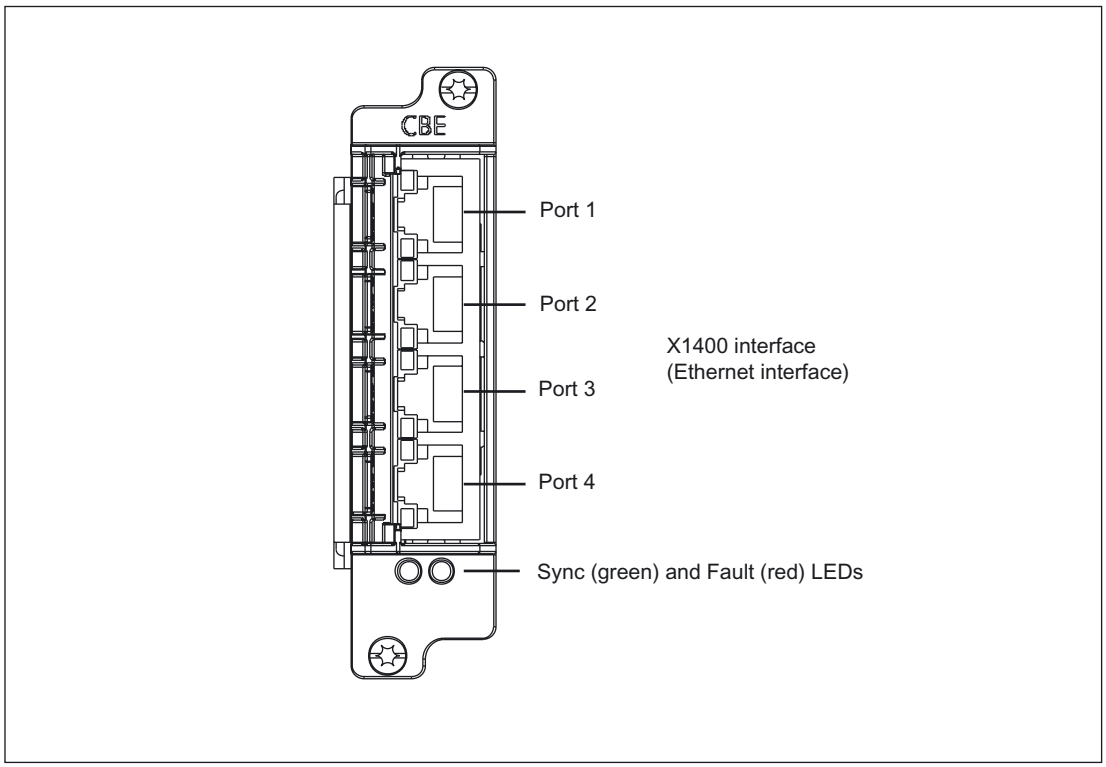


Figure 3-6 Interface description CBE20

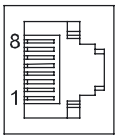
MAC address

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 Meanings of the LEDs on the CBE20 Communication Board Ethernet

Table 3-10 Communication Board Ethernet CBE20 – description of the LEDs

LED	Color	Status	Description, cause	Remedy
Link port	-	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	-	OFF	Electronics power supply is missing or outside permissible tolerance range.	–
	Yellow	Continuous	Data is being received or sent at port x.	–
Fault	–	OFF	If the Link Port LED is green: The CBE20 is operating normally, data is being exchanged with the configured IO Controller	–
	Red	Flashing	• The response monitoring interval has elapsed. • Communications is interrupted. • The IP address is incorrect. • Incorrect or no configuration. • Incorrect parameter settings. • Incorrect or missing device name. • IO Controller not connected/switched off, although an Ethernet connection has been established. • Other CBE20 errors	–
		Continuous	CBE20 bus error • No physical connection to a subnet/switch. • Incorrect transmission rate • Full duplex transmission is not activated.	–
Sync	–	OFF	If the Link Port LED is green: Control Unit task system is not synchronized with the IRT clock. An internal substitute clock is generated.	–
	Green	Flashing	The Control Unit task system has synchronized with the IRT clock cycle and data is being exchanged.	–
		Continuous	Task system and MC-PLL have synchronized with the IRT clock.	–
OPT on the Control Unit	–	OFF	Electronics power supply is missing or outside permissible tolerance range. Communication Board either defective or not inserted.	–
	Green	Continuous	Communication Board is ready and cyclic communication is taking place.	–
		Flashing 0.5 Hz	The Communication Board is ready, but cyclic communication is not yet taking place. Possible causes: • At least one fault is present. • Communication is being established.	–

LED	Color	Status	Description, cause	Remedy
	Red	Continuous	Cyclic communication via PROFINET has not yet been established. However, non-cyclic communications are possible. SINAMICS waits for a parameterizing/configuring telegram	–
		Flashing 0.5 Hz	The firmware has not been successfully downloaded to the CBE20 (error). Possible causes: • The CBE20 is defective. • The memory card for the Control Unit is defective. In this state CBE20 cannot be used.	–
		Flashing 2.5 Hz	Communication between the Control Unit and CBE20 is faulty. Possible causes: • Board was withdrawn after booting. • The board is defective	Correctly insert the board, if required, replace.
	Orange	Flashing 2.5 Hz	Firmware is being downloaded.	–

3.3.4 Installation

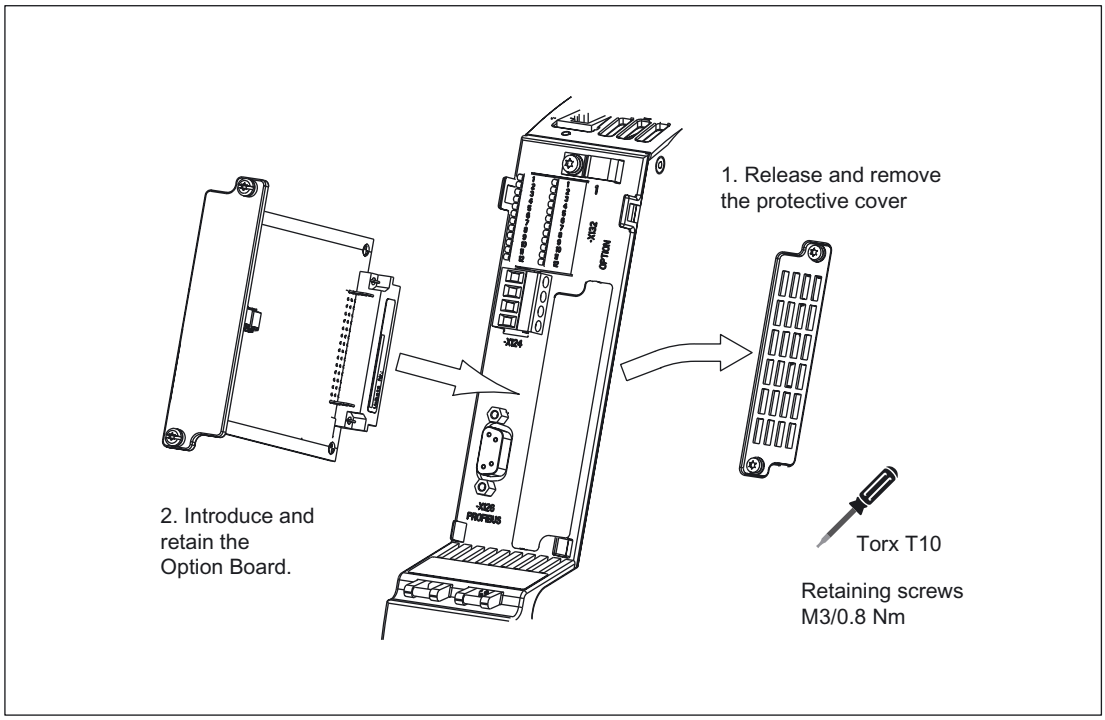


Figure 3-7 Installing the CBE20

3.3.5 Technical specifications

Table 3-11 Technical specifications

Communication Board CBE20 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 TB30

3.4.1 Description

The Terminal Board TB30 is a terminal expansion board for plugging onto the Control Unit.

The TB30 contains the following terminals:

Table 3-12 Interface overview of the TB30

Type	Quantity
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

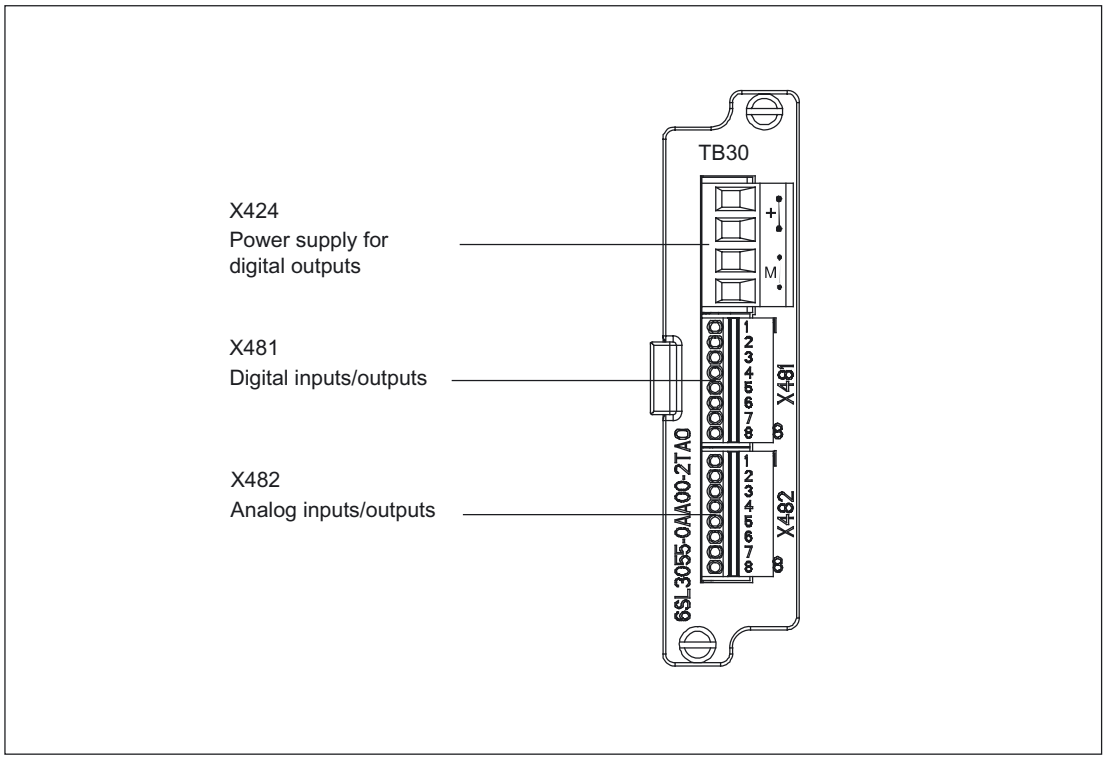


Figure 3-8 Interface description of the TB30

3.4.3.2 Connection example

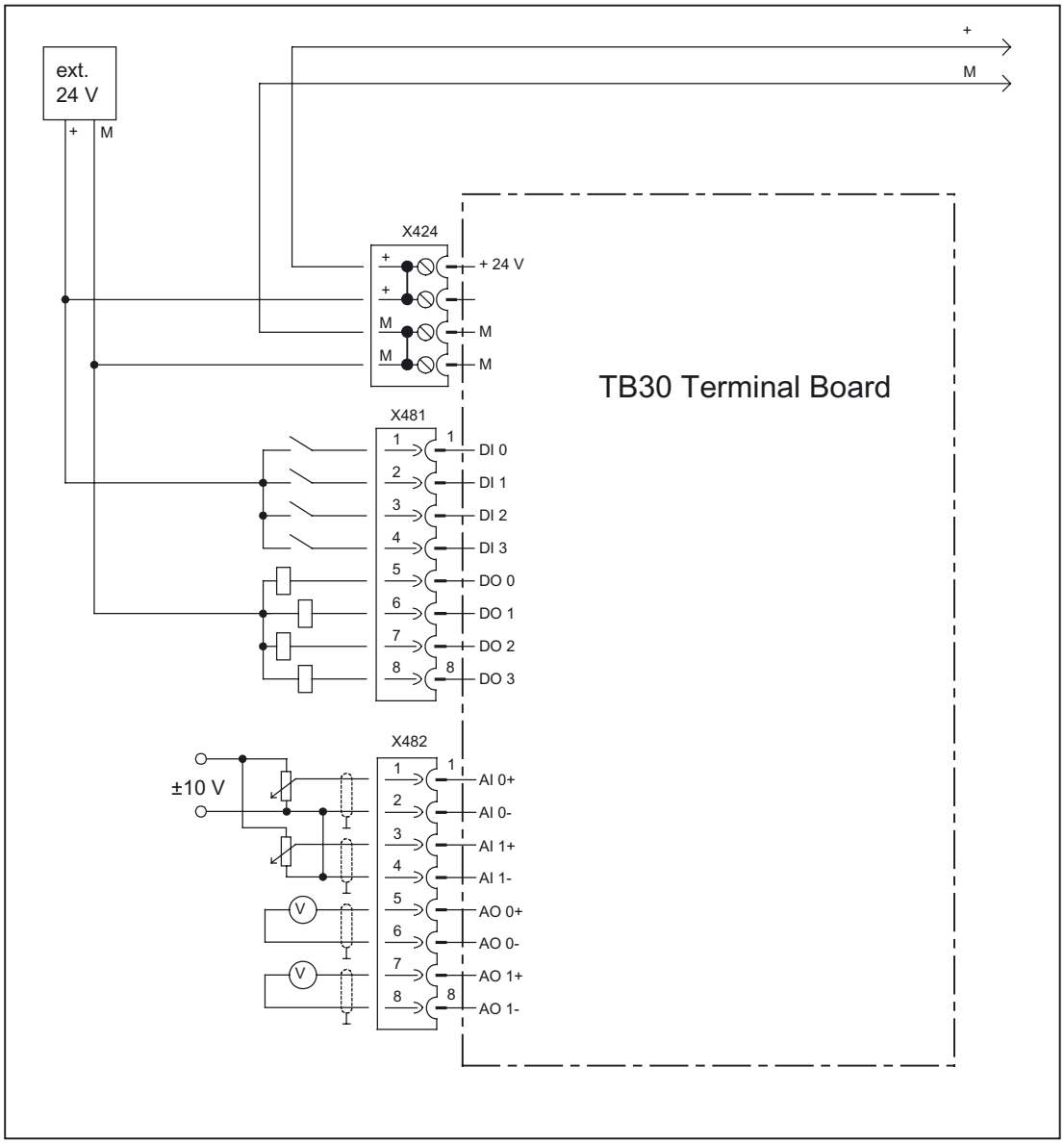
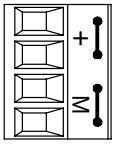


Figure 3-9 Example connection of TB30

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) Current consumption: max. 4 A (per digital output max. 0.5 A) Max. current via jumper in connector: 20 A at 55 °C
	+	Power supply	
	M	Ground	
	M	Ground	
Max. connectable cross-section: 2.5 mm^2 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

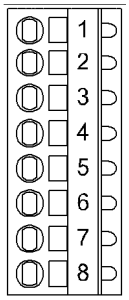
The power supply of the digital outputs and the electronics power supply of the Control Unit are isolated.

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	Designation[1)]	Technical data
	1	DI 0	Voltage: - 3 V to 30 V Typical current consumption: 10 mA at 24 V DC Ground reference: X424. M Input delay: - for "0" to "1": 20 µs - for "1" to "0": 100 µs Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DO 0	Voltage: 24 V DC Max. load current per output: 500 mA Reference ground: X424.M Sustained short-circuit-proof Output delay: - for "0" to "1": Typically 150 µs at 0.5 A ohmic load (500 µs maximum) - for "1" to "0": Typically 50 µs at 0.5 A ohmic load
	6	DO 1	
	7	DO 2	
	8	DO 3	
Max. connectable cross-section: 0.5 mm^2 Type: Spring-loaded terminal 1 (see Appendix A)			

1) DI: digital input, DO: Digital output

Note

An open input is interpreted as "low".

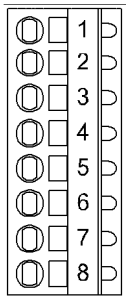
The power supply and the digital inputs/outputs are isolated from the Control Unit.

Note

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

3.4.3.5 Analog inputs/outputs X482

Table 3-15 Terminal block X482

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

1) AI: analog input, AO: Analog output

Note

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

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:

References: /IH1/ SINAMICS S120 Commissioning Manual

3.4.4 Installation/Mounting

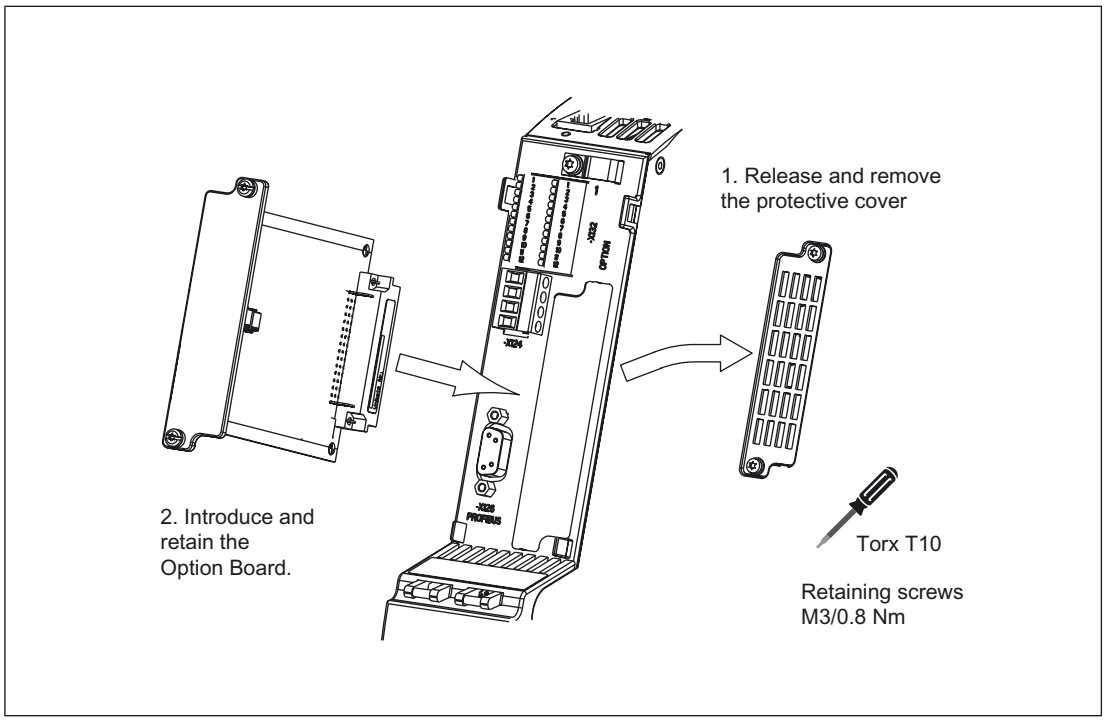


Figure 3-10 Installation of an option board in a CU320

3.4.5 Electrical Connection

Shield connection of the TB30 on the Control Unit

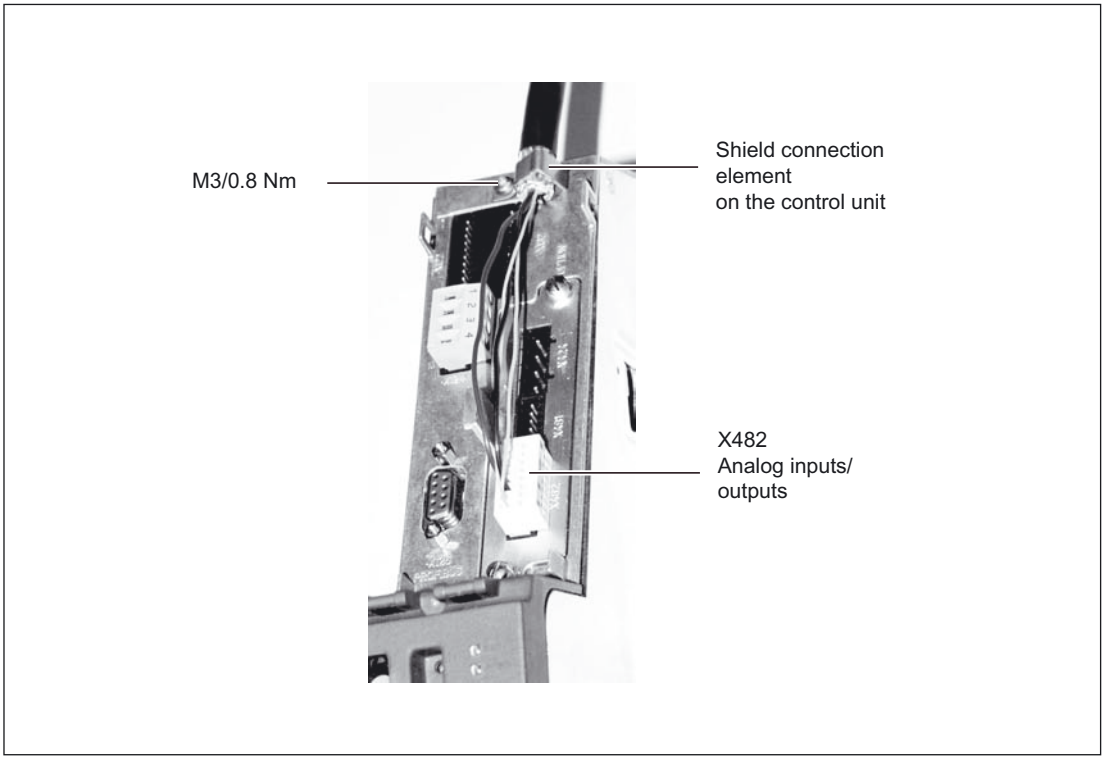


Figure 3-11 Shield contact for the TB30

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). **References:** SINAMICS S List Manual – "Function diagrams" chapter	
Weight	kg	0.1

3.5 Terminal Module TM15

3.5.1 Description

The Terminal Module TM15 is a terminal expansion module for snapping on to a DIN EN 60715 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	Quantity
Digital inputs/outputs	24 (isolation in 3 groups each with 8 DI/O)

3.5.2 Safety Information

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

3.5.3 Interface description

3.5.3.1 Overview

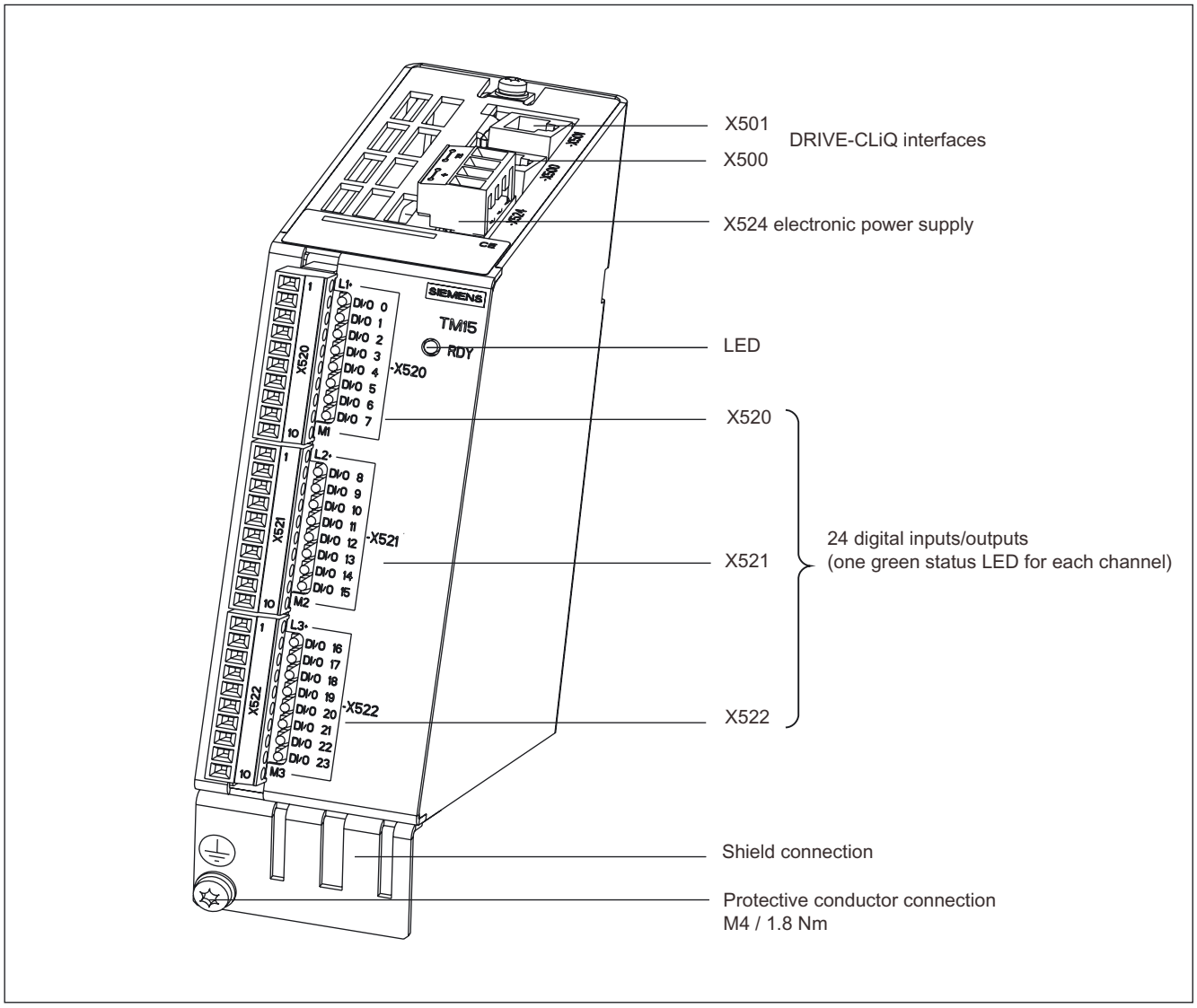


Figure 3-12 Interface description TM15

3.5.3.2 Connection example

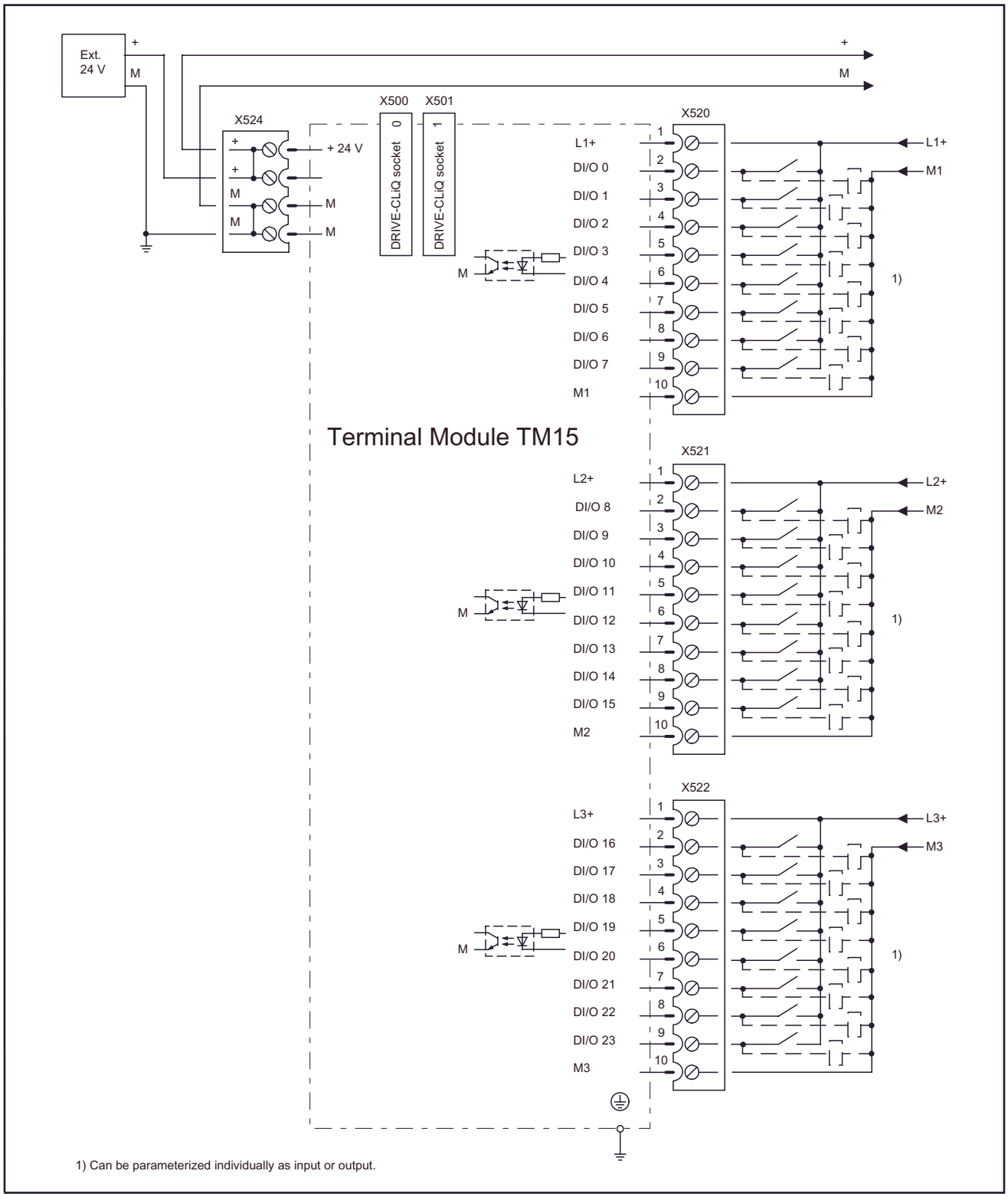
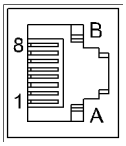


Figure 3-13 Example connection of TM15

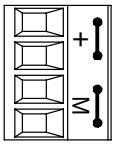
3.5.3.3 X500 and X501 DRIVE-CLiQ interface

Table 3-18 DRIVE-CLiQ interfaces X500 and X501

	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	M (0 V)	Electronics ground
Blanking plate on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13			

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) Current consumption: max. 0.15 A Max. current via jumper in connector: 20 A at 60 °C
	+	Electronics power supply	
	M	Electronic ground	
	M	Electronic ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

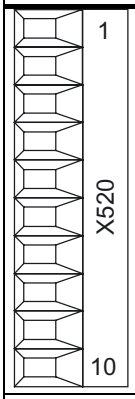
Note

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

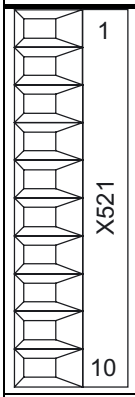
Table 3-20 Screw terminal X520

	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 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

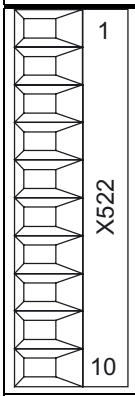
Table 3-21 Screw terminal X521

	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 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 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 Meanings of the LEDs on the Terminal Module TM15

Table 3-23 Terminal Module TM15 - description of LEDs

LED	Color	State	Description, cause	Remedy
READY	-	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:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing 0.5 Hz	Firmware is being downloaded.	–
		Flashing 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0154). **Note:** Both options depend on the LED status when component recognition is activated via p0154 = 1.	–

Cause and rectification of faults

The following reference contains information about the cause of faults and how they can be rectified:

Reference: /IH1/ SINAMICS S, Commissioning Manual

3.5.4 Dimension Drawing

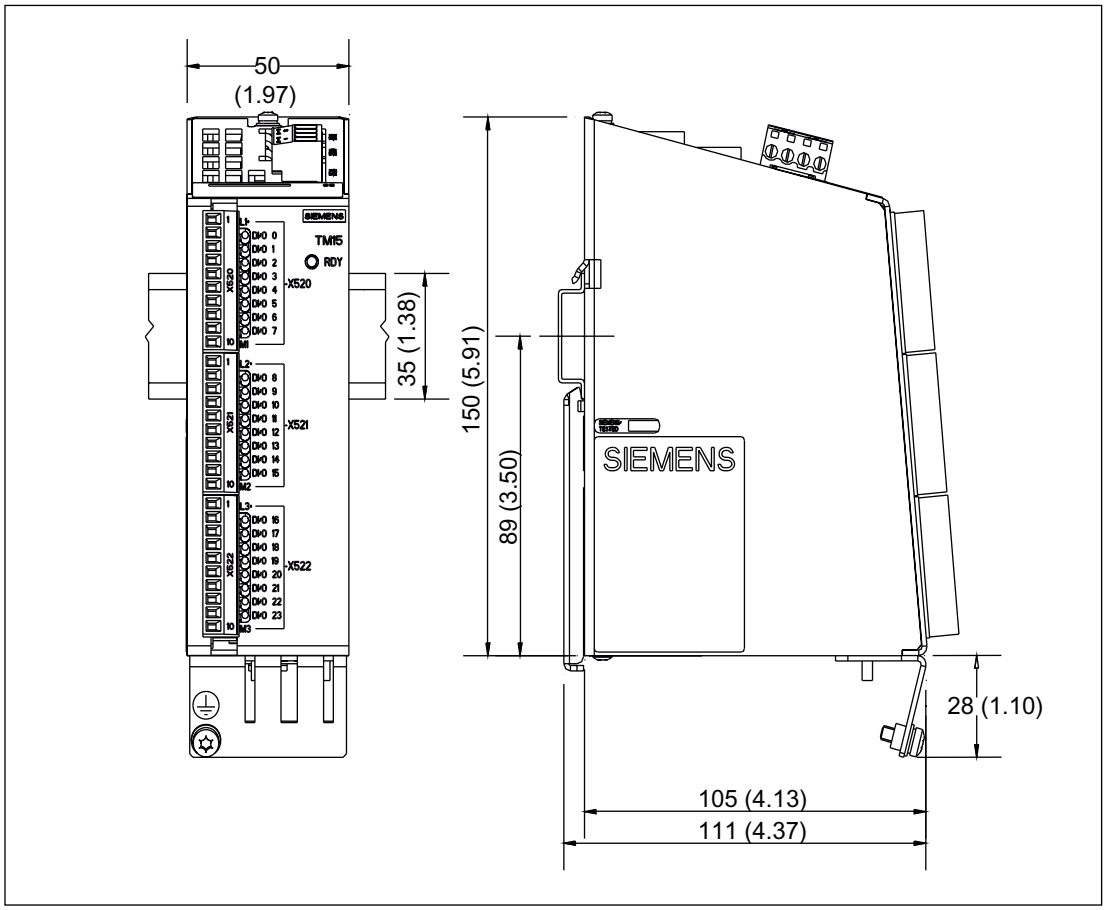


Figure 3-14 Dimension drawing of the TM15

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

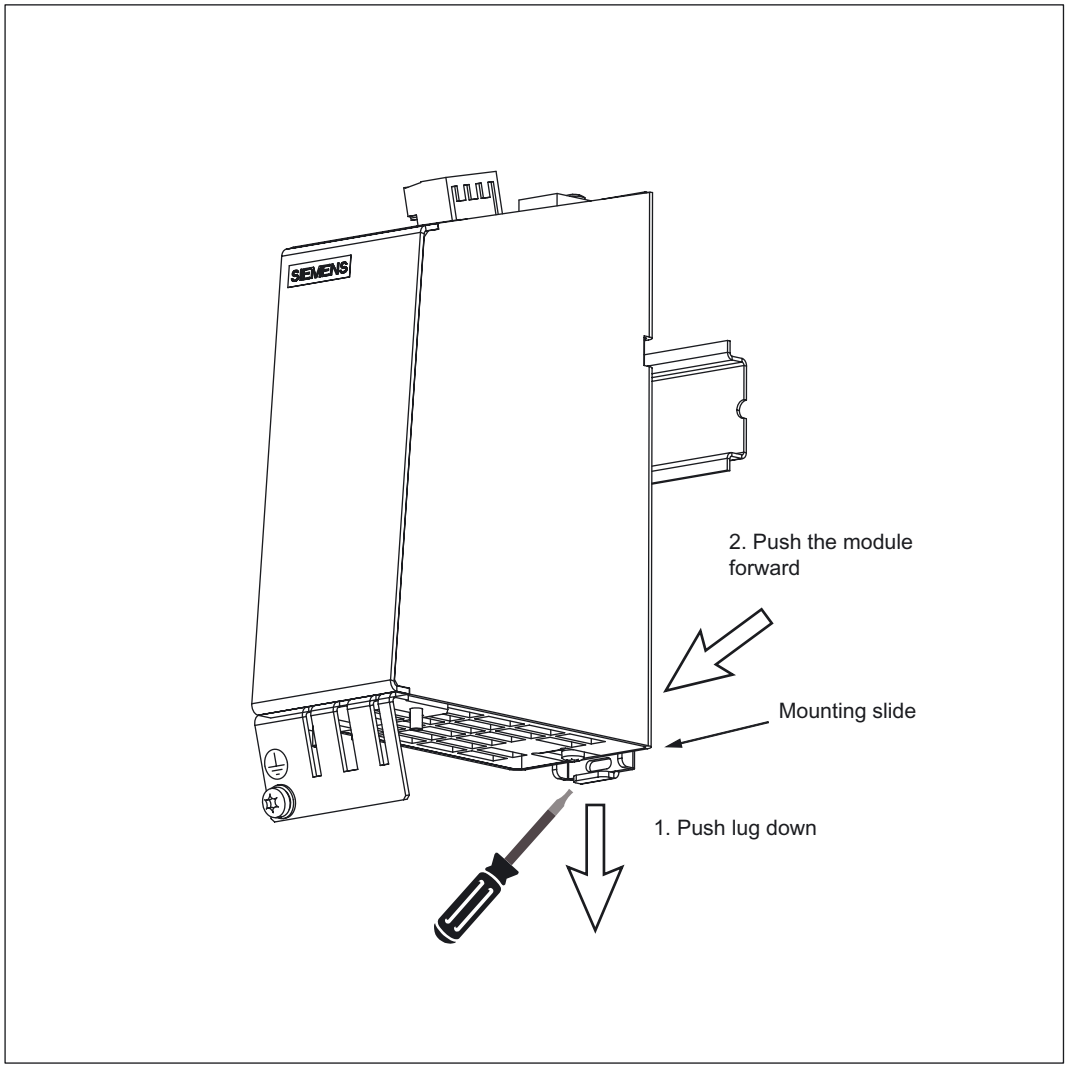


Figure 3-15 Releasing the component from a DIN rail

3.5.6 Electrical Connection

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

The following pictures show typical shield connection terminals from Weidmüller.

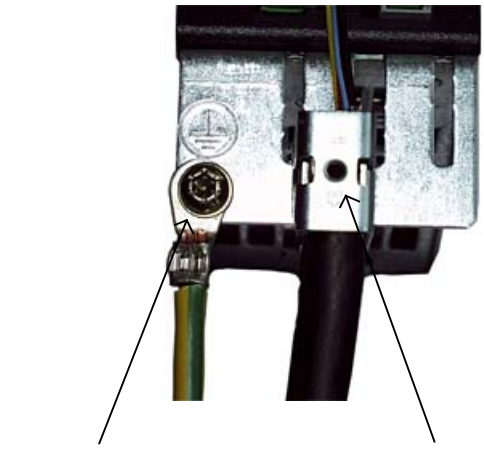


Figure 3-16 Shield contacts

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.

NOTICE
Only screws with a permissible screw-in depth of 4 - 6 mm may be used.

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 TM15. To encode a connector, you must insert at least one coding slider and cut off a coding lug on the connector:

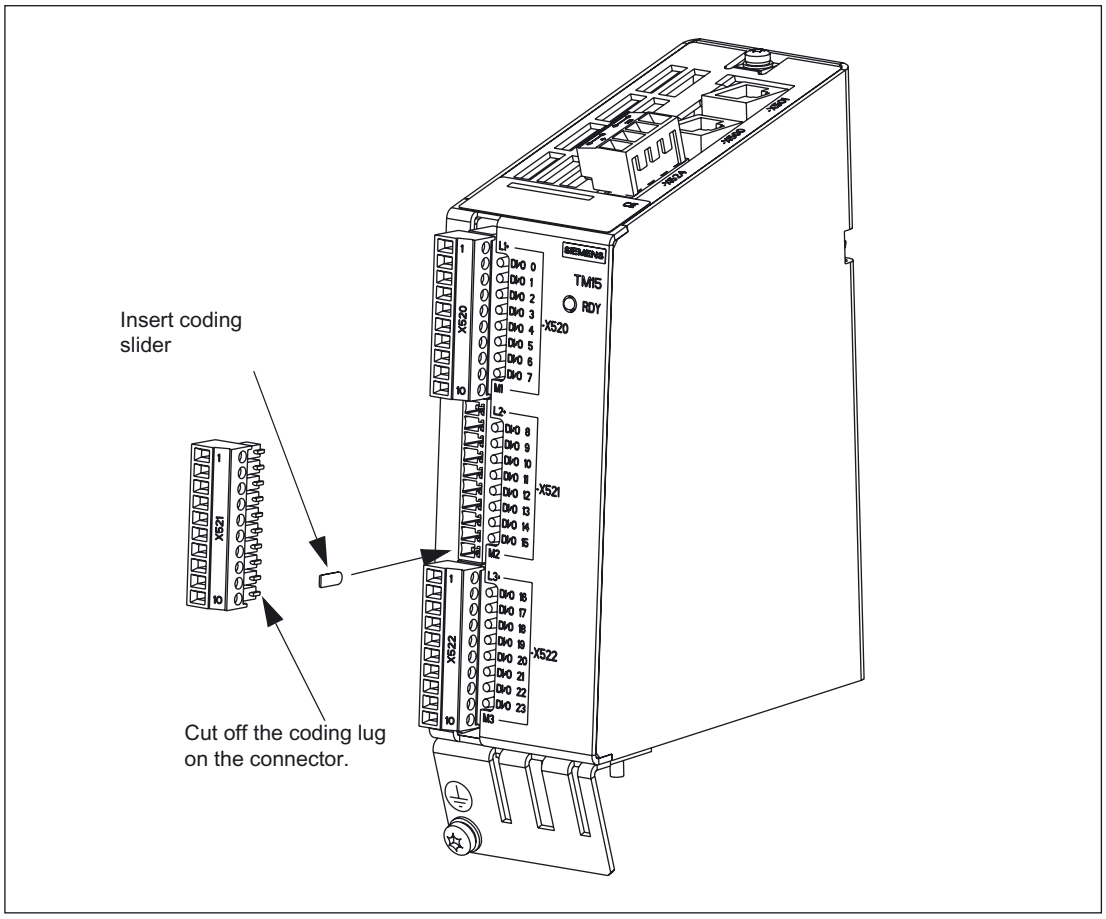


Figure 3-17 Procedure for encoding a connector

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 TM15 **6SL3055-0AA00-3FAx**	**Unit**	**Value**
Electronics power supply Voltage Current (without DRIVE-CLiQ or digital outputs) Power loss	 V_{DC} A_{DC} W	 24 DC (20.4 – 28.8) 0.15 <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 of 8	
• 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)
• Typical input delay of the digital inputs	µs	L → H: 50 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 H → L: 150
• maximum	µs	L → H: 100 H → L: 225
• Min. output pulse (100% amplitude, 0.5 A with resistive load)	µs	125 (typ.) 350 (max.)

Terminal Module TM15 **6SL3055-0AA00-3FAx**	**Unit**	**Value**
• Max. switching frequency (100% amplitude, 50%/50% duty cycle, with 0.5 A and a resistive load)	kHz	1 (typ.)
• 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 (I/O power supply to the output)	V_{DC}	0.5
• Max. total current of outputs (per group) up to 60 °C up to 50 °C up to 40 °C	 A_{DC} A_{DC} A_{DC}	 2 3 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 (TM15 DI/DO) consists of the following elements: • Response time on the component itself (approx. 1/2 DRIVE-CLiQ cycle). • Response transmit time via the DRIVE-CLiQ connection (approx. 1 DRIVE-CLiQ cycle). • Evaluation on the Control Unit (see function diagram) **References:** SINAMICS S List Manual – "Function diagrams" chapter.	
Weight	kg	0.86
Approbation	UL and cULus http://www.ul.com File: E164110, Vol. 2, Sec. 9	

3.6 Terminal Module TM17

3.6.1 Description

Information about Terminal Module TM17 is provided in the following literature:

References: Supplementary SINAMICS System Components for SIMOTION

3.7 Terminal Module TM31

3.7.1 Description

The Terminal Module TM31 is a terminal expansion module for snapping on to a DIN EN 60715 mounting rail. Terminal Module TM31 can be used to increase the number of available digital inputs/digital outputs and also the number of analog inputs/analog outputs within a drive system.

The TM31 contains the following terminals:

Table 3-25 Interface overview of the TM31

Type	Quantity
DRIVE-CLiQ interfaces	2
Digital inputs	8
Digital inputs/outputs	4
Analog inputs	2
Analog outputs	2
Relay outputs	2
Temperature sensor input	1

3.7.2 Safety Information

⚠ WARNING

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.

3.7.3 Interface description

3.7.3.1 Overview

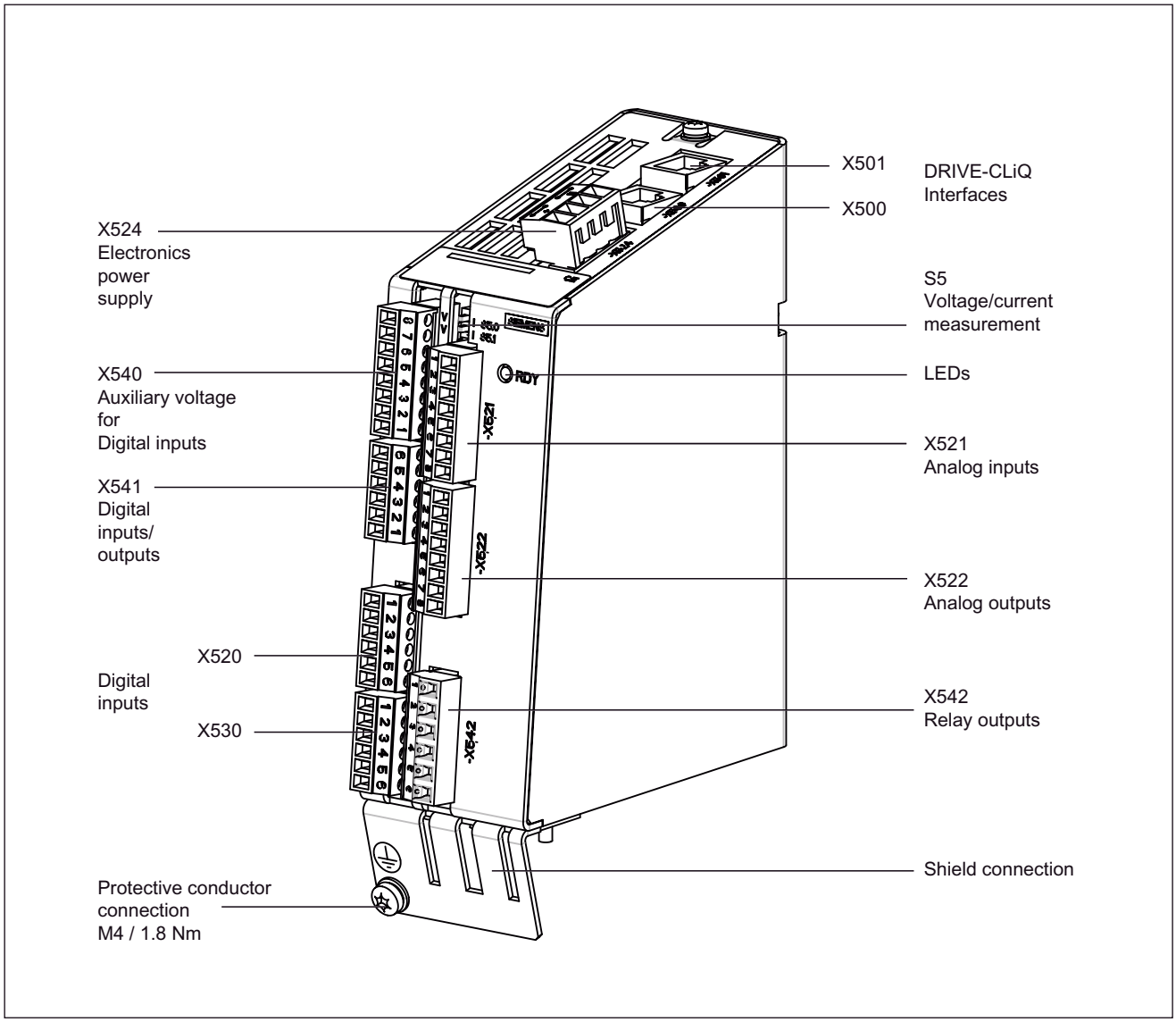


Figure 3-18 Interface description TM31, order number: 6SL3055-0AA00-3AA1

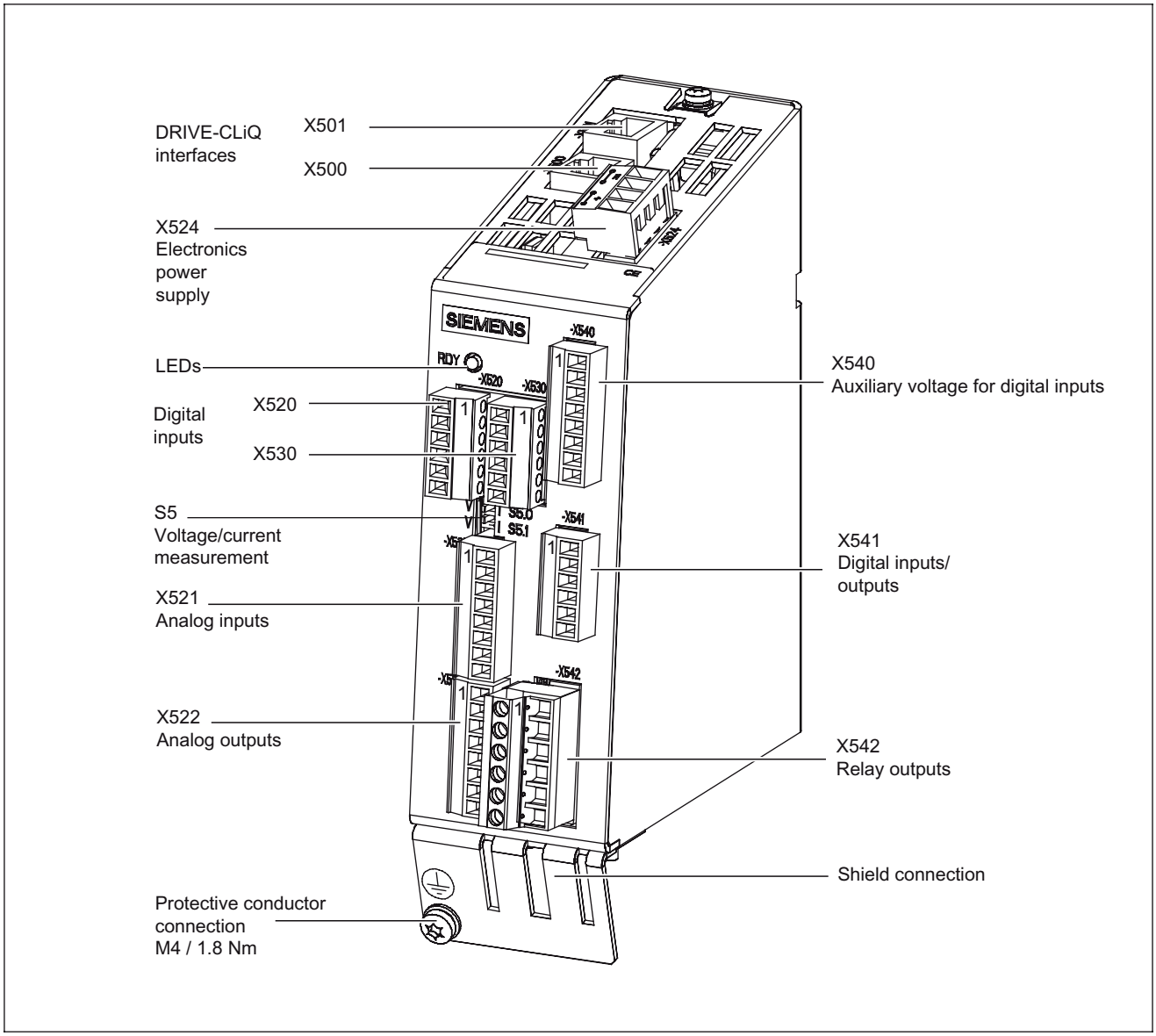


Figure 3-19 Interface description TM31, order number: 6SL3055-0AA00-3AA0

3.7.3.2 Connection example

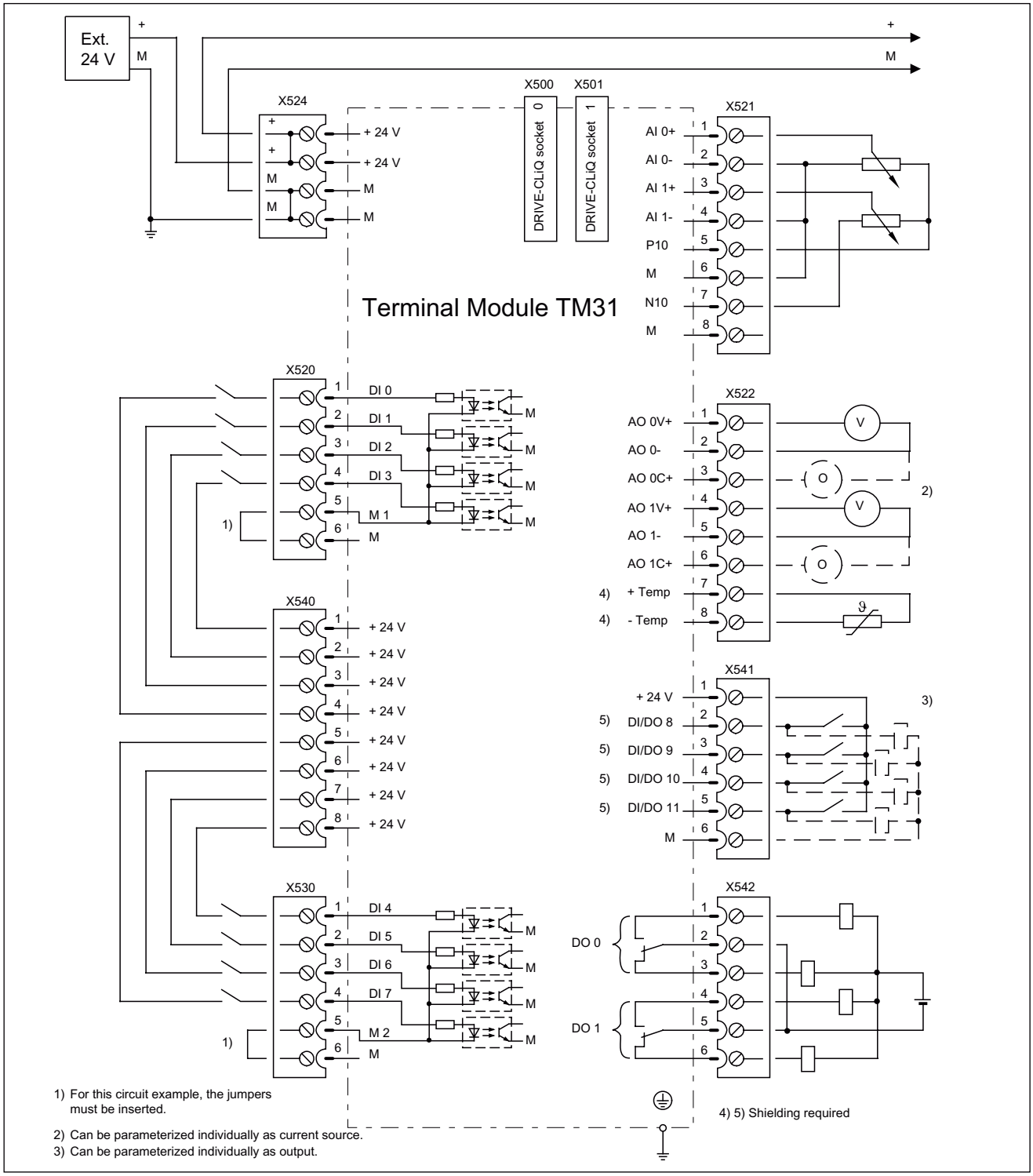
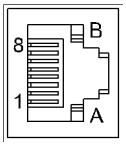


Figure 3-20 Example connection of TM31

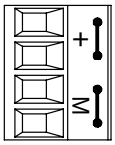
3.7.3.3 X500 and X501 DRIVE-CLiQ interface

Table 3-26 DRIVE-CLiQ interfaces X500 and X501

	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	M (0 V)	Electronics ground
Blanking plate on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13			

3.7.3.4 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) Current consumption: max. 0.5 A Max. 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 Type: Screw terminal 2 (see Appendix A)			

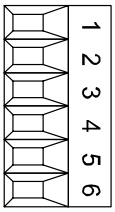
Note

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.

3.7.3.5 Digital inputs X520

Table 3-28 Screw terminal X520

	Terminal	Designation [1]	Technical specifications
	1	DI 0	Voltage: - 3 V to +30 V Typical current consumption: 10 mA at 24 V DC Input delay: - for "0" to "1": typ. 50 µs max. 100 µs - for "1" to "0": typ. 130 µs max. 150 µs electrical isolation: Reference potential is Terminal M1 Level (incl. ripple) High level: 15 V to 30 V 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 Type: Screw terminal 1 (see Appendix A)			

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

NOTICE

An open input is interpreted as "low".

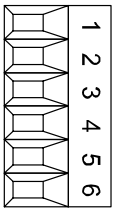
To enable the digital inputs to function, terminal M1 must be connected.
This can be achieved as follows:

1. The ground reference provided of the digital inputs, or
2. a jumper to terminal M

(Notice! This removes electrical isolation for these digital inputs).

3.7.3.6 Digital inputs X530

Table 3-29 Screw terminal X530

	Terminal	Designation[1)]	Technical specifications
	1	DI 4	Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Input delay: - for "0" to "1": typ. 50 µs max. 100 µs - for "1" to "0": typ. 130 µs max. 150 µs electrical isolation: Reference potential is Terminal M2 Level (incl. ripple) High level: 15 V to 30 V 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 Type: Screw terminal 1 (see Appendix A)			

1) DI: digital input; M: electronics 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 achieved as follows:

1. The ground reference provided of the digital inputs, or
2. a jumper to terminal M

(Notice! This removes electrical isolation for these digital inputs).

3.7.3.7 Auxiliary voltage for the digital inputs X540

Table 3-30 Screw terminal X540, for order number: 6SL3055-0AA00-3AA1

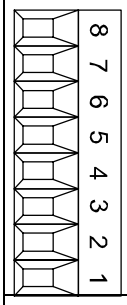
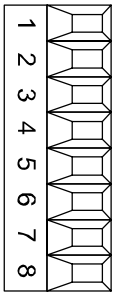
	Terminal	Designation	Technical specifications
	8	+24 V	Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage of terminals X540 and X541 combined: 150 mA
	7	+24 V	
	6	+24 V	
	5	+24 V	
	4	+24 V	
	3	+24 V	
	2	+24 V	
	1	+24 V	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

Table 3-31 Screw terminal X540, for order number: 6SL3055-0AA00-3AA0

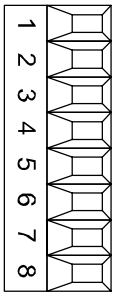
	Terminal	Designation	Technical specifications
	1	+24 V	Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage of terminals X540 and X541 combined: 150 mA
	2	+24 V	
	3	+24 V	
	4	+24 V	
	5	+24 V	
	6	+24 V	
	7	+24 V	
	8	+24 V	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

Note

This voltage supply is only for powering the digital inputs.

3.7.3.8 Analog inputs X521

Table 3-32 Terminal block X521

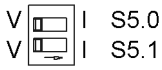
	Terminal	Designation [1]	Technical specifications
	1	AI 0+	The analog inputs can be toggled between current and voltage input using switches S5.0 and S5.1. Voltage: -10 V to 10 V; R_i = 100 kΩ Resolution: 11 bit + sign Current: R_i = 250 Ω Resolution: 10 bits + sign
	2	AI 0-	
	3	AI 1+	
	4	AI 1-	
	5	P10	Auxiliary voltage: P10 = 10 V N10 = -10 V Continued-short-circuit-proof
	6	M	
	7	N10	
	8	M	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

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

CAUTION
If more than ±35 mA flows through the analog current input, then the component could be destroyed. Permissible input voltage ±30V (destruction limit). Permissible Common Mode voltage ±10V, increased faults if exceeded. Permissible back-EMF at the auxiliary voltage outputs ±15V.

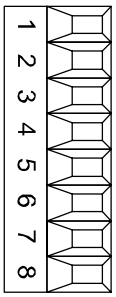
3.7.3.9 S5 current/voltage changeover switch for analog inputs

Table 3-33 Current/voltage selector S5

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

3.7.3.10 X522 analog outputs/temperature sensor

Table 3-34 Terminal block X522

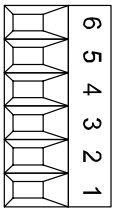
	Terminal	Designation[1)]	Technical specifications
	1	AO 0V+	You can set the following output signals using parameters: Voltage: -10 V to 10 V (max. 3 mA) Current 1: 4 mA to 20 mA (max. load resistance ≤ 500 Ω) Current 2: -20 mA to 20 mA (max. load resistance ≤ 500 Ω) Current 3: 0 mA to 20 mA (max. load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

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

CAUTION
Permissible back-EMF at the outputs: ±15V

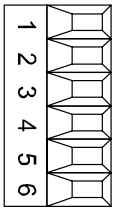
3.7.3.11 X541 bidirectional digital inputs/outputs

Table 3-35 Terminals for bidirectional digital inputs/outputs, for order number 6SL3055-0AA00-3AA1

	Terminal	Designation[1)]	Technical specifications
	6	M	Auxiliary voltage: Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage of terminals X540 and X541 combined: 150 mA As input: Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Input delay: - for "0" to "1": typ. 50 µs - for "1" to "0". Typ. 100 µs As output: Voltage: 24 V DC Max. load current per output: 500 mA Max. total current of outputs (including currents in the inputs): 100 mA / 1 A (can be parameterized) Sustained short-circuit Output delay: - for "0" to "1": Typically 150 µs at 0.5 A ohmic load (500 µs maximum) - for "1" to "0": Typically 50 µs at 0.5 A ohmic load
	5	DI/DO 11	
	4	DI/DO 10	
	3	DI/DO 9	
	2	DI/DO 8	
	1	+24 V	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) DI/DO: bidirectional digital input/output; M: Electronics ground

Table 3-36 Terminals for bidirectional digital inputs/outputs, for order number 6SL3055-0AA00-3AA0

	Terminal	Designation[1)]	Technical specifications
	1	+24 V	Auxiliary voltage: Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage of terminals X540 and X541 combined: 150 mA As input: Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Input delay: - for "0" to "1": typ. 50 µs - for "1" to "0": Typ. 100 µs As output: Voltage: 24 V DC Max. load current per output: 500 mA Max. total current of outputs (including currents in the inputs): 100 mA / 1 A (can be parameterized) Sustained short-circuit Output delay: - for "0" to "1": Typically 150 µs at 0.5 A ohmic load (500 µs maximum) - for "1" to "0": Typically 50 µs at 0.5 A ohmic load
	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 Type: Screw terminal 1 (see Appendix A)			

1) DI/DO: bidirectional digital input/output; M: Electronics ground

Note

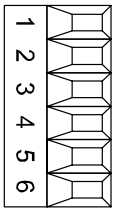
An open input is interpreted as "low".

Note

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

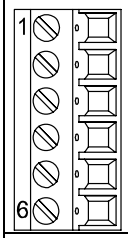
3.7.3.12 Relay outputs X542

Table 3-37 Terminal block X542, for order number: 6SL3055-0AA00-3AA1

	Terminal	Designation[1)]	Technical specifications
	1	DO 0.NC	Contact type: Two-way contact max. load current: 8 A Max. switching voltage: 250 V_{AC}, 30 V_{DC} Max. switching power at 250 V_{AC}: 2000 VA (cosϕ = 1) Max. switching power at 250 V_{AC}: 750 VA (cosϕ = 0.4) Max. switching power at 30 V_{DC}: 240 W (ohmic load) Required minimum current: 100 mA 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 Type: Screw terminal 3 (see Appendix A)			

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

Table 3-38 Terminal block X542, for order number: 6SL3055-0AA00-3AA0

	Terminal	Designation[1)]	Technical specifications
	1	DO 0.NC	Contact type: Two-way contact max. load current: 8 A Max. switching voltage: 250 V_{AC}, 30 V_{DC} Max. switching power at 250 V_{AC}: 2000 VA (cosϕ = 1) Max. switching power at 250 V_{AC}: 750 VA (cosϕ = 0.4) Max. switching power at 30 V_{DC}: 240 W (ohmic load) Required minimum current: 100 mA 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 Type: Screw terminal 3 (see Appendix A)			

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

3.7.3.13 Meanings of the LED on the Terminal Module TM31

Table 3-39 Terminal Module TM31 - description of LEDs

LED	Color	State	Description, cause	Remedy
READY	-	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:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing 0.5 Hz	Firmware is being downloaded.	–
		Flashing 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0154). **Note:** Both options depend on the LED status when component recognition is activated via p0154 = 1.	–

Cause and rectification of faults

The following reference contains information about the cause of faults and how they can be rectified:

Reference: /IH1/ SINAMICS S, Commissioning Manual

3.7.4 Dimension drawing

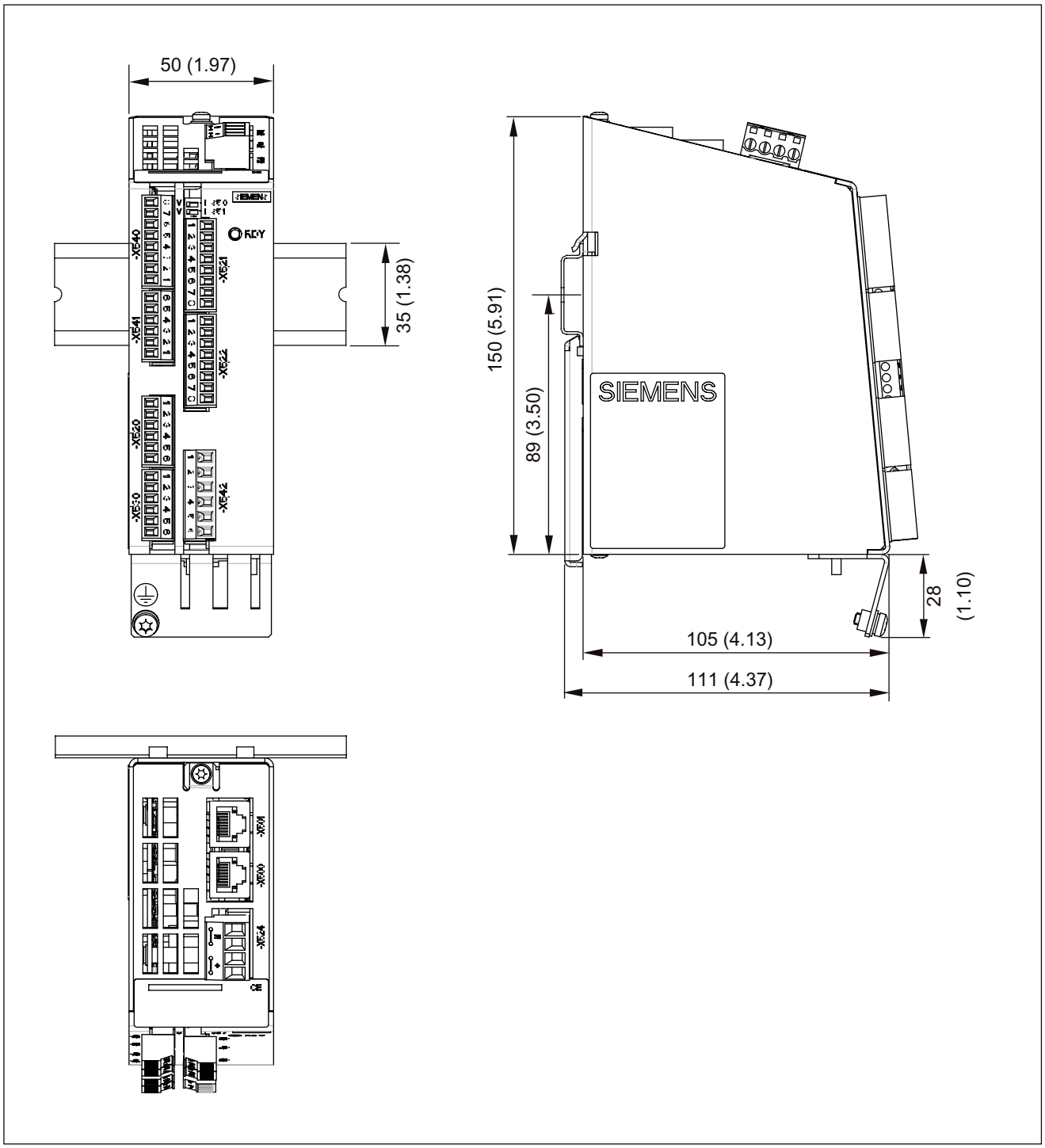


Figure 3-21 Dimension drawing TM31, order number: 6SL3055-0AA00-3AA1

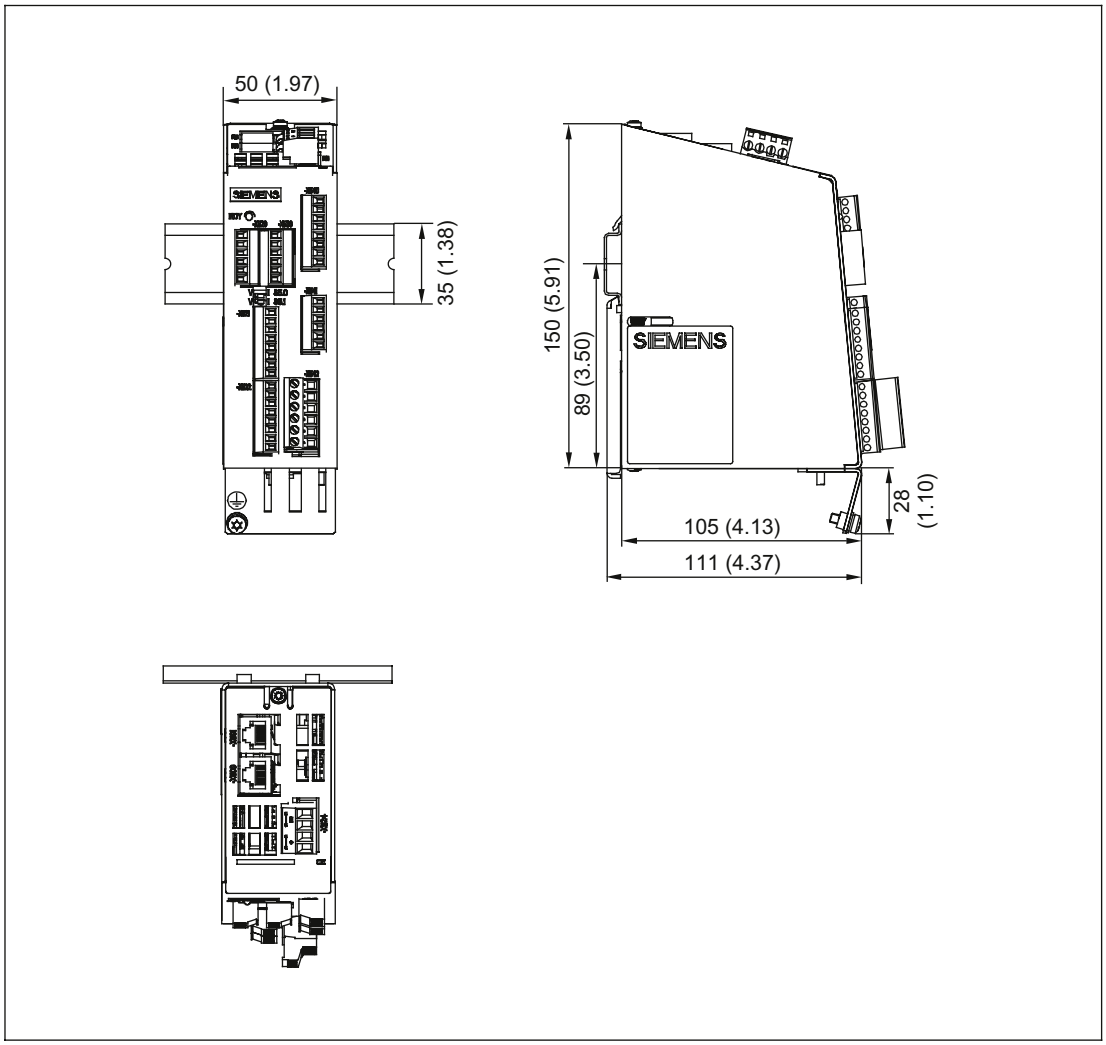


Figure 3-22 Dimension drawing TM31, order number: 6SL3055-0AA00-3AA0

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

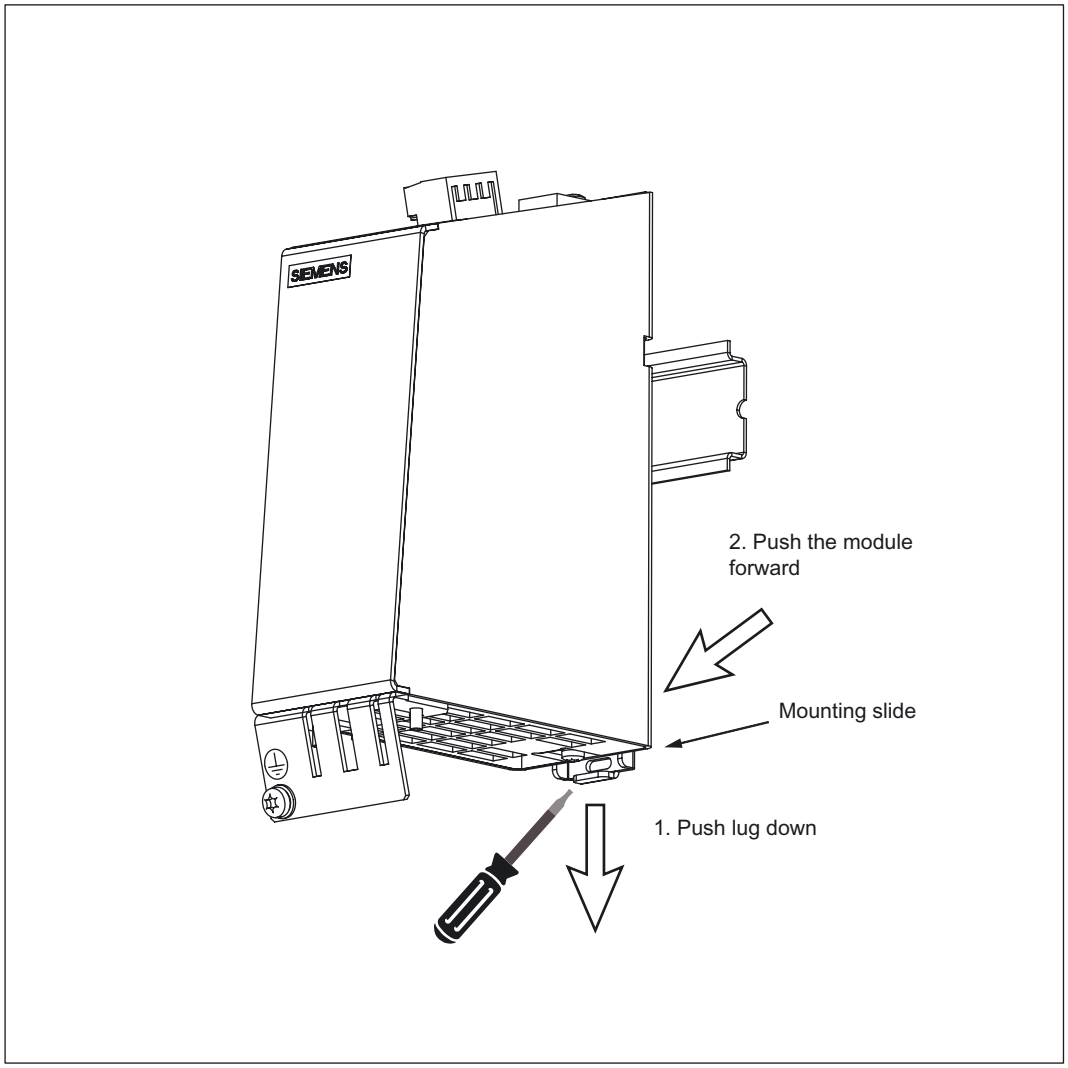


Figure 3-23 Releasing the component from a DIN rail

3.7.6 Electrical connection

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

The following pictures show typical shield connection terminals from Weidmüller.

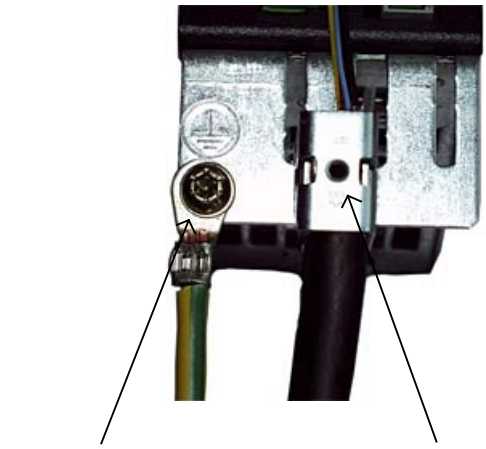


Figure 3-24 Shield contacts

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.

NOTICE
Only screws with a permissible screw-in depth of 4 - 6 mm may be used.

Connector codes

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

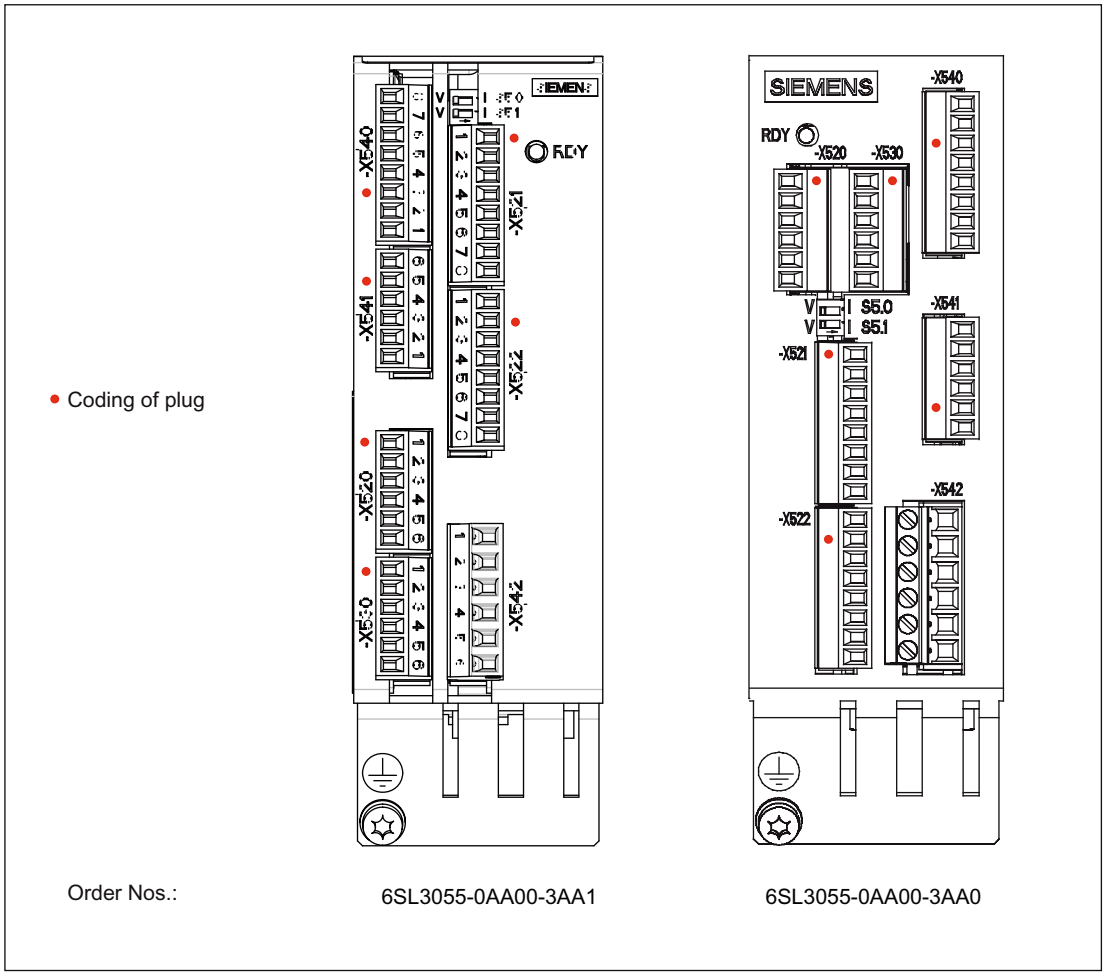


Figure 3-25 Connector codes of the TM31

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

3.7.7 Technical Specifications

Table 3-40 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	At the 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: • Response time on the component itself (approx. 1/2 DRIVE-CLiQ cycle). • Response transmit time via the DRIVE-CLiQ connection (approx. 1 DRIVE-CLiQ cycle). • Evaluation on the Control Unit (see function diagram). **References:**SINAMICS S List Manual – "Function diagrams" chapter	
Weight	kg	1

3.8 Terminal Module TM41

3.8.1 Description

The Terminal Module TM41 is an expansion module that is snapped onto a mounting rail (DIN EN 60715) in the cabinet.
An incremental encoder can be emulated using the encoder interface of the TM41. The TM41 can also be used to connect analog controls to SINAMICS.

TM41 is equipped with the following terminals:

Table 3-41 Interface overview of the TM41

Type	Quantity
Digital inputs, floating	4
Digital inputs/outputs	4
Analog inputs	1
TTL encoder output	1

TM41 can be used from firmware 2.4 onwards

3.8.2 Safety Information

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

3.8.3 Interface description

3.8.3.1 Overview

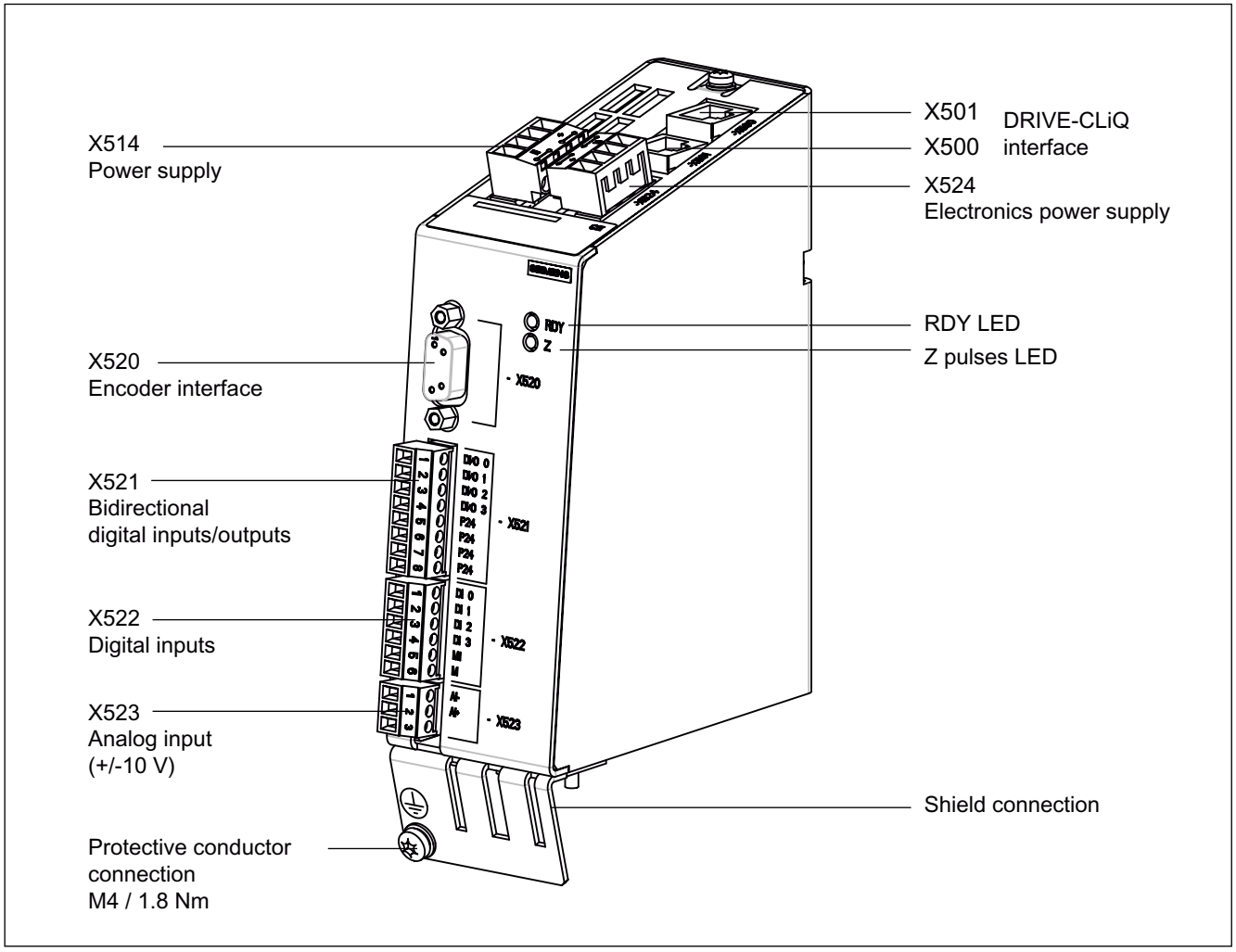


Figure 3-26 TM41 interface description, Order number 6SL3055-0AA00-3PA1

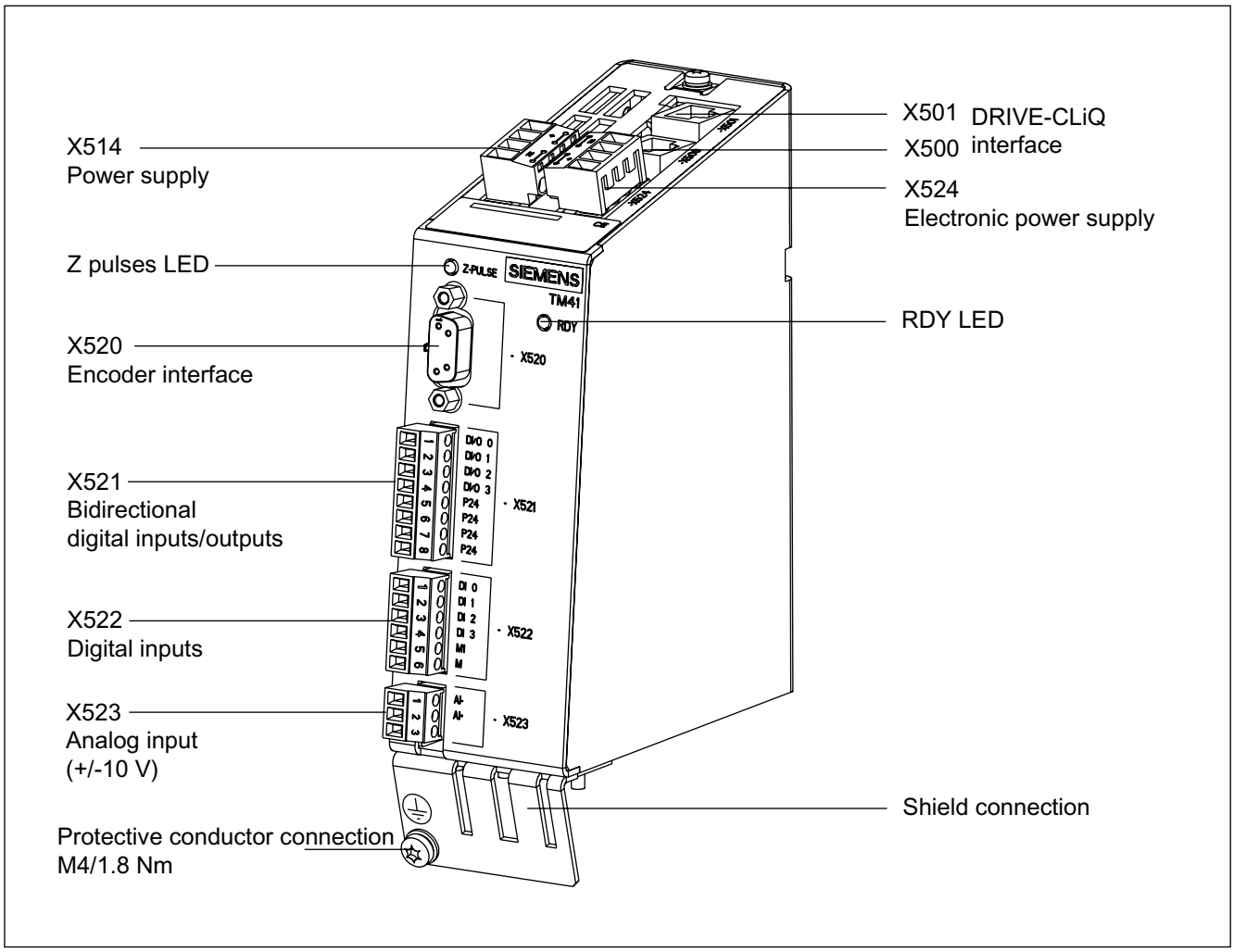


Figure 3-27 TM41 interface description, Order number 6SL3055-0AA00-3PA0

3.8.3.2 Connection example

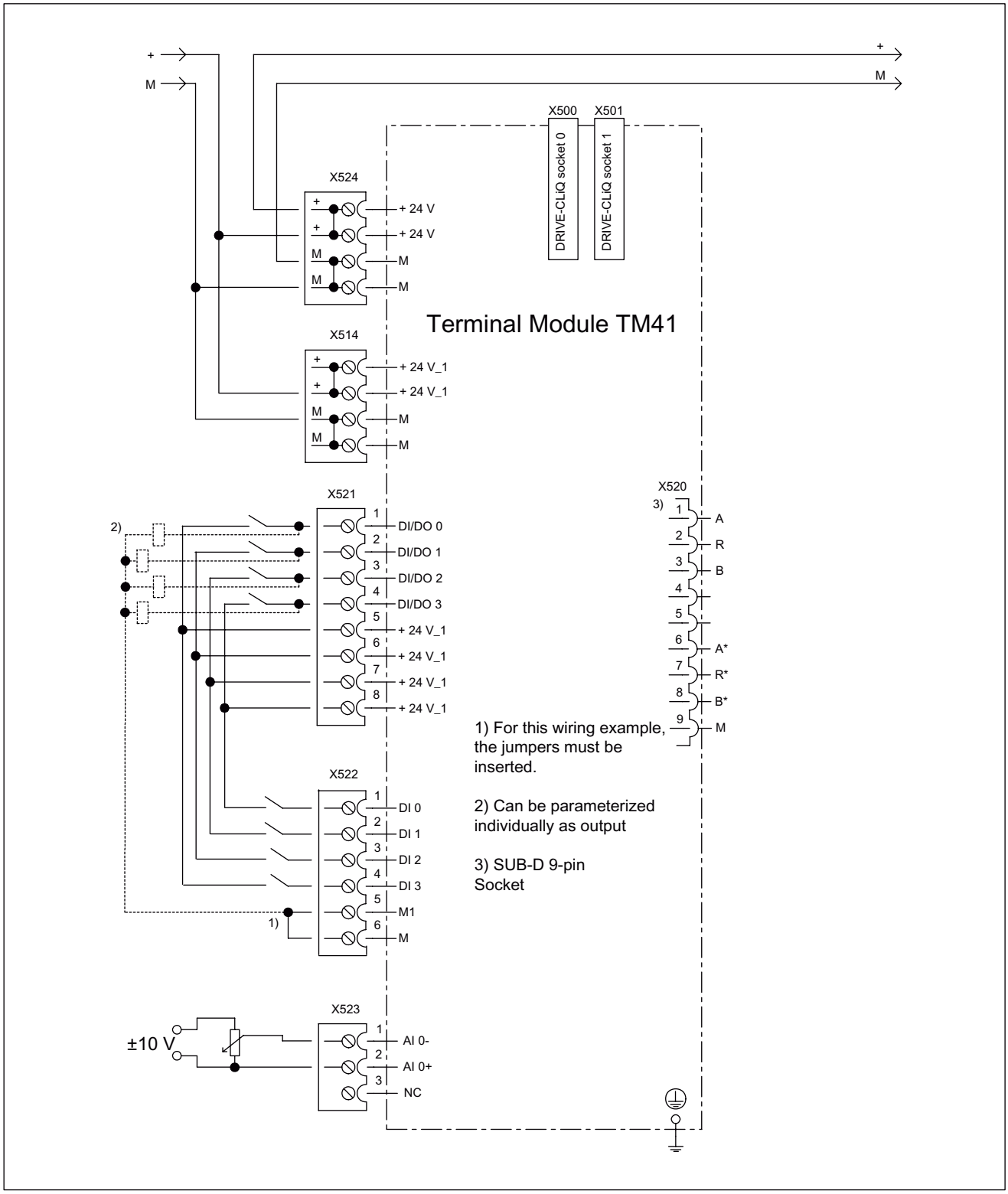
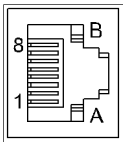


Figure 3-28 Sample connection of TM41

3.8.3.3 X500 and X501 DRIVE-CLiQ interface

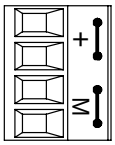
Table 3-42 DRIVE-CLiQ interfaces X500 and X501

	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	M (0 V)	Electronics ground
Blanking plate on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13			

3.8.3.4 X514 and X524 Power Supply

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

Table 3-43 Power supply terminals X514 and X524

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

Note

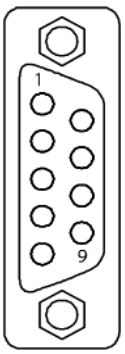
The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

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.

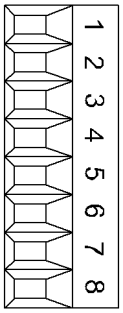
3.8.3.5 Sensor interface X520

Table 3-44 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 100 m max. cable length Type: 9-pin SUB-D female			

3.8.3.6 X521 bidirectional digital inputs/outputs

Table 3-45 Screw terminal X521

	Terminal	Designation	Technical specifications
	1	DI/DO 0	As input: Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Level (including ripple) High level: 15 V to 30 V Low level: -3 V to 5 V Input delay: - for "0" to "1": typ. 50 µs max. 100 µs - for "1" to "0": typ. 50 µs, max. 100 µs As output: Voltage: 24 V DC Max. load current per output: 0.5 mA Max. total current of outputs: 2 A Continued-short-circuit-proof Output delay: - for "0" to "1": Typically 150 µs at 0.5 A ohmic load (500 µs maximum) - for "1" to "0": Typically 150 µs at 0.5 A ohmic load
	2	DI/DO 1	
	3	DI/DO 2	
	4	DI/DO 3	
	5	+24 V	Voltage: +24 V DC Max. load current per terminal: 500 mA
	6	+24 V	
	7	+24 V	
	8	+24 V	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

Note

This voltage supply is only for powering the digital inputs.

Note

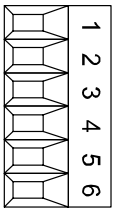
An open input is interpreted as "low".

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.

3.8.3.7 X522 digital inputs / floating (isolated)

Table 3-46 Screw terminal X522

	Terminal	Designation[1)]	Technical specifications
	1	DI 0	Voltage: - 3 V to 30 V Typical current consumption: 6.5 mA at 24 V DC Input delay: - for "0" to "1": typ. 50 µs max. 100 µs - for "1" to "0": typ. 110 µs max. 150 µs electrical isolation: Reference potential is Terminal M1 Level (incl. ripple) High level: 15 V to 30 V 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 Type: Screw terminal 1 (see Appendix A)			

1) DI: digital input; M: Electronics ground M1: Ground reference

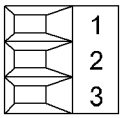
NOTICE

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

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

3.8.3.8 Analog input X523

Table 3-47 Terminal block X523

	Terminal	Designation[1)]	Technical specifications
	1	AI 0-	Voltage: -10 V to 10 V; R_i = 40 kΩ for component -3PA1 Ri = 100 kΩ Resolution: 14 Bit (13 bits + sign) [1] Resolution: 13 Bit (12 bits + sign) [2]
	2	AI 0+	
	3	Reserved, do not use	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

[1] Component order numbers that end with -3PA0

[2] Component order numbers that end with -3PA1

CAUTION
The Common Mode range may not be violated. Permissible input voltage ±30 V (destruction limit). Permissible Common Mode voltage ±10 V, increased faults if exceeded. If the range is infringed, incorrect results may occur during analog/digital conversion

3.8.3.9 Descriptions of the LEDs on the Terminal Module TM41

Table 3-48 Terminal Module TM41 - description of LEDs

LED	Color	State	Description, cause	Remedy
READY	-	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:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing 0.5 Hz	Firmware is being downloaded.	–
		Flashing 2 Hz	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0154). **Note:** Both options depend on the LED status when component recognition is activated via p0154 = 1.	–
Z pulses	–	OFF	Zero marker found; wait for zero marker output; OR component switched off.	–
	Red	Continuous	Zero mark not enabled or zero mark search.	–
	Green	Continuous	Stopped at zero mark.	–
		Flashing	Zero mark is output at each virtual revolution.	–

Cause and rectification of faults

The following reference contains information about the cause of faults and how they can be rectified:

Reference: /IH1/ SINAMICS S, Commissioning Manual

3.8.4 Dimension drawing

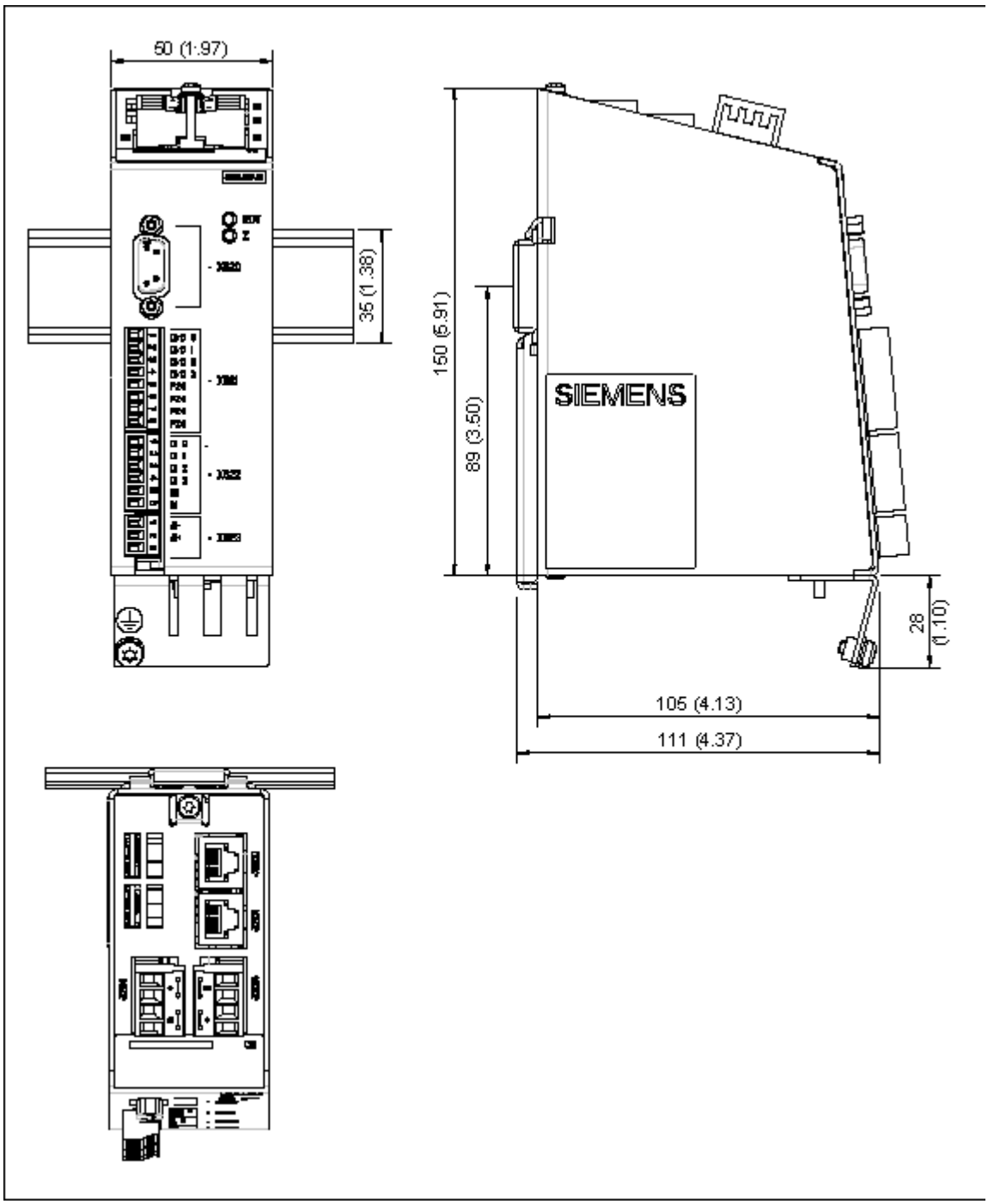


Figure 3-29 Dimension drawing TM41, Order number 6SL3055-0AA00-3PA1

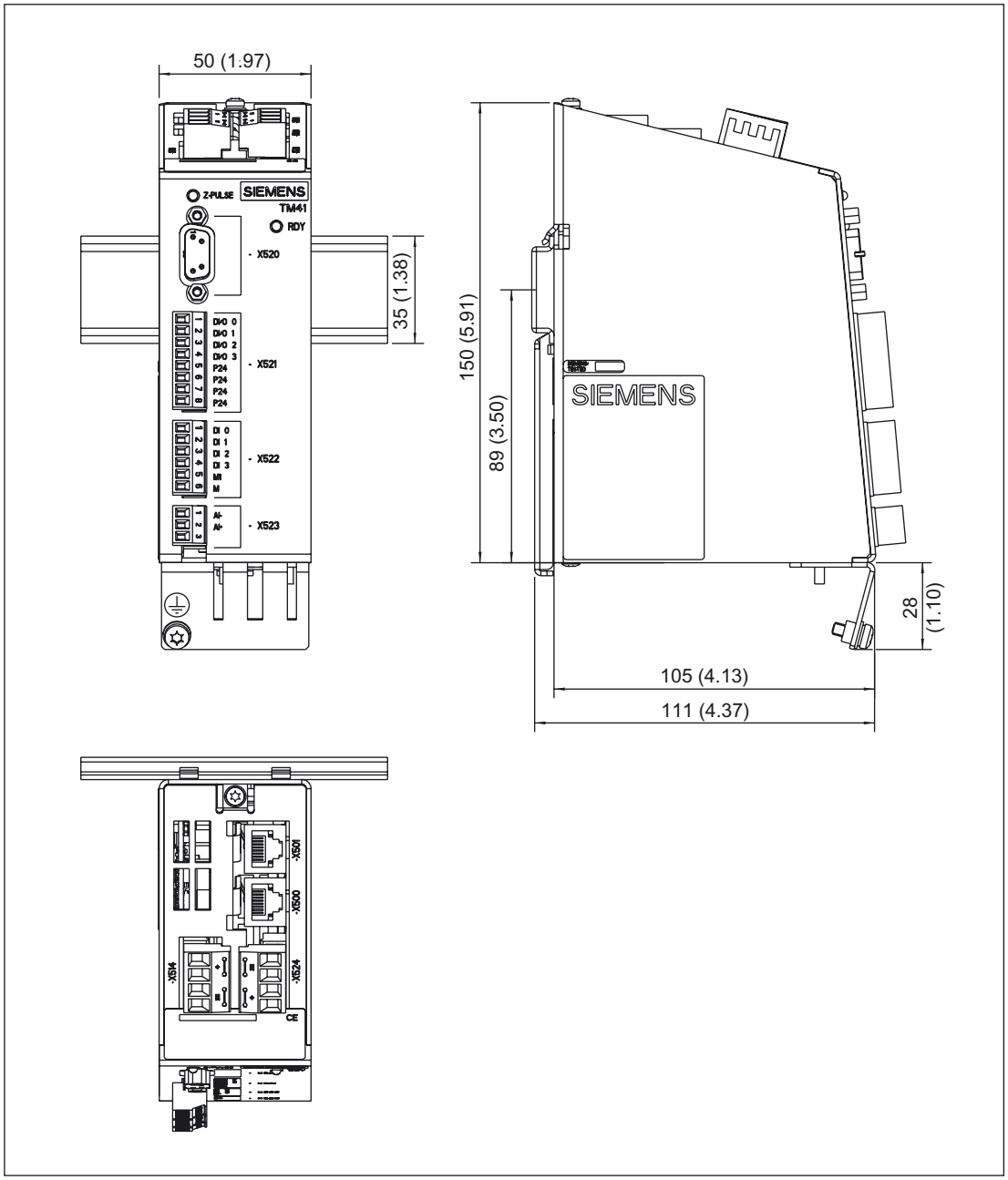


Figure 3-30 Dimension drawing TM41, Order number 6SL3055-0AA00-3PA0

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

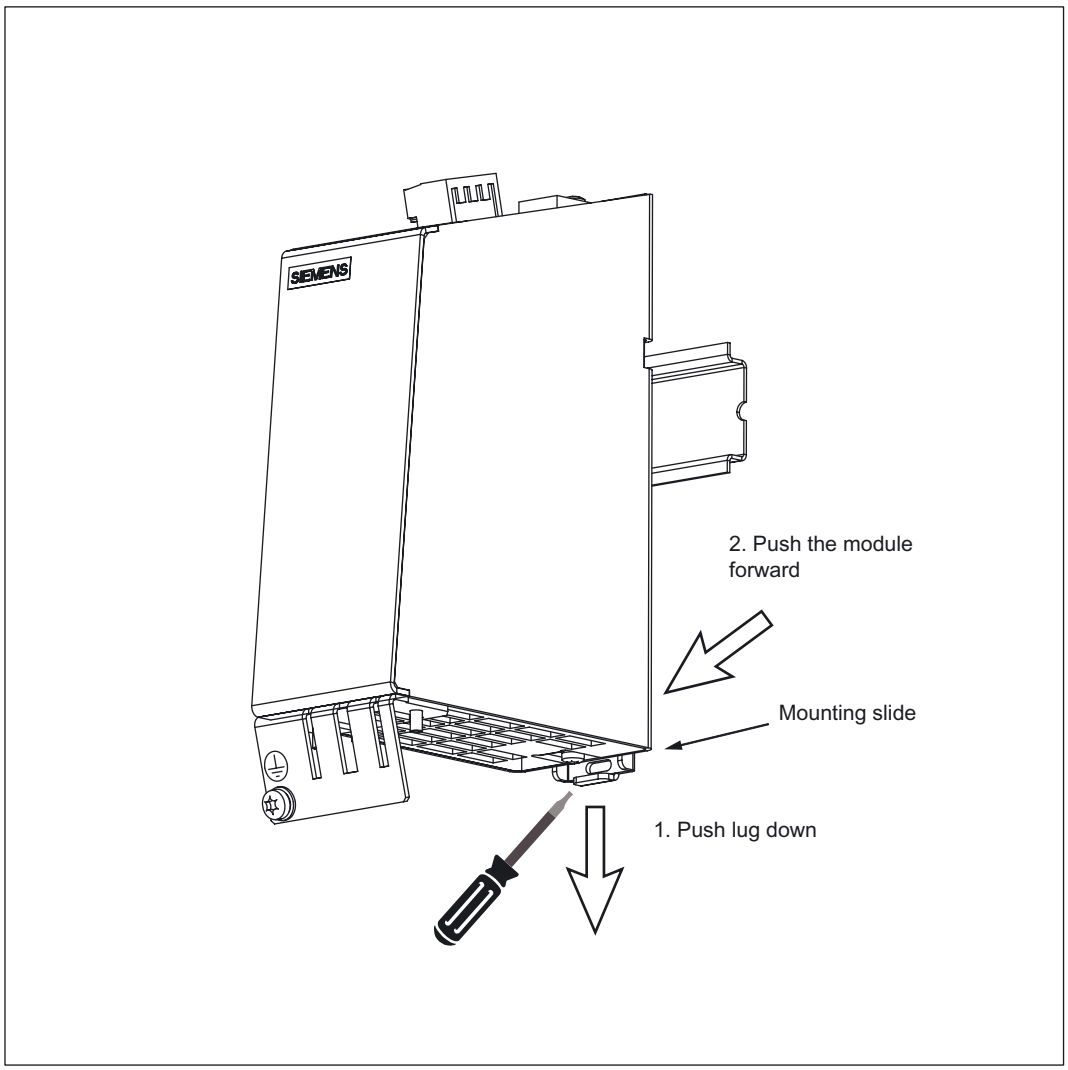


Figure 3-31 Releasing the component from a DIN rail

3.8.6 Electrical Connection

Shield connection terminals from Weidmüller for shield contacts

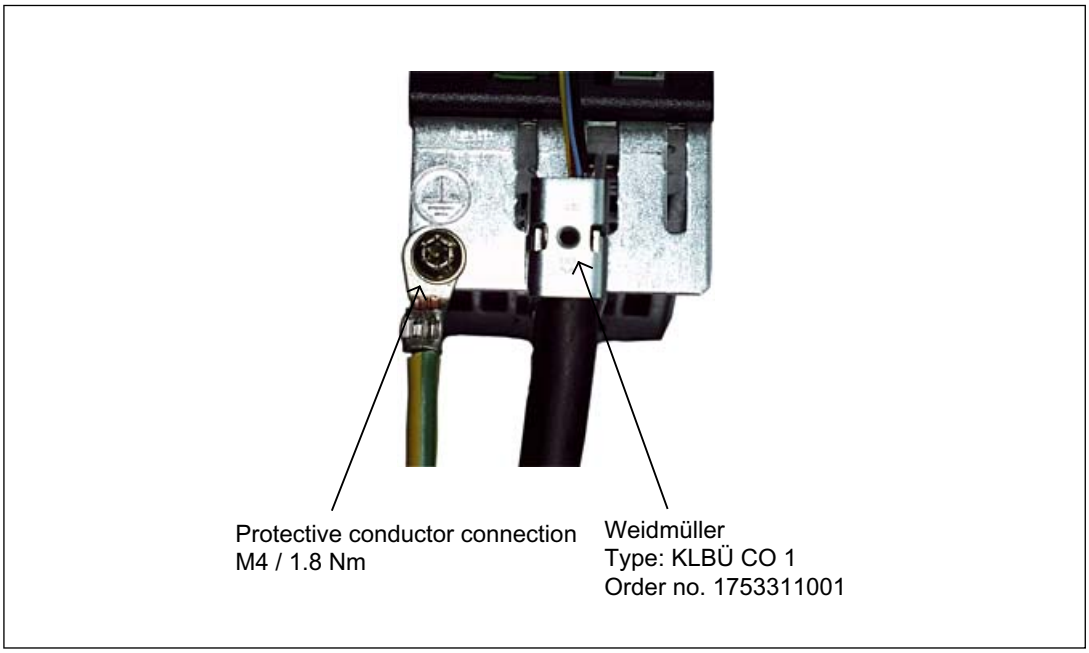


Figure 3-32 Shield contacts

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).

NOTICE
Only screws with a permissible screw-in depth of 4 - 6 mm may be used.

3.8.7 Technical Specifications

Table 3-49 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
PE/ground 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: • Response time on the component itself (approx. 1/2 DRIVE-CLiQ cycle). • Response transmit time via the DRIVE-CLiQ connection (approx. 1 DRIVE-CLiQ cycle). • Evaluation on the Control Unit (see function diagram). **References:** SINAMICS S List Manual – "Function diagrams" chapter.	
Weight	kg	0.85

3.9 Terminal Module TM54F (from V2.5 SP1)

3.9.1 Description

The Terminal Module TM54F is a terminal expansion module that is snapped on to a mounting rail according to DIN EN 60715. The TM54F provides safety digital inputs and outputs to control Safety Integrated functions of SINAMICS.

Precisely one TM54F is assigned to each Control Unit that is connected via DRIVE-CLiQ. Additional devices (e.g. TMxx, SMxx, MMxx) can be connected to the same DRIVE-CLiQ line.

The TM54F has the following terminals:

Table 3-50 Interface overview of the TM54F

Type	Quantity
Fail-safe digital outputs (F-DO)	4
Fail-safe digital inputs (F-DI)	10
Sensor[1] power supplies, with forced dormant error detection[2]	2
Sensor[1] power supply, without forced dormant error detection	1
Digital inputs to check F_DO for a test stop	4

[1] Sensors: Fail-safe devices to issue commands and sense - for example emergency stop pushbuttons and safety locks as well as position switches and light grids / light curtains.

[2] Dynamization: For the test stop to check the sensors, cable routing and evaluation electronics of the TM54, the sensor power supply is switched-in and switched-out.

The TM54F has 4 fail-safe digital outputs and 10 fail-safe digital inputs. A fail-safe digital output comprises a P/M switching output as well as a digital input to read back the switching state. A fail-safe digital input comprises two digital inputs.

3.9.2 Safety Information

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

3.9.3 Interface description

3.9.3.1 Overview

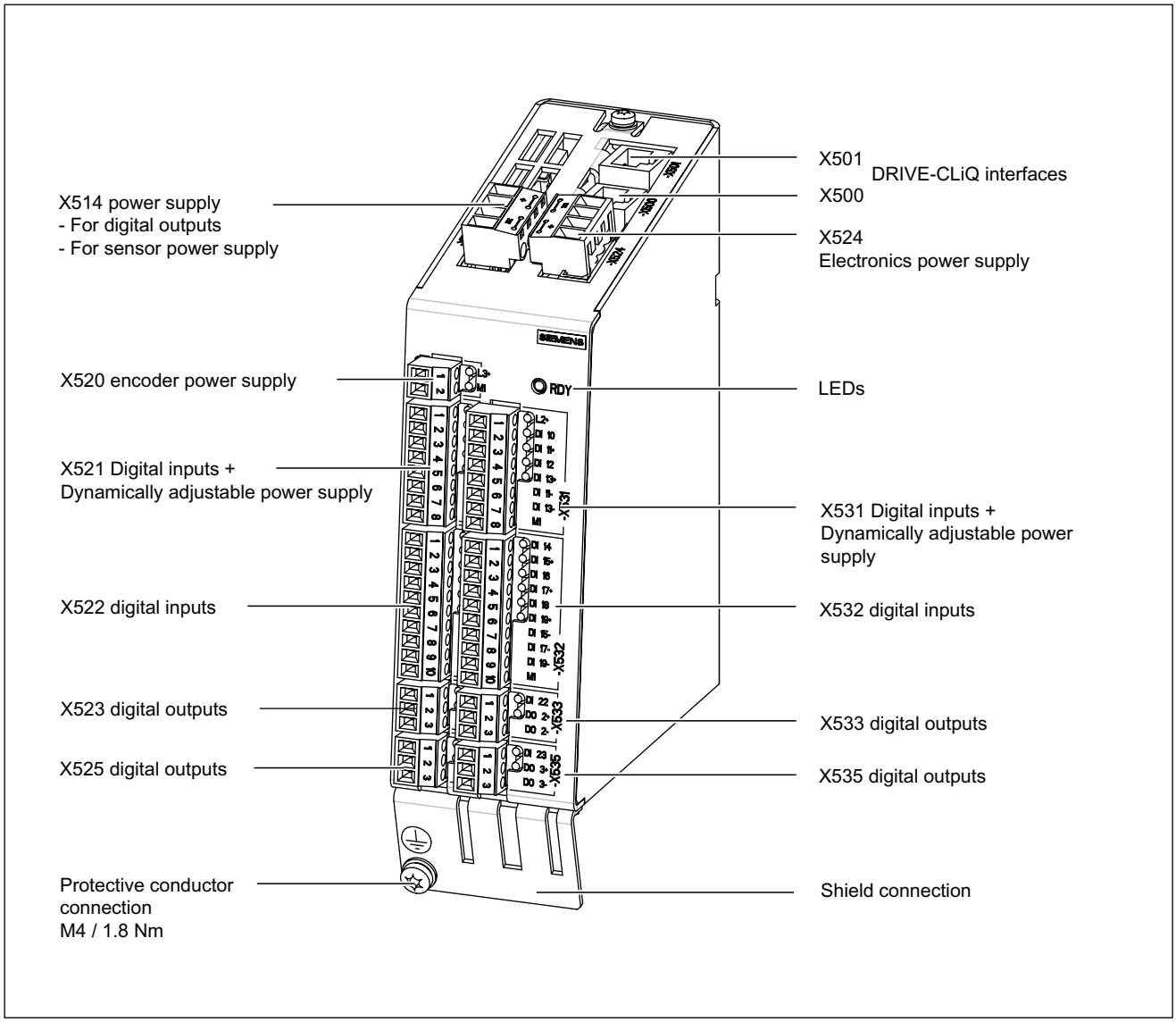


Figure 3-33 Interface description of the TM54F

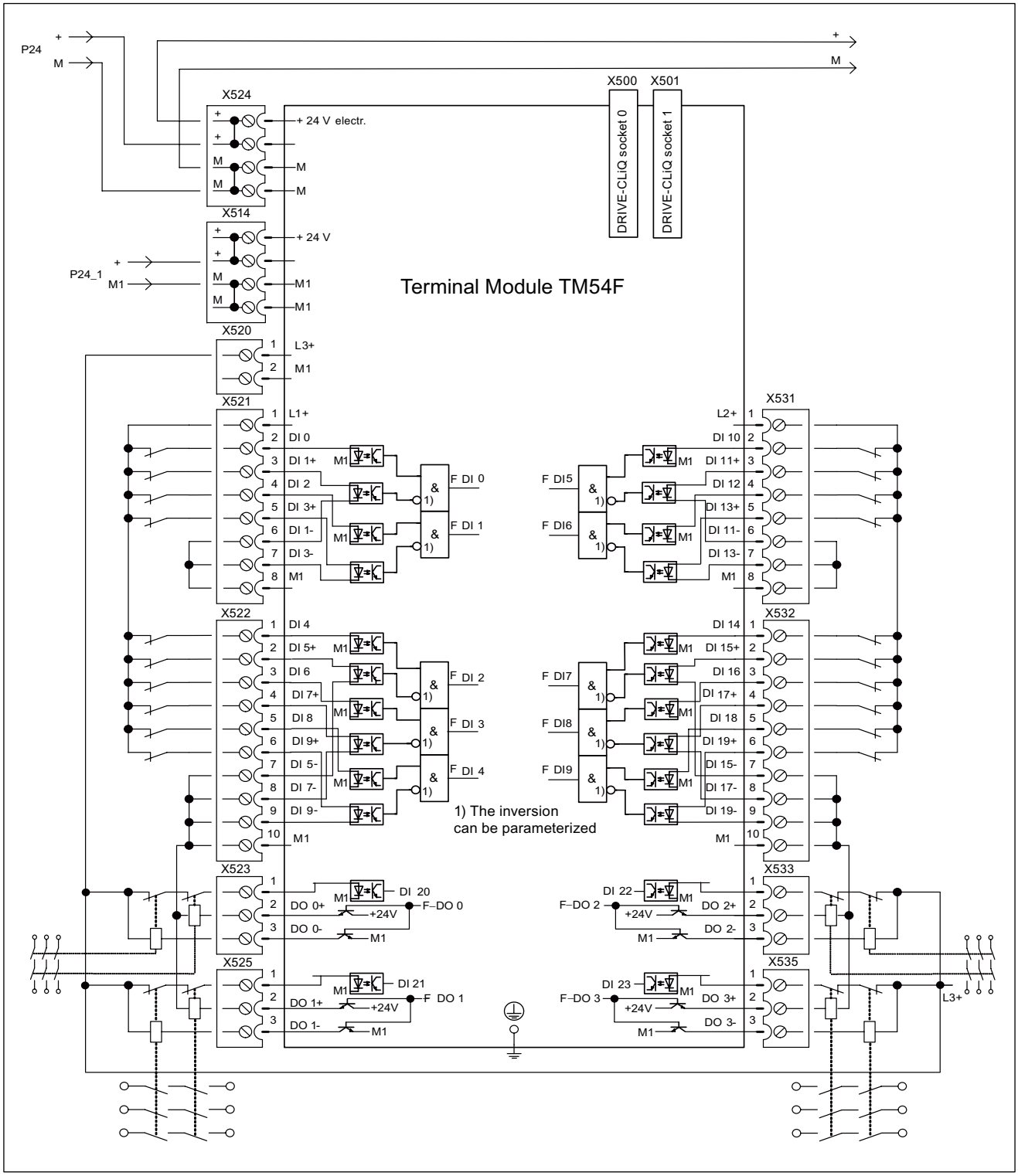


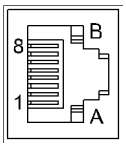
Figure 3-34 Connection example: TM54F

Additional circuit examples are included in:

- SINAMICS S120 Function Manual Safety Integrated, Order No.: 6SL3097-2AR00-0AP0
- System Manual: The safety program for world industry, Order No.: 6ZB5000-0AA01-0BA1, 5 Edition, Supplement: 6ZB5000-0AB01-0BA0

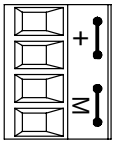
3.9.3.2 X500 and X501 DRIVE-CLiQ interface

Table 3-51 DRIVE-CLiQ interfaces X500 and X501

	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	M (0 V)	Electronics ground
Blanking plate on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13			

3.9.3.3 X514 power supply for digital outputs and sensors

Table 3-52 Terminals for the power supply X514

	Terminal	Designation	Technical data
	+	Power supply	Voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: Max. 4 A[1] Max. current via jumper in connector: 20 A at 55°C
	+	Power supply	
	M1	Electronics ground	
	M1	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

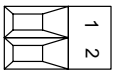
Note

The two "+" and "M1" terminals are jumpered in the connector. This ensures the supply voltage is looped through.

[1] including the current drain for the digital outputs and to supply the sensor.

3.9.3.4 X520 sensor power supply

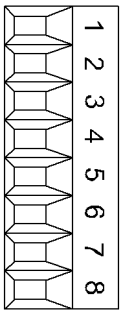
Table 3-53 Terminal X520

	Terminal	Designation	Technical data
	1	L3	500 mA, 24 V
	2	M1	

Without forced dormant error detection

3.9.3.5 X521 digital inputs + power supply with forced dormant error detection

Table 3-54 Screw terminal X521

	Terminal	Designation[1)]	Technical specifications
	1	L1+	Voltage: +24 V DC max. total load current: 500 mA
	2	DI 0	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential, refer to terminals 6, 7, 8 All digital inputs are electrically isolated. Input delay:[2)] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	3	DI 1+	
	4	DI 2	
	5	DI 3+	
	6	DI 1-	Reference potential for DI 1+
	7	DI 3-	Reference potential for DI 3+
	8	M1	Reference potential for DI 0, DI 2, L1+
An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed-out. F-DI 0 = terminals 2, 3 and 6 F-DI 1 = terminals 4, 5 and 7			
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) DI: Digital input; M1: Ground reference

2) Pure hardware delay

NOTICE

For the digital inputs DIx+ to function, the reference potential must be connected to input DIx in each case.

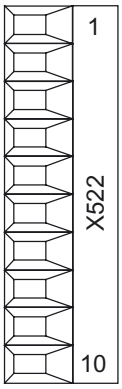
This can be achieved as follows:

1) The ground reference of the digital inputs provided, or

2) a jumper from DIx to terminal M1

3.9.3.6 X522 digital inputs

Table 3-55 Screw terminal X522

	Terminal	Designation[1)]	Technical specifications
	1	DI 4	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential, refer to terminals 7, 8, 9, 10 All digital inputs are electrically isolated. Input delay:[2)] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DI 5+	
	3	DI 6	
	4	DI 7+	
	5	DI 8	
	6	DI 9+	
	7	DI 5-	Reference potential for DI 5+
	8	DI 7-	Reference potential for DI 7+
	9	DI 9-	Reference potential for DI 9+
	10	M1	Reference potential for DI 4, DI 6 and DI 8
An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed-out. F-DI 2 = terminals 1, 2 and 7 F-DI 3 = terminals 3, 4 and 8 F-DI 4 = terminals 5, 6 and 9			
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) DI: Digital input; M1: Ground reference

2) Pure hardware delay

NOTICE

For the digital inputs DIx+ to function, the reference potential must be connected to input DIx in each case.

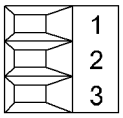
This can be achieved as follows:

1) The ground reference of the digital inputs provided, or

2) a jumper from DIx to terminal M1

3.9.3.7 X523 digital outputs

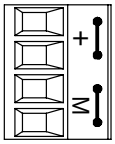
Table 3-56 Screw terminal X523

	Terminal	Designation	Technical data
	1	DI 20	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential is Terminal M1 The digital input is electrically isolated. Input delay:[1)] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DO 0+	0.5 A Reference potential is terminal M1
	3	DO 0-	0.5 A Reference potential is L1+, L2+ or L3+ Output delay:[1)] - for "0" to "1": 300 µs - for "1" to "0": 350 µs Total current drain of all DOs: 2 A
An F-DO comprises two digital outputs and a digital input to feed back the signal F-DO 0 = terminals 1, 2 and 3 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) Pure hardware delay

3.9.3.8 Electronics power supply X524

Table 3-57 Terminals for the electronics power supply

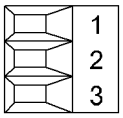
	Terminal	Designation	Technical specifications
	+	Electronics power supply	Voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: max. 0.7 A max. current via jumper in connector: 20 A at 55 °C
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

Note

The two "+" and "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.
The current consumption increases by the value for the DRIVE-CLiQ node.

3.9.3.9 X525 digital outputs

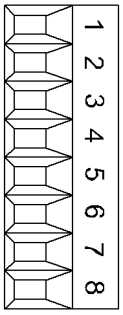
Table 3-58 Screw terminal X525

	Terminal	Designation	Technical data
	1	DI	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Input delay:[1)] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DO 1+	0.5 A Reference potential is terminal M1
	3	DO 1-	0.5 A Reference potential is terminal L1+, L2+ or L3+ Output delay:[1)] - for "0" to "1": 300 µs - for "1" to "0": 350 µs Total current drain of all DOs: 2 A
An F-DO comprises two digital outputs and a digital input F-DO 1 = terminals 1, 2 and 3:			
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) Pure hardware delay

3.9.3.10 X531 digital inputs + power supply with forced dormant error detection

Table 3-59 Screw terminal X531

	Terminal	Designation [1]	Technical specifications
	1	L 2+	Voltage: +24 V DC max. total load current: 500 mA
	2	DI 10	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential, refer to terminals 6, 7, 8 All digital inputs are electrically isolated. Input delay:[2] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	3	DI 11+	
	4	DI 12	
	5	DI 13+	
	6	DI 11-	Reference potential to DI 11+
	7	DI 13-	Reference potential to DI 13+
	8	M1	Reference potential to DI 10, DI 12, L2+
An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed-out. F-DI 5 = terminals 2, 3 and 6 F-DI 6 = terminals 4, 5 and 7			
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) DI: Digital input; M1: Ground reference

2) Pure hardware delay

NOTICE

For the digital inputs DIx+ to function, the reference potential must be connected to input DIx in each case.

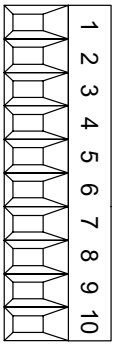
This can be achieved as follows:

1) The ground reference of the digital inputs provided, or

2) a jumper from DIx to terminal M1

3.9.3.11 X532 digital inputs

Table 3-60 Screw terminal X532

	Terminal	Designation[1)]	Technical specifications
	1	DI 14	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential, refer to terminals 7, 8, 9, 10. All digital inputs are electrically isolated. Input delay:[2)] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DI 15+	
	3	DI 16	
	4	DI 17+	
	5	DI 18	
	6	DI 19+	
	7	DI 15-	Reference potential to DI 15+
	8	DI 17-	Reference potential to DI 17+
	9	DI 19-	Reference potential to DI19+
	10	M1	Reference potential to DI14, DI16, DI18
An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed out. F-DI 7 = terminals 1, 2 and 7 F-DI 8 = terminals 3, 4 and 8 F-DI 9 = terminals 5, 6 and 9 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) DI: Digital input; M1: Ground reference

2) Pure hardware delay

NOTICE

For the digital inputs DIx+ to function, the reference potential must be connected to input DIx in each case.

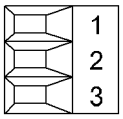
This can be achieved as follows:

1) The ground reference of the digital inputs provided, or

2) a jumper from DIx to terminal M1

3.9.3.12 X533 digital outputs

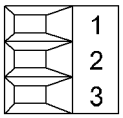
Table 3-61 Screw terminal X533

	Terminal	Designation	Technical data
	1	DI 22	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Input delay:[1)] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DO+	0.5 A Reference potential is terminal M1 0.5 A Reference potential is terminal L1+, L2+ or L3+ Output delay:[1)] - for "0" to "1": 300 µs - for "1" to "0": 350 µs Total current drain of all DOs: 2 A
	3	DO-	
An F-DO comprises two digital outputs and a digital input for the feedback signal F-DO 2 = terminals 1, 2 and 3 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) Pure hardware delay

3.9.3.13 X535 digital outputs

Table 3-62 X535 digital inputs/outputs

	Terminal	Designation	Technical data
	1	DI 23	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Input delay:[1)] - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DO 3+	0.5 A Reference potential is terminal M1 0.5 A Reference potential is terminal L1+, L2+ or L3+ Output delay:[1)] - for "0" to "1": 300 µs - for "1" to "0": 350 µs Total current drain of all DOs: 2 A
	3	DO 3-	
An F-DO comprises two digital outputs and a digital input for the feedback signal F-DO 3 = terminals 1, 2 and 3 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) Pure hardware delay

3.9.3.14 Descriptions of the LED on the Terminal Module TM54F

Table 3-63 Terminal Module TM54F - description of LEDs

LED	Color	State	Description, cause	Remedy
READY	-	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:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/red	Flashing 0.5 Hz	Firmware is being downloaded.	–
		Flashing 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/orange or Red/orange	Flashing	Component recognition via LED is activated (p0154). **Note:** Both options depend on the LED state when component recognition is activated via p0154 = 1.	–
L1+, L2+,	–	ON	The controllable sensor power supply is functioning fault-free.	–
	Red	Continuous	There is a fault in the controllable sensor power supply.	–
L3+	–	ON	Sensor power supply is functioning fault-free.	
	Red	Continuous	There is a fault in the sensor power supply.	
Fail-safe inputs / double inputs				
F_DI z (input x, (x+1)+, (x+1)-)	LED x – –	LED x+1 Red –	Continuous –	**NC contact / NC contact [1]: (z = 0..9, x = 0, 2, ..18)** Different signal states at input x and x+1 No signal at input x and no signal at input x+1	–
	– –	Red –	Continuous –	**NC contact / NO contact [1]: (z = 0..9, x = 0, 2, ..18)** Same signal states at input x and x+1 No signal at input x and a signal at input x+1	
	LED x Green	LED x+1 Green	Continuous	**NC contact / NC contact [1]: (z = 0..9, x = 0, 2, ..18)** A signal at input x and a signal at input x+1	–
	Green	Green	Continuous	**NC contact / NO contact [1]: (z = 0..9, x = 0, 2, ..18)** A signal at input x and no signal at input x+1	
[1] Inputs x+1 (DI 1+, 3+, .. 19+) can be set individually via parameter p10040. p10040 = 0: Input x+1 ist NC contact. p10040 = 1: Input x+1 is NO contact. Factory setting: p10040 = 0 for all inputs x+1.				
Single digital inputs, not fail-safe				
DI x	–	OFF	No signal at digital input x (x = 20..23)	–
	Green	Continuous	Signal at digital input x	–

LED	Color	State	Description, cause	Remedy
Fail-safe digital outputs with associated readback channel				
F_DO y (0+..3+, 0-..3-)	Green	Continuous	Output y (y=0 .. 3) carries a signal	–
Readback input DI 2y for output F_DO y (y = 0..3) at test stop. The state of the LEDs also depends on the type of external circuit.				
DI 2y	–	OFF	One of the two output lines y+ or y- or both lines of output y carry a signal	–
	Green	Continuous	Both output lines y+ and y- carry no signal	–

3.9.4 Dimension drawing

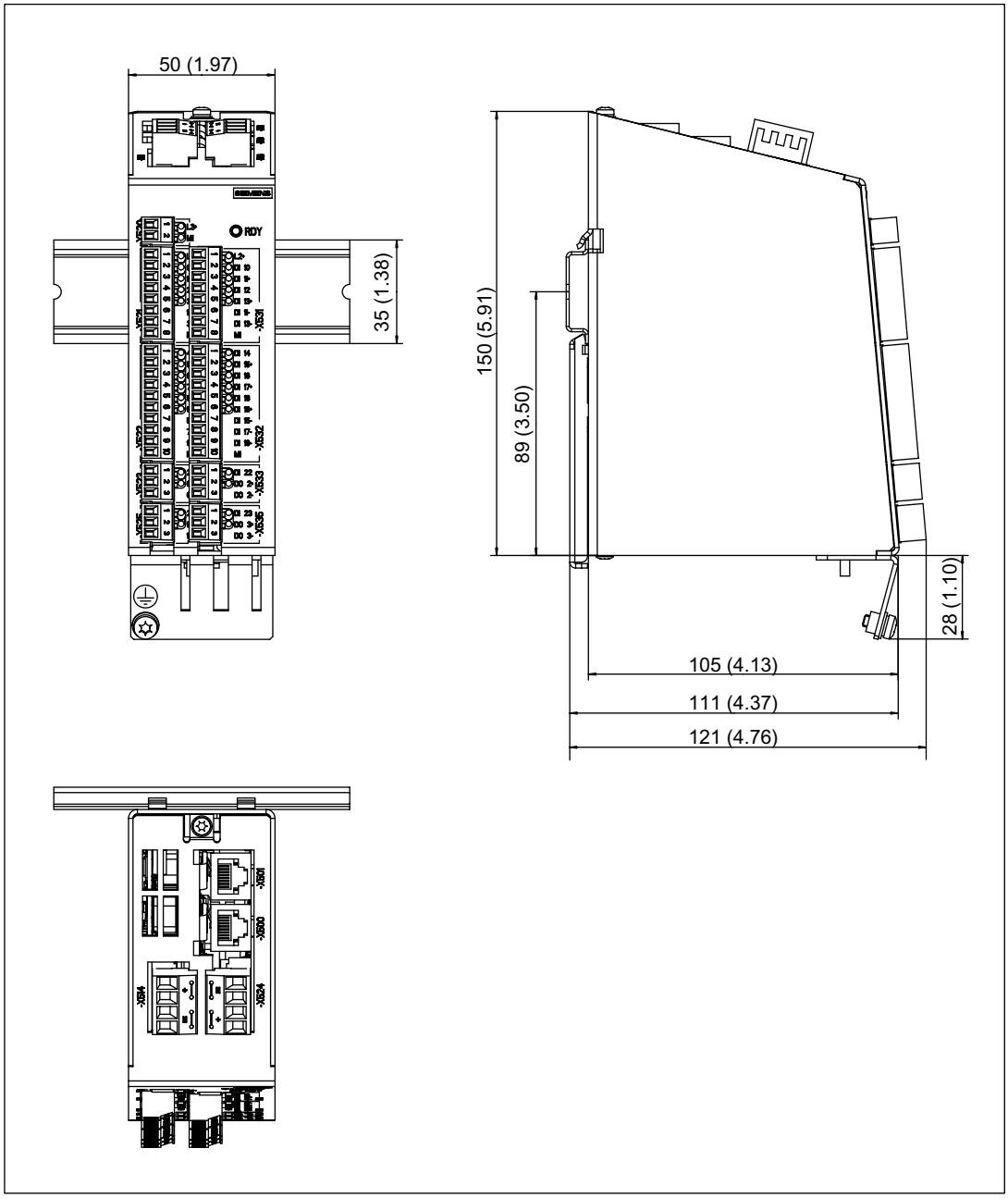


Figure 3-35 Dimension drawing of TM54F

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

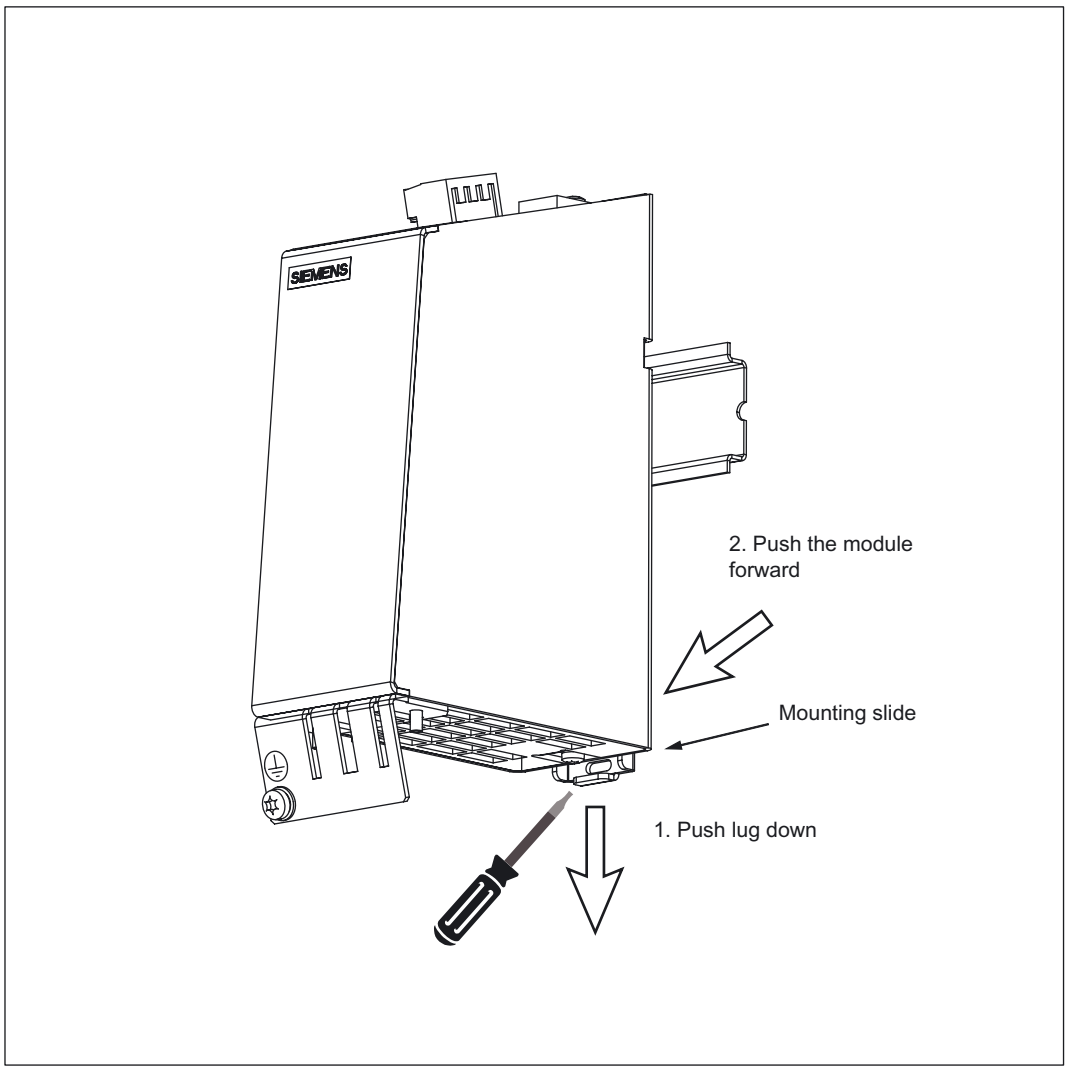


Figure 3-36 Releasing the component from a DIN rail

3.9.6 Technical specifications

Table 3-64 Technical data

	Unit	Value
Current requirement (X524 at 24 V DC) without DRIVE-CLiQ supply	mA	160
Current requirement (X514 at 24 V DC) without digital outputs and sensor power supply	mA	35
Sensor power supply with and without forced dormant error detection (L1+, L2+, L3+) • Voltage • Max. load current per output	 V A	 24 0.5
- cable length for the 24 V power supply: - for longer cable lengths, the "Weidmüller Type No. PU DS 24 16A" surge protector must be used.	m	< 30
• Fail-safe digital inputs (F-DI) (with electrical isolation) • Fail-safe digital outputs (F-DO) (with electrical isolation) • Standard digital inputs (with electrical isolation)		10 4 4
Fail-safe digital inputs (F-DI) and standard digital inputs • Voltage • Low-level (an open digital input is interpreted as "low") • High level • Current consumption (at 24 V DC) • Input delay[1)] – for "0" to "1" – for "1" to "0"	 V V V mA µs µs	 0 - 30 - 3 - + 5 15 - 30 approx. 3.2 approx. 30 (100 Hz) approx. 60 (100 Hz)
Fail-safe digital outputs (F-DO), continuous short-circuit proof • Voltage • Max. load current per digital output • Output delay[1)] – for "0" to "1" – for "1" to "0"	 V A µs µs	 24 0.5 300 350
Power loss	W	4.5 at 24 V
PE/ground connection		On housing with M4 screw
Weight	kg	approx. 0.9

1) Pure hardware delay

3.10 DRIVE-CLiQ Hub Module DMC20

3.10.1 Description

The DRIVE-CLiQ DMC20 Hub Module is used to implement 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.

3.10.2 Safety Information

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

3.10.3 Interface description

3.10.3.1 Overview

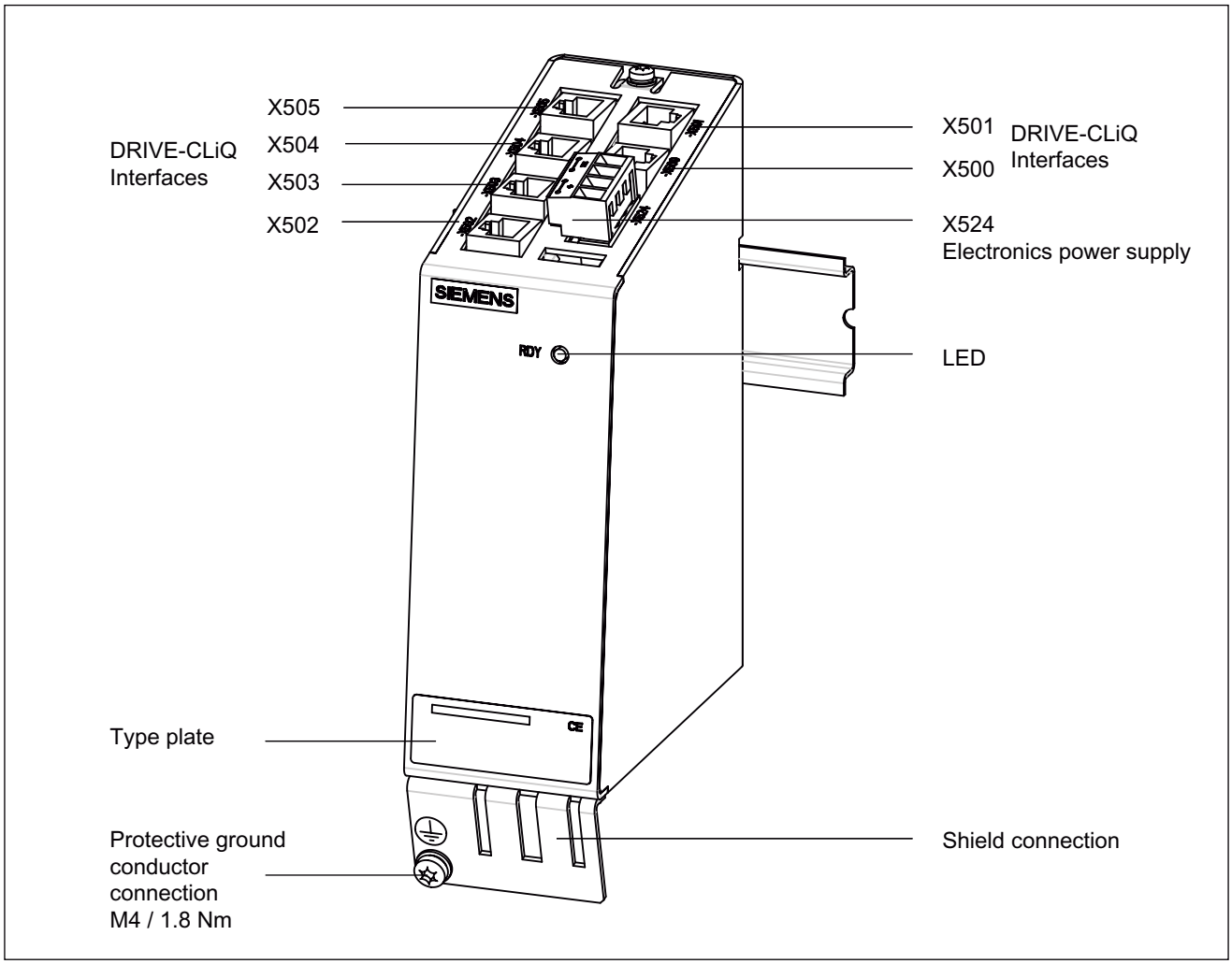
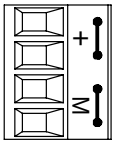


Figure 3-37 Interface description of the DMC20

3.10.3.2 Electronics power supply X524

Table 3-65 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 mm² Type: Screw terminal type 2 (see Appendix A)			

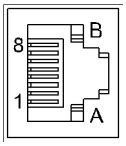
Note

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.

3.10.3.3 DRIVE-CLiQ interface

Table 3-66 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	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13			

3.10.3.4 Description of the LEDs on the DRIVE-CLiQ Hub Module DMC20

Table 3-67 DRIVE-CLiQ Hub Module DMC20 – description of the LEDs

LED	Color	State	Description, cause	Remedy
READY	-	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:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing 0.5 Hz	Firmware is being downloaded.	–
		Flashing 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0154). **Note:** Both options depend on the LED status when component recognition is activated via p0154 = 1.	–

3.10.4 Dimension drawing

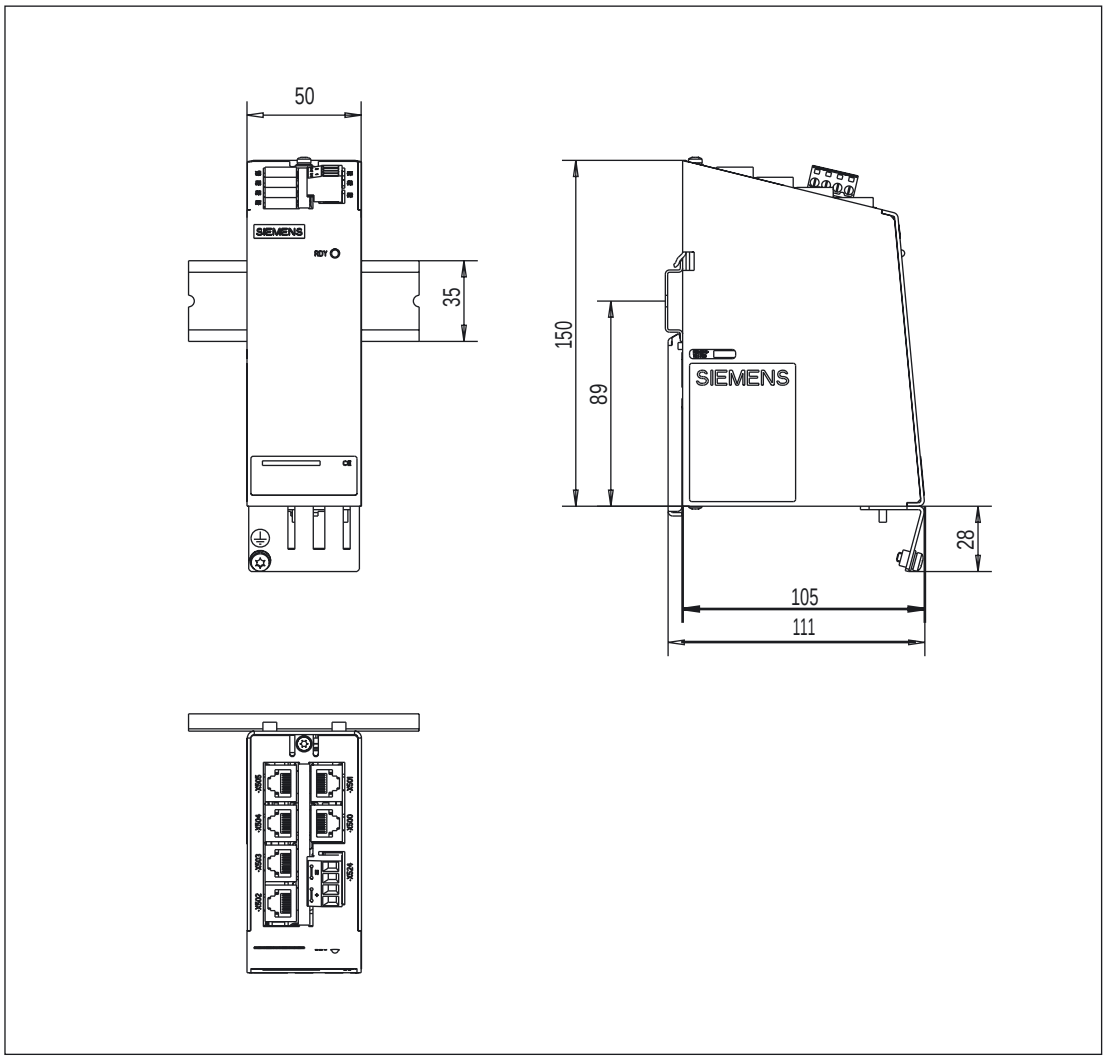


Figure 3-38 Dimension drawing of the DMC20

3.10.5 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

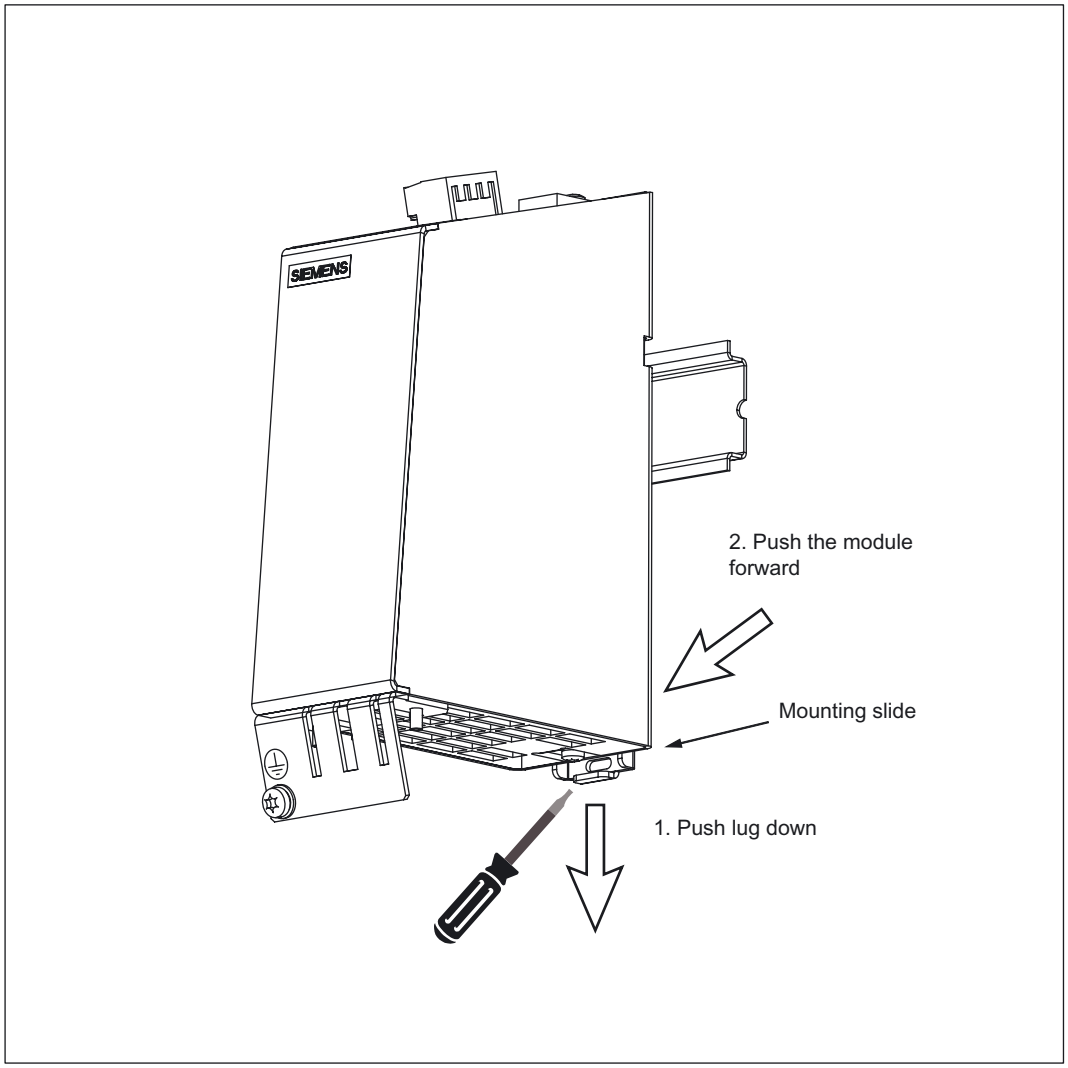


Figure 3-39 Releasing the component from a DIN rail

3.10.6 Technical data

Table 3-68 Technical data of the DMC20

	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 DC (20.4 – 28.8)
Current (without DRIVE-CLiQ consumer)	A_{DC}	0.15
PE/ground connection	At the housing with M4/1.8 Nm stud	
Weight	kg	0.8

3.11 DRIVE-CLiQ Hub Module External DME20

3.11.1 Description

The DRIVE-CLiQ Hub Module External DME20 is used to implement star-shaped distribution of a DRIVE-CLiQ line. With the DME20, an axis grouping can be expanded with 5 DRIVE-CLiQ sockets for additional subgroups.

The component has degree of protection IP67 and 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.

The DME20 can be operated from firmware 2.6 onwards.

3.11.2 Safety Information

NOTICE
In order to guarantee degree of protection IP67, all of the plug connectors must be correctly screwed into place and appropriately locked.

NOTICE
The unused DRIVE-CLiQ interfaces must be closed using a protective cap that is included in the scope of delivery.

3.11.3 Interface description

3.11.3.1 Overview

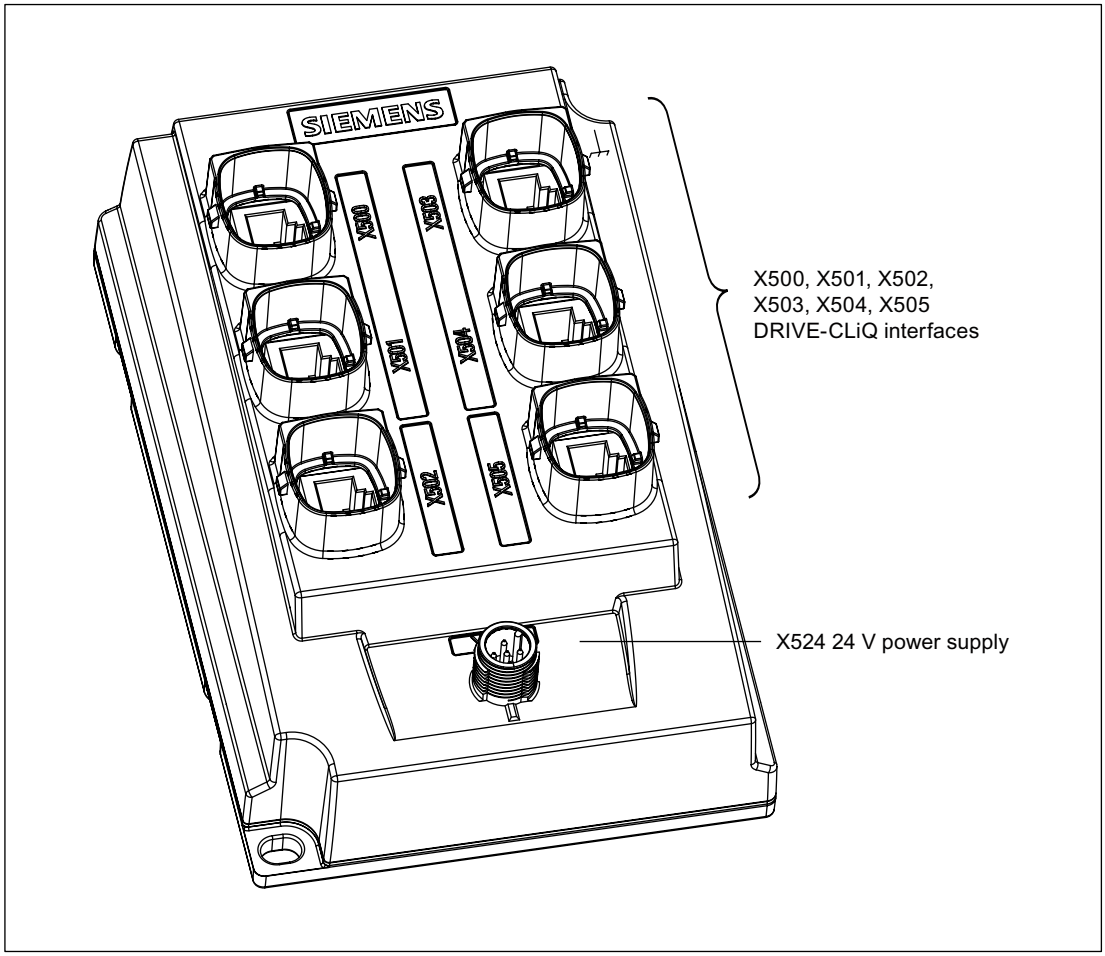
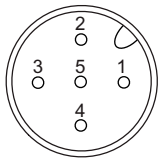


Figure 3-40 Interface overview: DME20

3.11.3.2 Electronics power supply X524

Table 3-69 X524 socket for the electronics power supply

	Pin	Designation	Technical specifications
	1	Electronics power supply	The connection voltage of 20.4 V – 28.8 V refers to the (terminal) voltage at the DME20. This must be taken into account when selecting the cable cross-section and supply cable lengths. Pin 1 and 2: jumpered internally Pin 3 and 4: jumpered internally
	2	Electronics power supply	
	3	Electronics ground	
	4	Electronics ground	
	5	not connected	
Max. connectable cross-section: 4 x 0.75 mm² e.g. 5-pole shielded connector, user-assembled: Phoenix company, Order No.: 1508365, 4-pole non-shielded connector, user-assembled, Speedcon quick-lock: Phoenix company, Order No. 1521601			

Note

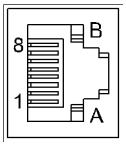
The maximum cable length for the P24 supply of the DME20 is 100 m.

Table 3-70 Cable length of P24 supply cable:

Connected loads [1]	1	2	3	4	5
Cross section					
0.34 mm²	75 m	45 m	30 m	25 m	20 m
2 x 0.34 mm²	100 m	90 m	65 m	50 m	40 m
0.75 mm²	100 m	100 m	75 m	60 m	50 m
2 x 0.75 mm²	100 m	100 m	100 m	100 m	100 m
[1] Connected motors with DRIVE-CLiQ encoder, DRIVE CLiQ mounted encoder SME					
Ta = 55 °C 100 m DRIVE-CLiQ					

3.11.3.3 DRIVE-CLiQ interface

Table 3-71 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	M (0 V)	Electronics ground

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. With MOTION-CONNECT 500, the maximum cable length is 100 m; with MOTION-CONNECT 800, it is 50 m.

3.11.4 Dimension drawing

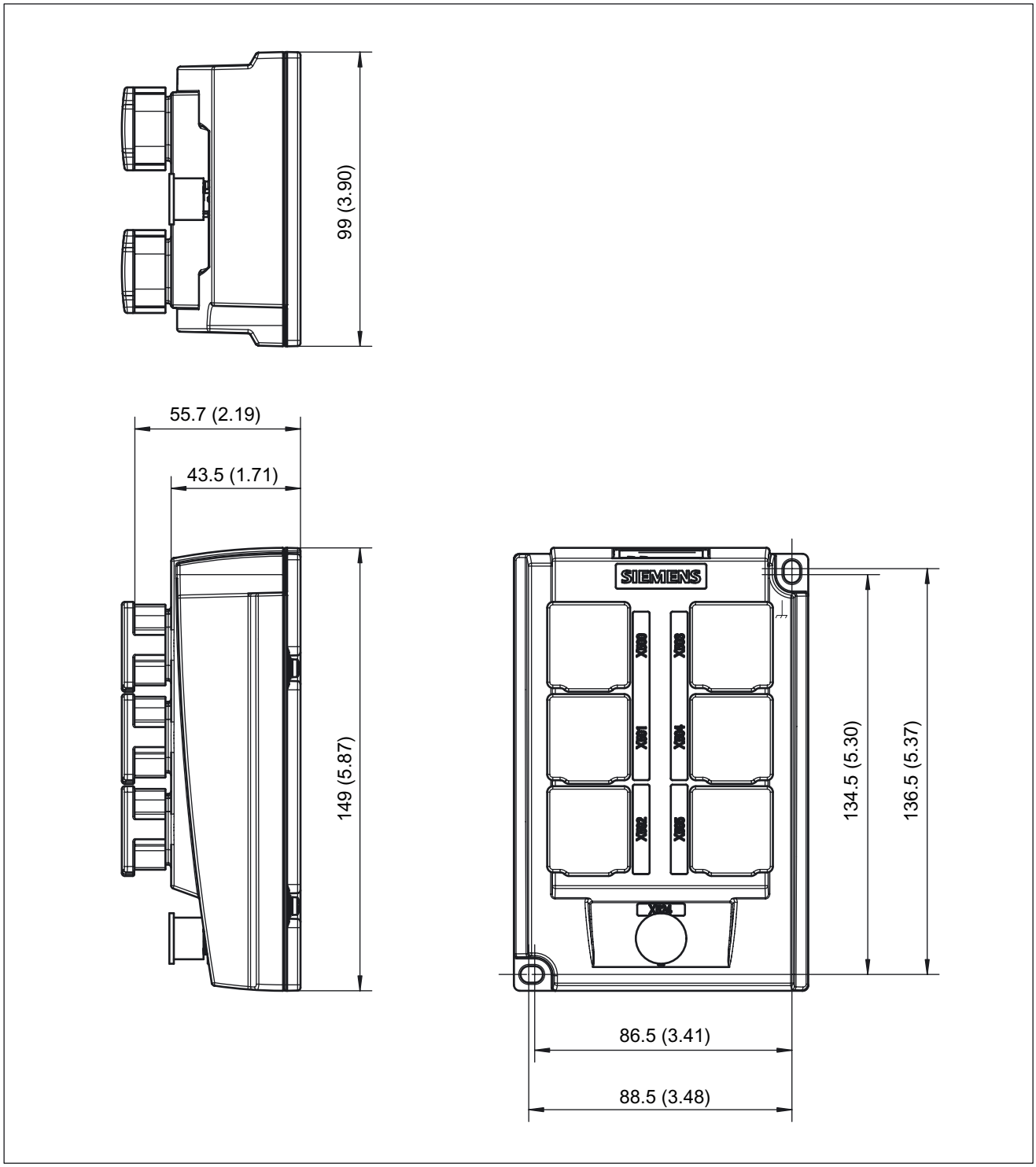


Figure 3-41 Dimension drawing: DME20

3.11.5 Installation

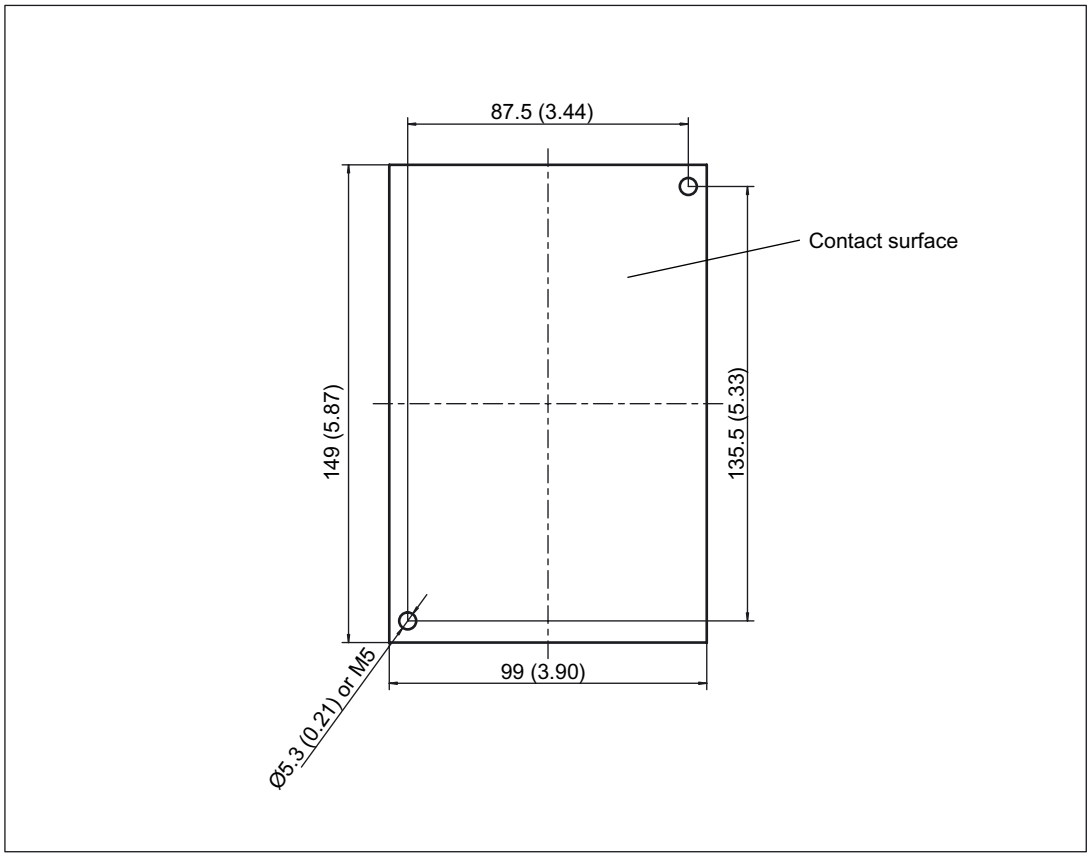


Figure 3-42 DME20 installation

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 tightening torque of 6.0 Nm.

3.11.6 Technical data

Table 3-72 Technical data of the DME20

	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 DC (20.4 – 28.8)
Current (without DRIVE-CLiQ node)	A_{DC}	0.15
PE/ground connection	Fastened to housing M5 / 6 Nm	
Degree of protection	IP67	
Weight	kg	0.8

3.12 Voltage Sensing Module VSM10

3.12.1 Description

The Voltage Sensing Module 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[1].

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 3-73 Interface overview of the VSM10

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

[1]The infeed control is a firmware function that is required for the open-loop and closed-loop control, monitoring and communication of an infeed.

3.12.2 Safety information

⚠ WARNING

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.

3.12.3 Interface description

3.12.3.1 Overview

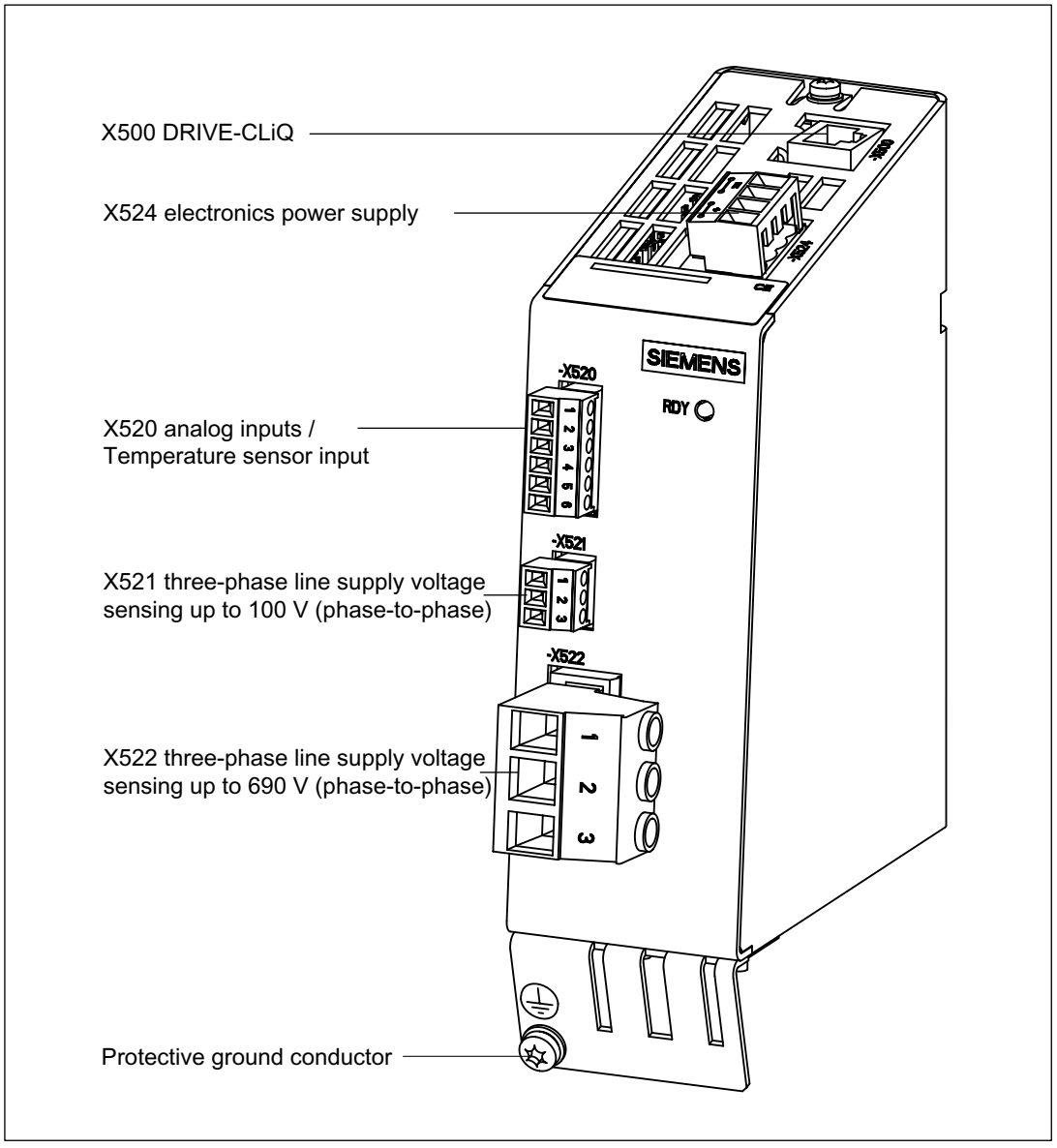


Figure 3-43 Voltage Sensing Module VSM10

3.12.3.2 Connection example

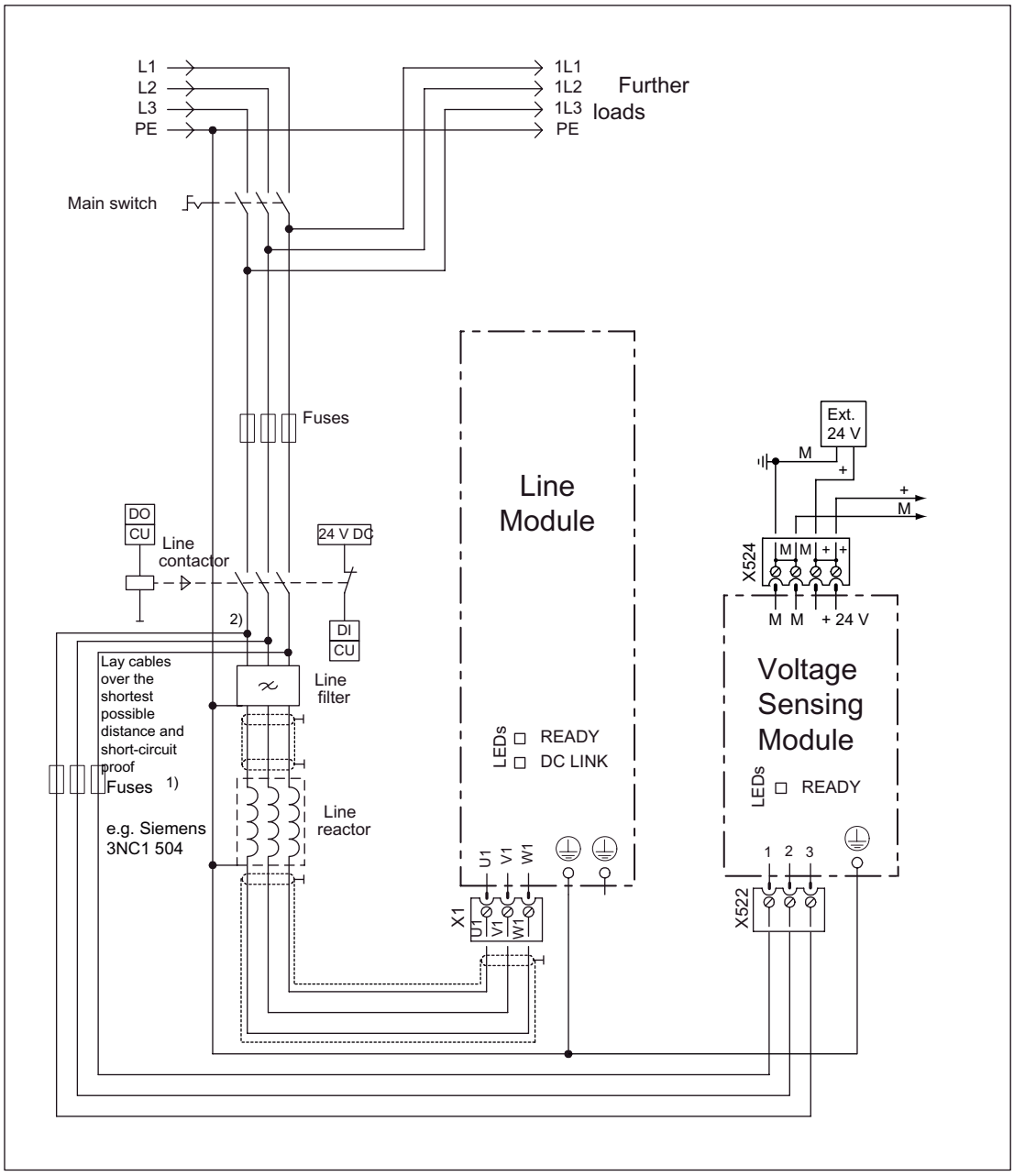


Figure 3-44 Connection example, VSM10

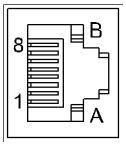
1)It is only possible to omit the fuses if the cables to the Voltage Sensing Module are laid according to EN 60439-1 so that no short-circuit or ground fault can be expected under normal operating conditions (short-circuit proof installation).

2)The line voltage can be taken as actual value for the Voltage Sensing Module VSM10 in the following ways, depending on the system configuration:

- Cable lug DIN 46234-8-2.5 for components with M8 connection bolt, e.g. Active Interface Module 80 kW and 120 kW
- Sensing terminals, type AGK (Phoenix Contact) for components with high-current terminals, e.g. Active Interface Module 55 kW
- Intermediate high-current connectors, type UHV (Phoenix Contact) and cable lug DIN 46234-8-2.5

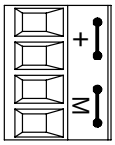
3.12.3.3 X500 DRIVE-CLiQ interface

Table 3-74 X500 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	M (0 V)	Electronics ground
Blanking plate on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13 The maximum cable length that can be connected is 50 m.			

3.12.3.4 Electronics power supply X524

Table 3-75 Terminals for the electronics power supply

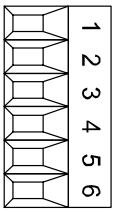
	Terminal	Designation	Technical specifications
	+	Electronics power supply	Voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: max. 0.2 A Max. current via jumper in connector: 20 A at 55 °C
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A) The maximum cable length that can be connected is 10 m.			

Note

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

3.12.3.5 X520 analog inputs/temperature sensor

Table 3-76 Terminal block X520

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

Note

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

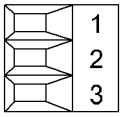
CAUTION
The common mode range may not be violated. This means that the analog differential voltage signals can have a maximum offset voltage of +/-30 V with respect to the ground potential. If the range is infringed, incorrect results may occur during analog/digital conversion.

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

This interface is not relevant for booksize units.

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

Table 3-77 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 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).

3.12.3.8 Meanings of the LEDs on the Voltage Sensing Module VSM10

Table 3-78 Voltage Sensing Module VSM10 – description of LEDs

LED	Color	State	Description, cause	Remedy
READY	-	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:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing 0.5 Hz	Firmware is being downloaded.	–
		Flashing 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0144) **Note:** Both options depend on the LED status when component recognition is activated via p0144 = 1.	–

3.12.4 Dimension drawing

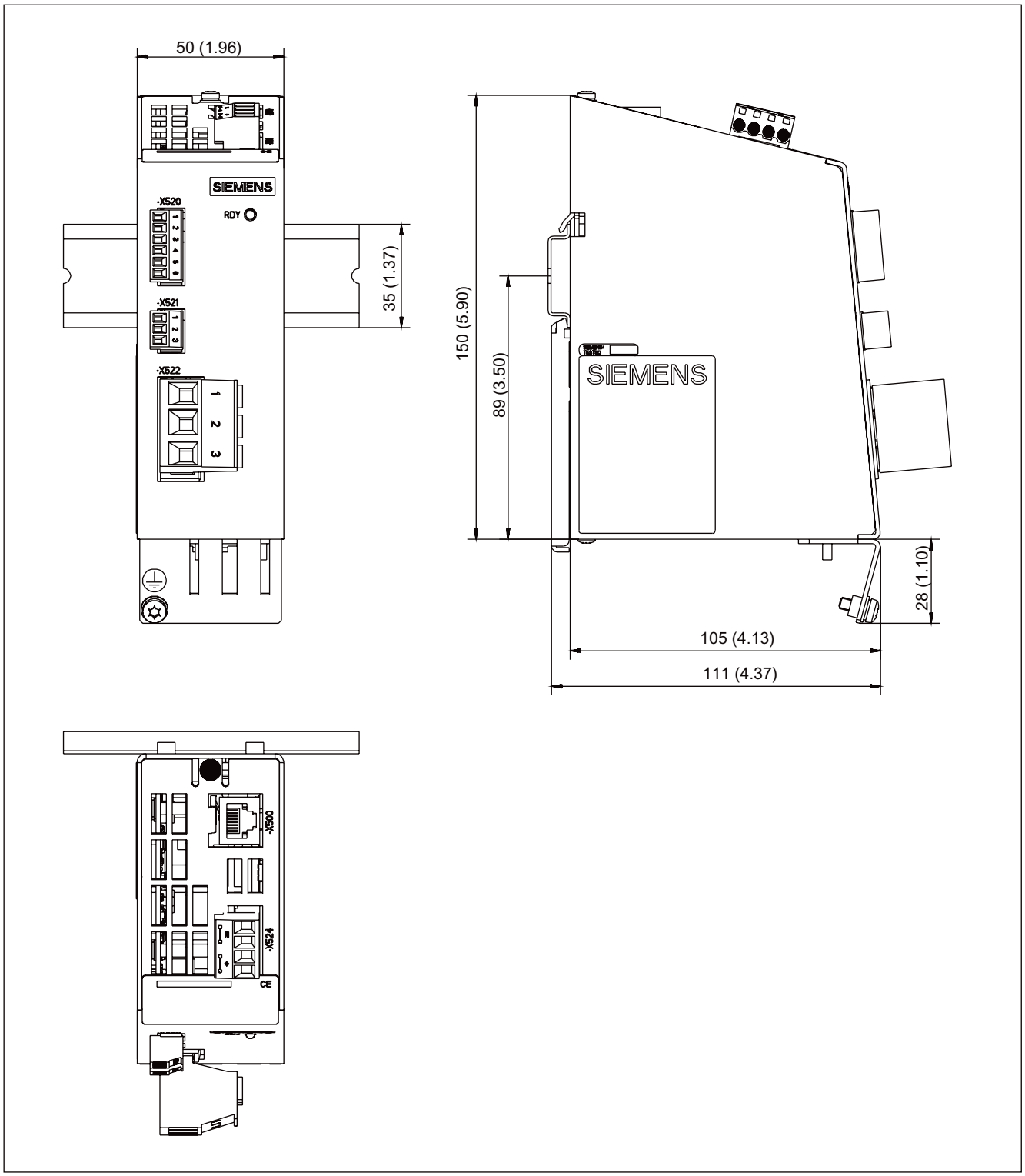


Figure 3-45 Dimension drawing: Voltage Sensing Module

3.12.5 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

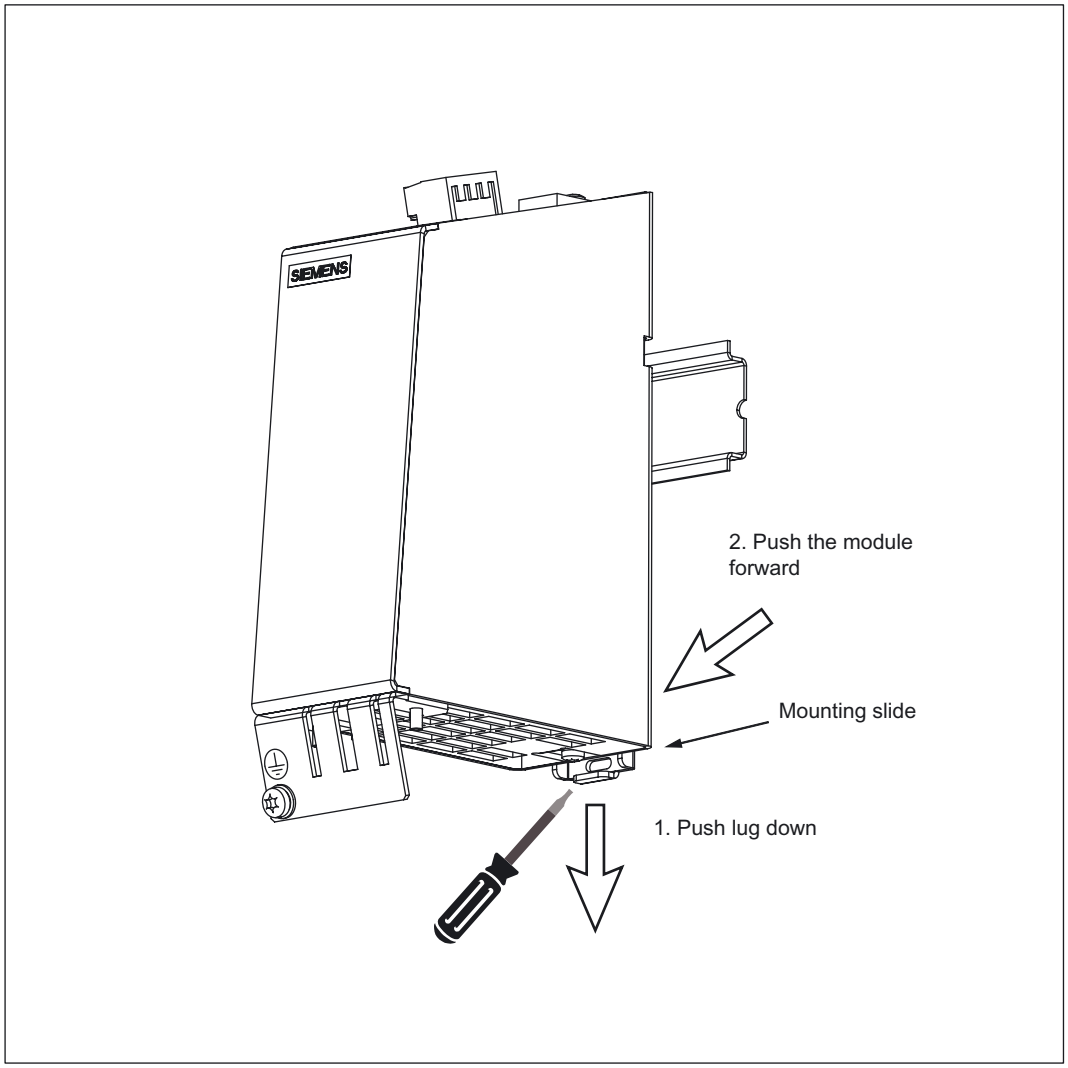


Figure 3-46 Releasing the component from a DIN rail

3.12.6 Electrical Connection

Shield connection terminals from Weidmüller for shield contacts

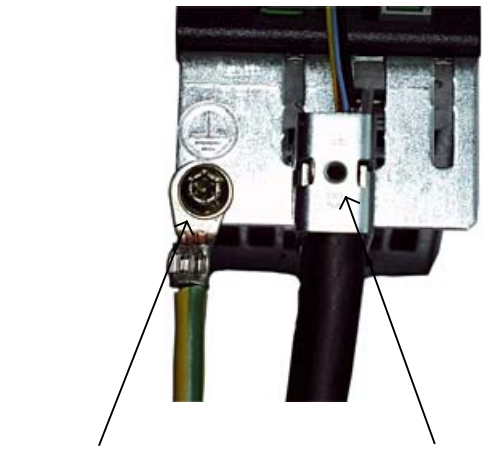


Figure 3-47 Shield contacts

Internet address of the company:

Weidmüller: http://www.weidmueller.com

NOTICE
Only screws with a permissible screw-in depth of 4 - 6 mm may be used.

3.12.7 Technical data

Table 3-79 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}	0.3
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 encoder 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 encoder and temperature signals as well as the electronic rating 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 diagnostics because the motor and encoder type are identified automatically.

Motors and external encoders without DRIVE-CLiQ interface

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

If not otherwise specified, only one encoder system can be connected to each Sensor Module.

Motors and external encoders with DRIVE-CLiQ interface

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 encoder - different encoder cables are no longer required; just one MOTION-CONNECT DRIVE-CLiQ cable can be used for all types.

Encoders with a DRIVE-CLiQ interface

The DRIVE-CLiQ encoder is an absolute encoder with integrated DRIVE-CLiQ interface (refer to Section "DRIVE-CLiQ encoder").

Further information

Encoder evaluations or encoders with a DRIVE-CLiQ interface are connected.

4.2 Overview of Sensor Modules

4.2.1 Description

Sensor Modules Cabinet-Mounted (SMC)

Sensor Modules Cabinet-Mounted can be ordered and configured separately. They are used when a motor with a DRIVE-CLiQ interface is not available or when external encoders in addition to the motor encoder are required. Only one encoder system can be connected to each Sensor Module Cabinet-Mounted. The SMEs evaluate these measuring systems and convert the calculated values to DRIVE-CLiQ.

Note

The SMC supplies the power to the encoder; the SMC, however, must be provided separately with 24 VDC power.

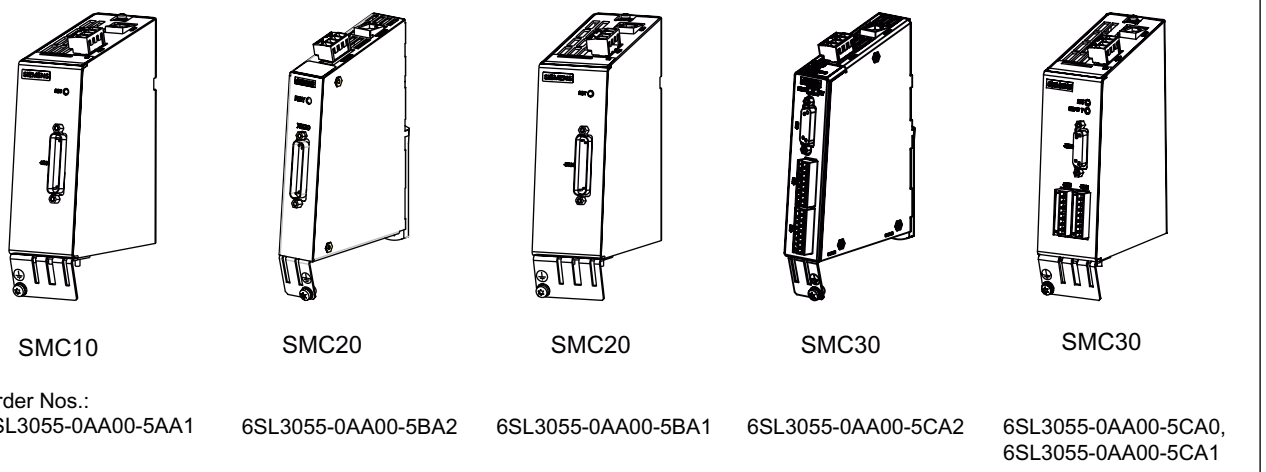


Figure 4-1 Sensor Modules Cabinet-Mounted (SMC)

Sensor Modules External (SME)

The Sensor Modules SME20, SME25, SME120 and SME125 are intended for use only with proprietary Drive-CLiQ connections and may only be used in NFPA 79 applications.

Direct encoder systems outside the cabinet can be connected to the Sensor Modules External. The SMEs evaluate these encoder systems and convert the calculated values to DRIVE-CLiQ. No motor or encoder data is stored in the SMEs.

Note

The SME provides the encoder power supply. The power supply for the SME is provided from the connected DRIVE-CLiQ cable. This must be taken into consideration when the DRIVE-CLiQ cable is selected.

The Sensor Modules External have a higher degree of protection (IP67) and are therefore suitable for installation outside the cabinet.

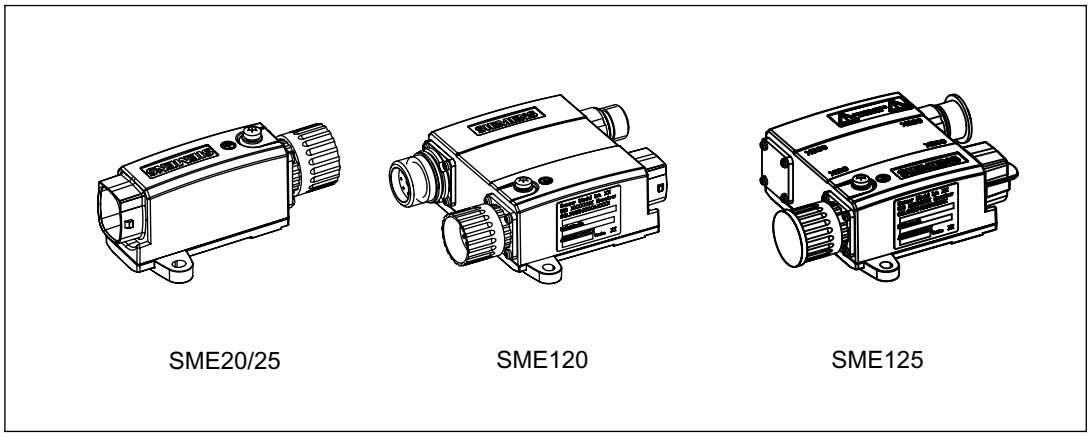


Figure 4-2 Sensor Modules External (SME)

Connectable encoder systems

Table 4-1 Connectable encoder systems

	SMC					SME			
Encoder systems	**SMC10**	**SMC20 30 mm**	**SMC20 50 mm**	**SMC30 30 mm**	**SMC30 50 mm**	**SME20**	**SME25**	**SME120**	**SME125**
Resolver	Yes	-	-	-	-	-	-	-	-
Incremental encoder sin / cos (1 Vpp) with/without reference signal	-	Yes	Yes	-	-	Yes	-	Yes	-
Absolute encoder EnDat 2.1	-	Yes	Yes	-	-	-	Yes	-	Yes
Incremental encoder TTL / HTL	-	-	-	Yes	Yes	-	-	-	-
Absolute encoder SSI	-	Yes[1)]	Yes[1)]	Yes[2)]	Yes[2)]	-	Yes[1)]	-	Yes[1)]
Temperature evaluation	Yes	Yes	Yes	Yes	Yes	-	-	Yes (electri-cally isolated)	Yes (electri-cally isolated)

[1)] Only possible from firmware 2.4 (only SSI encoders with 5-V supply possible)

[2)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4 (SSI encoders with 5 V or 24 V supply possible)

4.2.2 Examples of encoder system integration

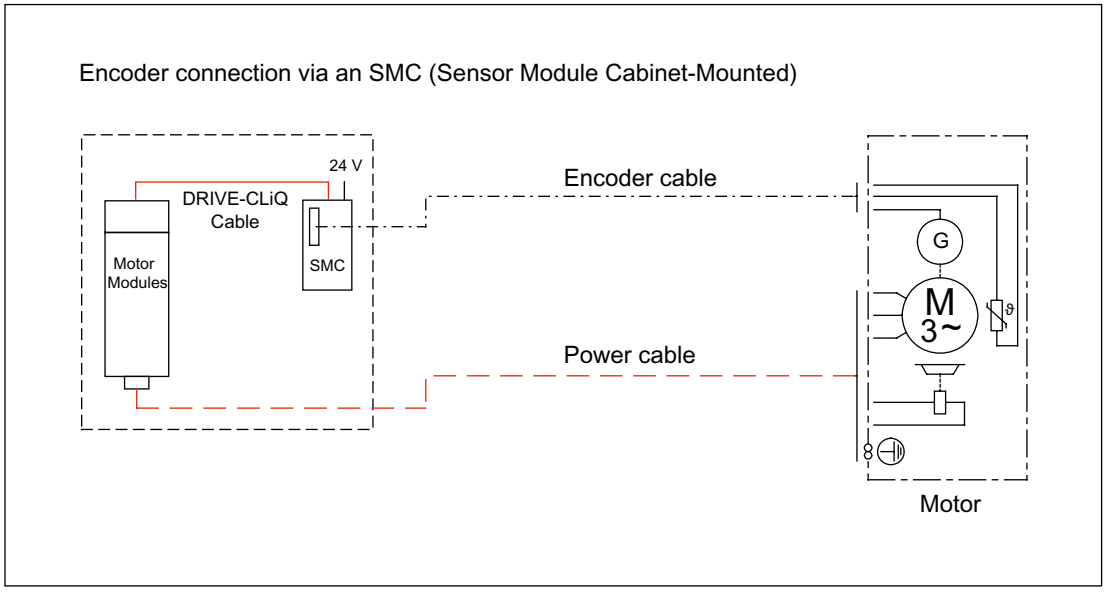


Figure 4-3 Encoder connection via an SMC (Sensor Module Cabinet-Mounted)

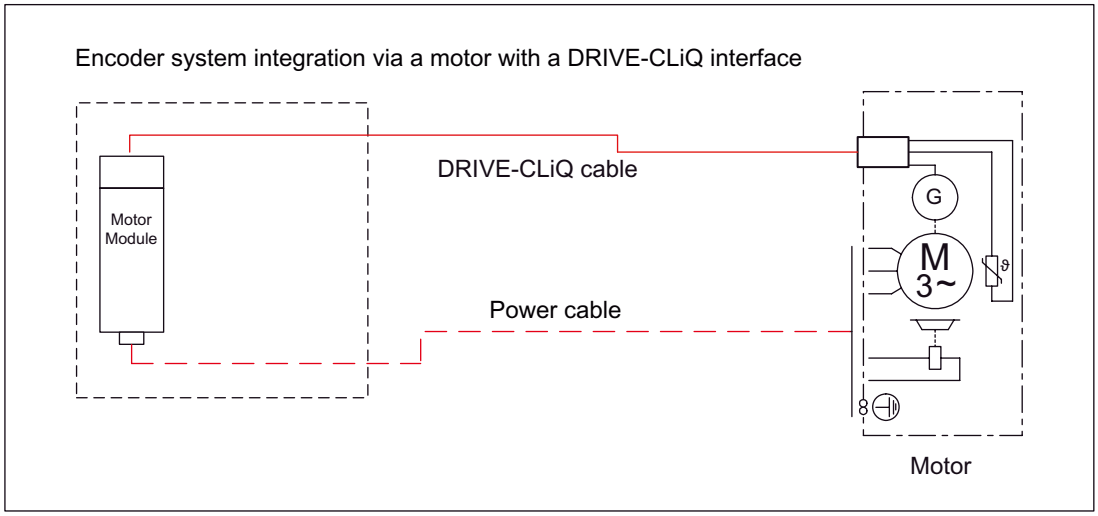


Figure 4-4 Encoder system integration via a motor with a DRIVE-CLiQ interface

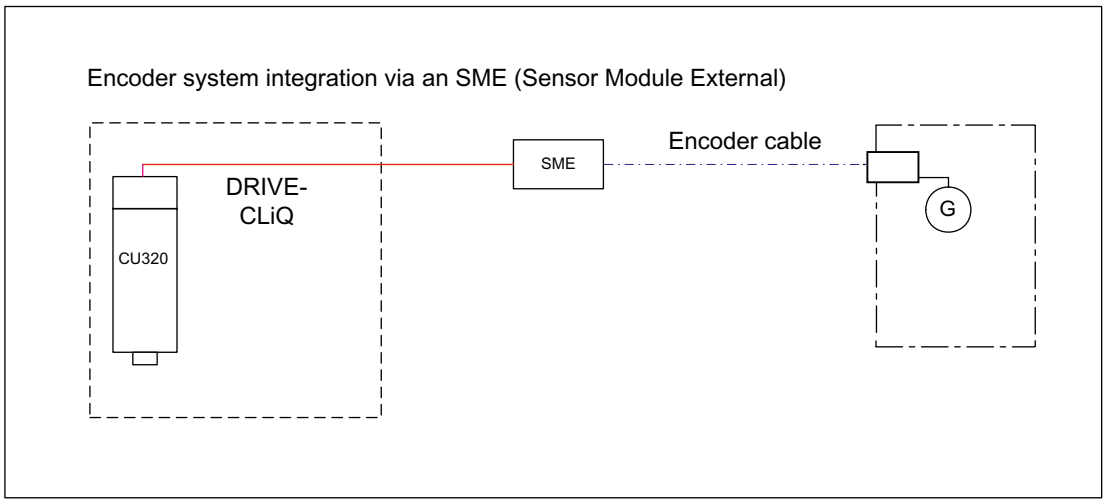


Figure 4-5 Encoder system integration via an SME (Sensor Module External)

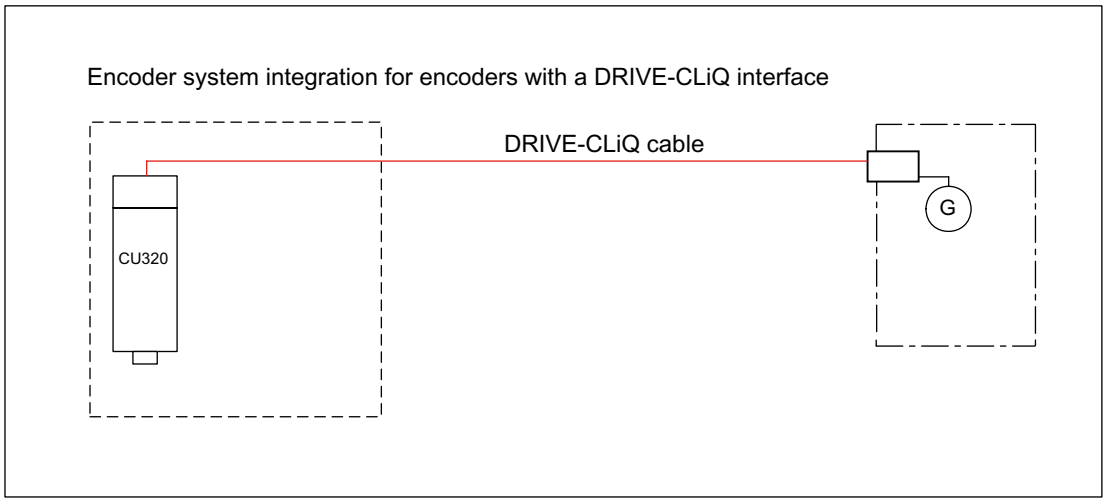


Figure 4-6 Encoder system integration of encoders with DRIVE-CLiQ interface (e.g. DRIVE-CLiQ encoder)

4.3 Sensor Module Cabinet-Mounted SMC10

4.3.1 Description

The Sensor Module Cabinet-Mounted 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 is used to evaluate sensor signals from resolvers.

4.3.2 Safety Information

⚠ WARNING

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

NOTICE

Only one encoder system may be connected per Sensor Module.

Note

There must be no electrical connection between the encoder system housing and the encoder system electronics (this requirement is fulfilled for most encoder systems). If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic 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

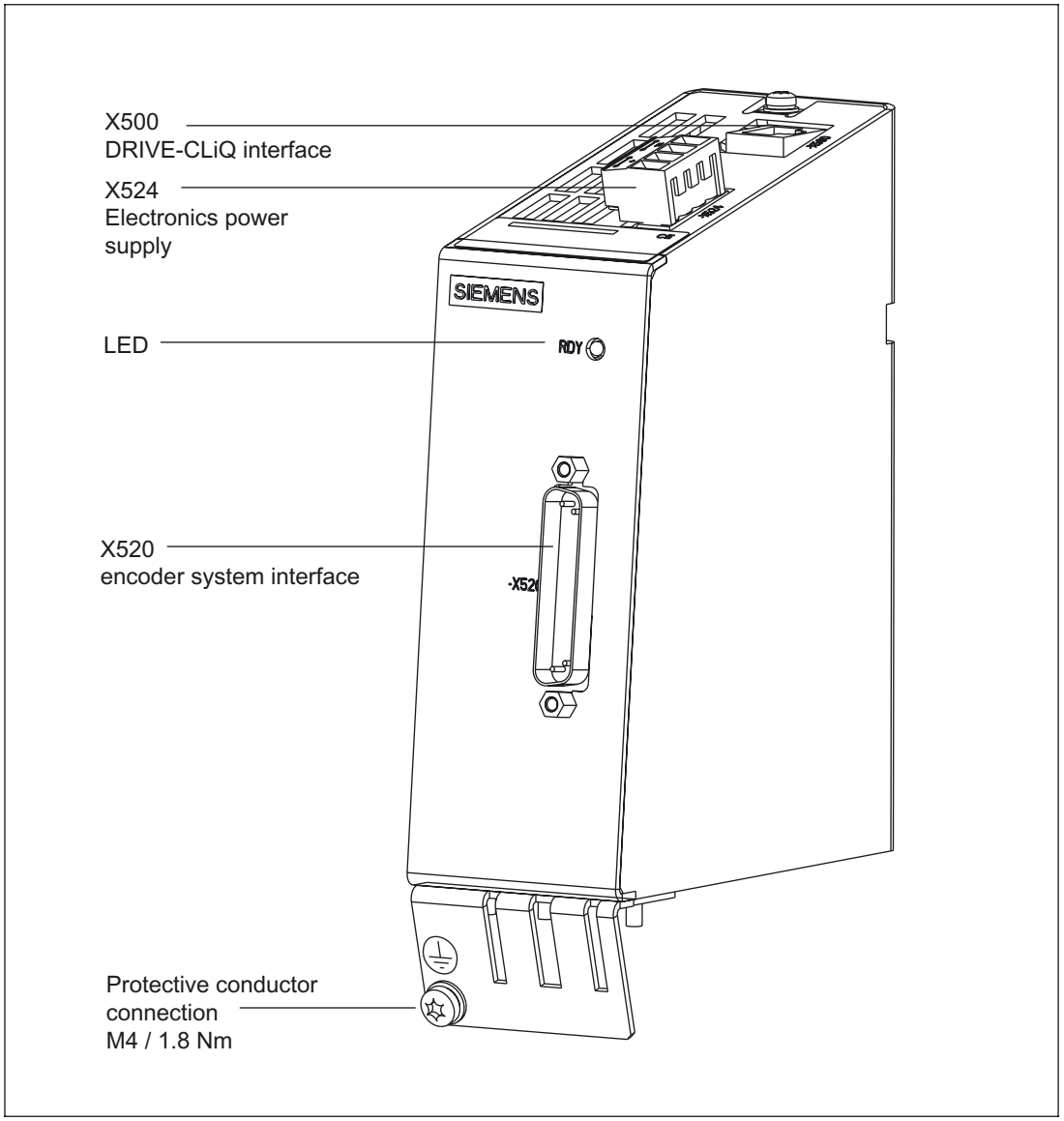
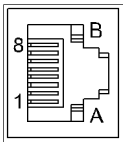


Figure 4-7 Interface description of the SMC10

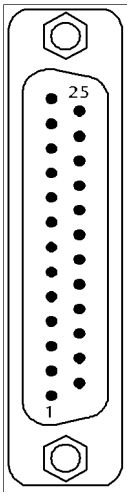
4.3.3.2 DRIVE-CLiQ interface X500

Table 4-2 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)	Electronics ground

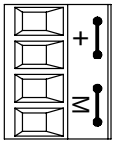
4.3.3.3 X520 encoder system interface

Table 4-3 X520 encoder system interface

	Pin	Signal name	Technical specifications
	1	Reserved, do not use	
	2	Reserved, do not use	
	3	S2	Resolver signal A (sin+)
	4	S4	Inverse resolver signal A (sin-)
	5	Ground	Ground (for internal shield)
	6	S1	Resolver signal B (cos+)
	7	S3	Inverse resolver signal B (cos-)
	8	Ground	Ground (for internal shield)
	9	R1	Resolver excitation positive
	10	Reserved, do not use	
	11	R2	Resolver excitation negative
	12	Reserved, do not use	
	13	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	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 KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC

4.3.3.4 Electronics power supply X524

Table 4-4 Terminal block X524

	Terminal	Function	Technical specifications
	+	Electronics power supply	Voltage: 24 V (20.4 V – 28.8 V) Current consumption: max. 0.35 A 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 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 Significance of LEDs on the Sensor Module Cabinet-Mounted SMC10

Table 4-5 Sensor Module Cabinet-Mounted SMC10 – description of the LEDs

LED	Color	State	Description, cause	Remedy
RDY READY	-	Off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing, 0.5 Hz	Firmware is being downloaded.	–
		Flashing, 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0144). **Note:** 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:

References: /IH1/ SINAMICS S, Commissioning Manual

4.3.4 Dimension drawing

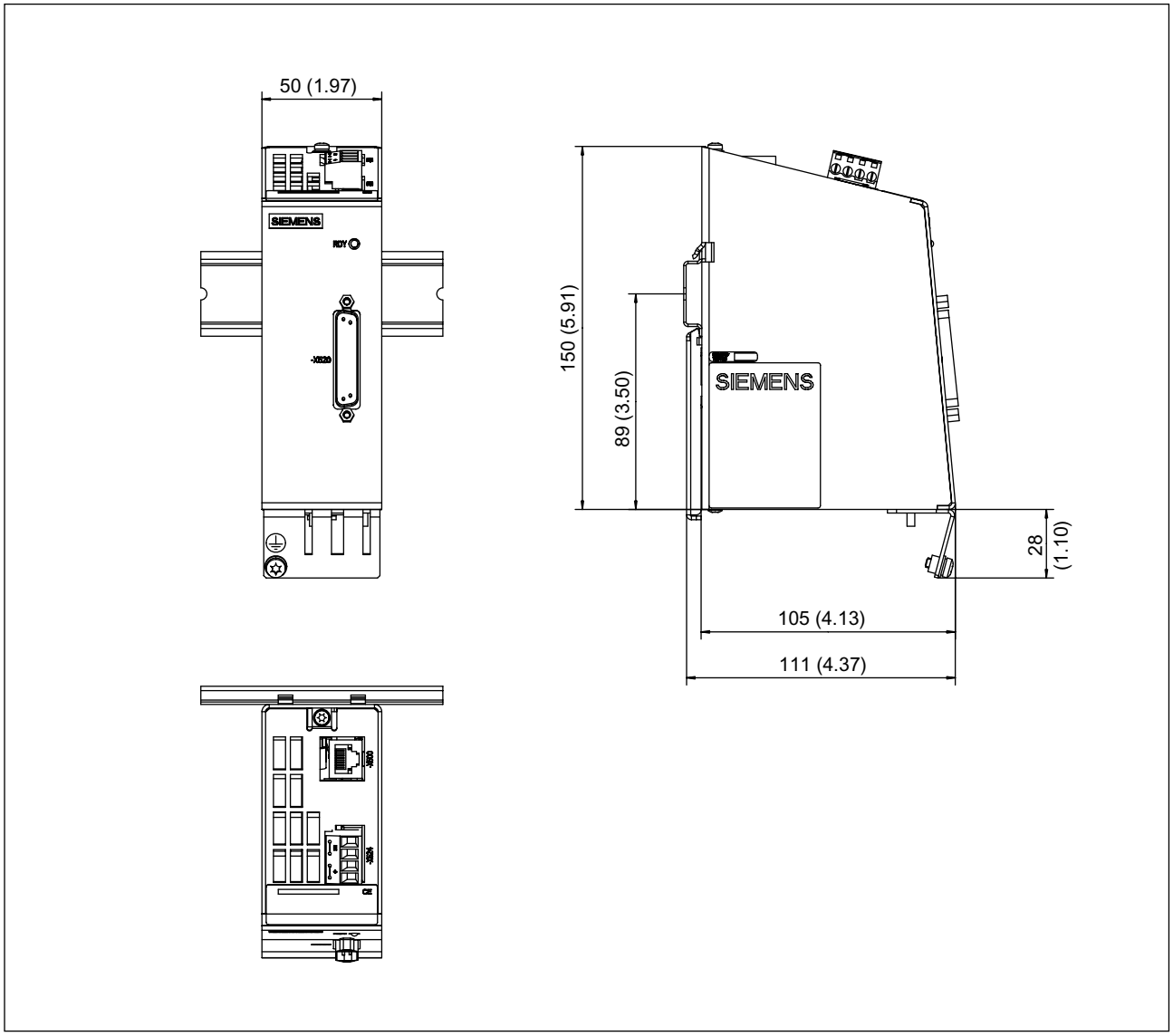


Figure 4-8 Dimension drawing of the SMC10

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

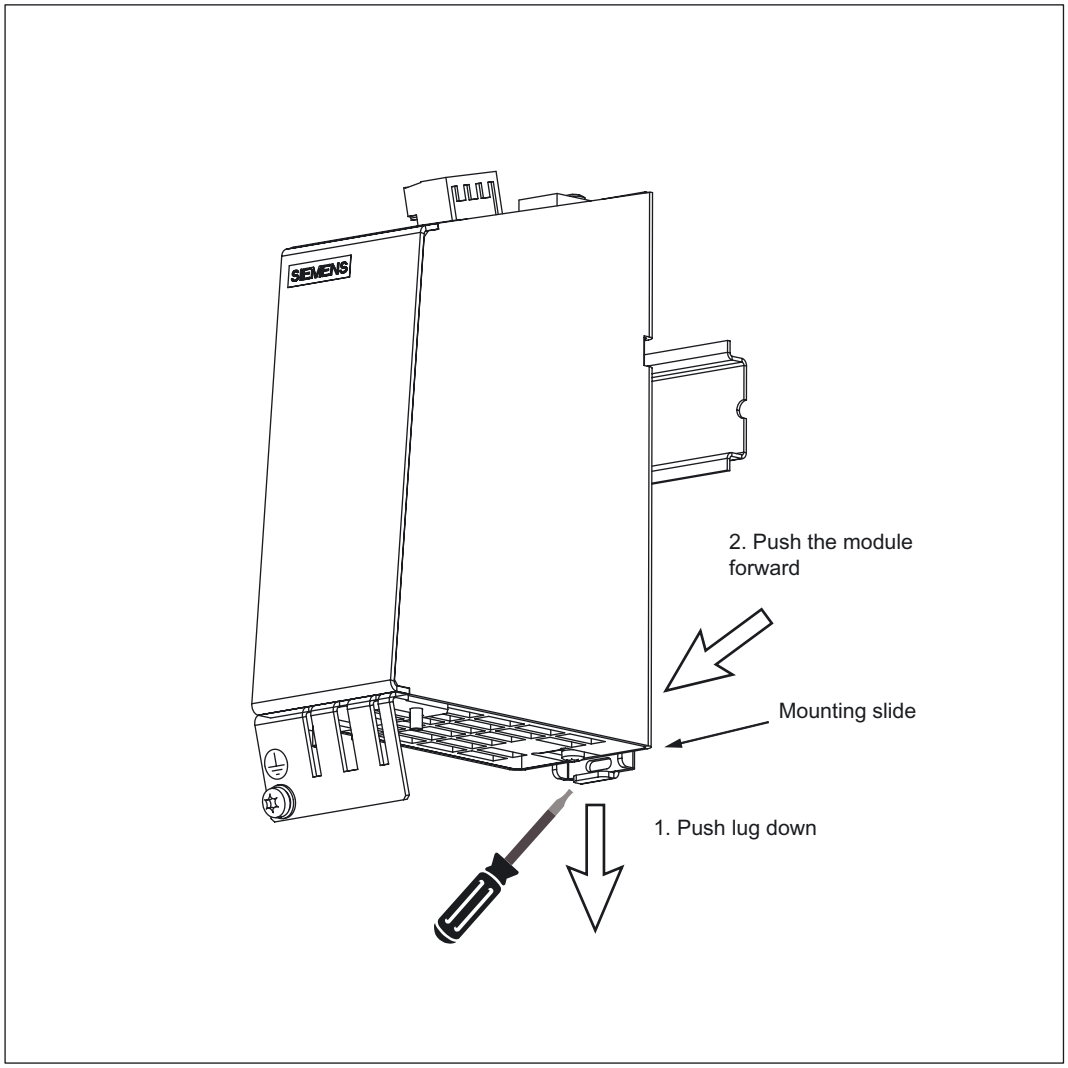


Figure 4-9 Releasing the component from a DIN rail

4.3.6 Technical data

Table 4-6 Technical data

Sensor Module Cabinet-Mounted SMC10 6SL3055-0AA00-5AAx	**Designation**	**Unit**	**Value**
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.35 ≤ 10
Specification Transmission ratio (ü) of the resolver Excitation voltage on the SMC10 when ü=0.5 Amplitude monitoring threshold (secondary tracks) of the SMC10	 ü = V_{rms} V_{rms}	 V V	 0.5 4.1 1
Excitation voltage (cannot be parameterized)	V_{rms}	V	4.1
Excitation frequency (synchronized to the current controller clock cycle)		kHz	5 to 10
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Max. encoder cable length		m	130
Weight		kg	0.8
Degree of protection		IP20 or IPXXB	

Table 4-7 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

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

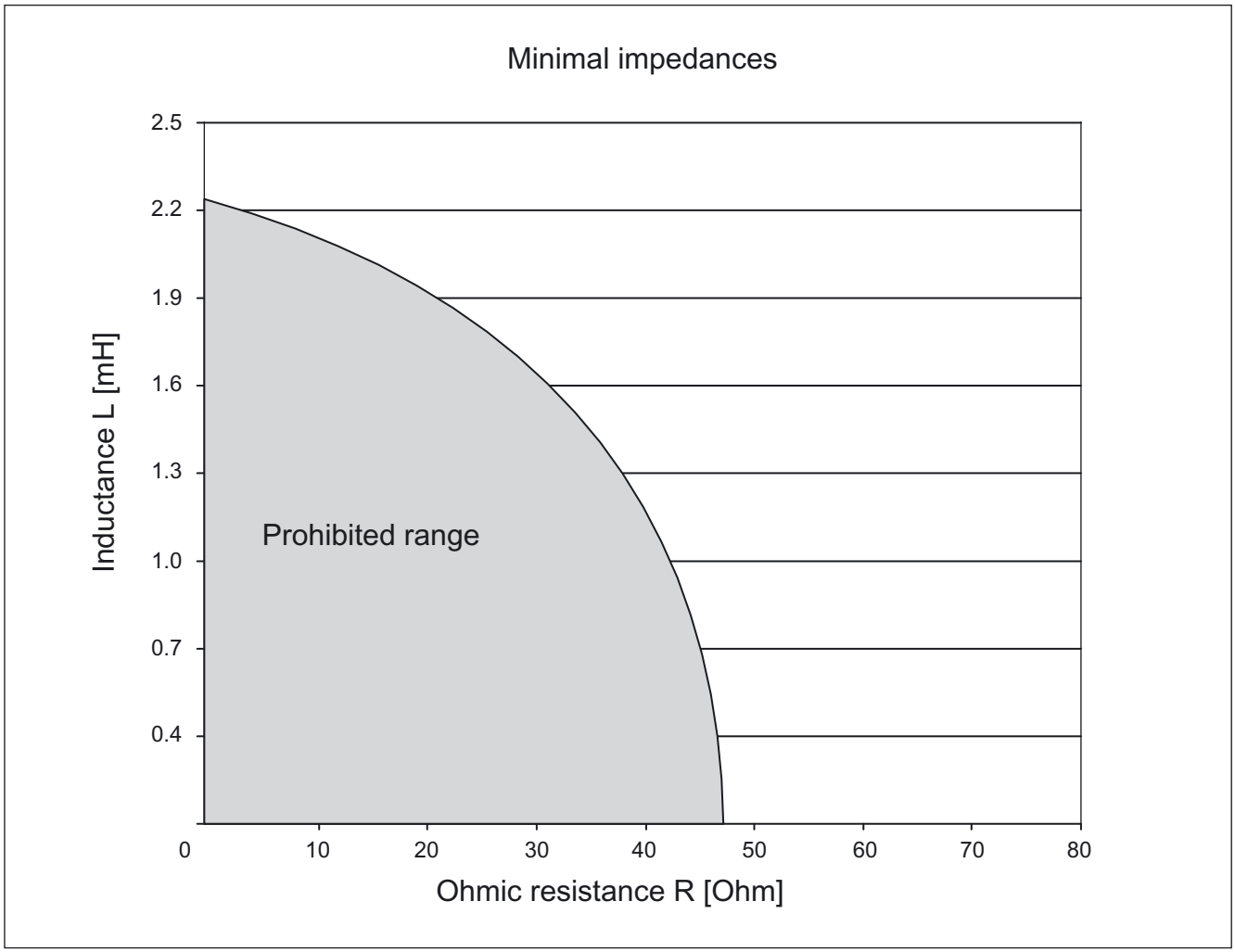


Figure 4-10 Connectable impedances with an excitation frequency f = 5000 Hz

4.4 Sensor Module Cabinet-Mounted SMC20

4.4.1 Description

The Sensor Module Cabinet-Mounted 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.

The SMC20 is used to evaluate encoder signals from incremental encoders with SIN/COS (1 Vpp) or absolute encoders with EnDat 2.1 or SSI.

4.4.2 Safety information

⚠ WARNING

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

NOTICE

Only one encoder system may be connected per Sensor Module.

Note

There must be no electrical connection between the encoder system housing and the encoder system electronics (this requirement is fulfilled for most encoder systems). If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic 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

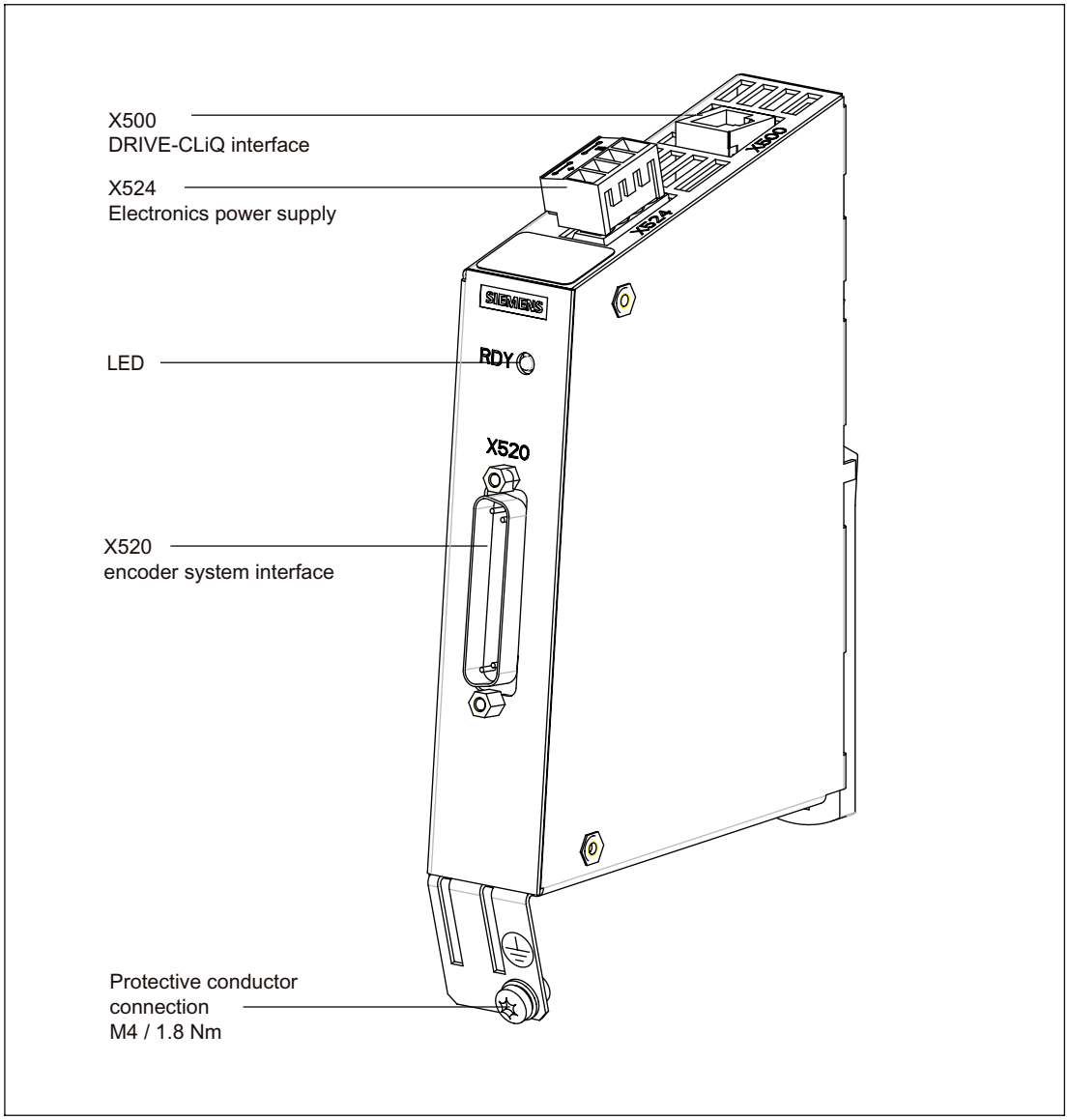


Figure 4-11 Interface description SMC20, 30 mm wide, order number: 6SL3055-0AA00-5BA2

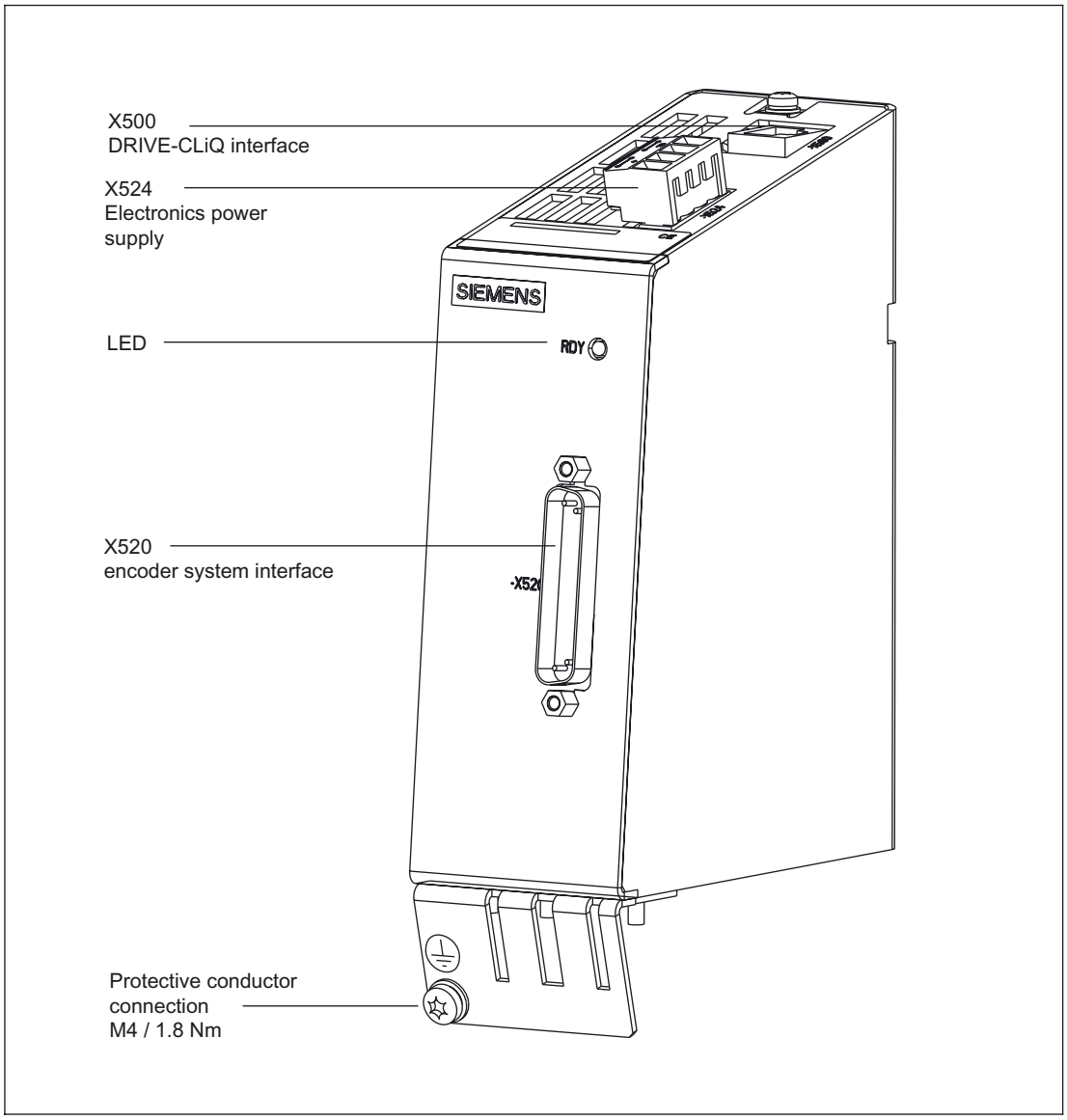
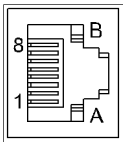


Figure 4-12 Interface description SMC20, 50 mm wide, order number: 6SL3055-0AA00-5BA1

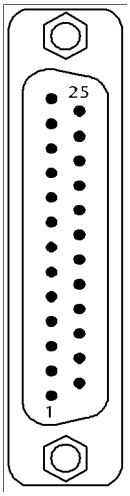
4.4.3.2 DRIVE-CLiQ interface X500

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)	Electronics ground

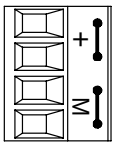
4.4.3.3 X520 sensor system

Table 4-9 X520 encoder system interface

	Pin	Signal name	Technical specifications
	1	P encoder	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	A	Incremental signal A
	4	A*	Inverse incremental signal A
	5	Ground	Ground (for internal shield)
	6	B	Incremental signal B
	7	B*	Inverse incremental signal B
	8	Ground	Ground (for internal shield)
	9	Reserved, do not use	
	10	Clock	Clock, EnDat interface, SSI clock
	11	Reserved, do not use	
	12	Clock*	Inverted clock, EnDat interface, inverted SSI clock
	13	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	14	P sense	Sense input encoder power supply
	15	Data	Data, EnDat interface, SSI data
	16	M sense	Ground sense input encoder power supply
	17	R	Reference signal R
	18	R*	Inverse reference signal R
	19	C	Absolute track signal C
	20	C*	Inverted absolute track signal C
	21	D	Absolute track signal D
	22	D*	Inverse absolute track signal D
	23	Data*	Inverse data, EnDat interface, Inverse SSI data
	24	Ground	Ground (for internal shield)
	25	- Temp	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC

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) Current consumption: max. 0.35 A 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 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 Significance of LEDs on the Sensor Module Cabinet-Mounted SMC20

Table 4-11 Sensor Module Cabinet-Mounted SMC20 – description of the LEDs

LED	Color	State	Description, cause	Remedy
RDY READY	-	Off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing, 0.5 Hz	Firmware is being downloaded.	–
		Flashing, 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0144). **Note:** 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:

References: /IH1/ SINAMICS S, Commissioning Manual

4.4.4 Dimension drawing

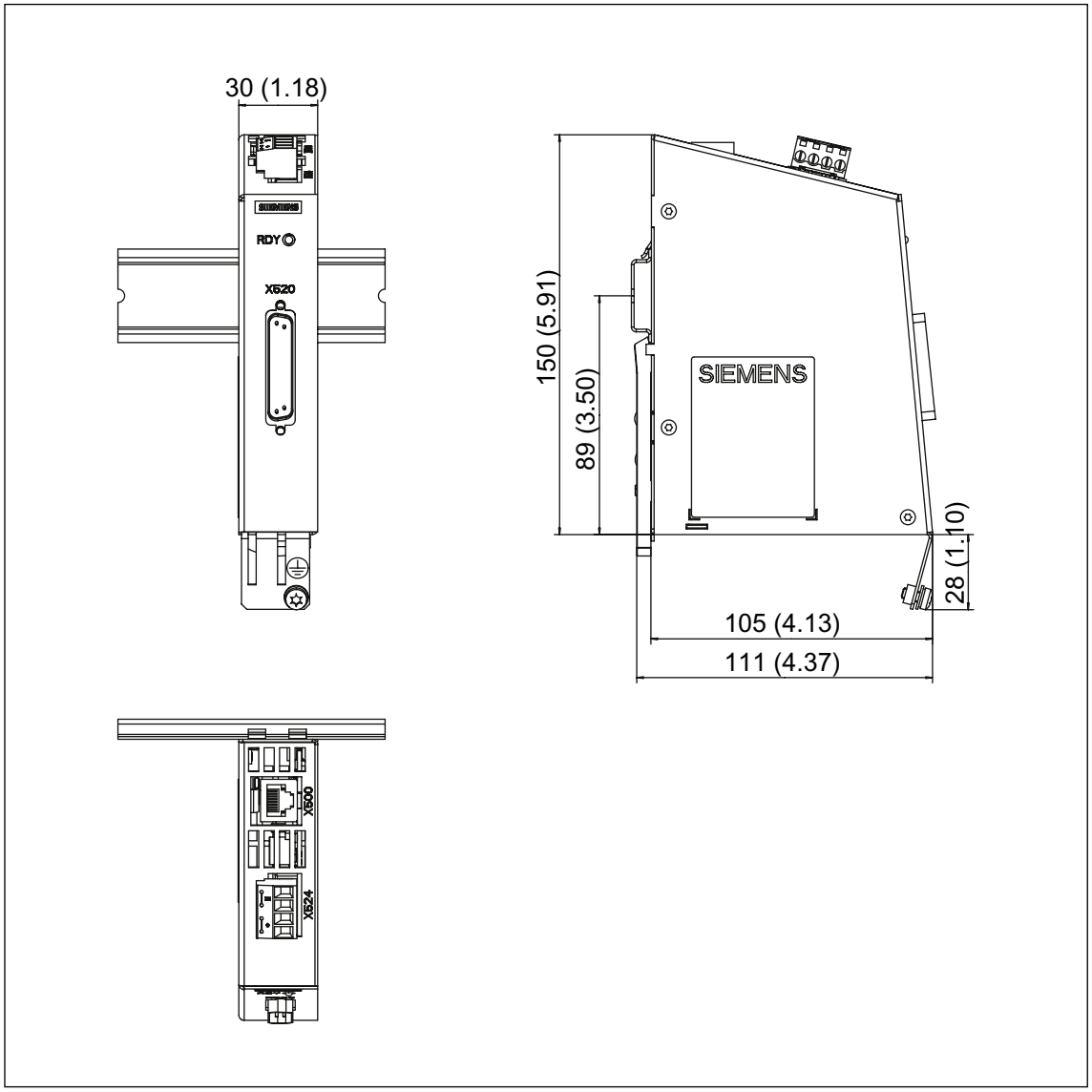


Figure 4-13 Interface description SMC20, 30 mm wide, order number: 6SL3055-0AA00-5BA2

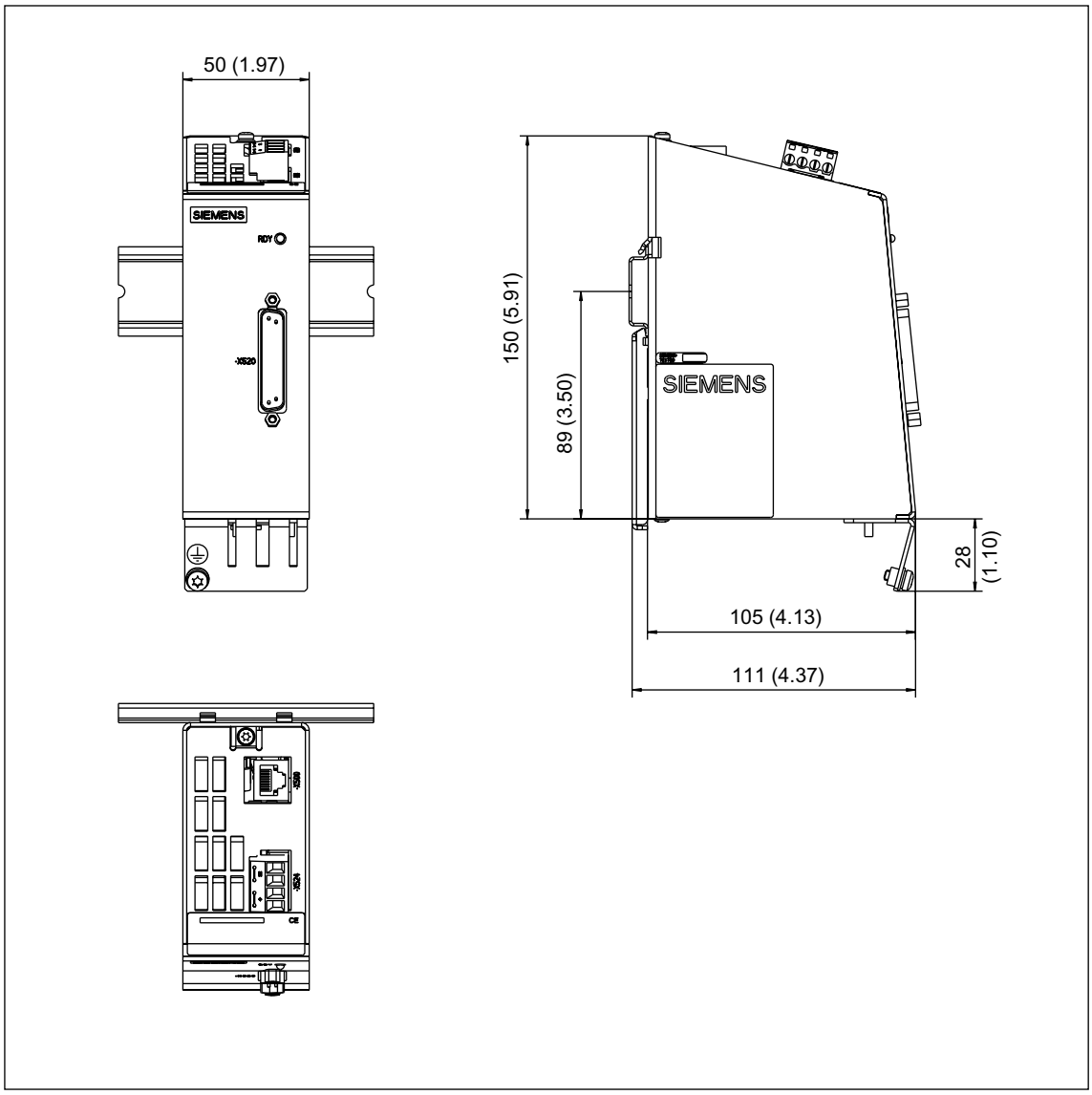


Figure 4-14 Interface description SMC20, 50 mm wide, order number: 6SL3055-0AA00-5BA1

4.4.5 Mounting

Mounting

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

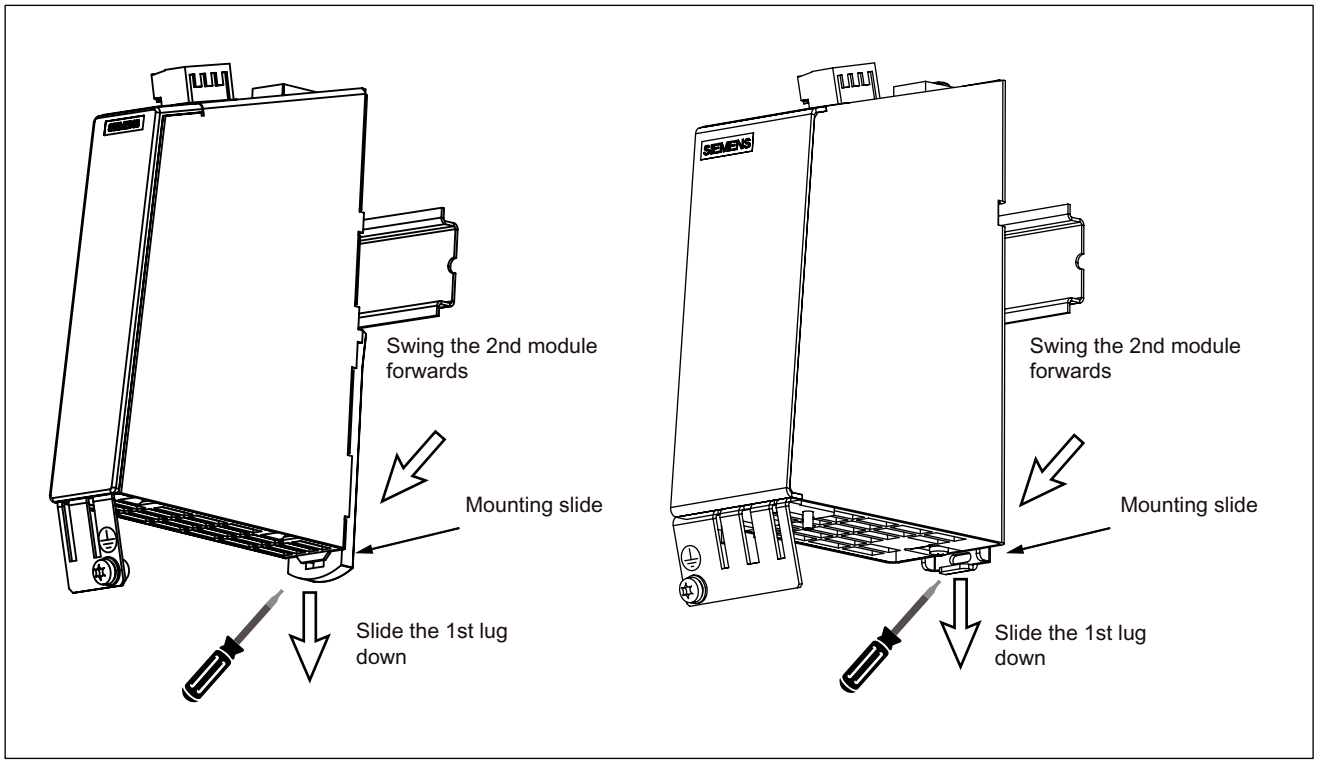


Figure 4-15 Disassembly of a DIN rail with a 30mm wide component (left) and with a 50mm wide component (right).

4.4.6 Technical Specifications

Table 4-12 Technical data

Sensor Module Cabinet-Mounted SMC20 6SL3055-0AA00-5BAx	**Designation**	**Unit**	**Value**
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.35 ≤ 10
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 V A	 5 V DC (with Remote Sense) [1] 0.35
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 500
SSI baud rate [2]		kHz	100
Max. encoder cable length		m	100
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0.45 (Order no.: 6SL3055-0AA00-5BA2) 0.8 (Order no.: 6SL3055-0AA00-5BA1)
Degree of protection		IP20 or IPXXB	

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

[2] only possible for SSI encoders with 5 V supply.

4.5 Sensor Module Cabinet-Mounted SMC30

4.5.1 Description

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

The SMC30 is used to evaluate sensor signals from encoders with TTL, HTL or SSI[1)] interfaces.

A combination of TTL/HTL signal and SSI absolute signal is possible at terminals X521/X531, if both signals are derived from the same measured variable.

4.5.2 Safety information

⚠ WARNING

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

NOTICE

Only one encoder system may be connected per Sensor Module.

Note

There must be no electrical connection between the encoder system housing and the encoder system electronics (this requirement is fulfilled for most encoder systems). If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic ground).

CAUTION

When the encoder system is connected via terminals, make sure that the cable shield is connected to 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

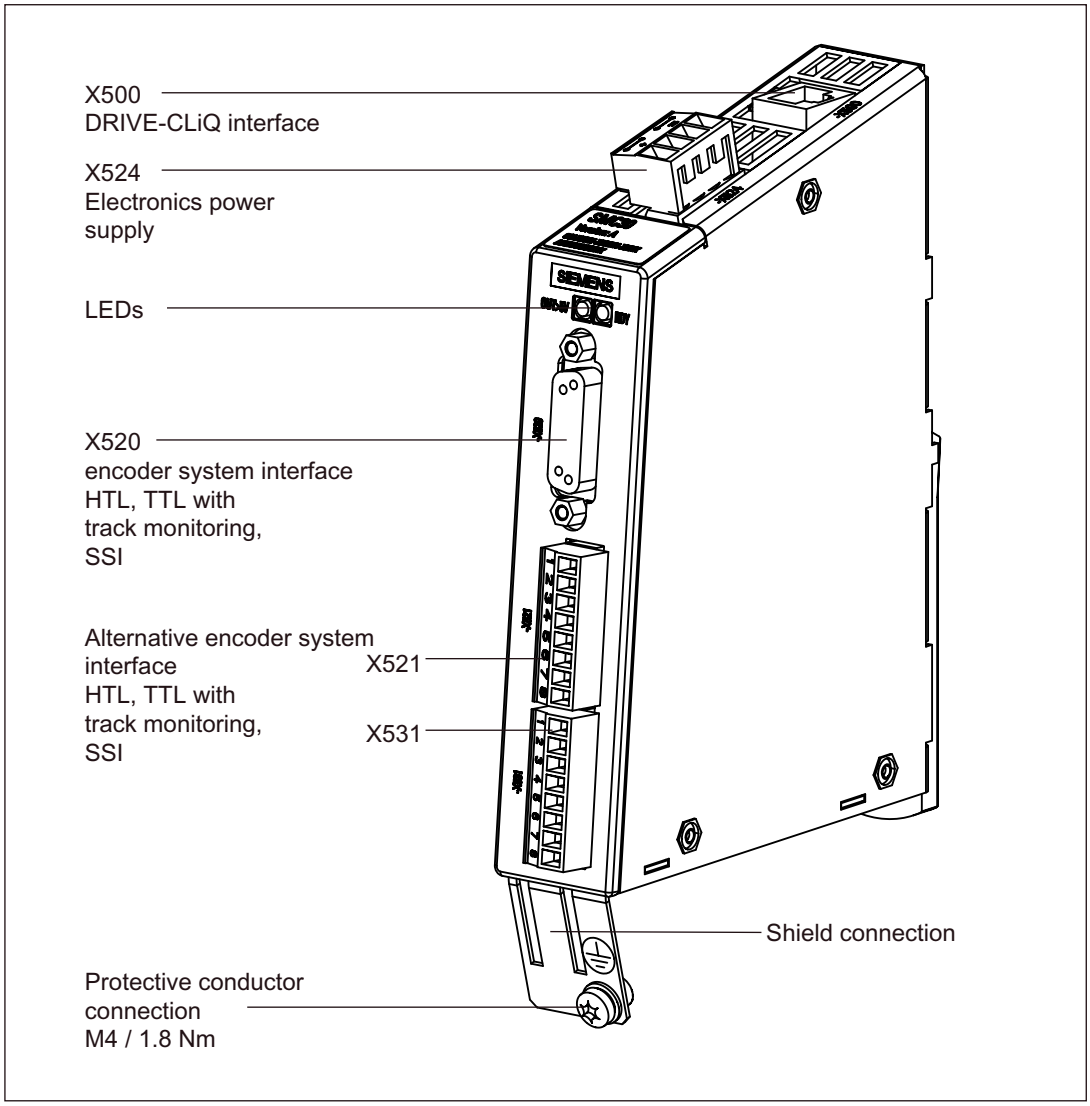


Figure 4-16 Interface description SMC30, 30 mm wide

The component is only available from order no. 6SL3055-0AA00-5CA2 and firmware 2.5 SP1 upwards.

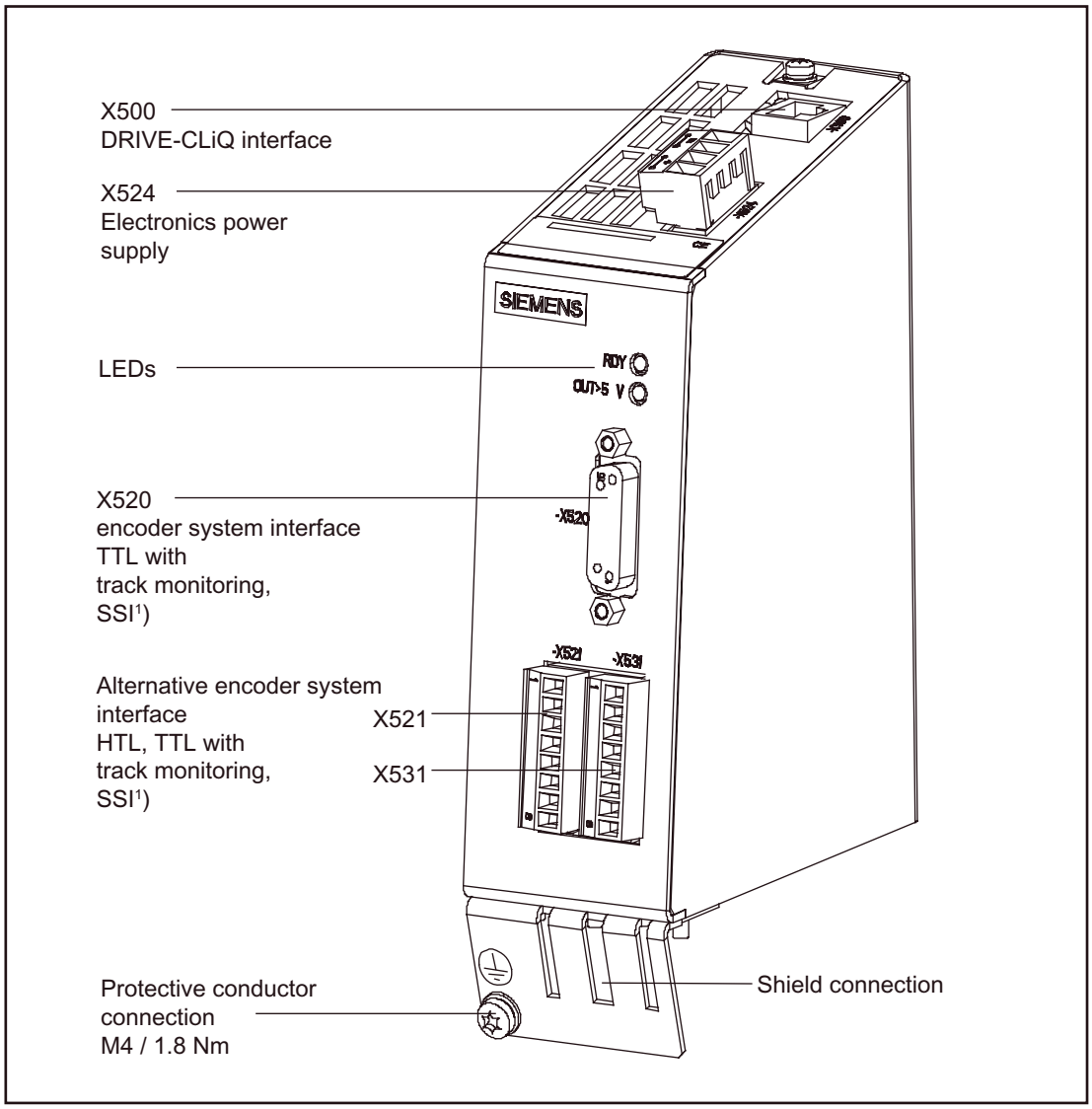


Figure 4-17 Interface description SMC30, 50 mm wide, order no. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1

1) SSI only available from order no. 6SL3055-0AA00-5CA1 and firmware 2.4 upwards.

4.5.3.2 Connection examples

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

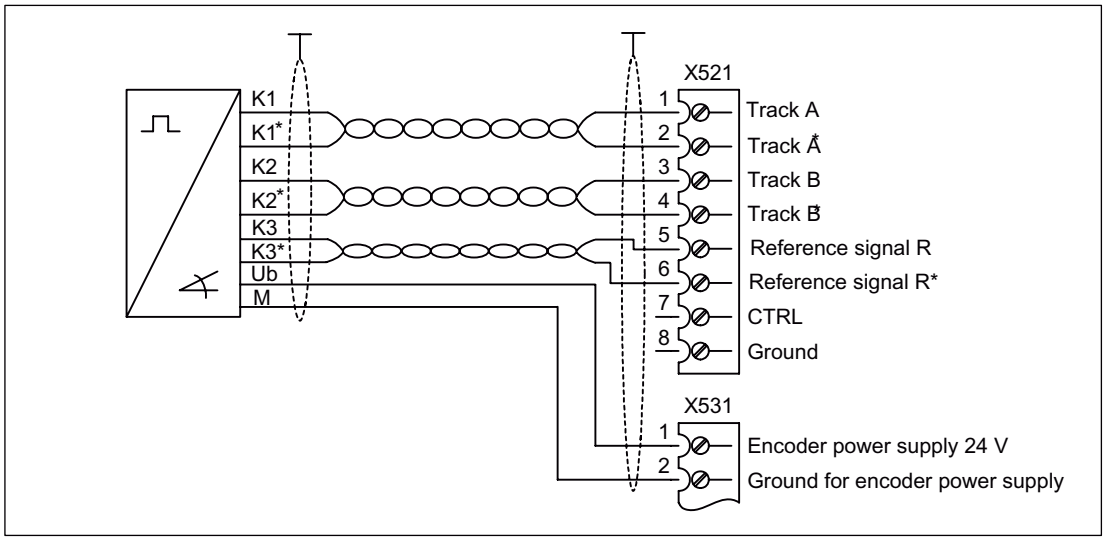


Figure 4-18 Connection example 1: HTL encoder, bipolar, with reference signal

Signal cables must be twisted in pairs in order to improve noise immunity against induced noise.

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

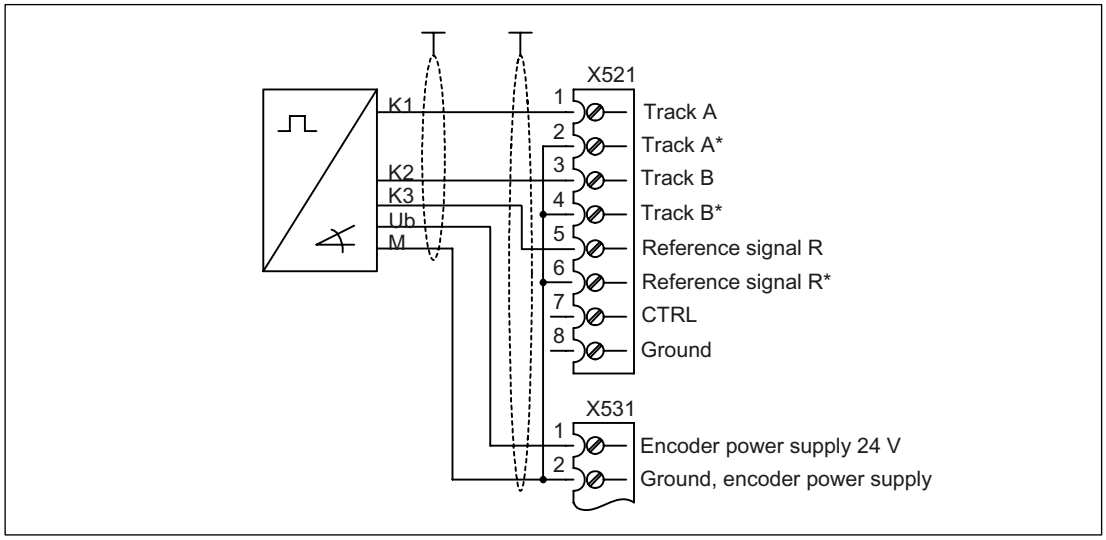


Figure 4-19 Connection example 2: HTL encoder, unipolar, with reference signal[1)]

[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.

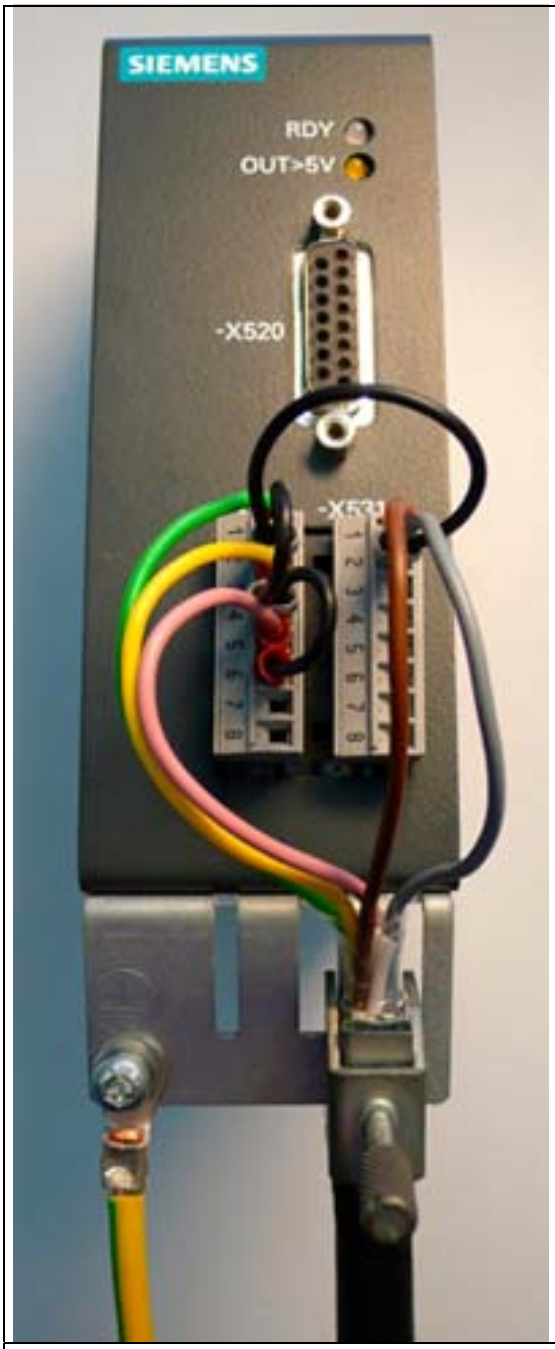
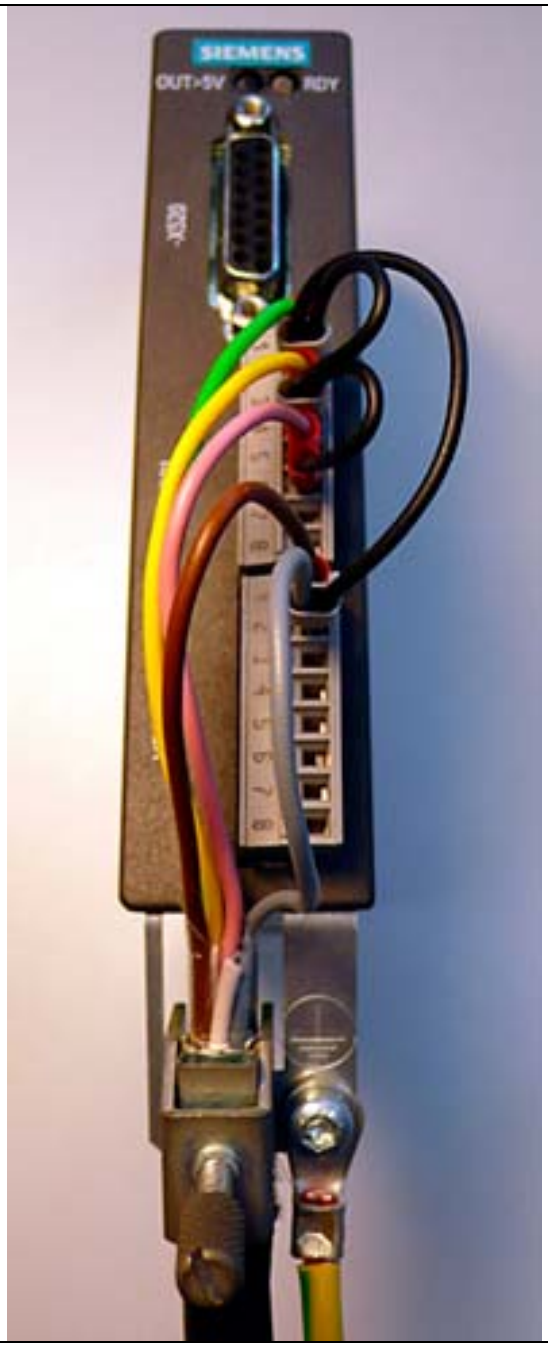
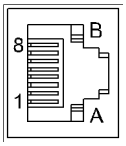
	

Photo of connection example 2: SMC30, 50 mm wide (Order No. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1)	Photo of connection example 2: SMC30, 30 mm wide, from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1
Note: Diagram of the wire jumpers to connect unipolar HTL encoders with reference signal	

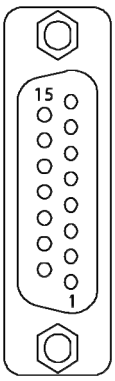
4.5.3.3 DRIVE-CLiQ interface X500

Table 4-13 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)	Electronics ground

4.5.3.4 X520 encoder system interface

Table 4-14 X520 encoder system interface

	Pin	Signal name	Technical specifications
	1	Reserved, do not use + Temp[2)]	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	2	Clock	SSI clock[1)]
	3	Clock*	Inverse SSI clock[1)]
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	
	6	P sense	Sense input encoder power supply
	7	M encoder (M)	Ground for encoder power supply
	8	Reserved, do not use - Temp[2)]	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC
	9	M sense	Ground sense input
	10	R	Reference signal R
	11	R*	Inverse reference signal R
	12	B*	Inverse incremental signal B
	13	B	Incremental signal B
	14	A* / data*	Inverse incremental signal A / inverse SSI data[1)]
	15	A / data	Incremental signal A / SSI data[1)]

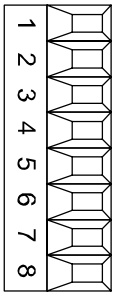
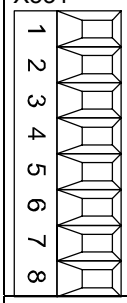
[1)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

[2)] Only from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1

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 encoder system interface

Table 4-15 X521 / X531 alternative encoder system interface

	Pin	Designation	Technical specifications
X521 	1	A	Incremental signal A
	2	A*	Inverse incremental signal A
	3	B	Incremental signal B
	4	B*	Inverse incremental signal B
	5	R	Reference signal R
	6	R*	Inverse reference signal R
	7	CTRL	Control signal
	8	M	Ground
	1	P_Encoder 5 V / 24 V	Encoder power supply
	2	M_Encoder	Ground for encoder power supply
X531 	3	- Temp	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC
	4	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	5	Clock	SSI clock[2)]
	6	Clock*	Inverse SSI clock[2)]
	7	Data	SSI data[2)]
	8	Data*	Inverse SSI data[2)]
Max. connectable cross-section: 1.5 mm^2 When using unipolar HTL encoders, at the terminal block A*, B*, R* must be connected to (jumper) M_Encoder (X531)[1)].			

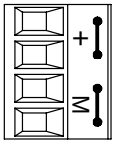
[1)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

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

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

4.5.3.6 Electronics power supply X524

Table 4-16 Terminal block X524

	Terminal	Function	Technical data
	+	Electronics power supply	Voltage: 24 V (20.4 V – 28.8 V) Current consumption: max. 0.55 A Max. current across jumper in connector: 20 A at 55°C
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² 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.

4.5.3.7 Meaning of LEDs on the Sensor Module Cabinet 30 (SMC30)

Table 4-17 Sensor Module Cabinet SMC30 – description of the LEDs

LED	Color	State	Description, cause	Remedy
RDY READY	-	Off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/ red	Flashing, 0.5 Hz	Firmware is being downloaded.	–
	Green/ red	Flashing, 2 Hz	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing	Component recognition via LED is activated (p0144). **Note:** 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. Power supply ≤ 5 V.	–
	Orange	Continuous light	Electronics power supply for encoder system available. Power supply > 5 V. **Important:** Make sure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics.	–

4.5.4 Dimension drawing

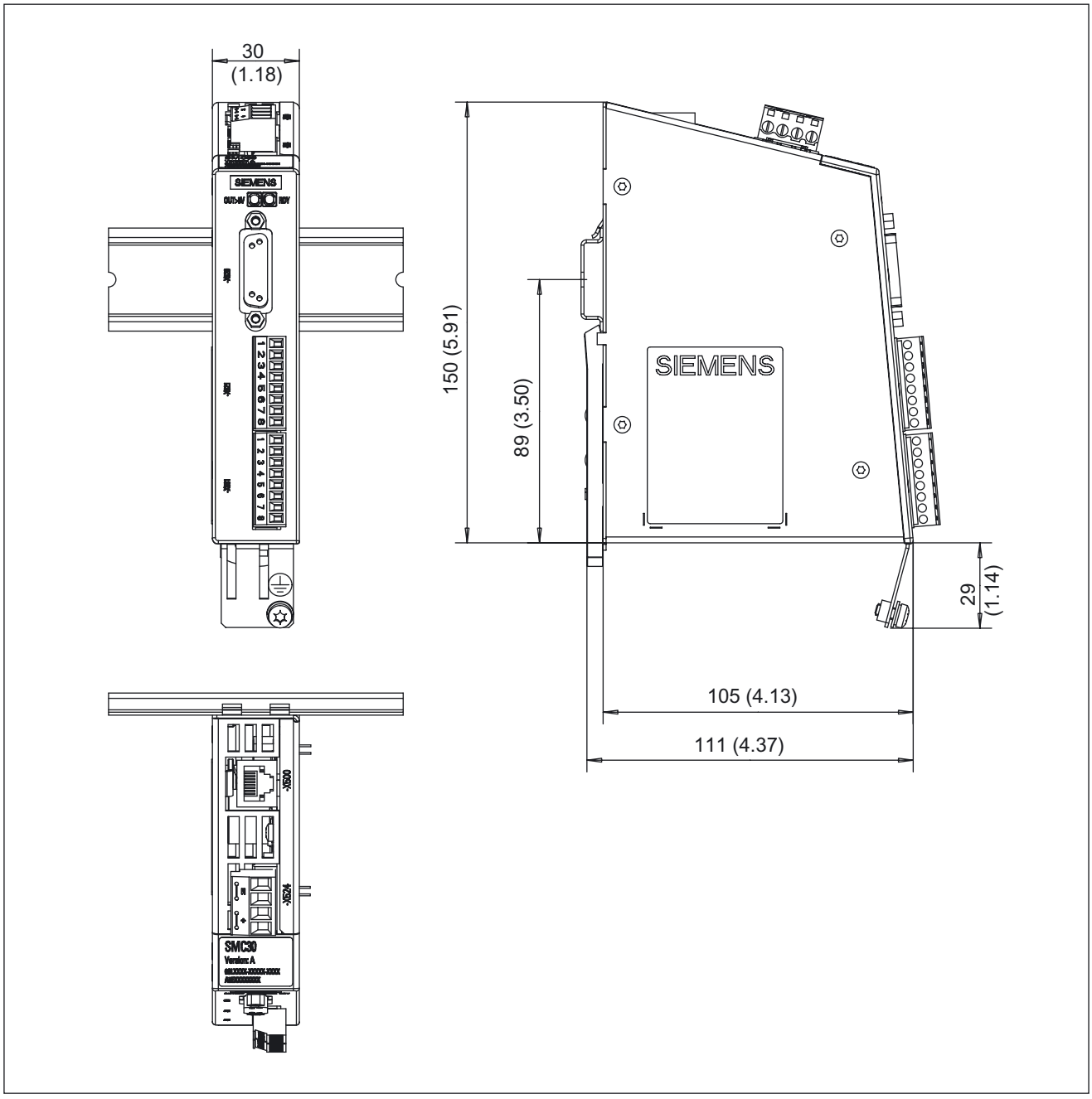


Figure 4-20 Dimension drawing SMC30: 30 mm wide

Only from Order No. 6SL3055-0AA00-5CA2 and firmware 2.5 SP1

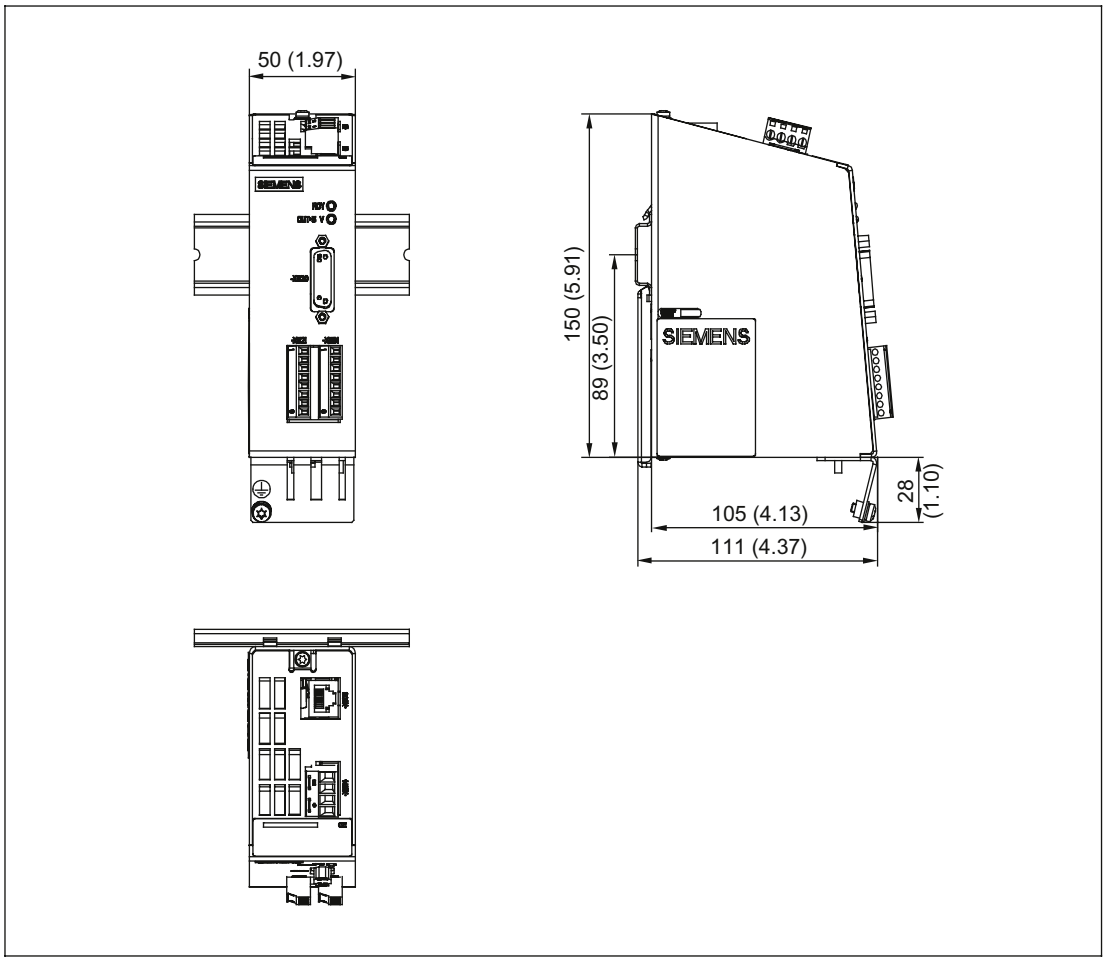


Figure 4-21 Dimension drawing SMC30: 50 mm wide

Order No.: 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1

4.5.5 Mounting

Mounting

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

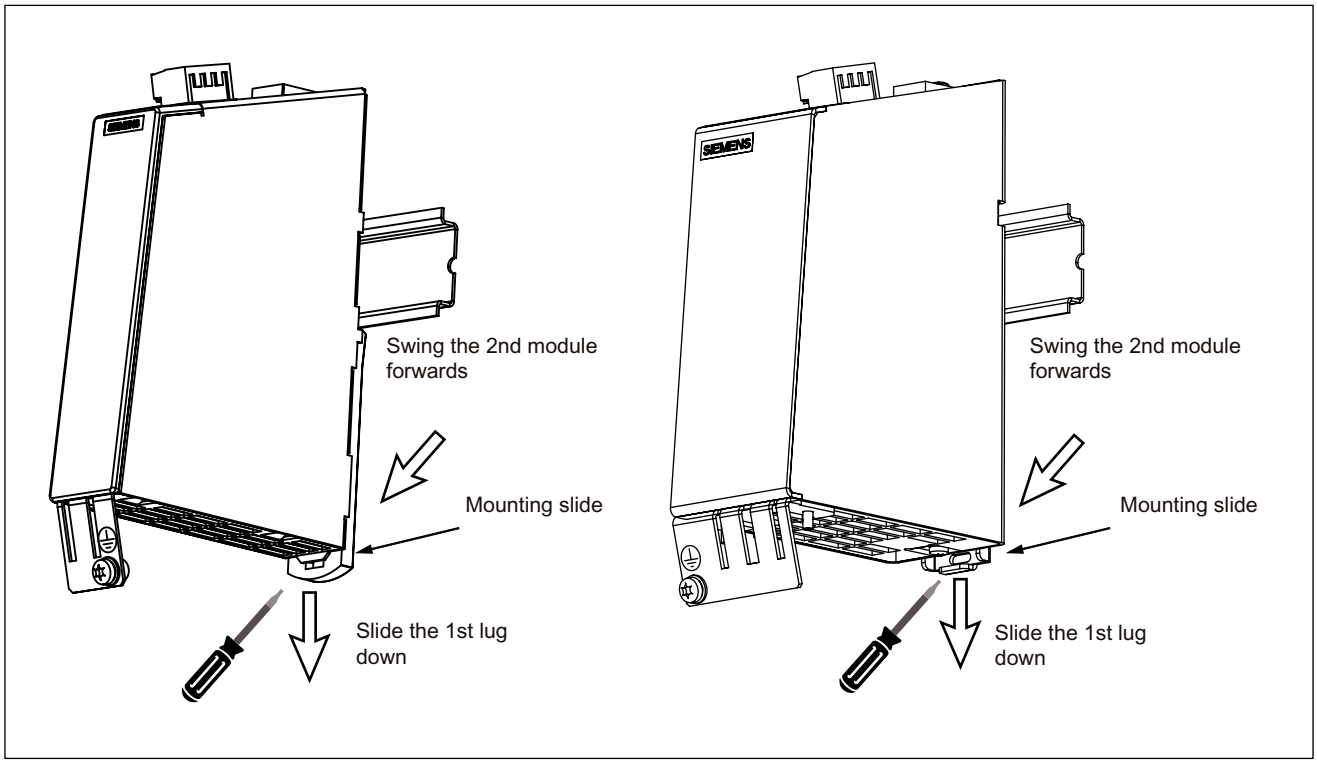


Figure 4-22 Disassembly of a DIN rail with a 30mm wide component (left) and with a 50mm wide component (right).

From Order No. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1

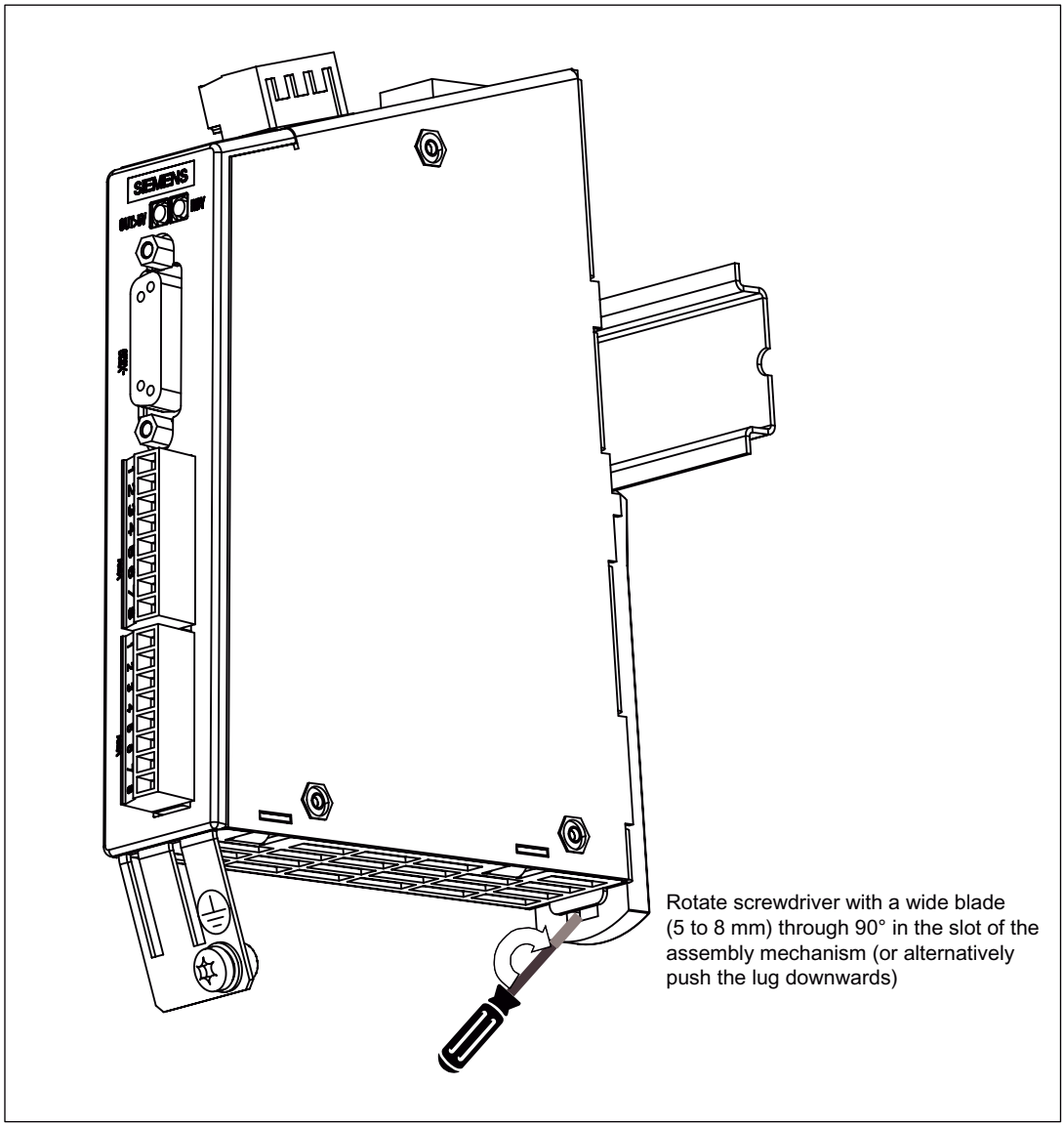


Figure 4-23 Removing: SMC30: 30 mm wide

Only from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1

4.5.6 Electrical Connection

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

Terminal element from Weidmüller for the SMC30

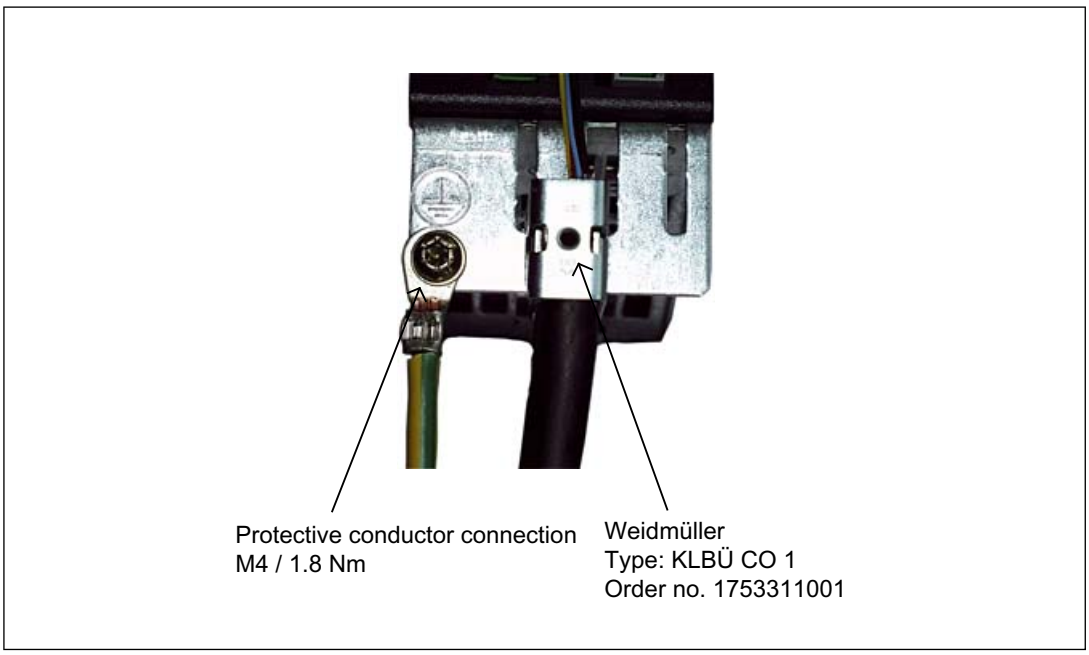


Figure 4-24 Shield contacts for the SMC30

Weidmüller: http://www.weidmueller.com

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

NOTICE
Only screws with a permissible screw-in depth of 4 - 6 mm may be used.

4.5.7 Technical Specifications

Table 4-18 Technical data

Sensor Module Cabinet-Mounted SMC30 6SL3055-0AA00-5CAx	**Designation**	**Unit**	**Value**
Electronics power supply			
Voltage	V_{DC}	V	24 DC (20.4 – 28.8)
Current (without encoder system)	A_{DC}	A	≤ 0.20
Current (with encoder system)	A_{DC}	A	≤ 0.55
Power loss	W	W	≤ 10
Encoder system power supply			
Voltage	$V_{encoder}$	V	5 V DC (with or without Remote Sense) [1] or V_{DC} - 1 V
Current	$A_{encoder}$	A	0.35
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 300
SSI baud rate		kHz	100 - 250
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0.45 (Order No. 6SL3055-0AA00-5CA2) 0.8 (Order No. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1)
Degree of protection		IP20 or IPXXB	

[1] A controller compares the encoder system supply voltage - sensed via the remote sense cables - with the reference supply voltage of the encoder system, and adjusts the supply voltage for the encoder system at the output of the drive module until the required supply voltage is obtained directly at the encoder system (only for 5 V encoder system power supply). Remote Sense only to X520.

Table 4-19 Specification of encoder systems that can be connected

Parameter	Designation	Threshold	Min.	Max.	Unit
High signal level (TTL bipolar at X520 or X521/X531)[1]	U_{Hdiff}		2	5	V
Low signal level (TTL bipolar at X520 or X521/X531)[1]	U_{Ldiff}		-5	-2	V
Signal level high (HTL unipolar)	U_H[4]	High	17	V_{CC}	V
		Low	10	V_{CC}	V
Signal level low (HTL unipolar)	U_L[4]	High	0	7	V
		Low	0	2	V
High signal level (HTL bipolar)[2]	U_{Hdiff}		3	V_{CC}	V
Low signal level (HTL bipolar)[2]	U_{Ldiff}		$-V_{CC}$	-3	V
High signal level (SSI bipolar at X520 or X521/X531)[1][3]	U_{Hdiff}		2	5	V
Low signal level (SSI bipolar at X520 or X521/X531)[1][3]	U_{Ldiff}		-5	-2	V
Signal frequency	f_S		-	300	kHz
Edge clearance	t_{min}		100	-	ns
"Zero pulse inactive time" (before and after A=B=high)	t_{Lo}		500	$(t_{ALo-BHi} - t_{Hi})/2$ [5]	ns
"Zero pulse active time" (while A=B=high and beyond)[6]	t_{Hi}		500	$t_{ALo-BHi} - 2*t_{Lo}$ [5]	ns

[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 encoder system.

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

[4] Only from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1 this value can be configured using software. For older firmware releases and Order Nos. less than 6SL3055-0AA00-5CA2 then the "low" threshold applies.

[5] $t_{ALo-BHi}$ is not a specified value, but is the time between the falling edge of track A and the next but one rising edge of track B.

[6] Further information on setting the "Zero pulse active time" can be found in the following:

References: /FH1/ SINAMICS S120, Function Manual, tolerant encoder monitoring for SMC30

Table 4-20 Encoders that can be connected

	X520 (D-Sub)	X521 (terminal)	X531 (terminal)	Track monitoring	Remote Sense[4)]
HTL bipolar 24 V	No / Yes[5)]	Yes		No / Yes[5)]	No
HTL unipolar 24 V[3)]	No / Yes[5)]	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 / 5 V[1)]	Yes	Yes		No	No
TTL unipolar	No				

[1)] As of order no. 6SL3055-0AA00-5CA1

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

[5)] As of Order No. 6SL3055-0AA00-5CA2

Table 4-21 Maximum encoder cable length

Encoder type	Maximum encoder cable length in m
TTL[1)]	100
HTL unipolar[2)]	100
HTL bipolar	300
SSI[3)]	100

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

[2)] 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.

[3)] As of order no. 6SL3055-0AA00-5CA1

For sensors with 5 V supply at X521 / X531, the cable lengths (for 0.5 mm^2) cable cross-sections) depend on the sensor current:

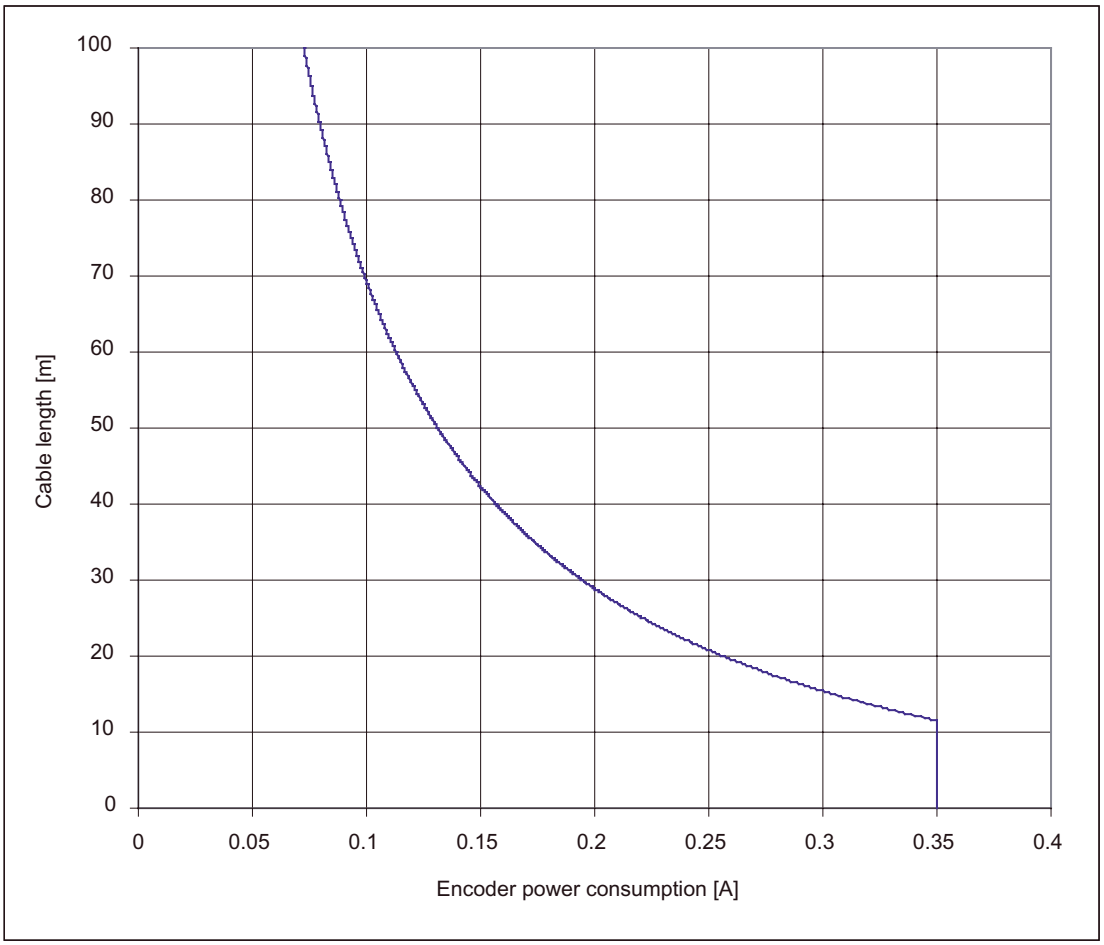


Figure 4-25 Max. cable length as a function of the encoder current drawn

For encoders without Remote Sense the permissible cable length is restricted to 100 m (reason: the voltage drop depends on the cable length and the encoder current).

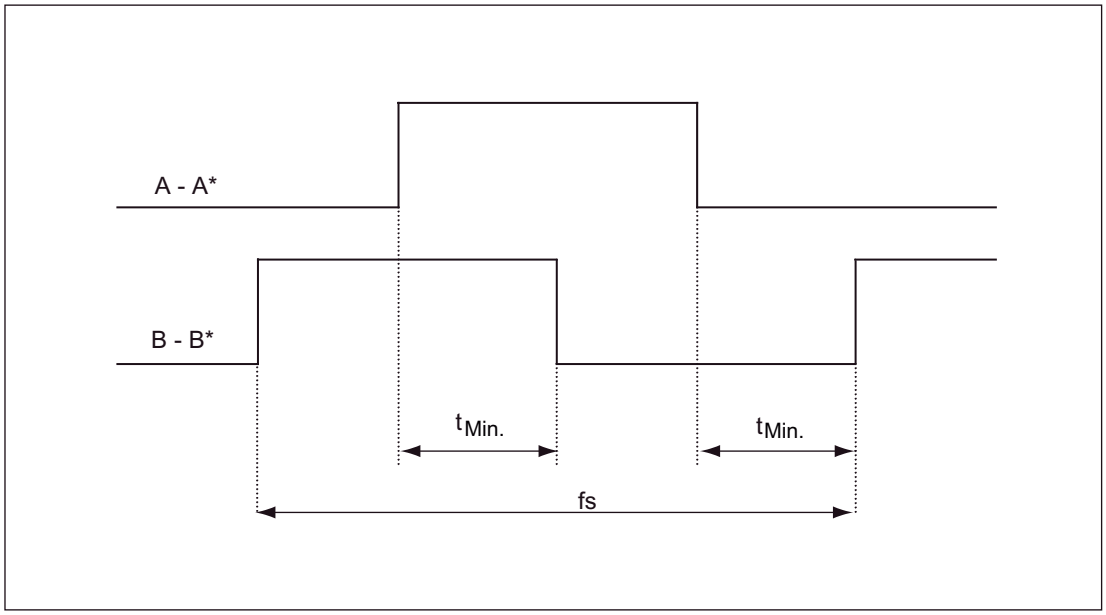


Figure 4-26 Signal characteristic of track A and track B between two edges: Time between two edges with pulse encoders

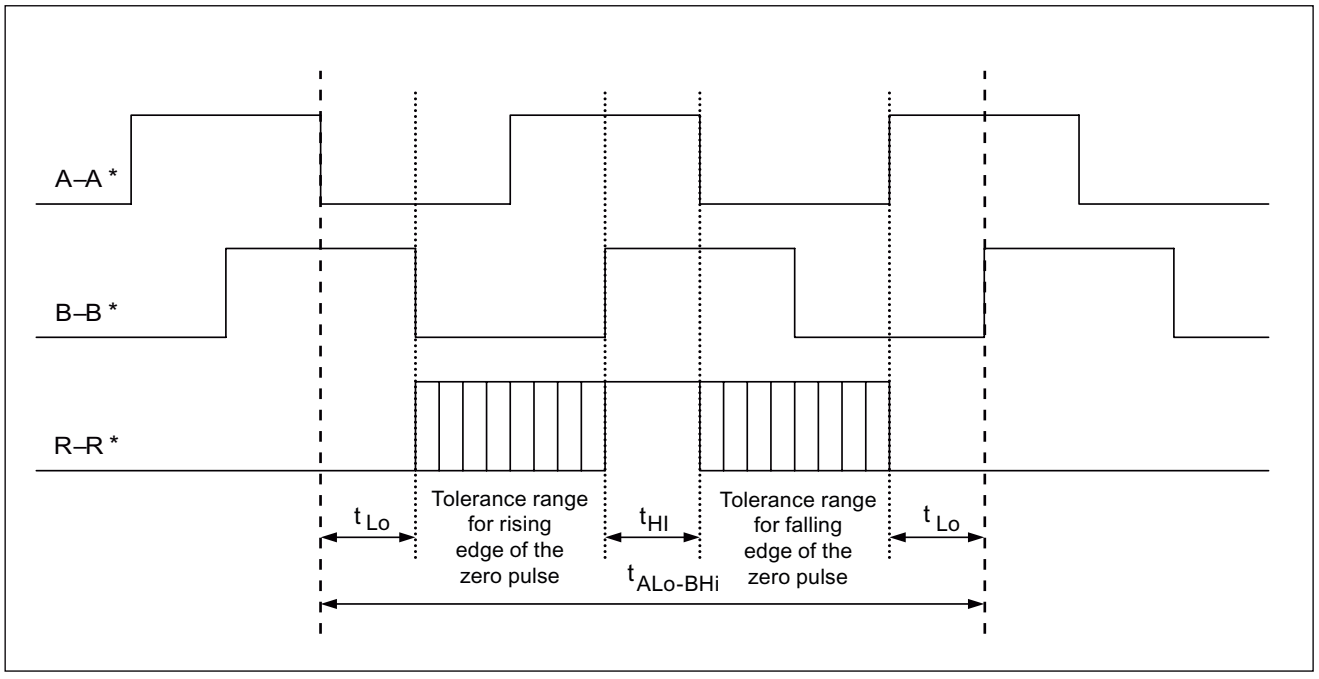


Figure 4-27 Position of the zero pulse to the track signals

4.6 Sensor Module External SME20

4.6.1 Description

Direct encoder systems outside the cabinet can be connected to the Sensor Module External SME20. The SME20 evaluates these encoder systems and converts the calculated values to DRIVE-CLiQ.

Incremental direct encoder systems with SIN/COS (1 Vpp) and reference signal can be connected.

It is possible to connect a motor with a 17-pole circular connector for the encoder to the 12 pole circular connector of the SME20 using adapter cable 6FX 8002-2CA88-xxxx.

- KTY/PTC temperature sensors can be used for evaluation of the motor temperature.
- The Sensor Module is only suitable for motors without absolute track signals (C/D track):
  - Induction motors (e.g. 1PH)
  - Synchronous motors with pole position identification (e.g. 1FN, 1FW, 1FE)

Neither motor nor encoder data are saved in the SME20.

The SME20 can only be operated from Firmware 2.3 onwards.

4.6.2 Safety Information

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.

4.6.3 Interface description

4.6.3.1 Overview

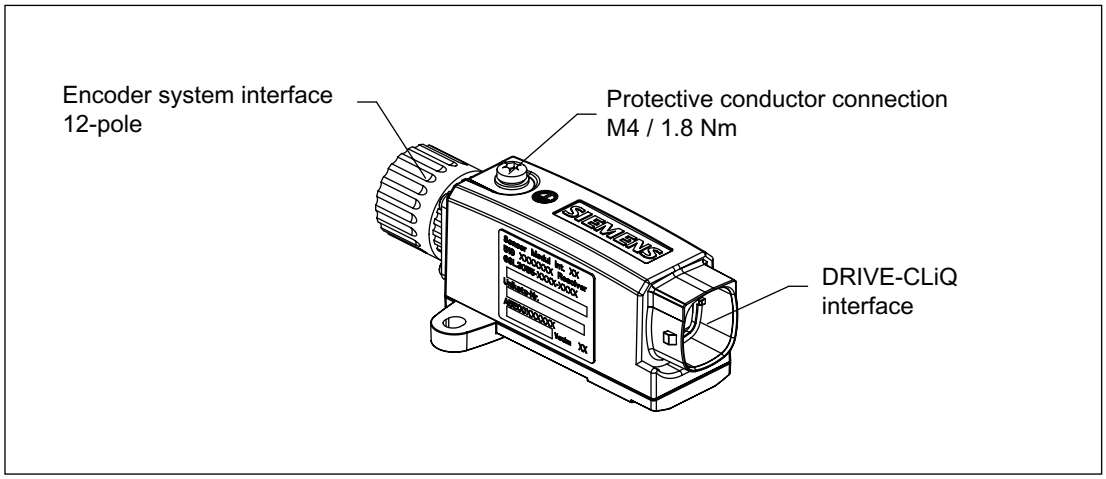
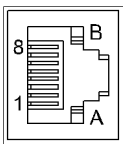


Figure 4-28 Interface description SME20

4.6.3.2 DRIVE-CLiQ interface

Table 4-22 DRIVE-CLiQ interface

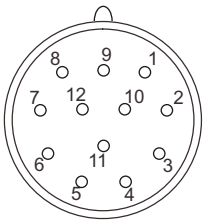
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Cover for the DRIVE-CLiQ interface is included in the scope of supply Current consumption: max. 0.25 A			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. With MOTION-CONNECT 500, the maximum cable length is 100 m; with MOTION-CONNECT 800, it is 50 m.

4.6.3.3 Encoder system interface

Table 4-23 Encoder system interface SME20

	Pin	Signal name	Technical specifications
	1	B*	Inverse incremental signal B
	2	P5	Encoder power supply
	3	R	Reference signal R
	4	R*	Inverse reference signal R
	5	A	Incremental signal A
	6	A*	Inverse incremental signal A
	7	-Temp	Temperature sensor connection 1) KTY841-C130 or PTC
	8	B	Incremental signal B
	9	+Temp	Temperature sensor connection 1) KTY841-C130 or PTC
	10	M	Ground for encoder power supply
	11	M	Ground for encoder power supply
	12	P5	Encoder power supply
Blanking plate for encoder system interface: Pöppelmann GmbH & Co. KG, Lohne, Order No.: GPN 300 F211 connector kits, 12-pole, Order No.: 6FX2003-0SA12			

1) Connection cable: Order number 6FX8002-2CA88-xxxx

4.6.4 Dimension drawing

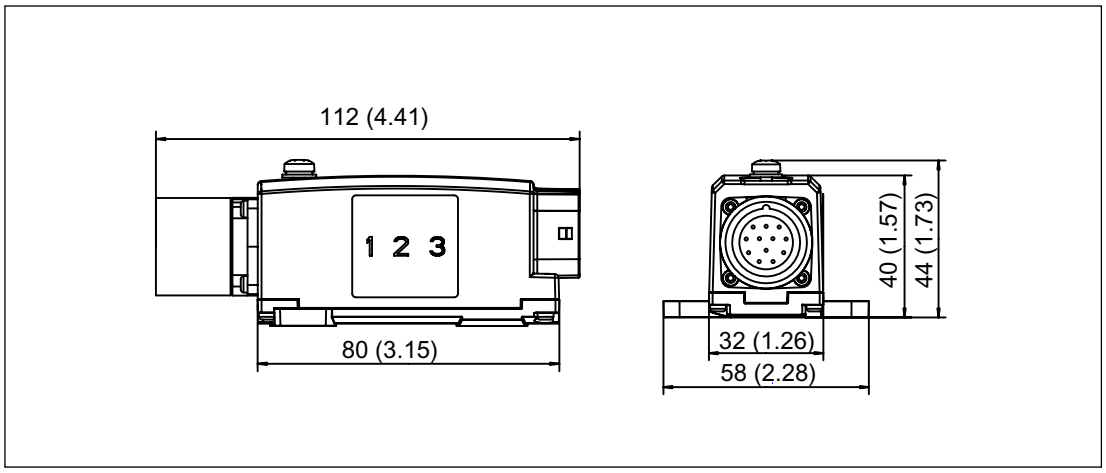


Figure 4-29 Dimension drawing SME20, Order number 6SL3055-0AA00-5EA3

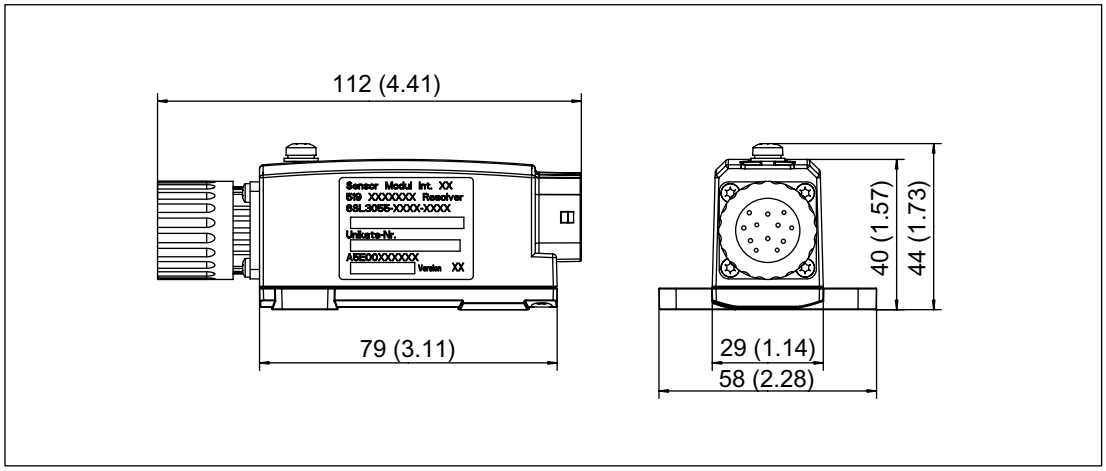
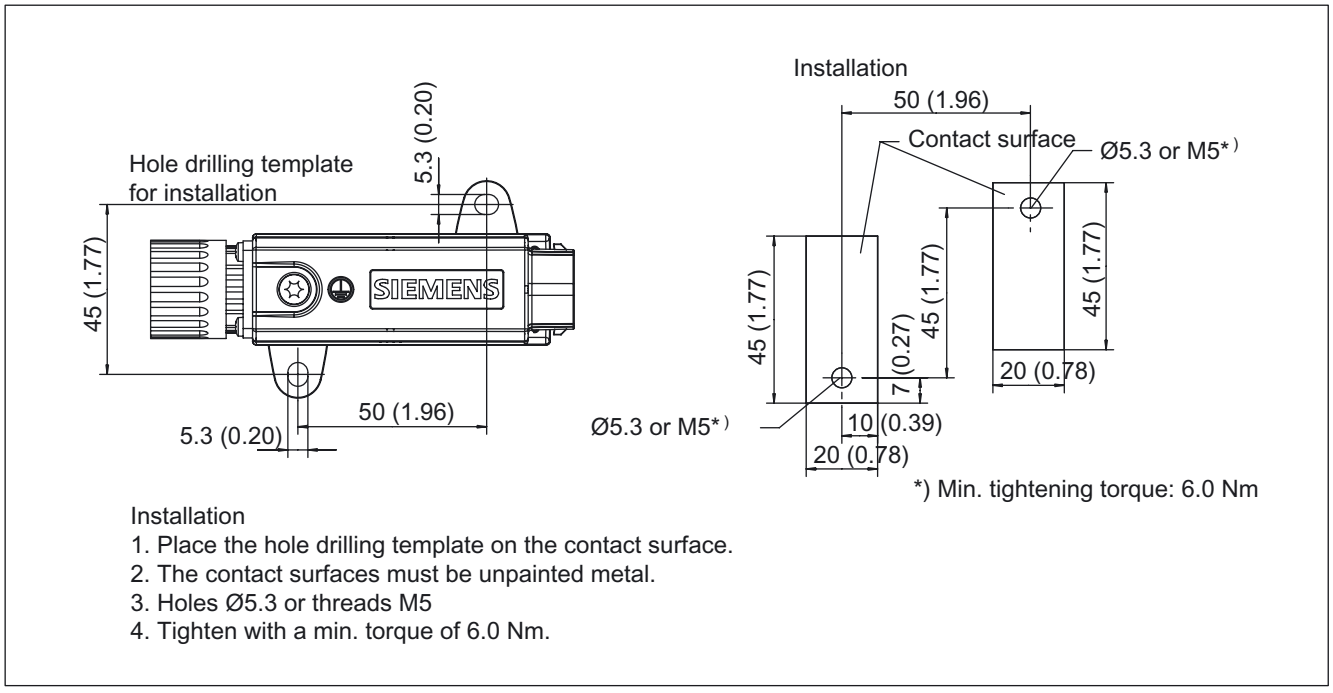


Figure 4-30 Dimension drawing SME20, Order number 6SL3055-0AA00-5EA0

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 4-31 Installing the SME20/SME25

4.6.6 Technical specifications

Table 4-24 Technical data

Sensor Module External SME20 6SL3055-0AA00-5EAx	**Designation**	**Unit**	**Value**
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.15 ≤ 0.25 ≤ 4
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 V A	 5 V DC 0.30
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 500
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0.18 for order number 6SL3055-0AA00-5EA0, 0.31 for order number 6SL3055-0AA00-5EA3
Degree of protection		IP67	

The maximum cable length for the encoder system interface depends on the current consumption of the encoder system and the cross-section of the wire in the cable. However, the maximum length is 10 m. The figure below applies to encoder systems that operate in the supply voltage range between 4.75 V and 5.25 V. The sample parameters shown are 0.28 mm² cross-section (0.14 mm² supply plus 0.14 mm² Remote Sense wires) and 0.64 mm² (0.5 mm² supply plus 0.14 mm² Remote Sense wires).

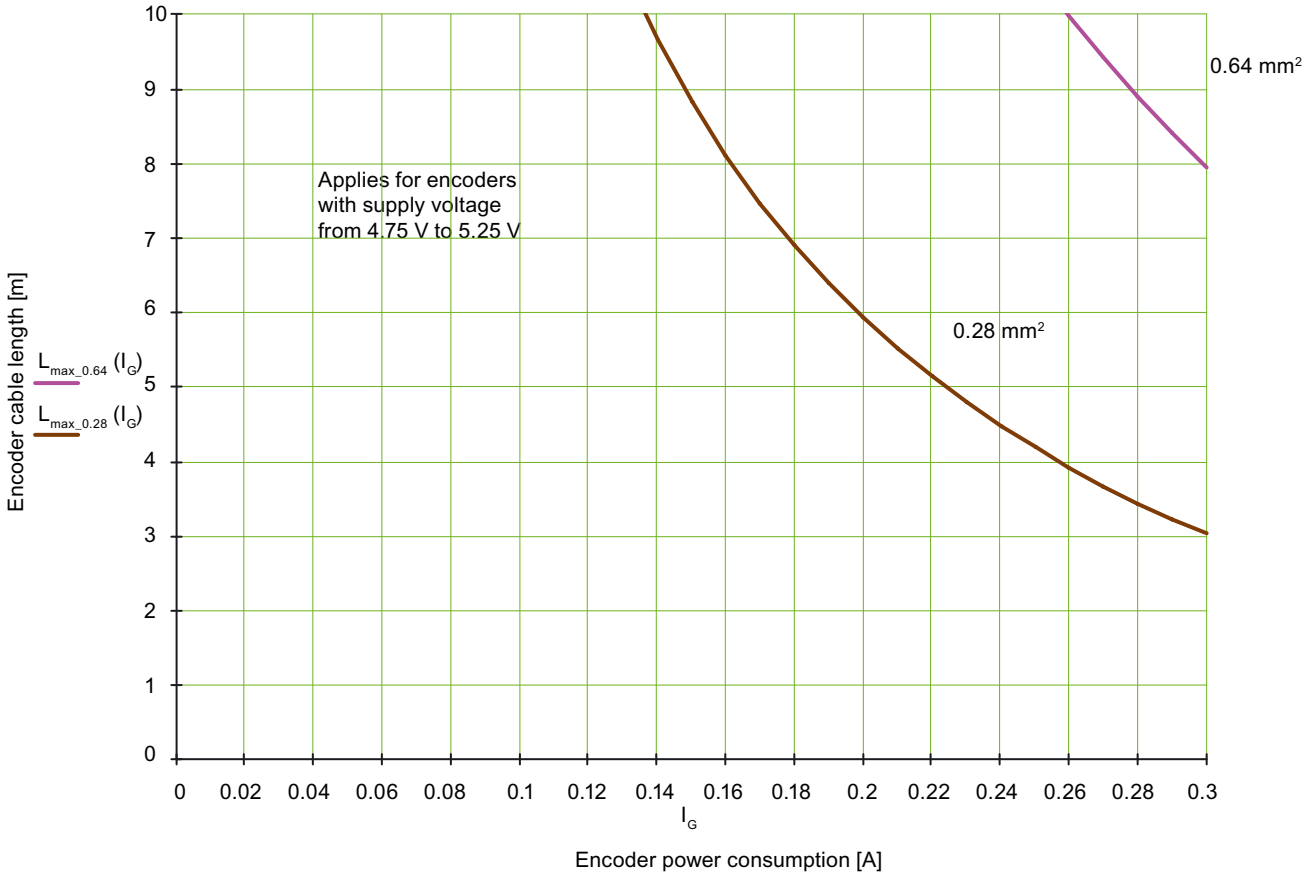


Figure 4-32 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range between 4.75 V and 5.25 V in the figure above, encoder systems are also available for the extended range down to 3.6 V. These are generally operable using encoder system cables up to 10 m in length, provided that the total cross-section of the supply plus Remote Sense wires does not exceed 0.14 mm².

4.7 Sensor Module External SME25

4.7.1 Description

Direct encoder systems outside the cabinet can be connected to the Sensor Module External SME25. The SME25 evaluates these encoder systems and converts the calculated values to DRIVE-CLiQ.

Direct encoder systems with EnDat 2.1 or SSI (from firmware 2.4) with SIN/COS (1 Vpp) incremental signals can be connected, however without reference signal.

Neither motor nor encoder data are saved in the SME25.

The SME25 can be operated from Firmware 2.3 onwards.

4.7.2 Safety information

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.

4.7.3 Interface description

4.7.3.1 Overview

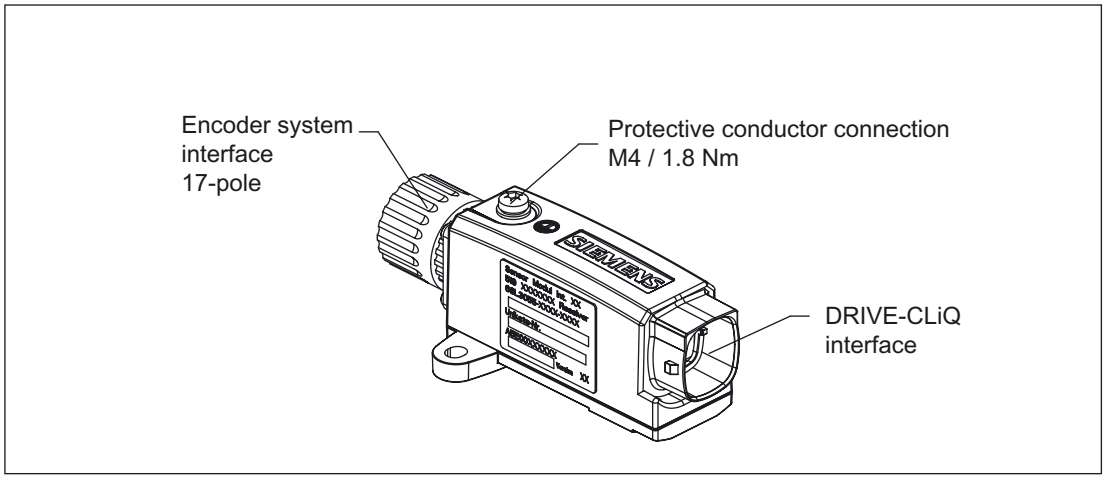
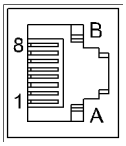


Figure 4-33 Interface description SME25

4.7.3.2 DRIVE-CLiQ interface

Table 4-25 DRIVE-CLiQ interface

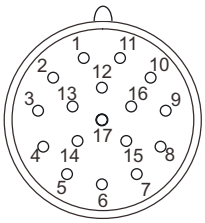
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Cover for the DRIVE-CLiQ interface is included in the scope of supply Current consumption: max. 0.25 A			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. With MOTION-CONNECT 500, the maximum cable length is 100 m; with MOTION-CONNECT 800, it is 50 m.

4.7.3.3 Encoder system interface

Table 4-26 Encoder system interface SME25

	Pin	Signal name	Technical specifications
	1	P5	Encoder power supply
	2	Reserved, do not use	
	3	Reserved, do not use	
	4	M	Ground for encoder power supply
	5	Reserved, do not use	
	6	Reserved, do not use	
	7	P5	Encoder power supply
	8	Clock	Clock, EnDat interface, SSI clock[1)]
	9	Clock*	Inverse clock, EnDat interface, Inverse SSI clock[1)]
	10	M	Ground for encoder power supply
	11	Enclosure potential	
	12	B	Incremental signal B
	13	B*	Inverse incremental signal B
	14	Data	Data, EnDat interface, SSI data[1)]
	15	A	Incremental signal A
	16	A*	Inverse incremental signal A
	17	Data*	Inverse data EnDat interface, Inverse SSI data[1)]
Blanking plate for encoder system interface: Pöppelmann GmbH & Co. KG, Lohne, Order No.: GPN 300 F211 connector kits, 17-pole, Order No.: 6FX2003-0SA17			

1) Only from Firmware 2.4 onwards

4.7.4 Dimension drawing

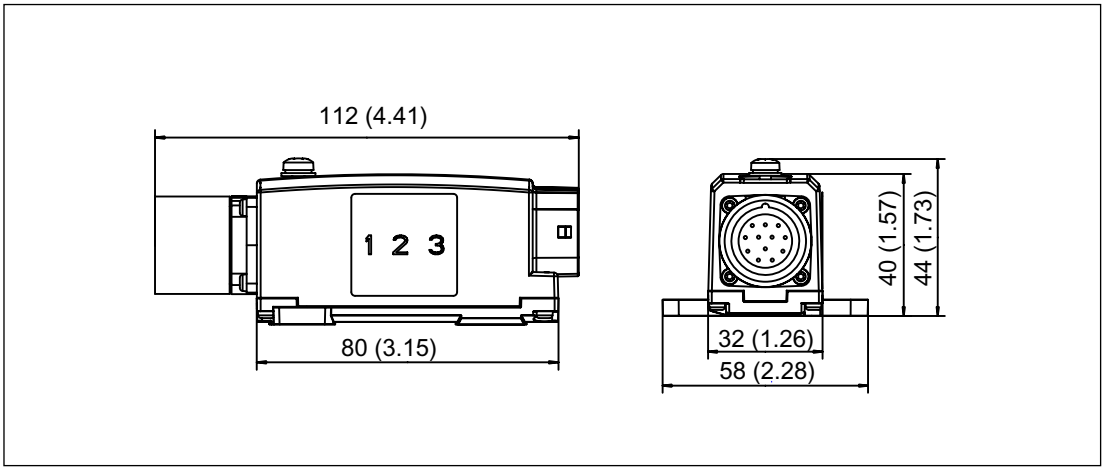


Figure 4-34 Dimension drawing SME25, Order number 6SL3055-0AA00-5HA3

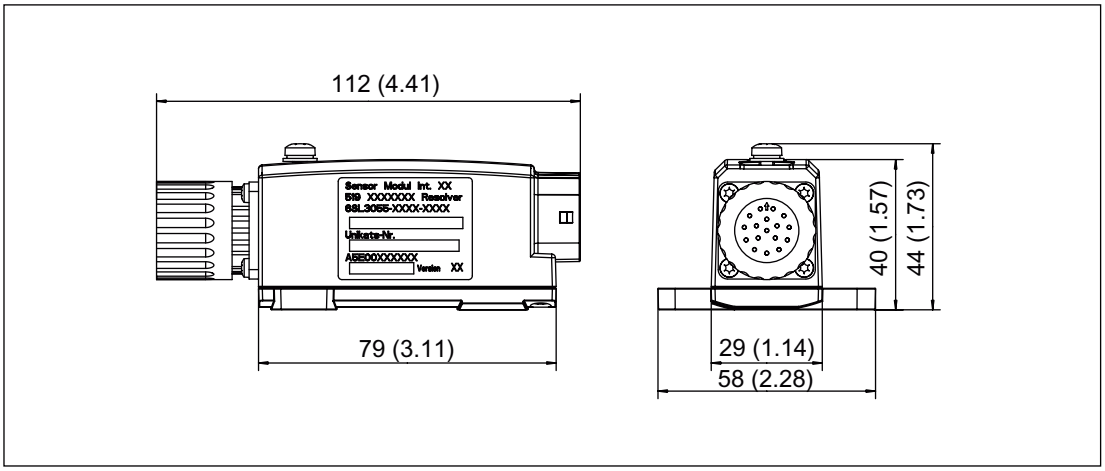
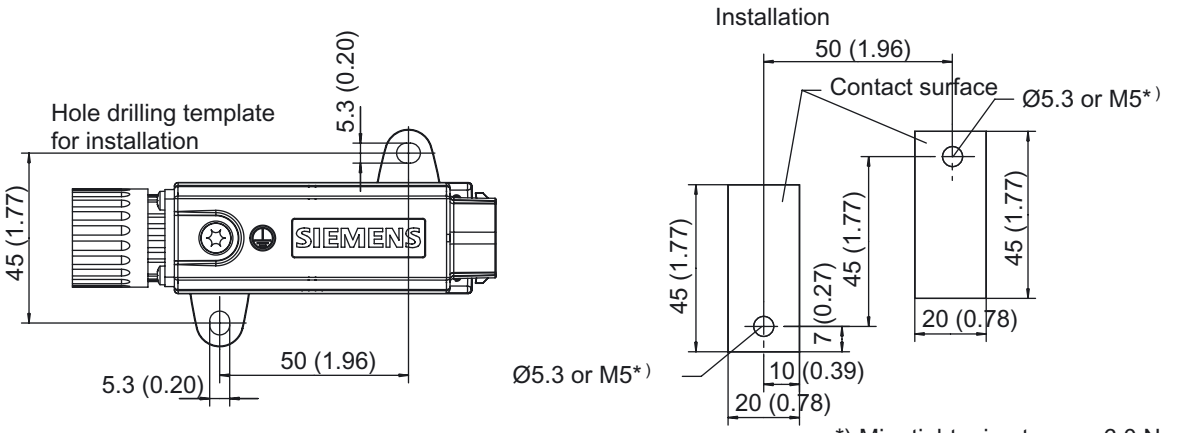


Figure 4-35 Dimension drawing SME25, Order number 6SL3055-0AA00-5HA0

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 4-36 Installing the SME20/SME25

4.7.6 Technical specifications

Table 4-27 Technical data

Sensor Module External SME25 6SL3055-0AA00-5HAx	**Designation**	**Unit**	**Value**
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.15 ≤ 0.25 ≤ 4
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 V A	 5 V DC 0.30
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 500
SSI/EnDat 2.1 baud rate		kHz	100
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0.18 for order number 6SL3055-0AA00-5HA0 0.31 for order number 6SL3055-0AA00-5HA3
Degree of protection		IP67	

The maximum cable length for the encoder system interface depends on the current consumption of the encoder system and the cross-section of the wire in the cable. However, the maximum length is 10 m. The figure below applies to encoder systems that operate in the supply voltage range between 4.75 V and 5.25 V. The sample parameters shown are 0.28 mm² cross-section (0.14 mm² supply plus 0.14 mm² Remote Sense wires) and 0.64 mm² (0.5 mm² supply plus 0.14 mm² Remote Sense wires).

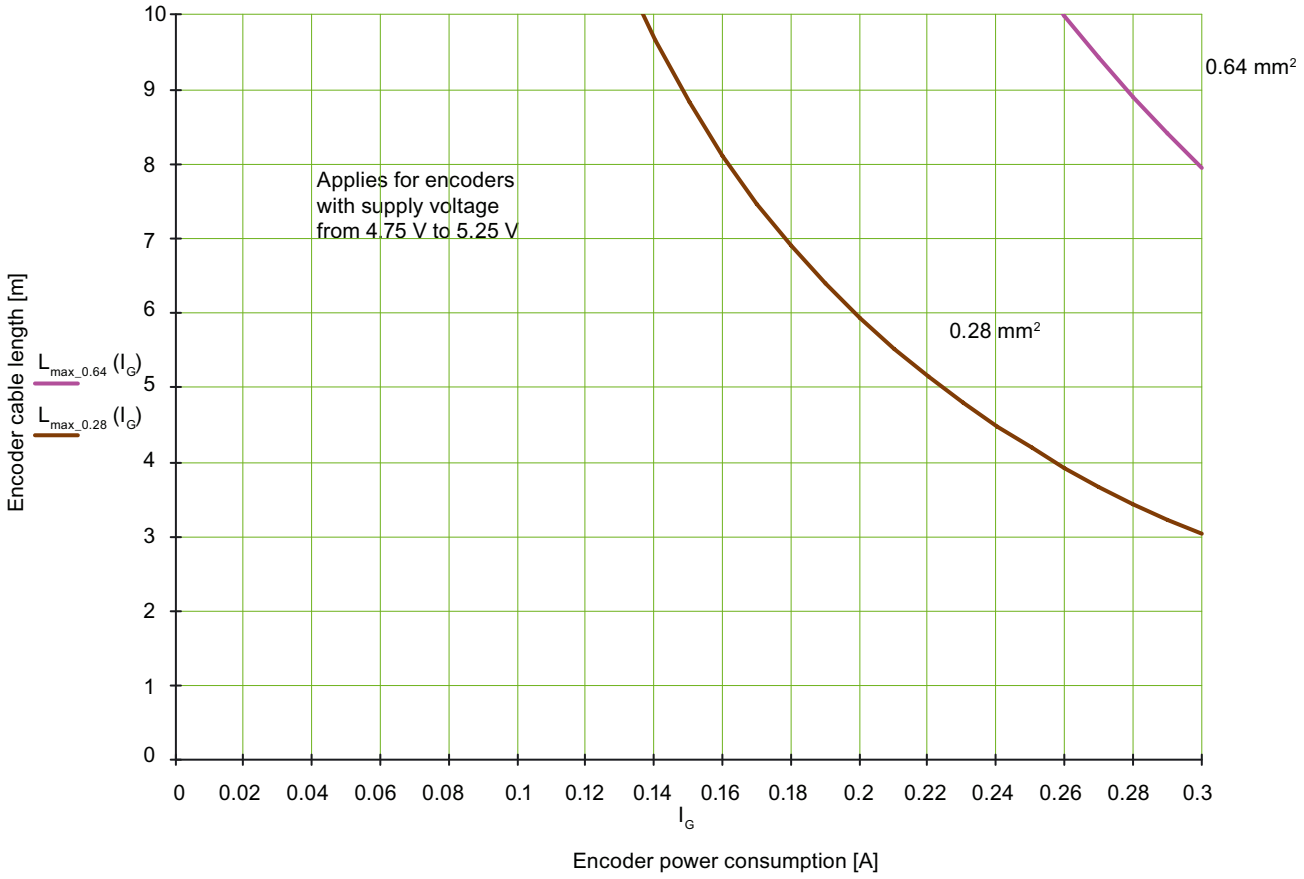


Figure 4-37 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range between 4.75 V and 5.25 V in the figure above, encoder systems are also available for the extended range down to 3.6 V. These are generally operable using encoder system cables up to 10 m in length, provided that the total cross-section of the supply plus Remote Sense wires does not exceed 0.14 mm².

4.8 Sensor Module External SME120

4.8.1 Description

Direct encoder systems outside the cabinet can be connected to the Sensor Module External SME120. The SME120 evaluates these encoder 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. SME120 is mainly used in linear motor applications.

A Hall sensor box can be connected to determine the commutation position of a linear motor.

Incremental direct encoder systems with SIN/COS (1 Vpp) and reference signal can be connected.

Neither motor nor encoder data are saved in the SME120.

The SME120 can be operated from Firmware 2.4 onwards.

4.8.2 Safety information

Sensor Module External 120 is a device, safety class I.

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

⚠DANGER

Commissioning is prohibited until it has been clearly identified that the machine in which this component is to be installed fulfills the conditions of Machinery Directive 98/37/EC.

All of the work must be carried out by qualified, appropriately trained personnel. Prior to commencing any work on the Sensor Module External the 5 safety rules have to be observed:

- Disconnect the system.
- Protect against reconnection.
- Make sure that the equipment is de-energized.
- Ground and short-circuit
- Cover or enclose adjacent components that are still live.

Never disable protective functions and devices even for trial operation.

It is mandatory that a protective conductor with a minimum cross-section of 2.5 mm^2 is connected in order to guarantee safe protective separation.

In order to ensure the degree of protection all connections, even connections that are not used, must be closed with connectors or suitable sealing caps.

The specified torques must be observed.

The plastic covers of connections X100, X200 and X500 do not comply with the degree of protection and must be replaced by the corresponding connectors prior to commissioning.

It is not permitted to open up the drive units! It is possible that the units are no longer adequately sealed! Repair and maintenance work may only be performed by a SIEMENS service center.

The unit should not be put into operation if it is evident that the packaging has been damaged by water.

4.8.3 Interface description

4.8.3.1 Overview

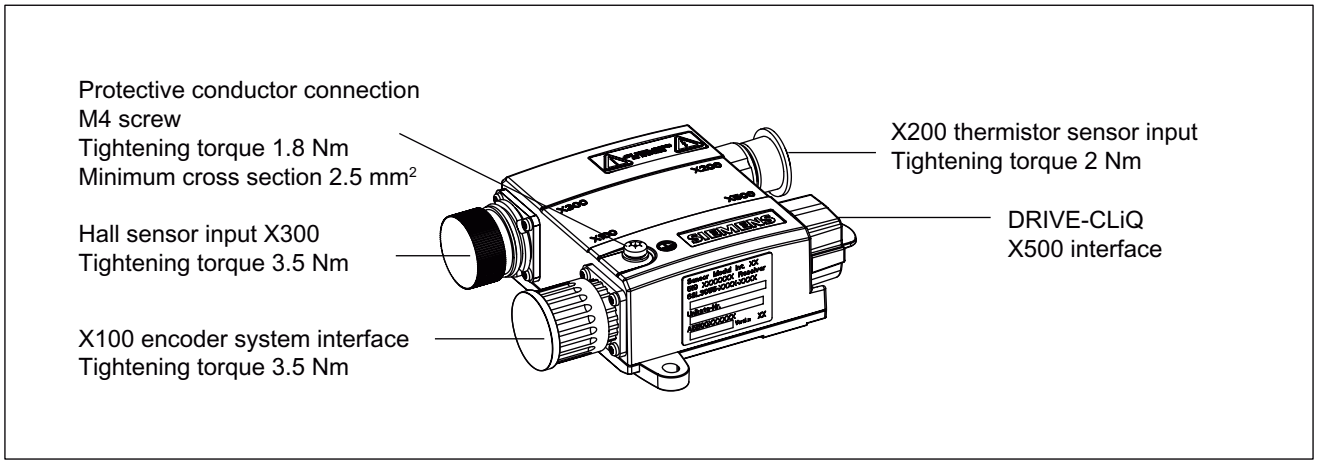


Figure 4-38 Interface description, SME120

4.8.3.2 Connection example

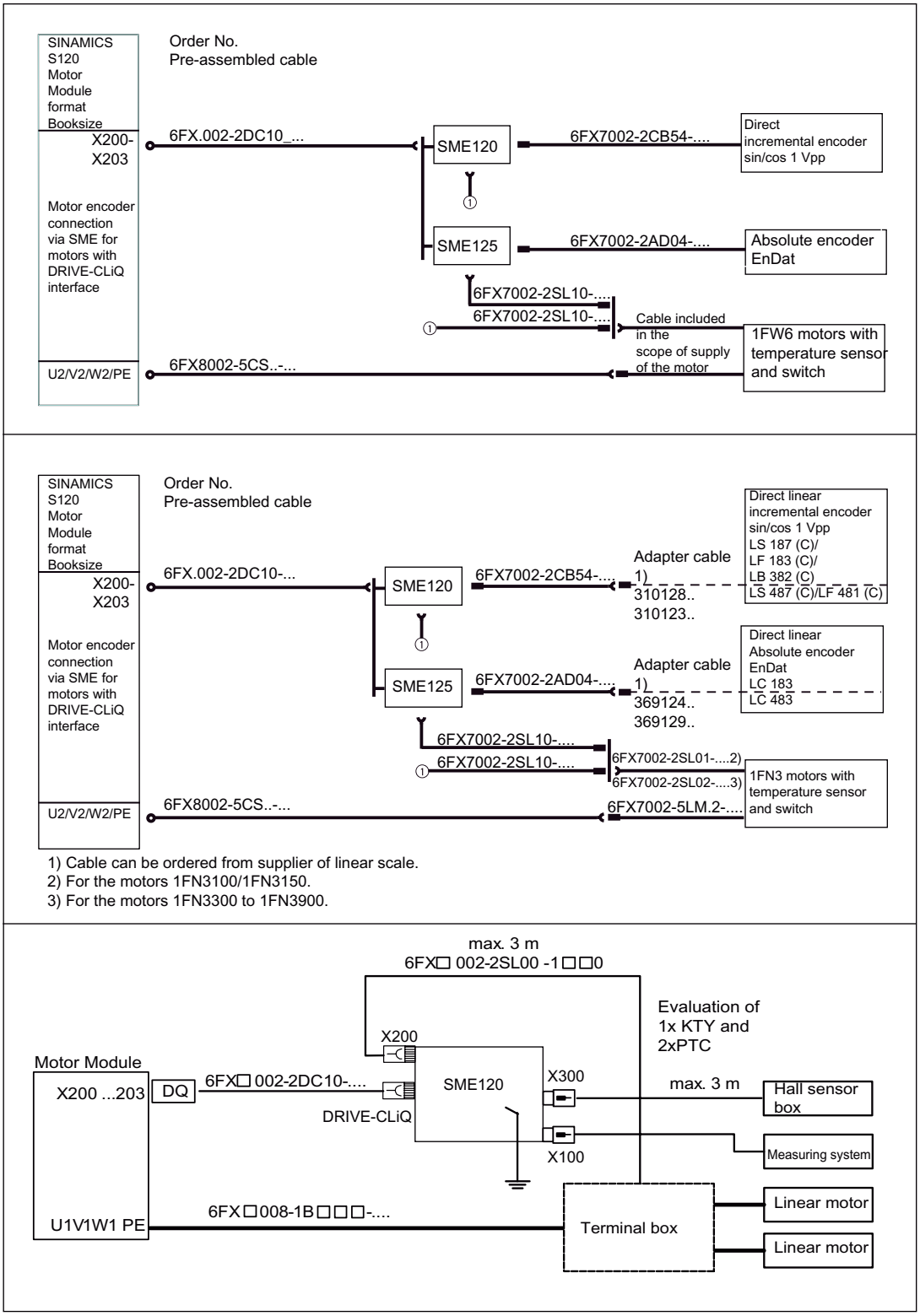
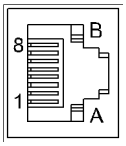


Figure 4-39 Connection examples, SME120

4.8.3.3 X500 DRIVE-CLiQ interface

Table 4-28 DRIVE-CLiQ interface

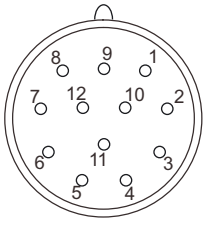
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Cover for the DRIVE-CLiQ interface is included in the scope of supply Current consumption: max. 0.30 A			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. With MOTION-CONNECT 500, the maximum cable length is 100 m; with MOTION-CONNECT 800, it is 50 m.

4.8.3.4 X100 encoder system interface

Table 4-29 Encoder system interface SME120

	Pin	Signal name	Technical specifications
	1	B*	Inverse incremental signal B
	2	P5	Encoder power supply
	3	R	Reference signal R
	4	R*	Inverse reference signal R
	5	A	Incremental signal A
	6	A*	Inverse incremental signal A
	7	Reserved, do not use	
	8	B	Incremental signal B
	9	Reserved, do not use	
	10	M	Ground for encoder power supply
	11	M	Ground for encoder power supply
	12	P5	Encoder power supply
Blanking plate for encoder system interface: Pöppelmann GmbH & Co. KG, Lohne, Order No.: GPN 300 F211 Connector kits, 12-pole, Order No.: 6FX2003-0SA12			

4.8.3.5 X200 thermistor sensor input

Table 4-30 X200 thermistor sensor input

Pin	Function	Technical specifications
1	-Temp	Temperature sensor connection KTY84–1C130 / PTC / Bimetallic-element switch with NC contact in linear motor applications, connect the KTY84-1C130 motor temperature sensor here
2	+Temp	
3	+Temp	Temperature sensor connection KTY84–1C130 / PTC / Bimetallic-element switch with NC contact in linear motor applications, connect the PTC drilling 1 or bimetallic-element switch here
4	-Temp	
5	+Temp	Temperature sensor connection KTY84–1C130 / PTC / Bimetallic-element switch with NC contact in linear motor applications, connect the PTC drilling 2 here
6	-Temp	
Connector kits, 6+1-pole, Order No.: 6FX2003-0SU07		

4.8.3.6 X300 Hall sensor input

Table 4-31 Hall sensor input X300

Pin	Signal name	Technical specifications
1	C	Absolute track signal C
2	C*	Inverse absolute track signal C
3	P5	Encoder power supply
4	M	Ground for encoder power supply
5	D	Absolute track signal D
6	D*	Inverse absolute track signal D
7	Not assigned	
8	Not assigned	
9	Ground	Ground (for internal shield)
Connector kits, 9-pole, Order No.: 6FX2003-0SU01		

4.8.4 Dimension drawing

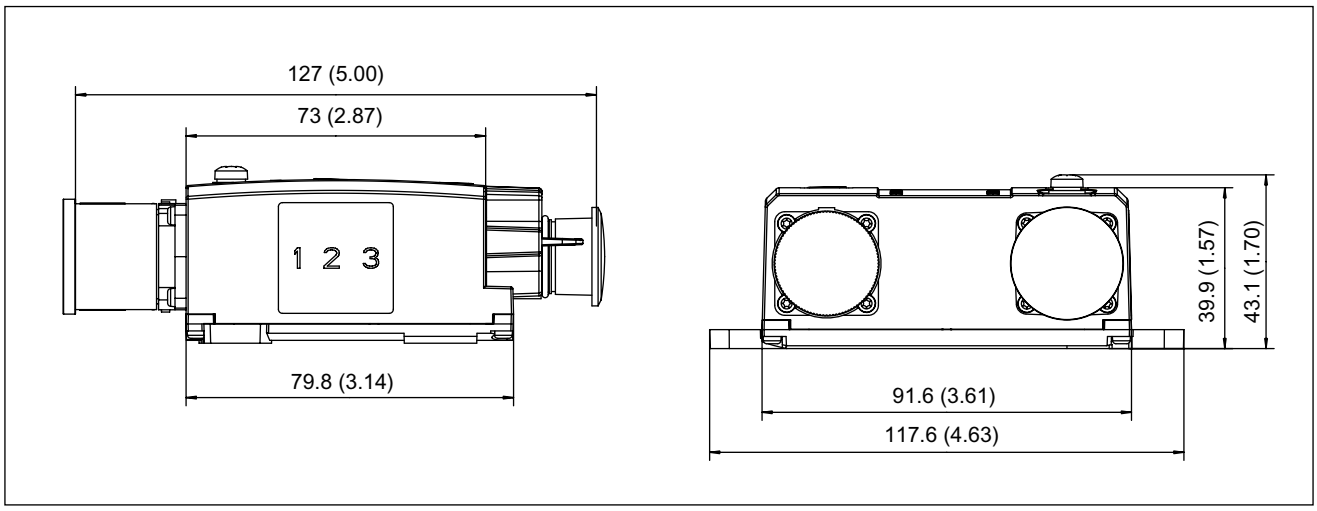


Figure 4-40 Dimension drawing SME120, Order number 6SL3055-0AA00-5JA3

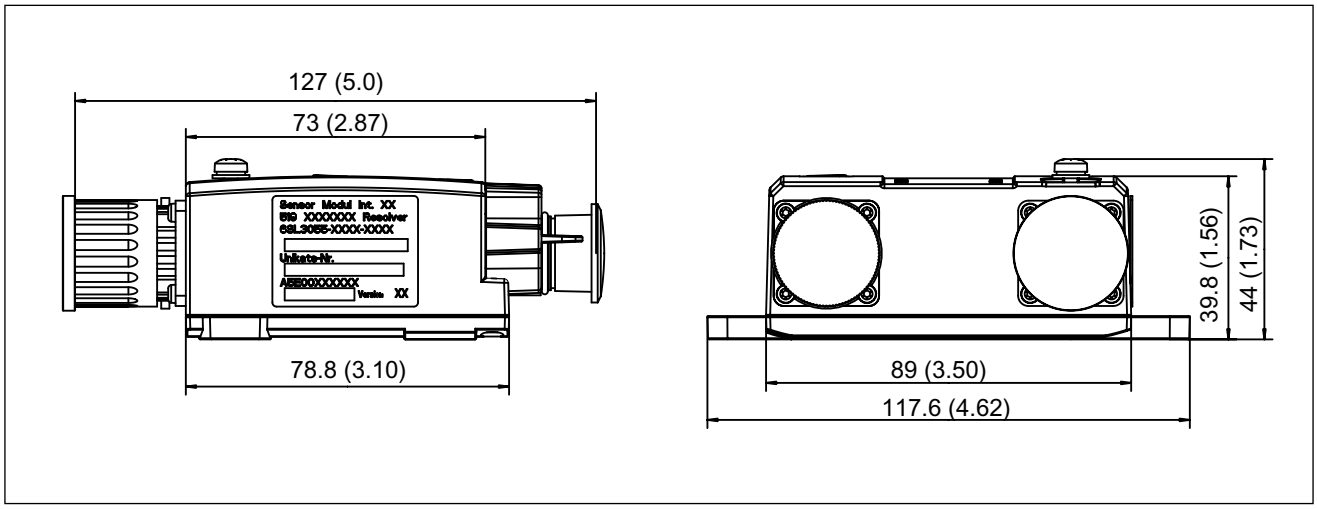


Figure 4-41 Dimension drawing SME120, Order number 6SL3055-0AA00-5JA0

4.8.5 Mounting

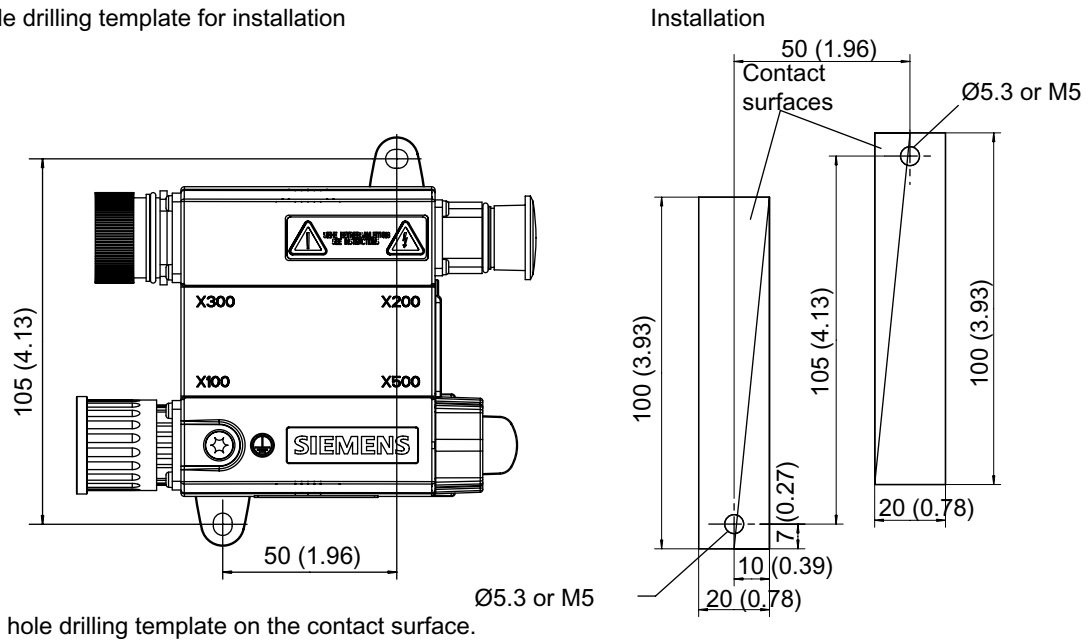


Figure 4-42 Installation, SME120

4.8.6 Technical data

Table 4-32 Technical data

Sensor Module External SME120 6SL3055-0AA00-5JAx	Designation	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.30 ≤ 4.5
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 V A	 5 V DC 0.30
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 500
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0.4 for order number 6SL3055-0AA00-5JA0 0.7 for order number 6SL3055-0AA00-5JA3
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.

The maximum cable length for the encoder system interface depends on the current consumption of the encoder system and the cross-section of the wire in the cable. However, the maximum length is 10 m. The figure below applies to encoder systems that operate in the supply voltage range between 4.75 V and 5.25 V. The sample parameters shown are 0.28 mm² cross-section (0.14 mm² supply plus 0.14 mm² Remote Sense wires) and 0.64 mm² (0.5 mm² supply plus 0.14 mm² Remote Sense wires).

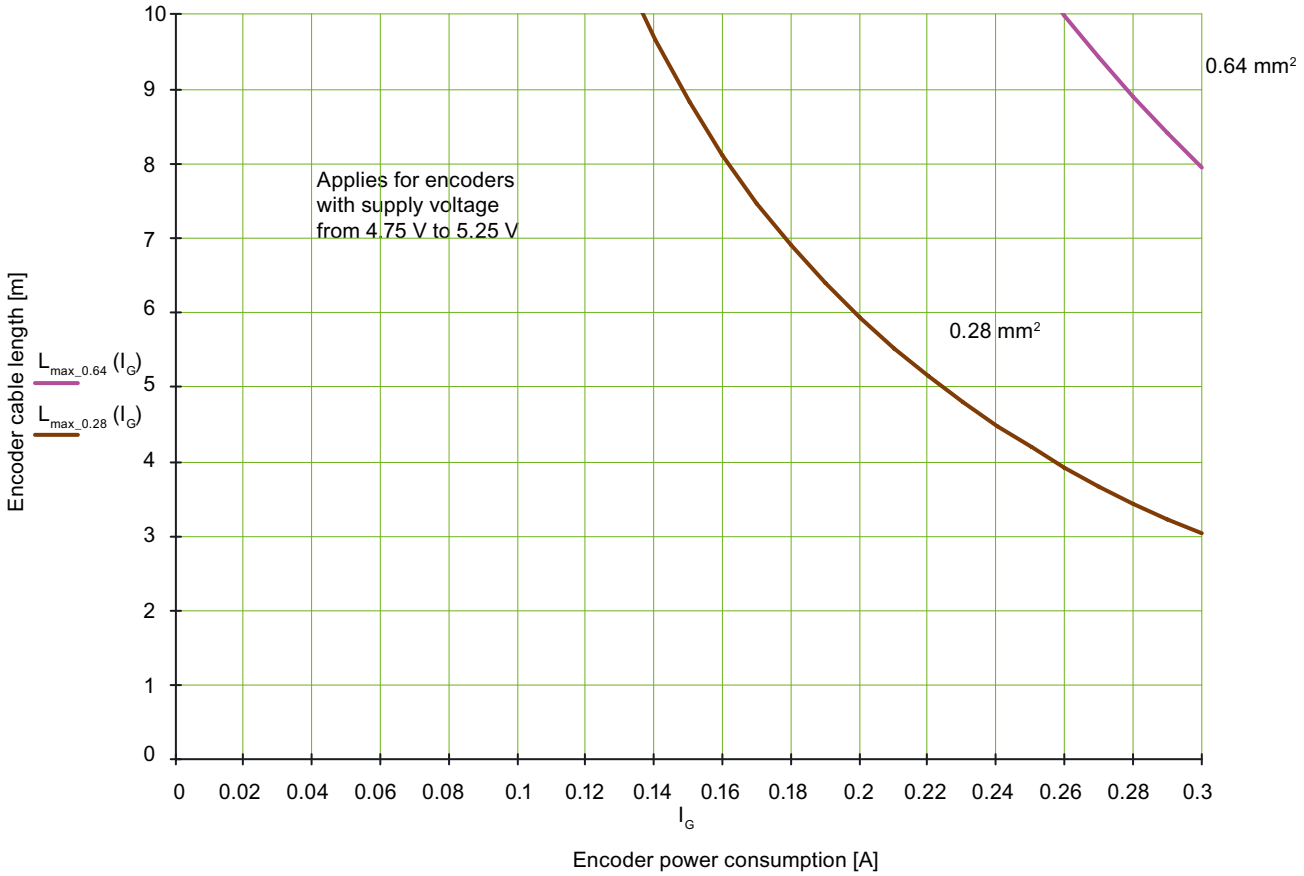


Figure 4-43 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range between 4.75 V and 5.25 V in the figure above, encoder systems are also available for the extended range down to 3.6 V. These are generally operable using encoder system cables up to 10 m in length, provided that the total cross-section of the supply plus Remote Sense wires does not exceed 0.14 mm².

4.9 Sensor Module External SME125

4.9.1 Description

Direct encoder systems outside the cabinet can be connected to the Sensor Module External SME125. The SME125 evaluates these encoder 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.

Direct encoder systems with EnDat 2.1 or SSI with SIN/COS (1 Vpp) incremental signals can be connected, however without reference signal.

Neither motor nor encoder data are saved in the SME125.

The SME125 can be operated from Firmware 2.4 onwards.

4.9.2 Safety information

Sensor Module External 125 is a device, safety class I.

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

⚠DANGER

Commissioning is prohibited until it has been clearly identified that the machine in which this component is to be installed fulfills the conditions of Machinery Directive 98/37/EC.

All of the work must be carried out by qualified, appropriately trained personnel. Prior to commencing any work on the Sensor Module External the 5 safety rules have to be observed:

- Disconnect the system.
- Protect against reconnection.
- Make sure that the equipment is de-energized.
- Ground and short-circuit
- Cover or enclose adjacent components that are still live.

Never disable protective functions and devices even for trial operation.

It is mandatory that a protective conductor with a minimum cross-section of 2.5 mm^2 is connected in order to guarantee safe protective separation.

In order to ensure the degree of protection all connections, even connections that are not used, must be closed with connectors or suitable sealing caps.

The specified torques must be observed.

The plastic covers of connections X100, X200 and X500 do not comply with the degree of protection and must be replaced by the corresponding connectors prior to commissioning.

It is not permitted to open up the drive units! It is possible that the units are no longer adequately sealed! Repair and maintenance work may only be performed by a SIEMENS service center.

The unit should not be put into operation if it is evident that the packaging has been damaged by water.

Note

The safety information on the Sensor Module must be observed.

After the product has served its lifetime, the individual parts should be disposed of in compliance with local regulations.

4.9.3 Interface description

4.9.3.1 Overview

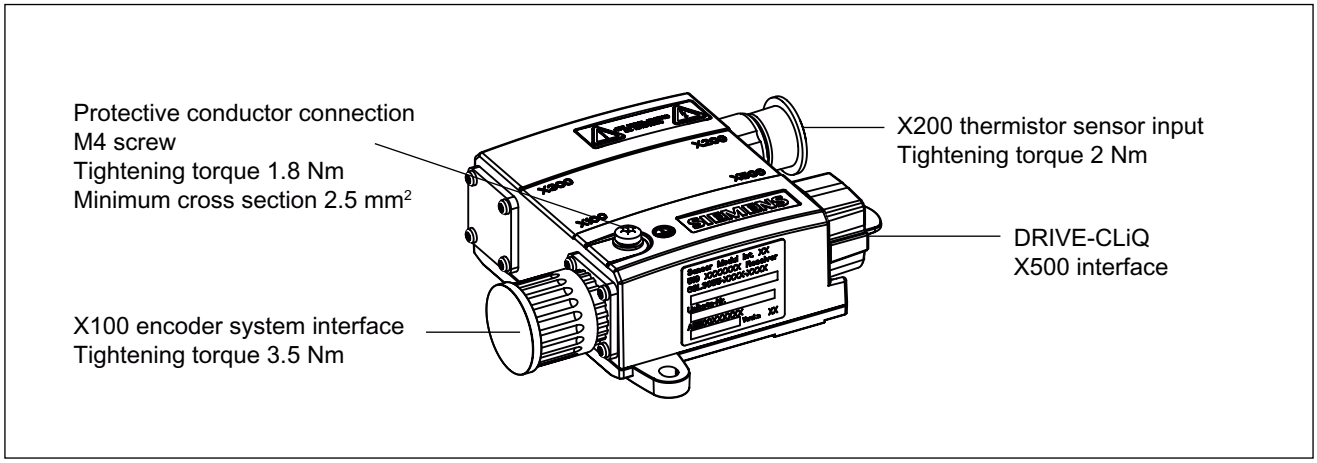


Figure 4-44 Interface description, SME125

4.9.3.2 Connection example

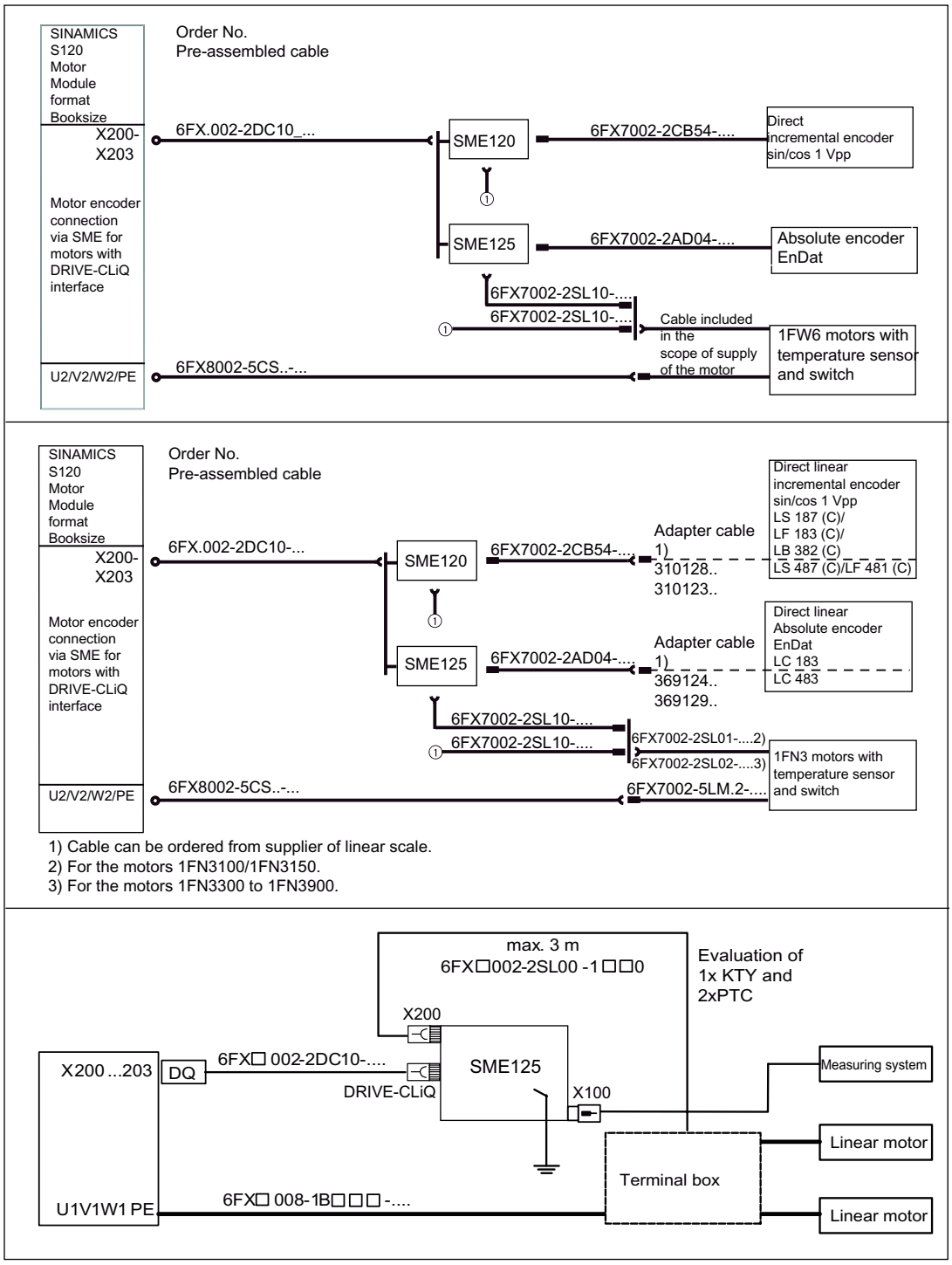
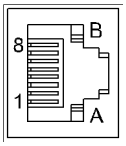


Figure 4-45 Connection examples, SME125

4.9.3.3 X500 DRIVE-CLiQ interface

Table 4-33 DRIVE-CLiQ interface

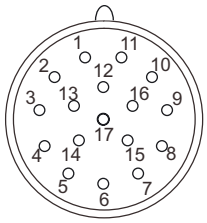
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Cover for the DRIVE-CLiQ interface is included in the scope of supply Current consumption: max. 0.30 A			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. With MOTION-CONNECT 500, the maximum cable length is 100 m; with MOTION-CONNECT 800, it is 50 m.

4.9.3.4 X100 encoder system interface

Table 4-34 Encoder system interface SME125

	Pin	Signal name	Technical specifications
	1	P5	Encoder power supply
	2	Reserved, do not use	
	3	Reserved, do not use	
	4	M	Ground for encoder power supply
	5	Reserved, do not use	
	6	Reserved, do not use	
	7	P5	Encoder power supply
	8	Clock	Clock, EnDat interface, SSI clock
	9	Clock*	Inverse clock EnDat interface Inverse SSI clock
	10	M	Ground for encoder power supply
	11	Enclosure potential	
	12	B	Incremental signal B
	13	B*	Inverse incremental signal B
	14	Data	Data, EnDat interface, SSI data
	15	A	Incremental signal A
	16	A*	Inverse incremental signal A
	17	Data*	Inverse data, EnDat interface, Inverse SSI data
Blanking plate for encoder system interface: Pöppelmann GmbH & Co. KG, Lohne, Order No.: GPN 300 F211 connector kits, 17-pole, Order No.: 6FX2003-0SA17			

* These connections do not have safe separation!

4.9.3.5 X200 thermistor sensor input

Table 4-35 X200 thermistor sensor input

Pin	Function	Technical specifications
1	-Temp	Temperature sensor connection KTY84–1C130 / PTC / Bimetallic-element switch with NC contact in linear motor applications, connect the KTY84-1C130 motor temperature sensor here
2	+Temp	
3	+Temp	Temperature sensor connection KTY84–1C130 / PTC / Bimetallic-element switch with NC contact in linear motor applications, connect the PTC drilling 1 or bimetallic-element switch here
4	-Temp	
5	+Temp	Temperature sensor connection KTY84–1C130 / PTC / Bimetallic-element switch with NC contact in linear motor applications, connect the PTC drilling 2 here
6	-Temp	
Connector kits, 6+1-pole, Order No.: 6FX2003-0SU07		

4.9.4 Dimension drawing

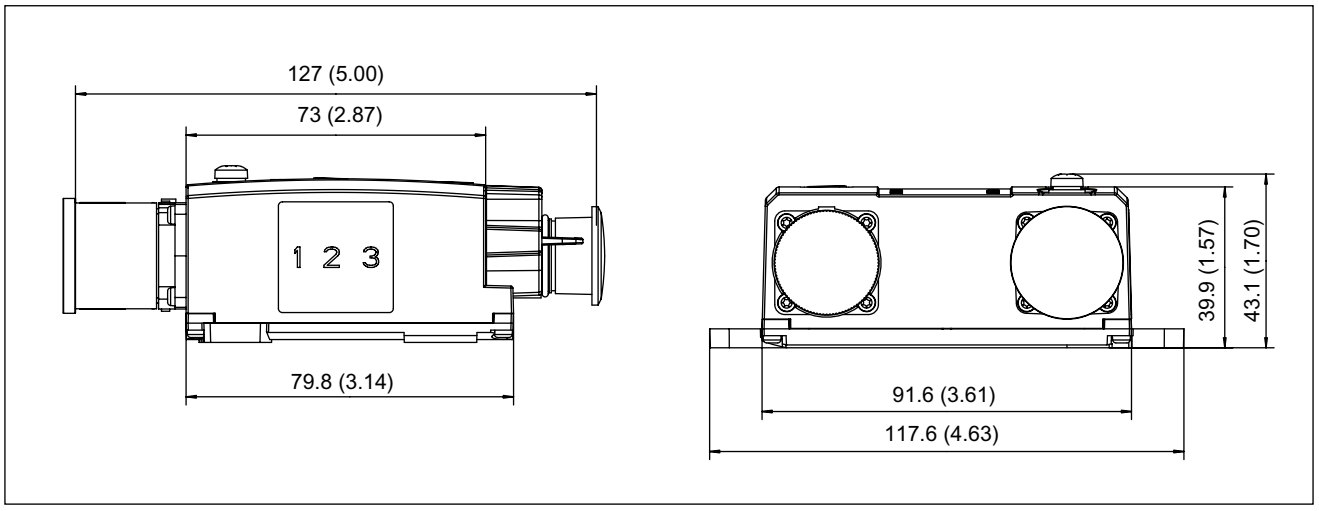


Figure 4-46 Dimension drawing SME125, Order number 6SL3055-0AA00-5KA3

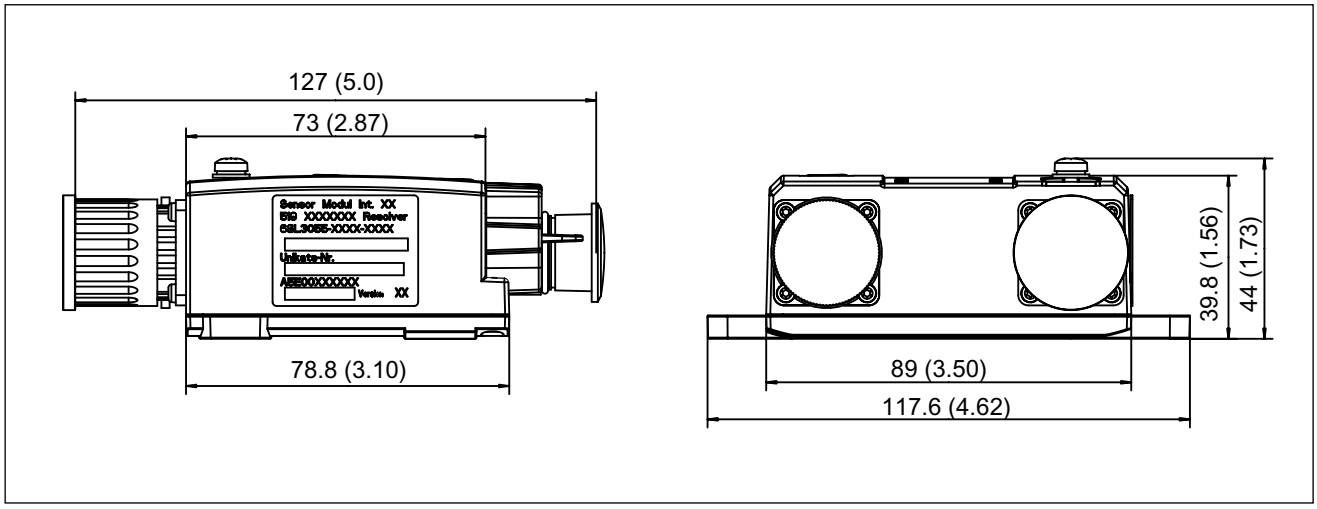
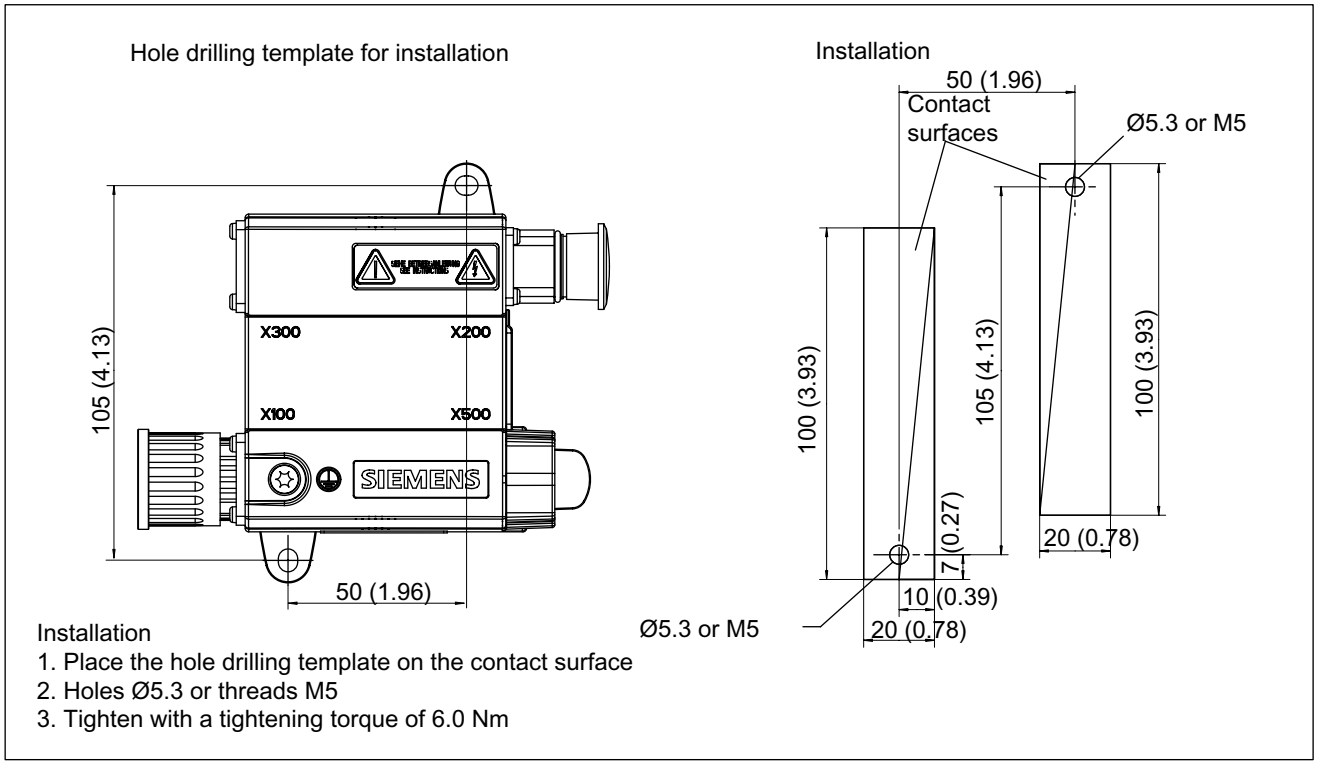


Figure 4-47 Dimension drawing SME125, Order number 6SL3055-0AA00-5KA0

4.9.5 Mounting



Installation
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 4-48 Mounting, SME125

4.9.6 Technical data

Table 4-36 Technical data

Sensor Module External SME125 6SL3055-0AA00-5KAx	**Designation**	**Unit**	**Value**
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.30 ≤ 4.5
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 V A	 5 V DC 0.30
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 500
SSI/EnDat 2.1 baud rate		kHz	100
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0.4 for order number 6SL3055-0AA00-5KA0 0.7 for order number 6SL3055-0AA00-5KA3
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.

The maximum cable length for the encoder system interface depends on the current consumption of the encoder system and the cross-section of the wire in the cable. However, the maximum length is 10 m. The figure below applies to encoder systems that operate in the supply voltage range between 4.75 V and 5.25 V. The sample parameters shown are 0.28 mm² cross-section (0.14 mm² supply plus 0.14 mm² Remote Sense wires) and 0.64 mm² (0.5 mm² supply plus 0.14 mm² Remote Sense wires).

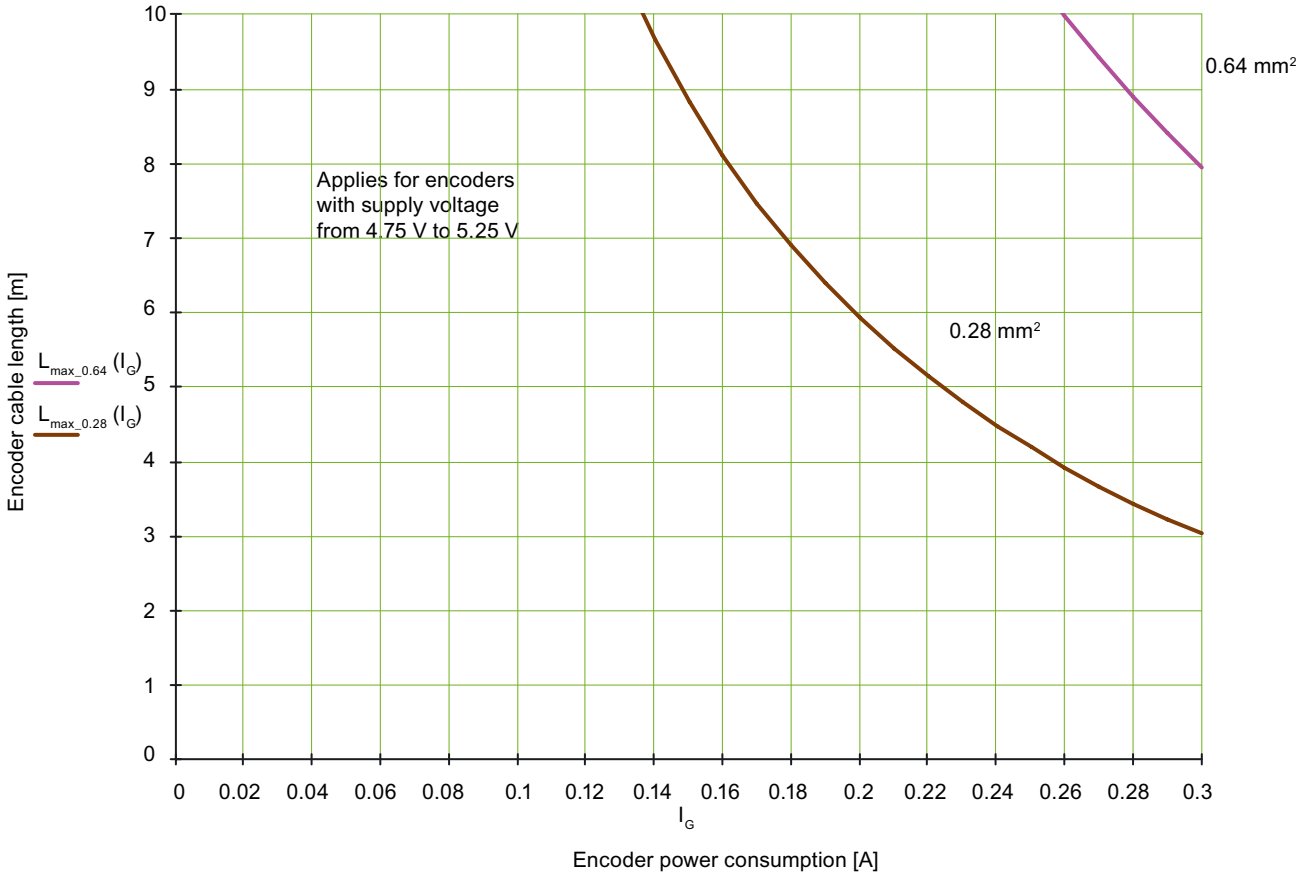


Figure 4-49 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range between 4.75 V and 5.25 V in the figure above, encoder systems are also available for the extended range down to 3.6 V. These are generally operable using encoder system cables up to 10 m in length, provided that the total cross-section of the supply plus Remote Sense wires does not exceed 0.14 mm².

4.10 DRIVE-CLiQ encoder

4.10.1 Description

The DRIVE-CLiQ encoder is available as absolute encoder with integrated DRIVE-CLiQ interface. The encoder senses absolute position values extending over 4096 revolutions.

The most important advantages are:

- Automatic commissioning via DRIVE-CLiQ
- High operating temperatures of 100 °C are possible
- Integrated diagnostics concept

Table 4-37 Encoder for mounting with DRIVE-CLiQ

Designation	Order number	Description
DRIVE-CLiQ synchronous flange VW 6 mm	6FX2001-5FD13-0AAx	Absolute encoder with DRIVE-CLiQ, single-turn
DRIVE-CLiQ clamping flange VW 10 mm	6FX2001-5QD13-0AAx	Absolute encoder with DRIVE-CLiQ, single-turn
DRIVE-CLiQ hollow shaft 10 mm	6FX2001-5VD13-0AAx	Absolute encoder with DRIVE-CLiQ, single-turn
DRIVE-CLiQ hollow shaft 12 mm	6FX2001-5WD13-0AAx	Absolute encoder with DRIVE-CLiQ, single-turn
DRIVE-CLiQ synchronous flange VW 6 mm	6FX2001-5FD25-0AAx	Absolute encoder with DRIVE-CLiQ, multiturn
DRIVE-CLiQ clamping flange VW 10 mm	6FX2001-5QD25-0AAx	Absolute encoder with DRIVE-CLiQ, multiturn
DRIVE-CLiQ hollow shaft 10 mm	6FX2001-5VD25-0AAx	Absolute encoder with DRIVE-CLiQ, multiturn
DRIVE-CLiQ hollow shaft 12 mm	6FX2001-5WD25-0AAx	Absolute encoder with DRIVE-CLiQ, multiturn

4.10.2 Safety information

⚠ CAUTION

The encoder has direct contact to components that can be destroyed by electrostatic discharge (ESDS). Neither hands nor tools that could be electrostatically charged may come into contact with the connections.

4.10.3 Interface description

4.10.3.1 Overview

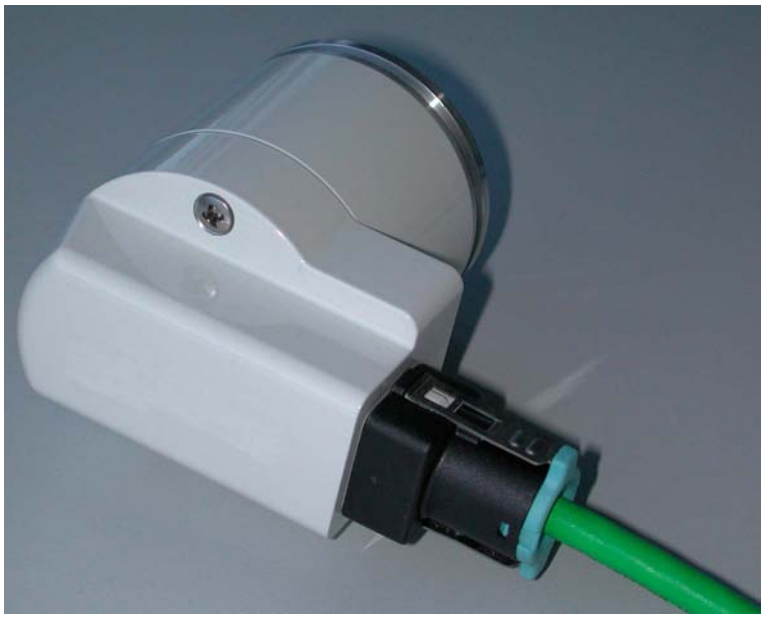
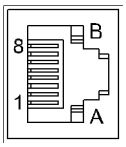


Figure 4-50 DRIVE-CLiQ encoder

4.10.3.2 DRIVE-CLiQ interface

Table 4-38 DRIVE-CLiQ interface

	Pin	Signal name	Technical data
	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	M (0 V)	Electronics ground
Blanking plate on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13			

4.10.4 Dimension drawings

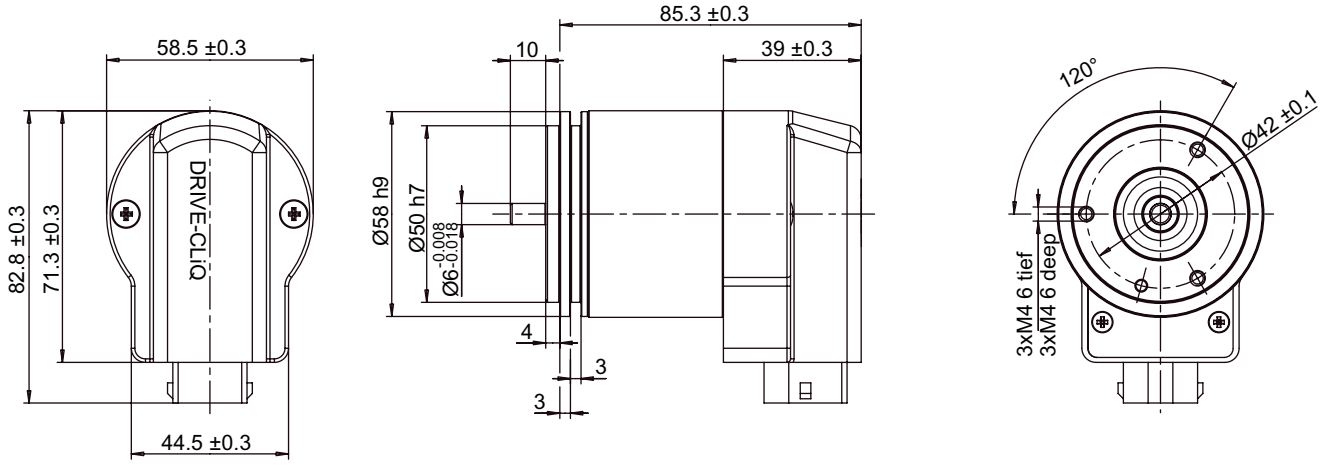


Figure 4-51 Dimension drawing: Synchronous flange

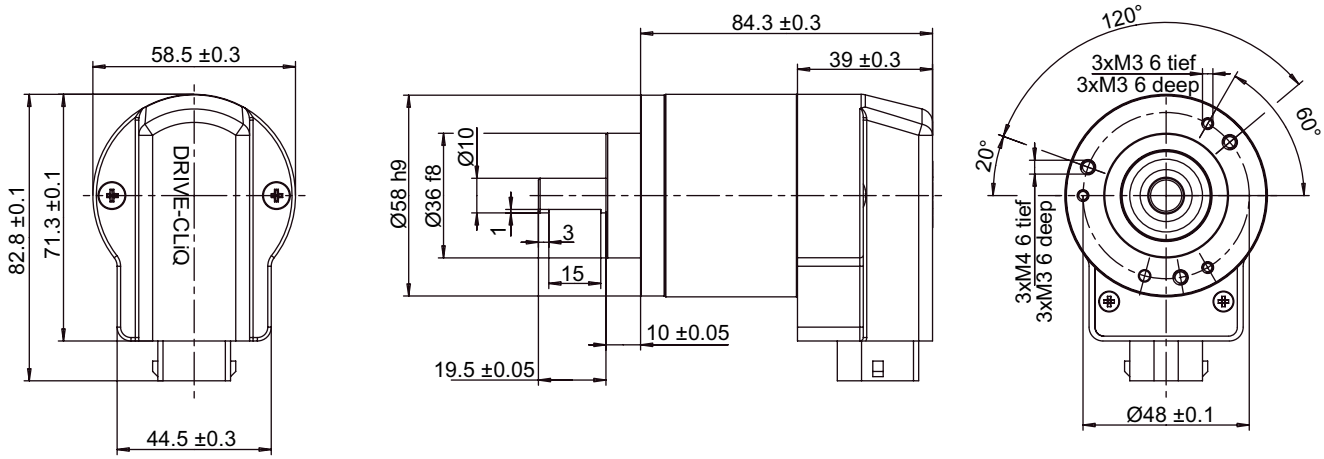


Figure 4-52 Dimension drawing: Clamping flange

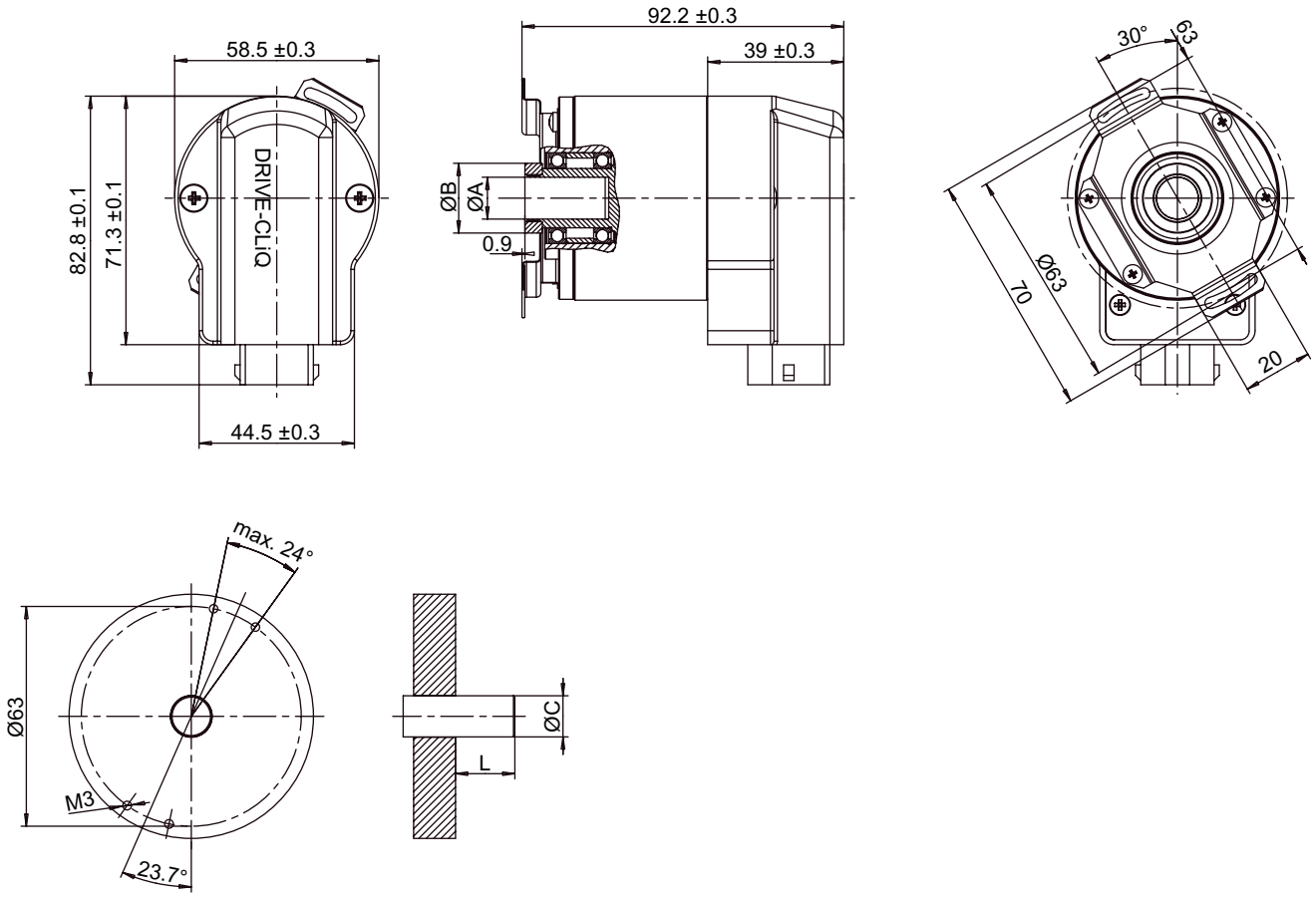


Figure 4-53 Dimension drawing: Hollow shaft with blink bore

Table 4-39 Dimensions

	Dimensions		Unit
Hollow shaft ØA	$10^{+0.012}$ (0.39)	$12^{+0.012}$ (0.47)	mm (inch)
Connection shafts ØC	10 (0.39)	12 (0.47)	mm (inch)
Clamping ring ØB	18 (0.70)	20 (0.78)	mm (inch)
L min.	15 (0.59)	18 (0.70)	mm (inch)
L max.	20 (0.78)	20 (0.78)	mm (inch)
Shaft code	2 (0.07)	7 (0.27)	mm (inch)

L = Engaged depth of the connection shaft into the encoder

4.10.5 Installation

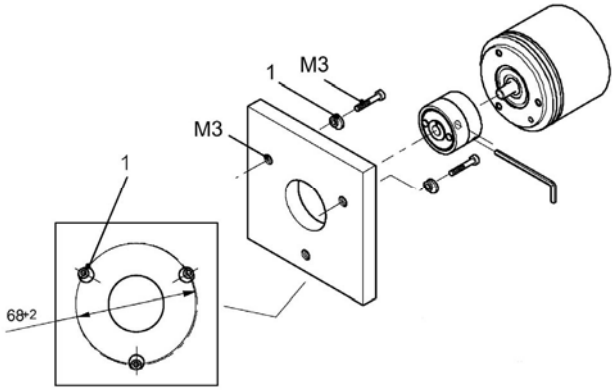


Figure 4-54 Installation: Synchronous flange, 1: Clamp straps

Clamp straps / couplings

Clamp straps and couplings are required as mounting accessories. The clamp straps are used to fix the encoders with a synchronous flange.

Table 4-40 Selection and ordering data

Designation	Order No.
Clamp strap (No.1 in the drawing) for encoder with synchronous flange (3 units are required)	6FX2001-7KP01
Spring disk coupling Shaft diameter: • 6 mm / 6 mm • 6 mm / 5 mm	 6FX2001-7KF10 6FX2001-7KF06
Plug-in coupling Shaft diameter: • 6 mm / 6 mm • 10 mm / 10 mm	 6FX2001-7KS06 6FX2001-7KS10

Table 4-41 Installation instructions

Product name	Spring disk coupling	Plug-in coupling
Transmission torque, max.	0.8 Nm	0.7 Nm
Shaft diameter	6 mm both ends or d_1 = 6 mm, d_2 = 5 mm	6 mm both ends or 10 mm both ends
Center offset of shafts, max.	0.4 mm	0.5 mm
Axial offset	± 0.4 mm	± 0.5 mm
Angular displacement of shafts, max.	3°	1°
Torsional rigidity	150 Nm / rad	31 Nm / rad
Lateral spring stiffness	6 N / mm	10 N / mm
Moment of inertia	19 gcm^2	20 gcm^2
Max. speed	12000 rpm	12000 rpm
Operating temperature	-20 ... +150 °C	-20 ... +80 °C
Weight, approx.	16 g	20 g

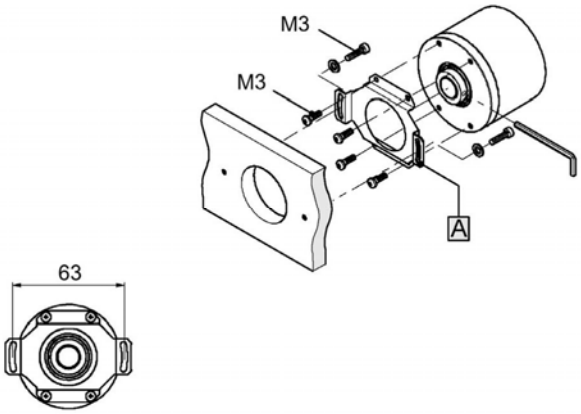


Figure 4-55 Installation: Hollow shaft, A: Spring plate (included in scope of supply)

4.10.6 Technical specifications

Table 4-42 Technical specifications DRIVE-CLiQ encoders

Design	Unit	Absolute encoder with DRIVE-CLiQ
Operating voltage at encoder	V	24 V -15 % + 20 %
Current drain Single-turn Multiturn	 mA mA	 approx. 245 approx. 325
Interface		DRIVE-CLiQ
Electrical speed, permissible	rpm	14.000
Mechanical speed, max.	rpm	10.000
Cable length to the downstream electronics	m	100
Connection		DRIVE-CLiQ connector, radial
Resolution Single-turn Multiturn	 Bit Bit	 22 34 (22 bit single-turn + 12 bit multiturn)
Accuracy	Angular seconds	+/- 35
Frictional torque	Nm	<= 0.01 (at 20 °C)
Starting torque	Nm	<= 0.01 (at 20 °C)
Shaft load capability d 10 x 19.5 70° n > 6000 rpm n <= 6000 rpm		 axial 40 N / radial 40 N at the shaft end axial 40 N / radial 60 N at the shaft end
Angular acceleration, max.	rad/s^2	10^5
Moment of inertia of the rotor, solid shaft Moment of inertia of the rotor, hollow shaft	kgm^2	1.90 * 10-6 kgm^2 2.80 * 10-6 kgm^2
Vibratory load acc. to DIN IEC 68-2-6	m/s^2	<= 100 (10 - 500 Hz)
Shock (6 ms) acc. to DIN IEC 68-2-27	m/s^2	<= 1000 (6 ms)
Operating temperature min. Operating temperature, max.	°C °C	- 20 100
Degree of protection (acc. to DIN EN 60529)		IP67 at the frame IP64 at the shaft input
Weight Single-turn Multiturn	 kg kg	 0.40 0.44
CE mark		Yes

5 Information on electromagnetic compatibility (EMC)

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 units

Order No.: 6SL3097-2AC00-0AP7, Edition: 10.2008

Appendix A

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 With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.14 mm^2 to 1.5 mm^2 0.25 mm^2 to 1.5 mm^2 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	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm^2 to 1.5 mm^2 0.25 mm^2 to 1.5 mm^2 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	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm^2 to 2.5 mm^2 0.5 mm^2 to 2.5 mm^2 0.5 mm^2 to 1.5 mm^2
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
3	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm^2 to 2.5 mm^2 0.25 mm^2 to 1 mm^2 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	

Screw terminal type			
4	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm^2 to 4 mm^2 0.25 mm^2 to 4 mm^2 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 With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm^2 to 6 mm^2 0.5 mm^2 to 6 mm^2 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 With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm^2 to 10 mm^2 0.5 mm^2 to 10 mm^2 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	
7	Connectable conductor cross-sections	0.5 mm^2 to 16 mm^2	
	Insulation stripping length	14 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.5 to 1.7 Nm	

Appendix B

B

B.1 List of abbreviations

Note:

The following list of abbreviations contains the abbreviations and their meanings used in the entire SINAMICS user documentation.

Abbreviation	Derivation of abbreviation	Meaning
A		
A...	Alarm	Alarm
AC	Alternating Current	Alternating current
ADC	Analog Digital Converter	Analog digital converter
AI	Analog Input	Analog input
AIM	Active Interface Module	Active Interface Module
ALM	Active Line Module	Active Line Module
AO	Analog Output	Analog output
AOP	Advanced Operator Panel	Advanced Operator Panel
APC	Advanced Positioning Control	Advanced positioning control
AR	Automatic Restart	Automatic restart
ASC	Armature Short-Circuit	Armature short-circuit
ASCII	American Standard Code for Information Interchange	American Standard Code for Information Interchange
ASM	Asynchronmotor	Induction motor
B		
BERO	-	Tradename for a type of contactless proximity switch
BI	Binector Input	Binector input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	German Institute for Occupational Safety
BICO	Binector Connector Technology	Binector connector technology
BLM	Basic Line Module	Basic Line Module
BO	Binector Output	Binector output
BOP	Basic Operator Panel	Basic Operator Panel

Abbreviation	Derivation of abbreviation	Meaning
C		
C	Capacitance	Capacitance
C...	-	Safety message
CAN	Controller Area Network	Serial bus system
CBC	Communication Board CAN	CAN communication board
CD	Compact Disc	Compact Disc
CDS	Command Data Set	Command data set
CF Card	CompactFlash Card	CompactFlash card
CI	Connector Input	Connector input
CLC	Clearance Control	Clearance control
CNC	Computer Numerical Control	Computer numerical control
CO	Connector Output	Connector output
CO/BO	Connector Output/Binector Output	Connector output/Binector output
COB-ID	CAN Object-Identification	CAN object identification
COM	Common contact of a change-over relay	Common contact of a change-over relay
COMM	Commissioning	Commissioning
CP	Communications Processor	Communications processor
CPU	Central Processing Unit	Central processing unit
CRC	Cyclic Redundancy Check	Cyclic redundancy check
CSM	Control Supply Module	Control Supply Module
CU	Control Unit	Control Unit
D		
DAC	Digital Analog Converter	Digital Analog Converter
DC	Direct Current	Direct current
DCB	Drive Control Block	Drive Control Block
DCC	Drive Control Chart	Drive Control Chart
DCC	Data Cross-Check	Data cross-check
DCN	Direct Current Negative	Direct current negative
DCP	Direct Current Positive	Direct current positive
DDS	Drive Data Set	Drive data set
DI	Digital Input	Digital input
DI/DO	Digital Input/Digital Output	Bidirectional digital input/digital output
DMC	DRIVE-CLiQ Hub Module Cabinet	DRIVE-CLiQ Hub Module Cabinet
DME	DRIVE-CLiQ Hub Module External	DRIVE-CLiQ Hub Module External
DO	Digital Output	Digital output
DO	Drive Object	Drive object
DP	Distributed I/Os	Distributed I/Os
DPRAM	Dual-Port Random Access Memory	Dual-Port Random Access Memory

Abbreviation	Derivation of abbreviation	Meaning
DRAM	Dynamic Random Access Memory	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic servo control
E		
EASC	External Armature Short-Circuit	External armature short-circuit
EDS	Encoder Data Set	Encoder data set
ELCB	Earth Leakage Circuit Breaker	Earth leakage circuit breaker
ELP	Earth Leakage Protection	Earth leakage protection
EMC	Electromagnetic Compatibility	Electromagnetic compatibility
EMF	Electromagnetic Force	Electromagnetic force
EN	Europäische Norm	European Standard
EnDat	Encoder-Data-Interface	Encoder interface
EP	Enable Pulses	Enable Pulses
EPOS	Einfachpositionierer	Basic positioner
ES	Engineering System	Engineering system
ESB	Ersatzschaltbild	Equivalent circuit diagram
ESD	Electrostatic Sensitive Devices	Electrostatic sensitive devices
ESR	Extended Stop and Retract	Extended stop and retract
F		
F...	Fault	Fault
FAQ	Frequently Asked Questions	Frequently asked questions
FBL	Free Blocks	Free function blocks
FCC	Function Control Chart	Function Control Chart
FCC	Flux Current Control	Flux current control
FD	Function Diagram	Function diagram
F-DI	Failsafe Digital Input	Failsafe digital input
F-DO	Failsafe Digital Output	Failsafe digital output
FEM	Fremderregter Synchronmotor	Separate-field synchronous motor
FEPROM	Flash-EPROM	Non-volatile write and read memory
FG	Function Generator	Function generator
FI	-	Fault current
FO	Fiber-Optic Cable	Fiber optic cable
FPGA	Field Programmable Gate Array	Field Programmable Gate Array
FW	Firmware	Firmware

Abbreviation	Derivation of abbreviation	Meaning
G		
GB	Gigabyte	Gigabyte
GC	Global Control	Global Control Telegram (Broadcast Telegram)
GND	Ground	Reference potential for all signal and operating voltages, usually defined with 0 V (also designated as M)
GSD	Gerätestammdatei	Device master file: describes the features of a PROFIBUS slave
GSV	Gate Supply Voltage	Gate supply voltage
GUID	Globally Unique Identifier	Globally unique identifier
H		
HF	High Frequency	High frequency
HFD	Hochfrequenzdrossel	High-frequency reactor
HMI	Human Machine Interface	Human Machine Interface
HTL	High-Threshold Logic	High-threshold logic
HW	Hardware	Hardware
I		
I/O	Input/Output	Input/Output
I2C	Inter Integrated Circuit	Internal serial data bus
IASC	Internal Armature Short-Circuit	Internal armature short-circuit
ID	Identifier	Identifier
IEC	International Electrotechnical Commission	International standard in electrical engineering
IF	Interface	Interface
IGBT	Insulated Gate Bipolar Transistor	Bipolar transistor with insulated control electrode
IGCT	Integrated Gate-Controlled Thyristor	Semiconductor circuit-breaker with integrated control electrode
IL	Impulslöschung	Pulse suppression
IP	Internet Protocol	Internet Protocol
IPO	Interpolator	Interpolator
IT	Isolé Terré	Insulated three-phase supply system
IVP	Internal Voltage Protection	Internal voltage protection
J		
JOG	Jogging	Jogging
K		
KIP	Kinetische Pufferung	Kinetic buffering

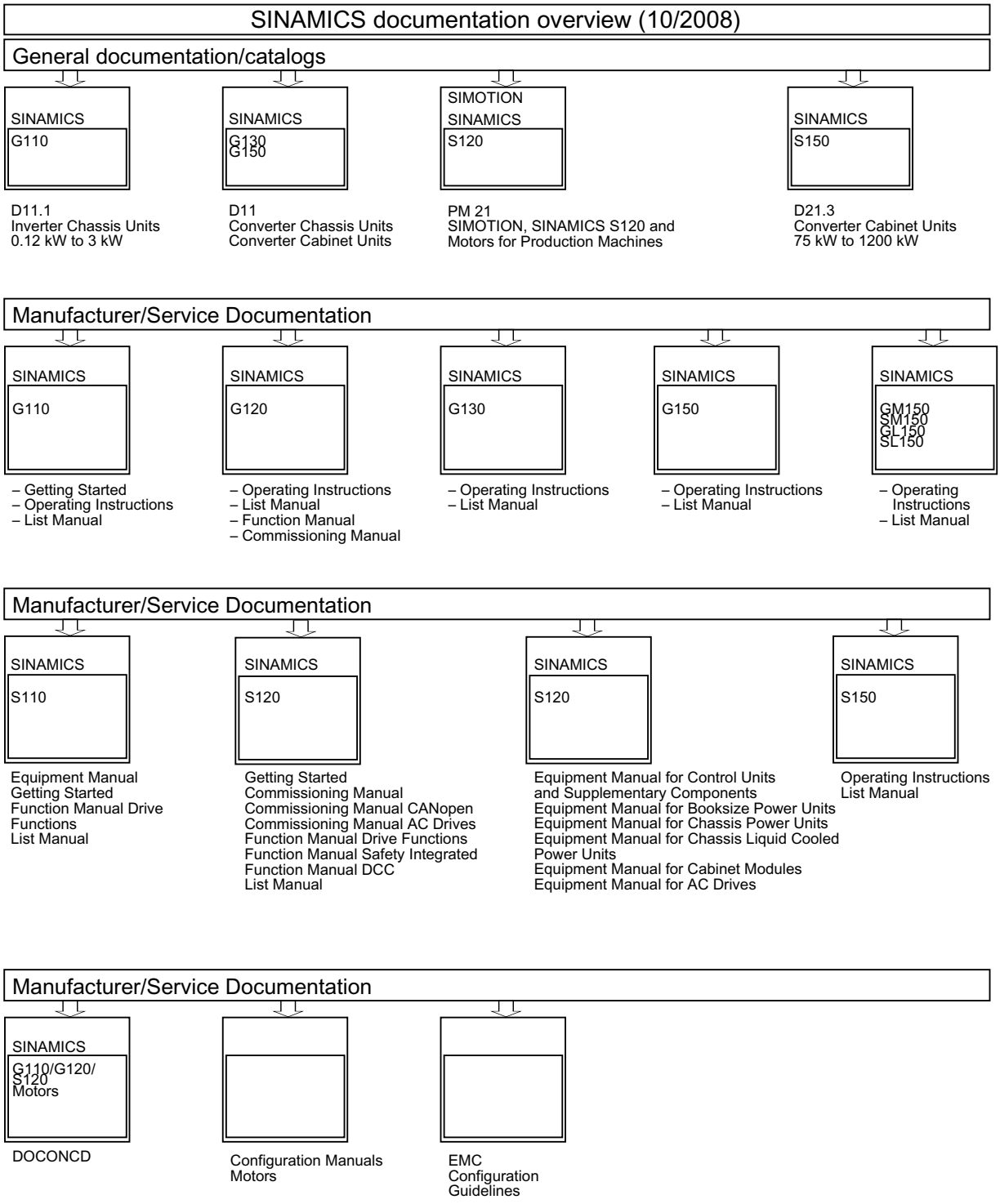
Abbreviation	Derivation of abbreviation	Meaning
Kp	-	Proportional gain
KTY	-	Special temperature sensor
L		
L	-	Formula symbol for inductance
LED	Light Emitting Diode	Light Emitting Diode
LIN	Linearmotor	Linear motor
LR	Lageregler	Position controller
LSB	Least Significant Bit	Least Significant Bit
LSC	Line-Side Converter	Line-Side Converter
LSS	Line Side Switch	Line Side Switch
LU	Length Unit	Length Unit
M		
M	-	Formula symbol for torque
M	Masse	Reference potential for all signal and operating voltages, usually defined with 0 V (also designated as GND)
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDS	Motor Data Set	Motor data set
MLFB	Maschinenlesbare Fabrikatebezeichnung	Machine-readable product designation
MMC	Man-Machine Communication	Man-Machine Communication
MMC	Micro Memory Card	Micro Memory Card
MSB	Most Significant Bit	Most Significant Bit
MSC	Motor-Side Converter	Motor-Side Converter
MSCY_C1	Master Slave Cycle Class 1	Cyclic communication between master (class 1) and slave
MT	Messtaster	Probe
N		
N. C.	Not Connected	Not connected
N...	No Report	No report or internal message
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie	Standardization association for measurement and control in chemical indstries
NC	Normally Closed (contact)	Normally Closed (contact)
NC	Numerical Control	Numerical control
NEMA	National Electrical Manufacturers Association	Standards association in USA
NO	Normally Open (contact)	Normally Open (contact)
O		
OA	Open Architecture	Open Architecture

Abbreviation	Derivation of abbreviation	Meaning
OC	Operating Condition	Operating condition
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
OLP	Optical Link Plug	Optical link plug
OMI	Option Module Interface	Option Module Interface
P		
p...	-	Setting parameter
PB	PROFIBUS	PROFIBUS
PcCtrl	PC Control	Master control
PD	PROFIdrive	PROFIdrive
PDS	Power unit Data Set	Power unit data set
PE	Protective Earth	Protective Earth
PELV	Protective Extra Low Voltage	Protective Extra Low Voltage
PEM	Permanenterregter Synchronmotor	Permanent-field synchronous motor
PG	Programmiergerät	Programming device
PI	Proportional Integral	Proportional Integral
PID	Proportional Integral Differential	Proportional Integral Differential
PLC	Programmable Logic Controller	Programmable logic controller
PLL	Phase-Locked Loop	Phase-Locked Loop
PN	PROFINET	PROFINET
PNO	PROFIBUS Nutzerorganisation	PROFIBUS User Organization (PROFIBUS International)
PPI	Point to Point Interface	Point to point interface
PRBS	Pseudo Random Binary Signal	Pseudo Random Binary Signal
PROFIBUS	Process Field Bus	Serial data bus
PS	Power Supply	Power supply
PSA	Power Stack Adapter	Power stack adapter
PTC	Positive Temperature Coefficient	Positive Temperature Coefficient
PTP	Point-To-Point	Point-to-point
PWM	Pulse Width Modulation	Pulse width modulation
PZD	Prozessdaten	Process data
Q		
R		
r...	-	Display parameter (read only)
RAM	Random Access Memory	Read and write memory
RCCB	Residual Current Circuit Breaker	Residual current circuit breaker
RCD	Residual Current Device	Residual current device
RFG	Ramp-Function Generator	Ramp-function generator

Abbreviation	Derivation of abbreviation	Meaning
RJ45	Registered Jack 45	Describes an 8-pole connector system for data transfer with shielded or unshielded multicore copper cables
RKA	Rückkühlanlage	Cooling unit
RO	Read Only	Read only
RPDO	Receive Process Data Object	Receive Process Data Object
RS232	Recommended Standard 232	Interface standard for conducted serial data transfer between a transmitter and a receiver (also designated as EIA232)
RS485	Recommended Standard 485	Interface standard for a conducted differential, parallel and/or serial bus system (data transfer between several transmitters and receivers, also designated as EIA485)
RTC	Real Time Clock	Real time clock
S		
S1	-	Continuous duty
S3	-	Intermittent duty
SBC	Safe Brake Control	Safe brake control
SBH	Sicherer Betriebshalt	Safe Operating Stop
SBR	-	Safe Acceleration Monitor
SCA	Safe Cam	Safe cam
SD Card	SecureDigital Card	Secure Digital Card
SE	Sicherer Software-Endschalter	Safe software limit switch
SG	Sicher reduzierte Geschwindigkeit	Safely reduced speed
SGA	Sicherheitsgerichteter Ausgang	Safety-related output
SGE	Sicherheitsgerichteter Eingang	Safety-related input
SH	Sicherer Halt	Safe standstill
SP	Safety Integrated	Safety Integrated
SIL	Safety Integrity Level	Safety Integrity Level
SLM	Smart Line Module	Smart Line Module
SLP	Safely-Limited Position	Safely-Limited Position
SLS	Safely-Limited Speed	Safely Limited Speed
SLVC	Sensorless Vector Control	Sensorless Vector Control
SM	Sensor Module	Sensor Module
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SME	Sensor Module External	Sensor Module External
SN	Sicherer Software-Nocken	Safe software cam
SOS	Safe Operating Stop	Safe operating stop
SP	Service Pack	Service pack
SPC	Setpoint Channel	Setpoint channel

Abbreviation	Derivation of abbreviation	Meaning
SPI	Serial Peripheral Interface	Serial I/O interface
SS1	Safe Stop 1	Safe Stop 1 (time-monitored, ramp-monitored)
SS2	Safe Stop 2	Safe Stop 2
SSI	Synchronous Serial Interface	Synchronous serial interface
SSM	Safe Speed Monitor	Safe feedback from speed monitor (n < nx)
SSR	Safe Stop Ramp	Safe brake ramp
STO	Safe Torque Off	Safely switched-off torque
STW	Steuerwort	Control word
SVA	Space-vector approximation	Space-vector approximation
T		
TB	Terminal Board	Terminal Board
TIA	Totally Integrated Automation	Totally Integrated Automation
TM	Terminal Module	Terminal Module
TN	Terre Neutre	Grounded three-phase supply system
Tn	-	Integral time
TPDO	Transmit Process Data Object	Transmit Process Data Object
TT	Terre Terre	Grounded three-phase supply system
TTL	Transistor-Transistor Logic	Transistor-Transistor-Logic
Tv	-	Derivative action time
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
UPS	Uninterruptible Power Supply	Uninterruptible power supply
V		
VC	Vector Control	Vector control
Vdc	-	DC link voltage
VdcN	-	Partial DC link voltage negative
VdcP	-	Partial DC link voltage positive
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	Verein Deutscher Ingenieure	Assocation of German Engineers
VPM	Voltage Protection Module	Voltage Protection Module
Vpp	Volt peak to peak	Volt peak to peak
VSM	Voltage Sensing Module	Voltage Sensing Module
W		
WZM	Werkzeugmaschine	Machine tool
X		
XML	Extensible Markup Language	Extensible Markup Language (standard language for Web publishing and document management)

Abbreviation	Derivation of abbreviation	Meaning
Y		
Z		
ZK	Zwischenkreis	DC link
ZM	Zero Mark	Zero mark
ZSW	Zustandswort	Status word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Suggestions and/or corrections

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