SINAMICS S120

Control Units and additional system components

Manual · 01/2011

SINAMICS

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S120
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Manual

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

Proper use of Siemens products

Note the following:

⚠WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be 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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Ⓟ 12/2010

Preface

SINAMICS documentation

The SINAMICS documentation is organized in the following categories:

- General documentation/catalogs
- User documentation
- Manufacturer/service documentation

More information

Using the following link, you can find information on the topics:

- Ordering documentation/overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

http://www.siemens.com/motioncontrol/docu

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following e-mail address: docu.motioncontrol@siemens.com

My Documentation Manager

Using the following link, you can find information on how to create your own individual documentation based on Siemens' content, and adapt it for your own machine documentation:

http://www.siemens.com/mdm

Training

Using the following link, you can find information on SITRAIN - training from Siemens for products, systems and automation engineering solutions:

http://www.siemens.com/sitrain

FAQs

You can find Frequently Asked Questions in the Service&Support pages under **Product Support**:

http://support.automation.siemens.com

SINAMICS

You can find information on SINAMICS at:

http://www.siemens.com/sinamics

Usage phases and the available tools/documents

Table 1 Usage phases and the available tools/documents

Usage phase	Tools
Orientation	SINAMICS S sales documentation
Planning/engineering	• SIZER configuration tool • Configuration manuals, motors
Decision making/ordering	SINAMICS S Catalogs
Configuring/installation	• SINAMICS S120 Equipment Manual for Control Units and Additional System Components • SINAMICS S120 Equipment Manual for Booksize Power Units • SINAMICS S120 Equipment Manual for Chassis Power Units • SINAMICS S120 Manual for AC Drives
Commissioning	• STARTER commissioning tool • SINAMICS S120 Getting Started • SINAMICS S120 Commissioning Manual • SINAMICS S120 CANopen Commissioning Manual • SINAMICS S120 Function Manual • SINAMICS S120/S150 List Manual
Using/operating	• SINAMICS S120 Commissioning Manual • SINAMICS S120/S150 List Manual
Maintenance/Service	• SINAMICS S120 Commissioning Manual • SINAMICS S120/S150 List Manual
List of references	• SINAMICS S120/S150 List Manual

Target group

This documentation is intended for machine manufacturers, commissioning engineers, and service personnel who use the SINAMICS drive system.

Benefits

This Manual provides all the information, procedures and operational instructions required for commissioning and servicing SINAMICS S120.

Standard scope

The scope of the functionality described in this document may differ from the scope of the functionality of the drive system that is actually supplied.

- Other 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.
- The documentation can also contain descriptions of functions that are not available in a particular product version of the drive system. The functionalities of the supplied drive system should only be taken from the ordering documentation.
- Extensions or changes made by the machine manufacturer must be documented by the machine manufacturer.

For reasons of clarity, this documentation does not contain all of the detailed information on all of the product types. This documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

Technical Support

Country-specific telephone numbers for technical support are provided in the Internet under Contact:

http://www.siemens.com/automation/service&support

EC Declarations of Conformity

The EC Declaration of Conformity for the EMC Directive can be found on the Internet at:

http://support.automation.siemens.com

There – as a search term – enter the number 15257461 or contact your local Siemens office.

The EC Declaration of Conformity for the Low Voltage Directive can be found on the Internet at:

http://support.automation.siemens.com

There – as a search term – enter the number 22383669

Spare parts

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

Test certificates

The Safety Integrated functions of SINAMICS components are generally certified by independent institutes. An up-to-date list of already certified components is available on request from your local Siemens office. If you have any questions relating to certifications that have not been completed, please ask your Siemens contact.

ESD information

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) that occur during operation can pose a danger to persons who are present in the direct vicinity of the product - especially persons with pacemakers, implants, or similar devices.

The relevant directives and standards must be observed by the machine/plant operators and persons 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 persons are derived and applied, and exposure and danger zones are defined and observed.

The relevant safety notes in each chapter must be observed.

General safety guidelines

⚠ DANGER
Commissioning is absolutely prohibited until it has been completely ensured that the machine, in which the components described here are to be installed, is in full compliance with the provisions of the EC Machinery Directive. Only qualified personnel may install, commission and service SINAMICS S 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 may cause serious injuries or death when touched. 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. According to EN 61800-5-1 and UL 508, only safely isolated protective extra-low voltages may be connected to any of the terminals on the electronic modules.

⚠ 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, other protective measures against electric shock must be applied, e.g., shock-hazard protection.

CAUTION
Operating the components in the immediate vicinity (< 1.5 m) of mobile telephones with a transmitting power of > 1 W may lead to incorrect functioning of the devices.

Explanation of symbols

Table 2 Symbols

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

Residual risks

Residual risks of power drive systems

The control and drive components of a power drive system (PDS) are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used.

These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety information and instructions on the components and in the associated technical user documentation.

When carrying out a risk assessment of a 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
   - Condensation / conductive contamination
   - 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. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Note

Functional safety of SINAMICS components

The components must be protected against conductive contamination (e.g. by installing them in a cabinet with degree of protection IP54B to EN 60529).

Assuming that conductive contamination at the installation site can definitely be excluded, a lower degree of cabinet protection may be permitted.

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

Table of contents

System overview

1

1.1 Field of application

SINAMICS is the family of drives from Siemens designed for machine 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.
- High-precision servo drives in the manufacture of wind turbines
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines.

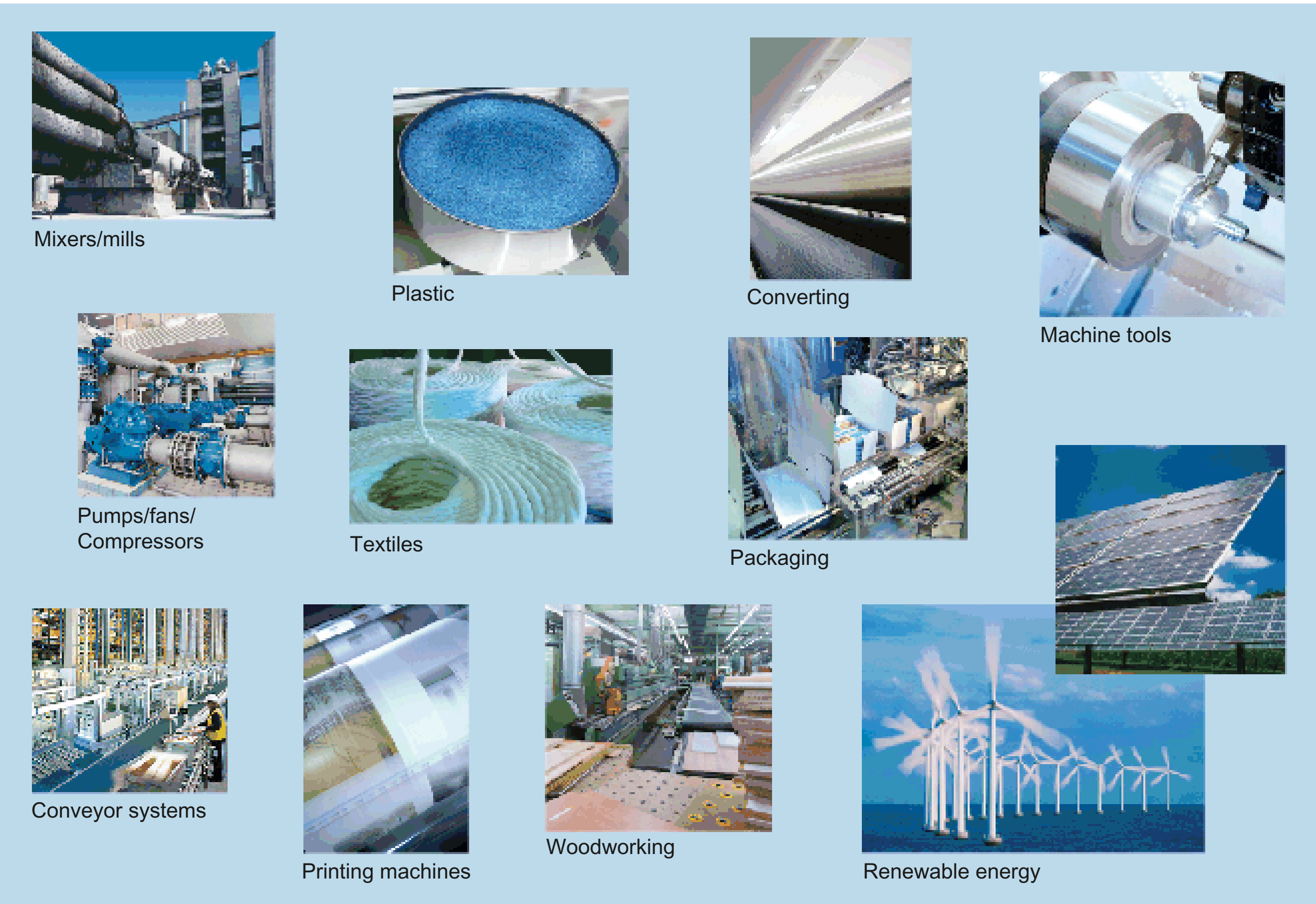


Figure 1-1 SINAMICS applications

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

- SINAMICS G is designed for standard applications with induction motors. These applications have less stringent requirements regarding the dynamic performance of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous/induction motors and fulfills stringent requirements regarding
  - the dynamic performance and accuracy
  - the integration of extensive technological functions in the drive control system
- SINAMICS DC MASTER is the DC drive belonging to the SINAMICS family. As a result of its standard expandability, it addresses both basic as well as demanding drive applications and in complementary markets.

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.

Totally Integrated Automation (TIA) with SINAMICS S120

Apart from SIMATIC, SIMOTION and SINUMERIK, SINAMICS is one of the core components of TIA. The STARTER commissioning tool is an integral element of the TIA platform. It is thus possible to parameterize, program and commission all components in the automation system using a standardized engineering platform and without any gaps. The system-wide data management functions ensure consistent data and simplify archiving of the entire plant project.

PROFIBUS DP, the standard fieldbus of the TIA system, is supported by all SINAMICS S120 variants. It provides a high-performance, system-wide communication network which links all automation components: HMI, controls, drives and I/O devices.

SINAMICS S120 is also available with a PROFINET interface. This Ethernet-based bus enables control data to be exchanged at high speed via PROFINET IO with IRT or RT and makes SINAMICS S120 a suitable choice for integration in top-performance multi-axis applications. At the same time, PROFINET also uses standard IT mechanisms (TCP/IP) to transport information, e.g. operating and diagnostic data, to higher-level systems. This makes it easy to integrate into an IT corporate network.

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

1.3 Introduction

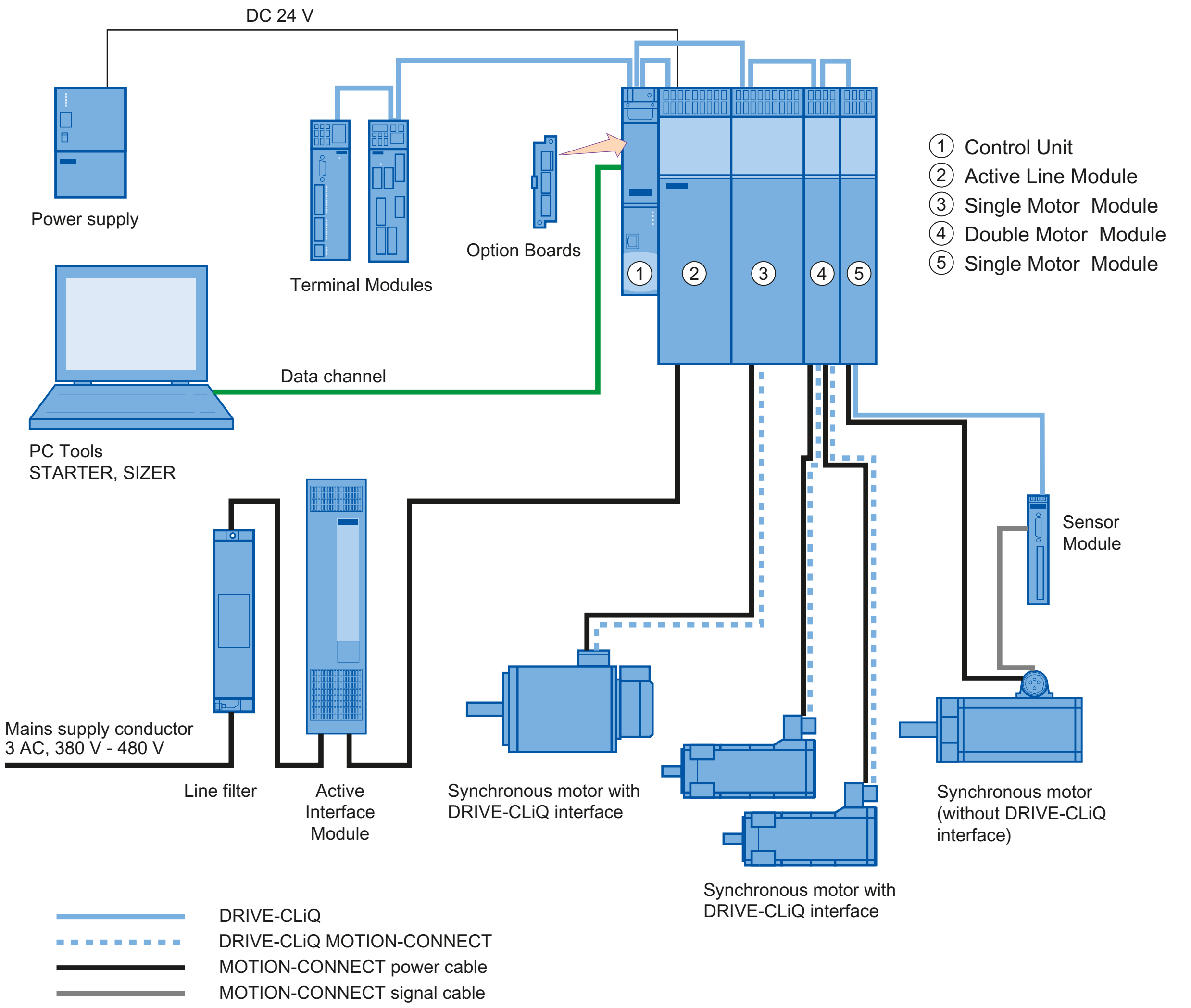


Figure 1-3 SINAMICS S120 system overview

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.

System architecture with a central Control Unit

On the SINAMICS S120, the drive intelligence is combined with closed-loop control functions into Control Units. These units are capable of controlling drives in the vector, servo and V/f modes. They also perform the speed and torque control functions plus other intelligent drive functions for all axes on the drive. Inter-axis connections can be established within a component and easily configured in the STARTER commissioning tool using a mouse.

Functions for higher efficiency

- Basic functions: Speed control, torque control, positioning functions
- Intelligent starting functions for independent restart after power supply interruption
- BICO technology with interconnection of drive-related I/Os for easy adaptation of the drive system to its operating environment
- Integrated safety functions for rational implementation of safety concepts
- Regulated infeed/regenerative feedback functions for preventing undesirable reactions on the supply, allowing recovery of braking energy and ensuring greater stability against line fluctuations.

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

An important digital linkage element of the SINAMICS S120 drive system are the electronic type plates integrated in every component. They allow all drive components to be detected automatically via a DRIVE-CLiQ link. As a result, data do not need to be entered manually during commissioning or component replacement – helping to ensure that drives are commissioned successfully!

The 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.

In addition to the technical data, the rating plate includes logistical data (manufacturer ID, order number, and 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.

1.4 SINAMICS S120 Components

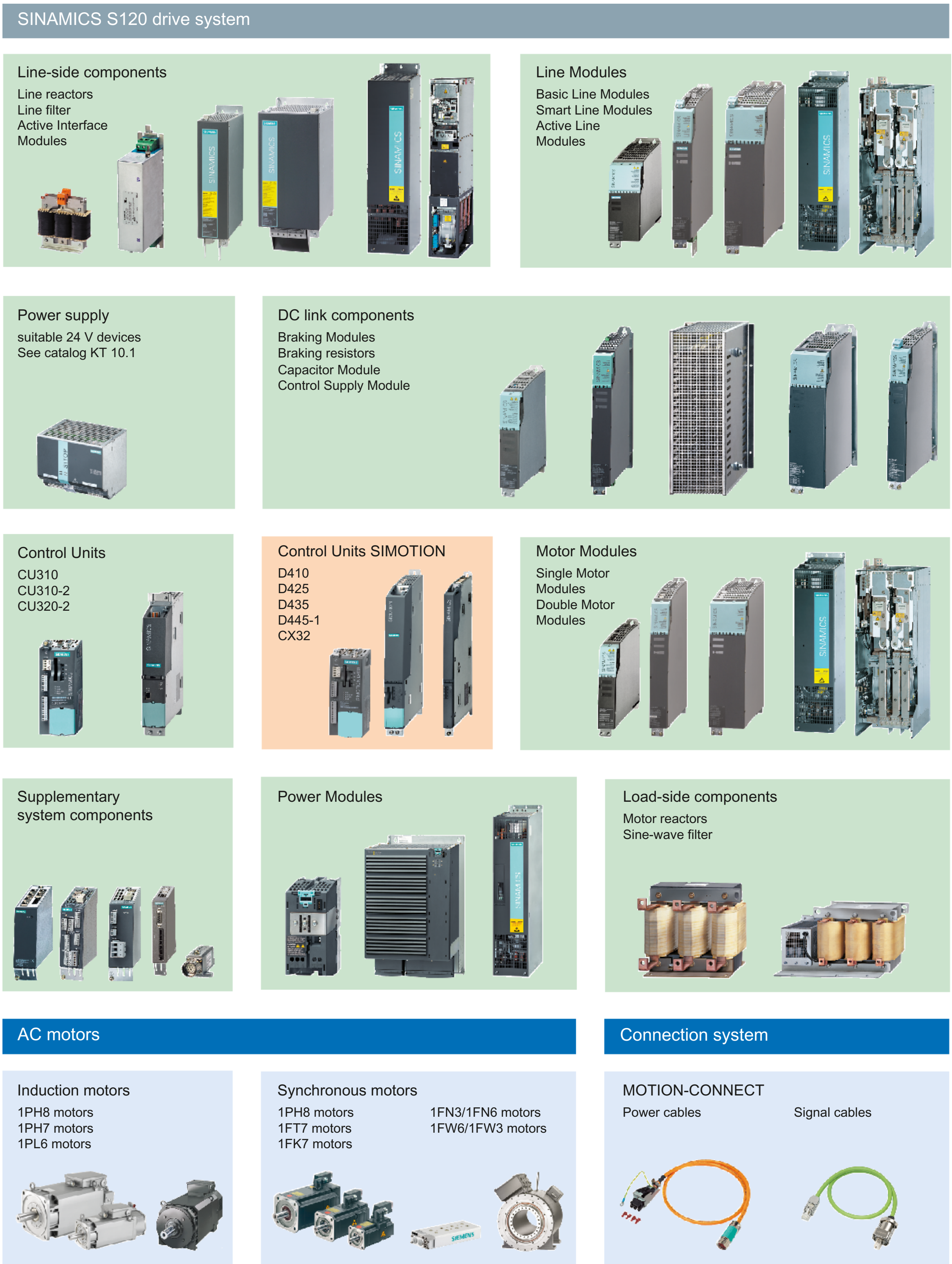


Figure 1-4 Overview of SINAMICS S120 components

System components

- 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:

- Control Units that processes the 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 are intended 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

Note

Installation location in the cabinet

The SINAMICS S120 components must always be mounted vertically in the cabinet. Other permissible installation locations are given in the descriptions for the individual components.

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
- Liquid Cooled

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 compact 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.

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

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 data	
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	
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.
Protection class for line current circuits Protection class for 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 of 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 environmental 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 atmospheric humidity 5% to 90% Oil mist, salt mist, icing, condensation, dripping, spraying, splashing, and water jet 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)
Approvals	cULus

1.6 Standards

Note

The standards listed in the table below are non-binding and do not in any way claim to be complete. The standards listed do not represent a guaranteed property of the product.

Only the statements made in the Declaration of Conformity shall be deemed binding.

Table 1- 1 Fundamental, application-relevant standards in succession: EN, IEC/ISO, DIN, VDE

Standards*	Title
EN 1037 ISO 14118 DIN EN 1037	Safety of machinery; avoiding unexpected starting
EN ISO 9001 ISO 9001 DIN EN ISO 9001	Quality management systems - requirements
EN ISO 12100-x ISO 12100-x DIN EN ISO 12100-x	Safety of Machinery; General Design Guidelines; Part 1: Basic terminology, methodology Part 2: Technical Principles and Specifications
EN ISO 13849-x ISO 13849-x DIN EN ISO 13849-x	Safety of machinery; safety-related parts of control systems; Part 1: General basic design principles Part 2: Validation
EN ISO 14121-1 ISO 14121-1 DIN EN ISO 14121-1	Safety of Machinery - Risk Assessment; Part 1: Guidelines
EN 55011 CISPR 11 DIN EN 55011 VDE 0875-11	Industrial, scientific and medical high-frequency devices (ISM devices) - radio interference - limit values and measuring techniques
EN 60146-1-1 IEC 60146-1-1 DIN EN 60146-1-1 VDE 0558-11	Semiconductor converters; general requirements and line-commutated converters; Part 1-1: Defining the basic requirements
EN 60204-1 IEC 60204-1 DIN EN 60204-1 VDE 0113-1	Electrical equipment of machines; Part 1: General definitions
EN 60228 IEC 60228 DIN EN 60228 VDE0295	Conductors for cables and insulated leads
EN 60269-1 IEC 60269-1 DIN EN 60269-1 VDE 0636-1	Low-voltage fuses; Part 1: General requirements

Standards*	Title
IEC 60287-1 to -3	Cables - Calculation of the current carrying capacity Part 1: Current carrying capacity equations (100 % load factor) and calculating the losses Part 2: Thermal resistance - Part 3: Main sections for operating conditions
HD 60364-x-x IEC 60364-x-x DIN VDE 0100-x-x VDE 0100-x-x	Erection of power installations with nominal voltages up to 1000 V; Part 200: Definitions Part 410: Protection for safety, protection against electric shock Part 420: Protection for safety, protection against thermal effects Part 430: Protection of cables and conductors for over-current Part 450: Protection for safety, protection against undervoltage Part 470: Protection for safety; use of protection for safety Part 5xx: Selecting and erecting electrical equipment Part 520: Wiring systems Part 540: Earthing, protective conductor, potential bonding conductor Part 560: Electrical equipment for safety purposes
EN 60439 IEC 60439 DIN EN 60439 VDE 0660-500	Low-voltage switchgear assemblies; Part 1: Type-tested and partially type-tested assemblies
EN 60529 IEC 60529 DIN EN 60529 VDE 0470-1	Degrees of protection provided by enclosures (IP code)
EN 60721-3-x IEC 60721-3-x DIN EN 60721-3-x	Classification of environmental conditions Part 3-0: Classification of environmental parameters and their severities; Introduction Part 3-1: Classification of environmental parameters and their severities; Long-term storage Part 3-2: Classification of environmental parameters and their severities; Transport Part 3-3: Classification of environmental parameters and their severities; stationary use, weather protected
EN 60947-x-x IEC 60947 -x-x DIN EN 60947-x-x VDE 0660-x	Low-voltage switchgear
EN 61000-6-x IEC 61000-6-x DIN EN 61000-6-x VDE 0839-6-x	Electromagnetic compatibility (EMC) Part 6-1: Generic standard; Immunity for residential, commercial and light-industrial environments Part 6-2: Generic standards; Immunity for industrial environments Part 6-3: Generic standards; Generic standard emission for residential, commercial and light-industrial environments Part 6-4: Generic standards; Generic standard noise emission for industrial environments
EN 61140 IEC 61140 DIN EN 61140 VDE 0140-1	Protection against electric shock; Common aspects for installation and equipment
EN 61800-2 IEC 61800-2 DIN EN 61800-2 VDE 0160-102	Adjustable-speed electrical power drive systems; Part 2: General requirements - Rating specifications for low-voltage adjustable frequency a.c. power drive systems
EN 61800-3 IEC 61800-3 DIN EN 61800-3 VDE 0160-103	Adjustable-speed electrical power drive systems; Part 3: EMC - Requirements and specific test methods

Standards*	Title
EN 61800-5-x IEC 61800-5-x DIN EN 61800-5-x VDE 0160-105-x	Adjustable-speed electrical power drive systems; Part 5: Safety requirements; Main section 1: Electrical, thermal and energy requirements Main section 2: Functional safety requirements
EN 62061 IEC 62061 DIN EN 62061 VDE 0113-50	Safety of machinery; Functional safety of safety-related electrical, electronic and programmable electronic control systems
UL 50 CSA C22.2 No. 94.1	Enclosures for Electrical Equipment
UL 508 CSA C22.2 No. 142	Industrial Control Equipment Process Control Equipment
UL 508C CSA C22.2 No. 14	Power Conversion Equipment Industrial Control Equipment

* The technical requirements in the standards listed are not necessarily identical.

1.7 Recycling and disposal

The applicable national guidelines must be observed when disposing of the product.

The products described in this manual are extensively recyclable on account of the low-toxic composition of the materials used. For environmentally-compliant recycling and disposal of your electronic waste, please contact a company for the disposal of electronic waste.

2 Control Units

2.1 Introduction

Description

Control Units CU320-2 DP and CU320-2 PN of the SINAMICS S system are 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 memory card.

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

Compatible firmware versions:

- CU320-2 DP V4.3 or higher
- CU320-2 PN V4.4 or higher

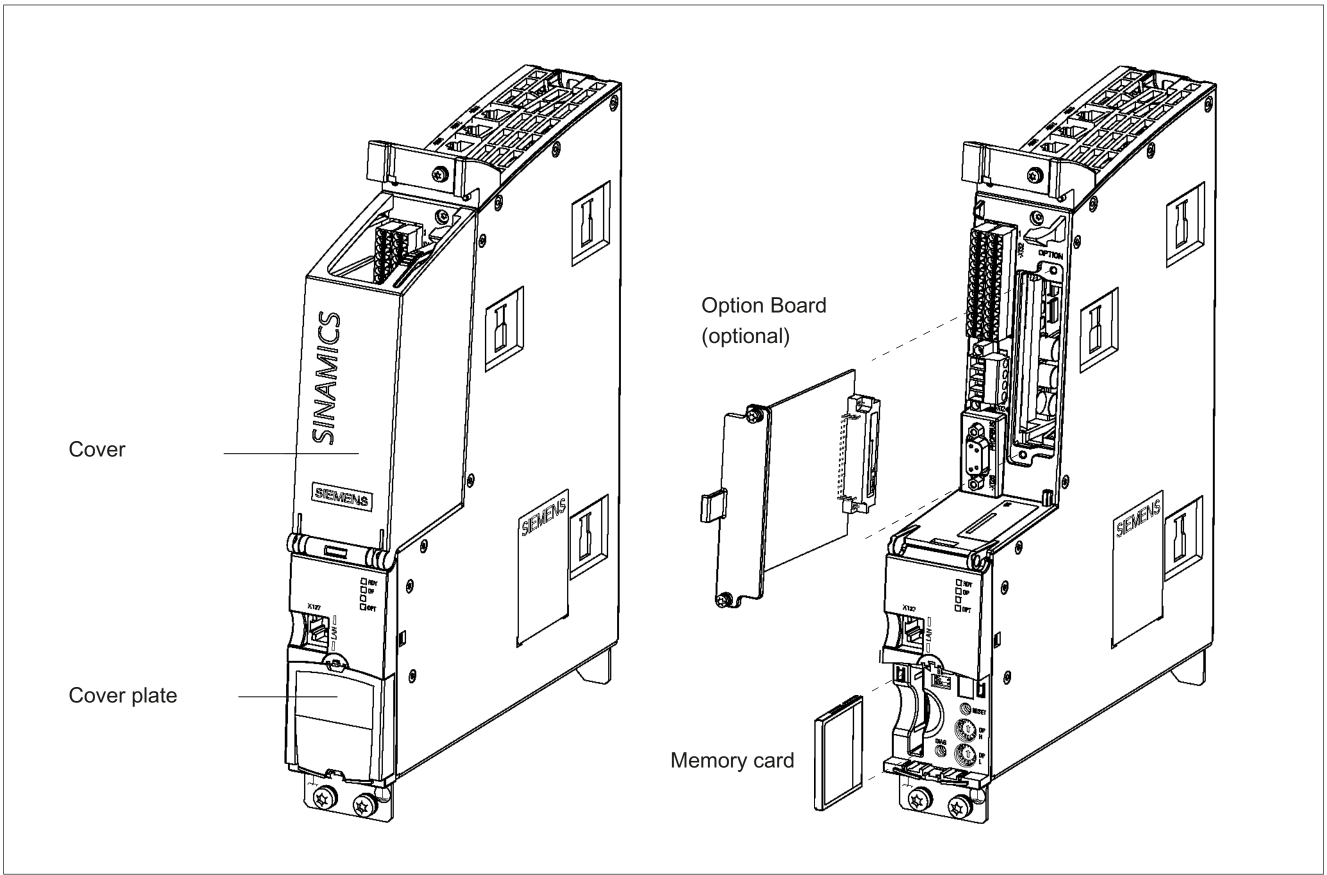


Figure 2-1 Overview, Control Unit CU320-2 DP

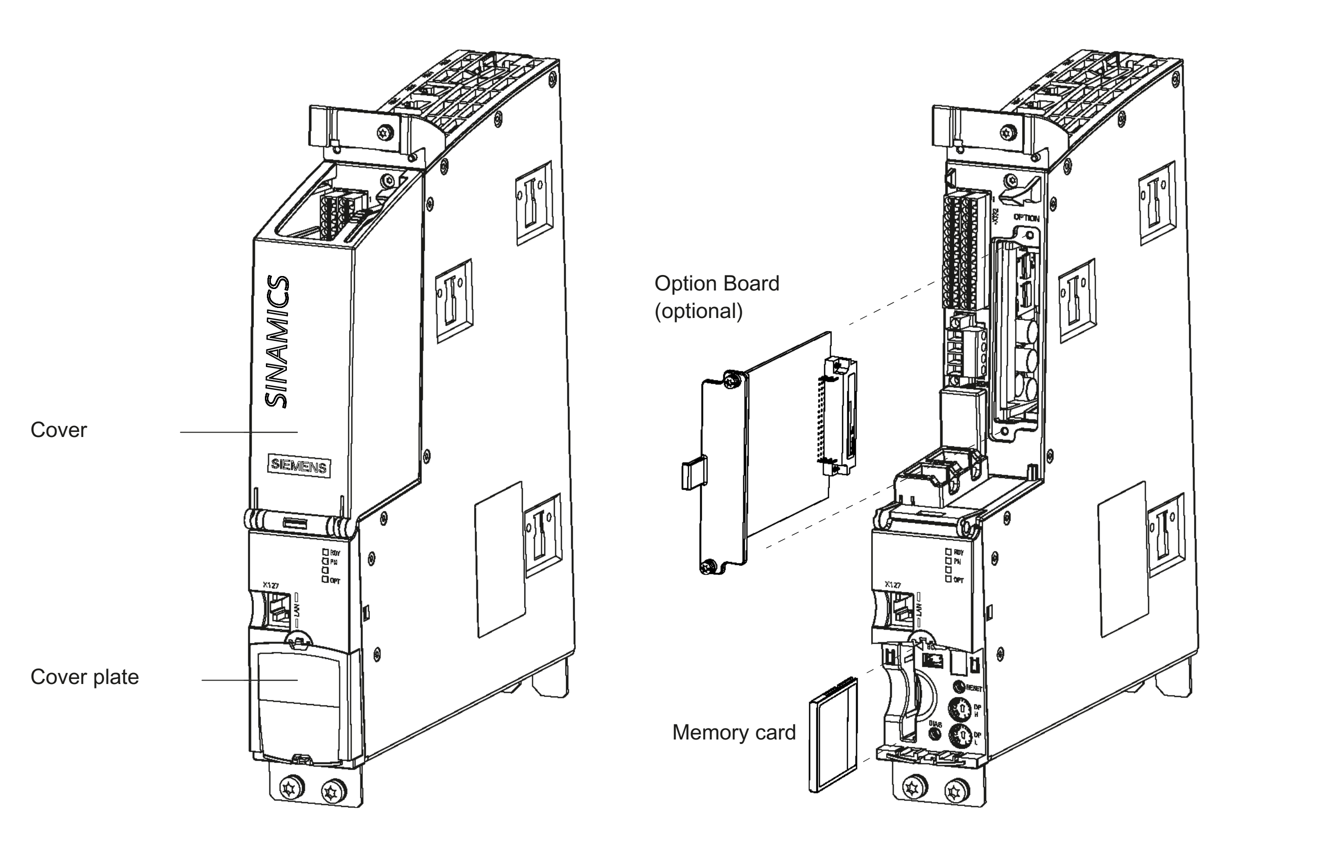


Figure 2-2 Overview, Control Unit CU320-2 PN

Note

The Control Unit, the option board, and the memory 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.

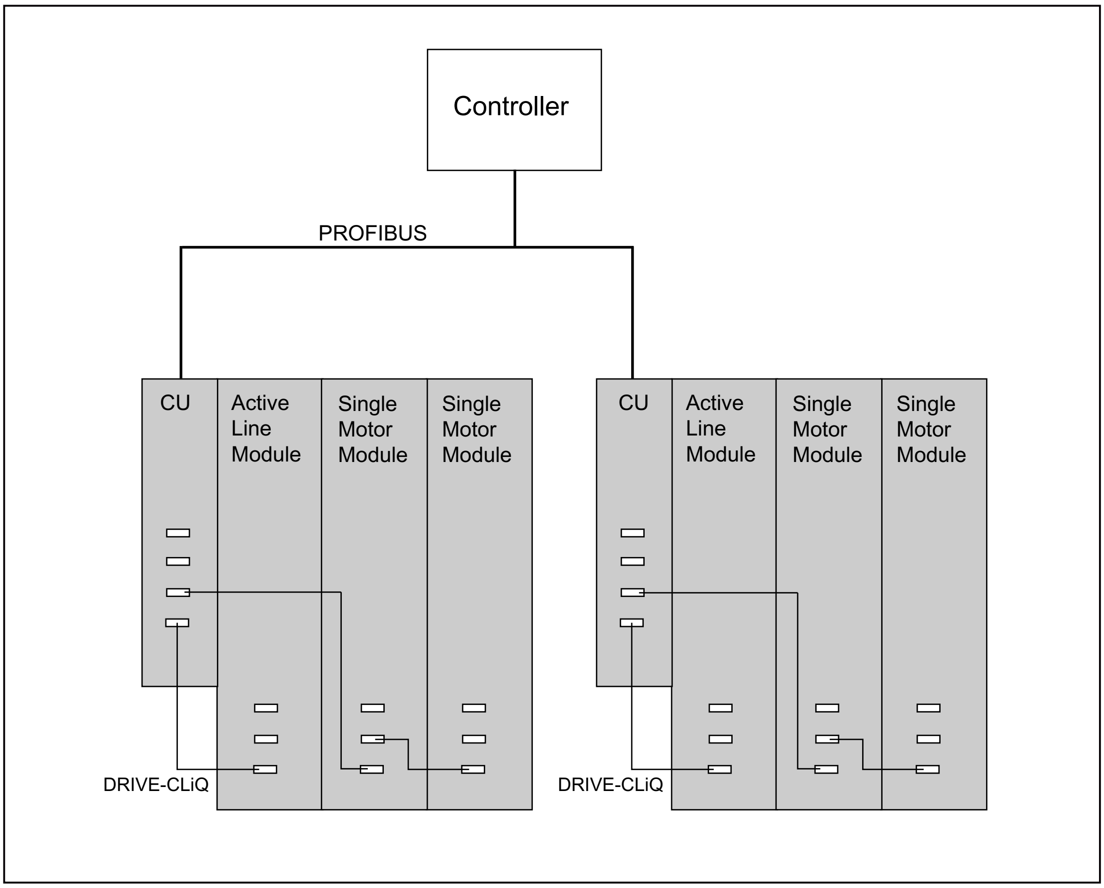


Figure 2-3 Sample configuration

2.2 Control Unit CU320-2 DP (PROFIBUS)

2.2.1 Description

The Control Unit CU320-2 DP 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. It can be used with firmware version 4.3 or higher.

The CU320-2 DP has the following interfaces (ports):

Table 2- 1 Overview of the CU320-2 DP interfaces

Type	Quantity
Digital inputs	12
Digital inputs/outputs	8
DRIVE-CLiQ interfaces	4
PROFIBUS interface	1
LAN (Ethernet)	1
Serial interface (RS232)	1
Option slot	1
Measuring sockets	3

2.2.2 Safety information

⚠ WARNING

The ventilation spaces of 80 mm above and below the component must be observed.

⚠ CAUTION

An equipotential bonding conductor with a cross-section of at least 25 mm² must be used between components in a system that are located at a distance from each other. If an equipotential bonding conductor is not used, high leakage currents that could destroy the Control Unit or other PROFIBUS nodes can be conducted via the PROFIBUS cable.

CAUTION

The Option Board should only be inserted and removed when the Control Unit and Option Board are at zero current.

2.2.3 Interface description

2.2.3.1 Overview

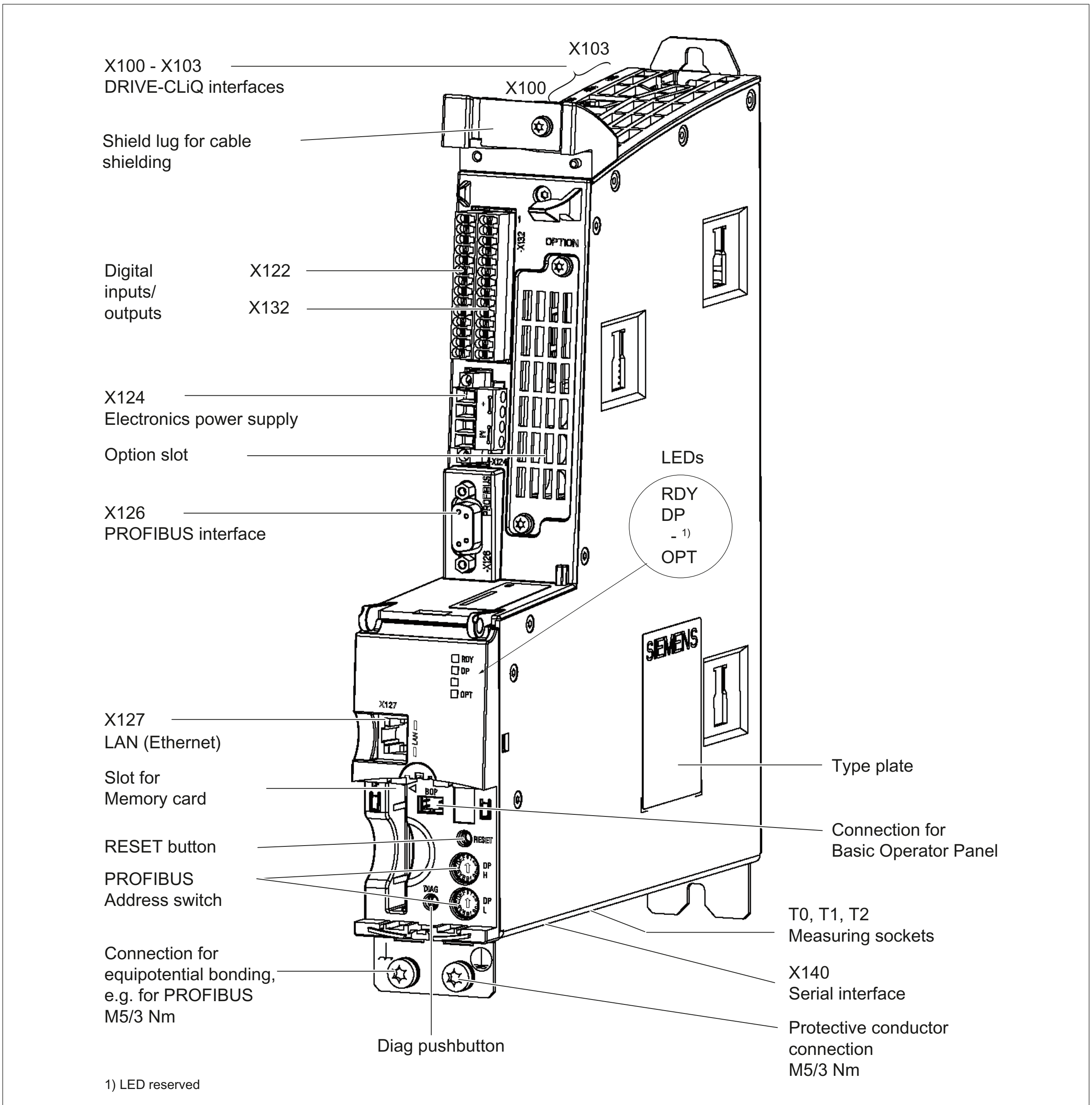


Figure 2-4 Interface description of the CU320-2 DP (covers removed)

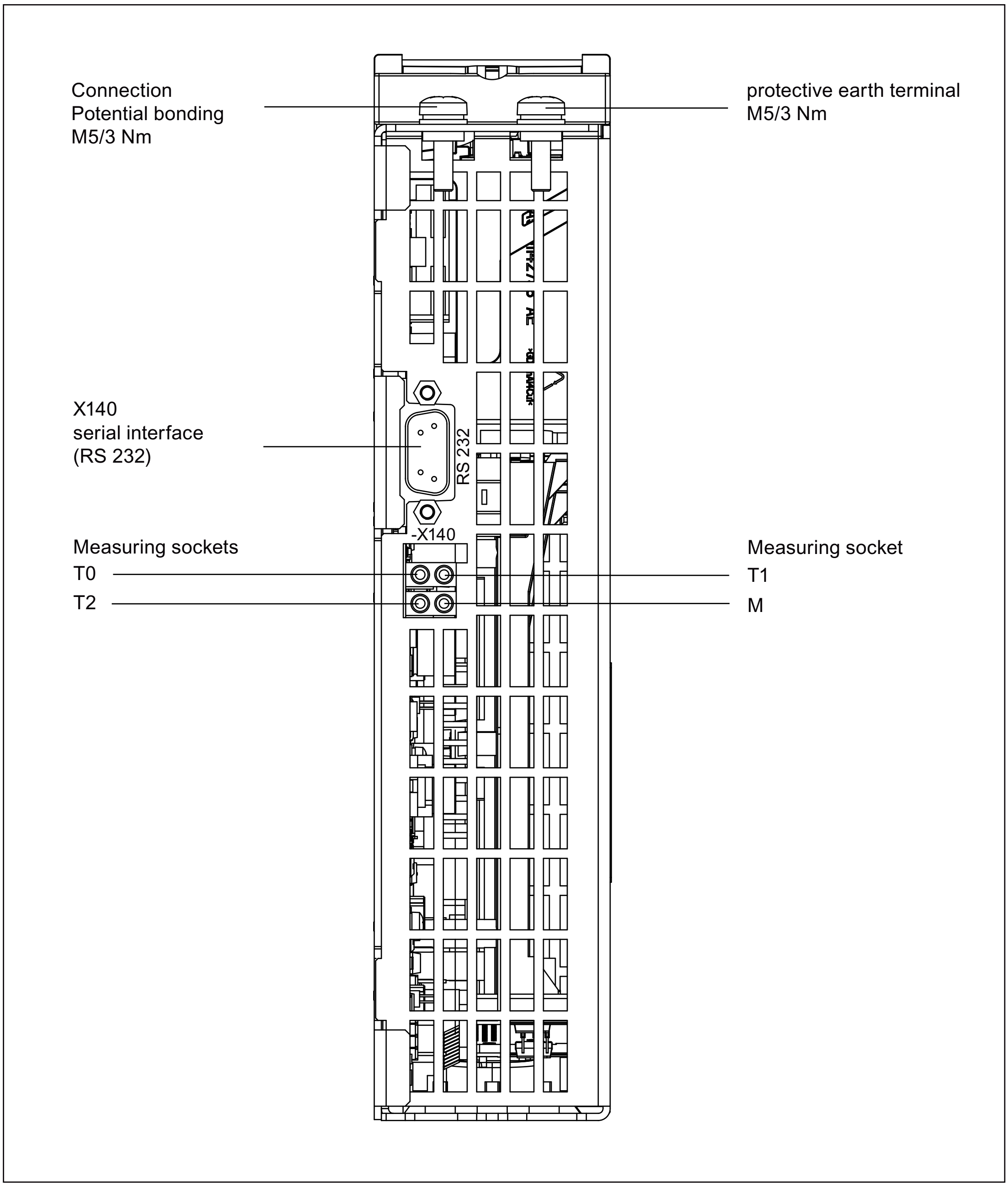
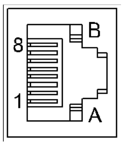


Figure 2-5 Interface X140 and measuring sockets T0 to T2 - CU320-2 DP (view from below)

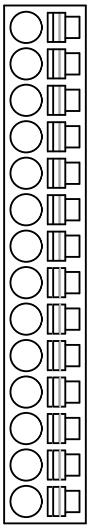
2.2.3.2 X100 - X103 DRIVE-CLiQ interface

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
Connector type: RJ45 socket; blanking plate for DRIVE-CLiQ interface included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

2.2.3.3 X122 Digital inputs/outputs

Table 2- 3 Terminal block X122

	Terminal	Designation 1)	Technical specifications
1 	1	DI 0	Voltage (max.): -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Electrical 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 (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 to 6
	8	M	Ground
	9	DI/DO 8	**As input**: Voltage: -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V DI/DO 8, 9, 10, and 11 are "rapid inputs" 2) Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continued-short-circuit-proof Output delay (typ./max.): 3) For "0" → "1": 150 µs/400 µs For "1" → "0": 75 µs/100 µs Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: 1.5 mm^2 Type: Spring-loaded terminal 3 (see Appendix A)			

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

2) The rapid inputs can be used as probe inputs or as inputs for the external zero mark

3) Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

NOTICE

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M1 must be connected.

This is achieved by:

1. Providing the ground reference of the digital inputs, or
2. A jumper to terminal M.

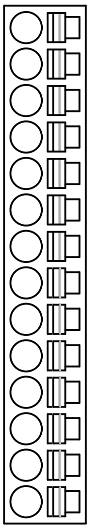
Notice! This removes the electrical isolation for these digital inputs.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

2.2.3.4 X132 Digital inputs/outputs

Table 2- 4 Terminal block X132

	Terminal	Designation 1)	Technical specifications
	1	DI 4	Voltage (max.): -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Electrical isolation: The reference potential is terminal M2 Level (incl. ripple) High level: 15 to 30 V Low level: -3 V to +5 V Input delay (typ.): For "0" → "1": 50 μs For "1" → "0": 150 μs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 to 6
	8	M	Ground
	9	DI/DO 12	**As input**: Voltage: -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Level (incl. ripple) High level: 15 to 30 V Low level: -3 V to +5 V DI/DO 12, 13, 14, and 15 are "rapid inputs" 2) Input delay (typ.): For "0" → "1": 5 μs For "1" → "0": 50 μs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continued-short-circuit-proof Output delay (typ./max.): 3) For "0" → "1": 150 μs/400 μs For "1" → "0": 75 μs/100 μs Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: 1.5 mm^2 Type: Spring-loaded terminal 3 (see Appendix A)			

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

2) The rapid inputs can be used as probe inputs or as inputs for the external zero mark

3) Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

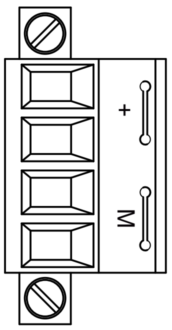
NOTICE
An open input is interpreted as "low". To enable the digital inputs (DI) to function, terminal M2 must be connected. This is achieved by: 1. Routing the ground reference of the digital inputs as well, or 2. A jumper to terminal M. Notice! This removes the electrical isolation for these digital inputs.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

2.2.3.5 X124 Electronics power supply

Table 2- 5 Terminal block X124

	Terminal	Designation	Technical specifications
	+	Electronics power supply	Voltage: 24 V DC (20.4 V to 28.8 V) Current consumption: Max. 1.0 A (without DRIVE-CLiQ or digital outputs) Max. current via jumper in connector: 20 A
	+	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.

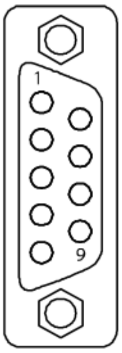
The current consumption increases by the value for the DRIVE-CLiQ node and digital outputs.

Note

The terminal block must be screwed on tightly using a flat-bladed screwdriver.

2.2.3.6 X126 PROFIBUS

Table 2- 6 PROFIBUS interface X126

	Pin	Signal name	Meaning	Range
	1	-	Not assigned	
	2	M24_SERV	Teleservice supply, 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	Teleservice supply, + (24 V)	24 V (20.4 V to 28.8 V)
	8	RxD/TxD–N	Receive/transmit data N (A)	RS485
	9	-	Not assigned	
Connector type: 9-pin SUB-D female				

Note

A teleservice adapter can be connected to the PROFIBUS interface (X126) for remote diagnostics 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 Control Unit and other CAN bus nodes may be destroyed.

CAUTION

A potential bonding conductor with a cross-section of at least 25 mm^2 must be used between components in a system that are located at a distance from each other. If a potential bonding conductor is not used, high leakage currents that could destroy the Control Unit or other PROFIBUS nodes can be conducted via the PROFIBUS cable.

PROFIBUS connectors

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

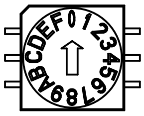
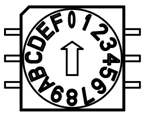
The bus terminating resistors are activated in the connector.

The cable shield must be connected at both ends and over a large surface area.

2.2.3.7 PROFIBUS address switch

On the CU320-2, the PROFIBUS address is set as a hexadecimal value via two rotary coding switches. Values between 0_{dec} (00_{hex}) and 127_{dec} ($7F_{hex}$) can be set as the address. The upper rotary coding switch (H) is used to set the hexadecimal value for 16^1, and the lower rotary coding switch (L) is used to set the hexadecimal value for 16^0.

Table 2- 7 PROFIBUS address switch

Rotary coding switches	Significance	Examples		
		21_{dec}	35_{dec}	126_{dec}
		15_{hex}	23_{hex}	$7E_{hex}$
 DP H	$16^1 = 16$	1	2	7
 DP L	$16^0 = 1$	5	3	E

Setting the PROFIBUS address

The factory setting for the rotary coding switches is 0_{dec} (00_{hex}).

There are two ways to set the PROFIBUS address:

1. Via p0918
   - To set the bus address for a PROFIBUS node using STARTER, first set the rotary code switches to 0_{dec} (00_{hex}) and 127_{dec} ($7F_{hex}$).
   - Then use parameter p0918 to set the address to a value between 1 and 126.
2. Via the PROFIBUS address switches on the Control Unit
   - The address is set manually to values between 1 and 126 using the rotary coding switches. In this case, p0918 is only used to read the address.

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

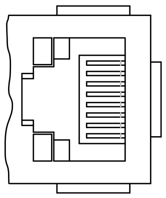
Setting the PROFIBUS address

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

SINAMICS S120 Commissioning Manual (IH1)

2.2.3.8 X127 LAN (Ethernet)

Table 2- 8 X127 LAN (Ethernet)

	Pin	Signal name	Technical specifications
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket			

Note

The LAN (Ethernet) interface supports commissioning and diagnostic functions. It is not permissible to set up a process data bus using this interface.

The LAN (Ethernet) interface does not support Auto MDI(X). For this reason, only crossed cables may be used to connect devices.

For diagnostic purposes, the X127 LAN interface features a green and a yellow LED. These LEDs indicate the following status information:

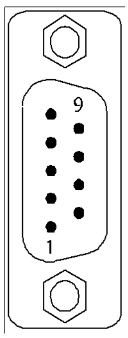
Table 2- 9 LED statuses for the X127 LAN interface

LED	Color	Status	Description
Link port	-	Off	Missing or faulty link
	Green	Continuous light	10 or 100 Mbit link available
Activity port	-	Off	No activity
	Yellow	Flashing light	Sending or receiving

2.2.3.9 X140 serial interface (RS232)

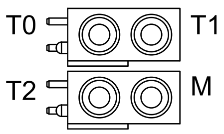
An external display and operator device for operator control/parameterization can be connected via the serial interface. The interface is located on the lower side of the Control Unit.

Table 2- 10 Serial interface (RS-232-C) X140

	Pin	Signal name	Technical data
	1	Reserved, do not use	
	2	RxD	Receive data
	3	TxD	Transmit data
	4	Reserved, do not use	
	5	Ground	Ground reference
	6	Reserved, do not use	
	7	Reserved, do not use	
	8	Reserved, do not use	
	9	Reserved, do not use	
Connector type: SUB-D, 9-pin			

2.2.3.10 Measuring sockets

Table 2- 11 Measuring sockets T0, T1, T2

	Socket	Function	Technical specifications
	T0	Measuring 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	Measuring socket 1	
	T2	Measuring socket 2	
	M	Ground	
The measuring sockets are only suitable for bunch pin plugs with a diameter of 2 mm.			

Note

The measuring sockets support commissioning and diagnostic functions. It must not be connected for normal operation.

2.2.3.11 Diag pushbutton

The DIAG pushbutton is reserved for service functions.

2.2.3.12 Slot for memory card

Figure 2-6 Slot for memory card

CAUTION

The memory card may only be removed and inserted when the Control Unit is in a voltage-free state; doing this during operation instead could result in a loss of data and, where applicable, a plant standstill.

The memory card may only be inserted as shown in the photo above (arrow at top right).

CAUTION

The memory card is an electrostatic sensitive component. ESD regulations must be observed when inserting and removing the card.

NOTICE

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

Note

Please note that only SIEMENS memory cards can be used to operate the Control Unit.

2.2.4 Connection example

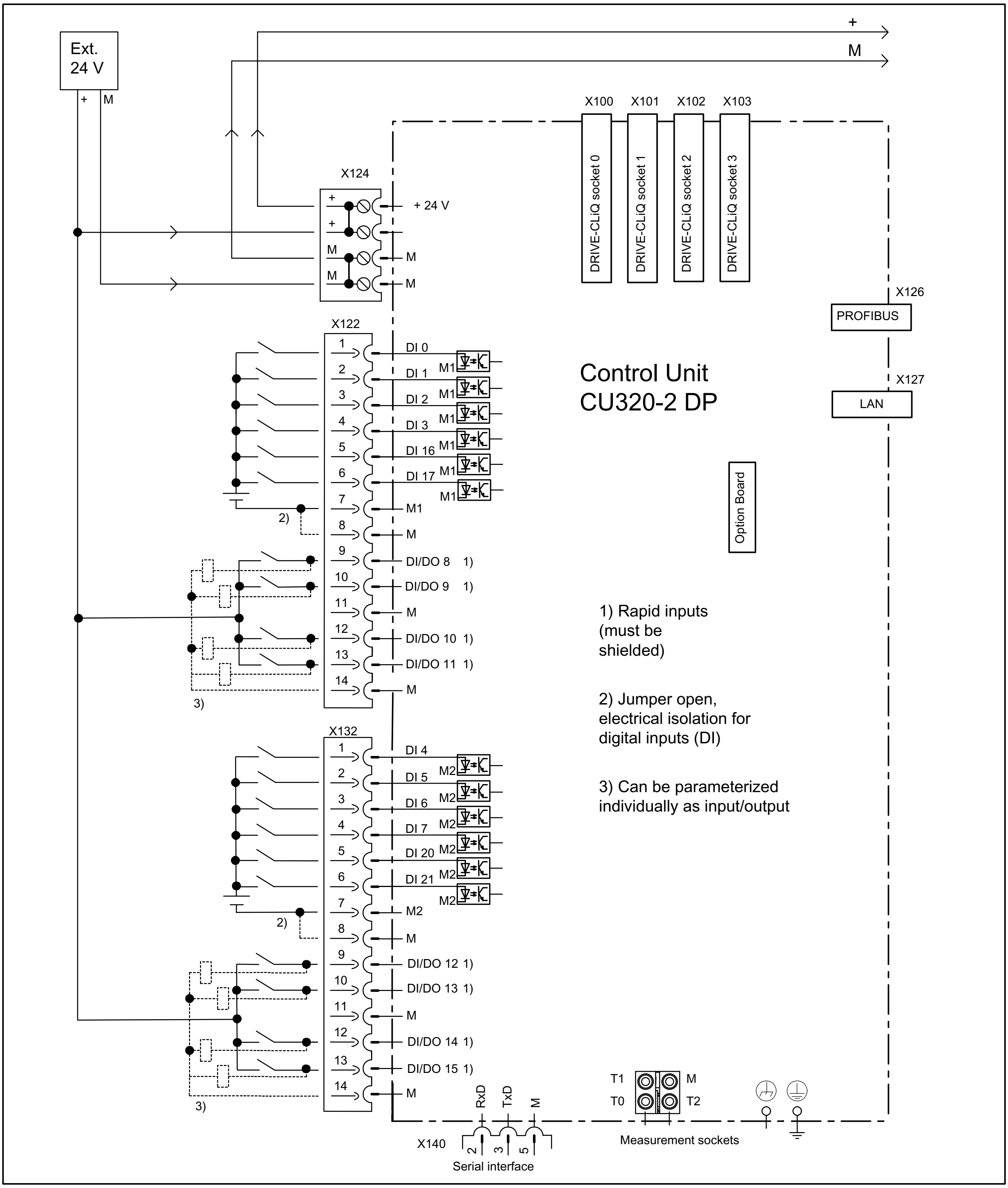


Figure 2-7 Connection example of CU320-2 DP

2.2.5 Meaning of LEDs

2.2.5.1 Description of the LED statuses

The different statuses that arise during the booting procedure are indicated by means of the LEDs on the Control Unit.

- The duration of the individual statuses varies.
- If an error occurs, the booting procedure is terminated and the cause is indicated accordingly via the LEDs.
- Once the unit has successfully booted up, all the LEDs are switched off briefly.
- Once the unit has booted up, the LEDs are controlled via the loaded software.

2.2.5.2 Behavior of the LEDs during booting

Table 2- 12 Load software

LED			Status	Comment
RDY	DP	OPT		
Red	Orange	Orange	Reset	Hardware reset RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red 2 Hz	Red 2 Hz	Off	File error	• Memory card not inserted or defective • Software on memory card not inserted or defective
Red	Orange Flashing light	Off	FW loading	RDY LED lights up red, PN LED flashes orange without fixed frequency
Red	Off	Off	FW loaded	-
Off	Red	Off	FW checked (no CRC error)	
Red 0.5 Hz	Red 0.5 Hz	Off	FW checked (CRC error)	• CRC invalid

Table 2- 13 Firmware

LED			Status	Comment
RDY	DP	OPT		
Orange	Off	Off	Initializing	–
Alternating			Running	See the table below

2.2.5.3 Behavior of the LEDs in the operating state

Table 2- 14 Control Unit CU320-2 DP – Description of the LEDs after booting

<table>
<tr><th>LED</th><th>Color</th><th>Status</th><th>Description, cause</th><th>Remedy</th></tr>
<tr><td rowspan="10">RDY (READY)</td><td>-</td><td>OFF</td><td>Electronics power supply is missing or outside permissible tolerance range.</td><td>Check power supply</td></tr>
<tr><td rowspan="3">Green</td><td>Continuous light</td><td>The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.</td><td>–</td></tr>
<tr><td>Flashing light 0.5 Hz</td><td>Commissioning/reset</td><td>–</td></tr>
<tr><td>Flashing light 2 Hz</td><td>Writing to the memory card</td><td>–</td></tr>
<tr><td>Red</td><td>Flashing light 2 Hz</td><td>General errors</td><td>Check parameterization/ configuration data</td></tr>
<tr><td>Red/ green</td><td>Flashing light 0.5 Hz</td><td>Control Unit is ready for operation.
However there are no software licenses.</td><td>Obtain licenses</td></tr>
<tr><td rowspan="2">Orange</td><td>Flashing light 0.5 Hz</td><td>Updating the firmware of the DRIVE-CLiQ components</td><td>–</td></tr>
<tr><td>Flashing light 2 Hz</td><td>DRIVE-CLiQ component firmware update complete. Wait for POWER ON for the components in question.</td><td>Turn POWER ON for the components in question</td></tr>
<tr><td>Green/ orange or red/ orange</td><td>Flashing light 2 Hz</td><td>Component detection via LED is activated (p0124[0]).
Note:
Both options depend on the LED status when component detection is activated via p0124[0] = 1.</td><td>–</td></tr>
<tr style="display:none"></tr>
<tr><td rowspan="3">DP PROFIdrive cyclic operation</td><td>–</td><td>Off</td><td>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).</td><td>–</td></tr>
<tr><td rowspan="2">Green</td><td>Continuous light</td><td>Cyclic communication is taking place.</td><td>–</td></tr>
<tr><td>Flashing light 0.5 Hz</td><td>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.</td><td>–</td></tr>
</table>

LED	Color	Status	Description, cause	Remedy
	Red	Flashing light 0.5 Hz	PROFIBUS master is sending wrong parameterization/configuration data	Adapt configuration between master/controller and CU
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Remedy fault
OPT (OPTION)	–	Off	Electronics power supply is missing or outside permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Continuous light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used.	–
	Red	Flashing light 2 Hz	At least one fault is present in this component. Option Board not ready (e.g. after power-on).	Remedy and acknowledge fault
RDY and DP	Red	Flashing light 2 Hz	Bus error - communication has been interrupted	Remedy fault
RDY and OPT	Orange	Flashing light 0.5 Hz	Firmware update in progress for connected Option Board CBE20	-

2.2.6 Dimension drawing

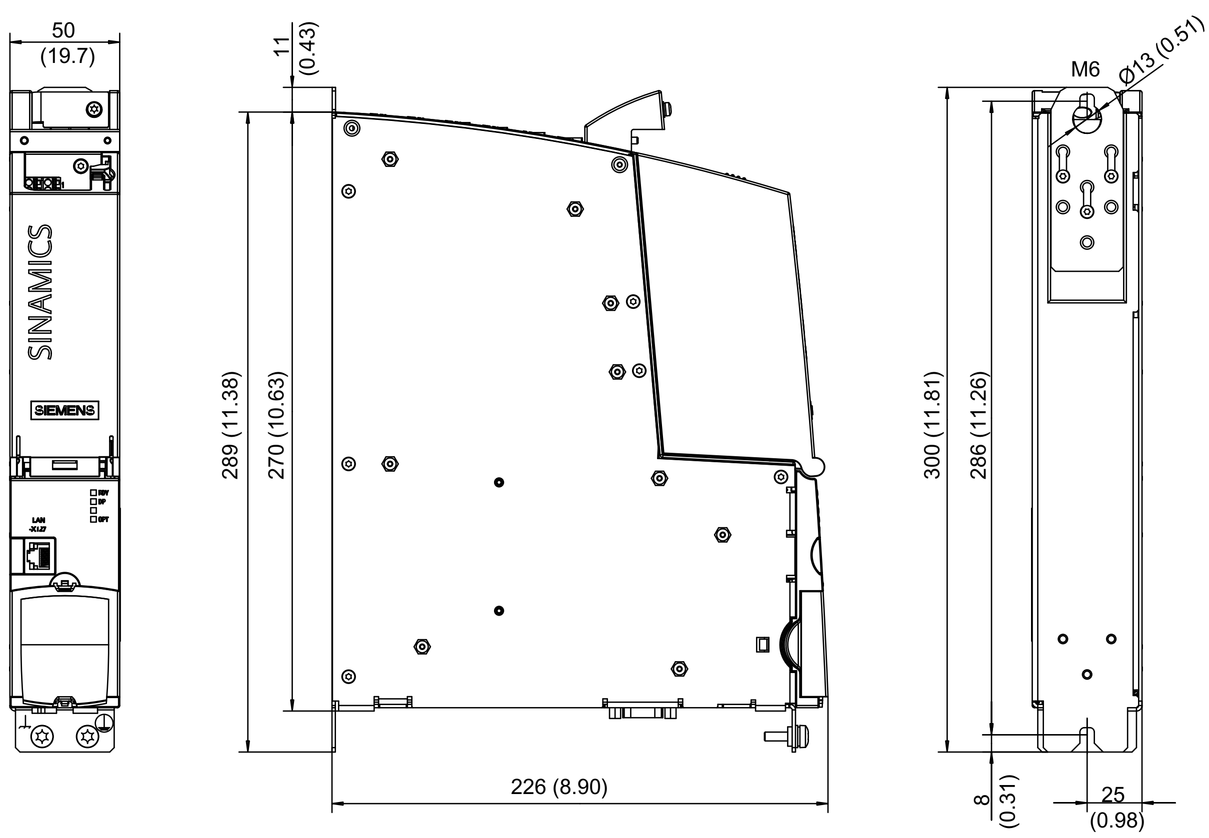


Figure 2-8 Dimension drawing of CU320-2 DP, all data in mm and (inches)

2.2.7 Technical data

Table 2- 15 Technical data

6SL3040-1MA00-0AA1	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 DC (20.4 to 28.8)
Current (without DRIVE-CLiQ or digital outputs)	A_{DC}	1.0
Power loss	W	24
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). Additional information: SINAMICS S120/S150 List Manual (LH1), Chapter "Function block diagrams"	
Weight	kg	2.3

2.3 Control Unit CU320-2 PN (PROFINET)

2.3.1 Description

The Control Unit CU320-2 PN 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. It can be used with firmware version 4.4 or higher.

The CU320-2 PN has the following interfaces (ports):

Table 2- 16 Overview of the CU320-2 PN interfaces

Type	Quantity
Digital inputs	12
Digital inputs/outputs	8
DRIVE-CLiQ interfaces	4
PROFINET interfaces	2
LAN (Ethernet)	1
Serial interface (RS232)	1
Option slot	1
Measuring sockets	3

2.3.2 Safety information

⚠WARNING
The ventilation spaces of 80 mm above and below the component must be observed.

⚠CAUTION
An equipotential bonding conductor must be used between components in a system that are located at a distance from each other. If an equipotential bonding conductor is not used, high leakage currents that could destroy the Control Unit or other PROFINET nodes can be conducted via the PROFINET cable.

CAUTION
The Option Board should only be inserted and removed when the Control Unit and Option Board are at zero current.

2.3.3 Interface description

2.3.3.1 Overview

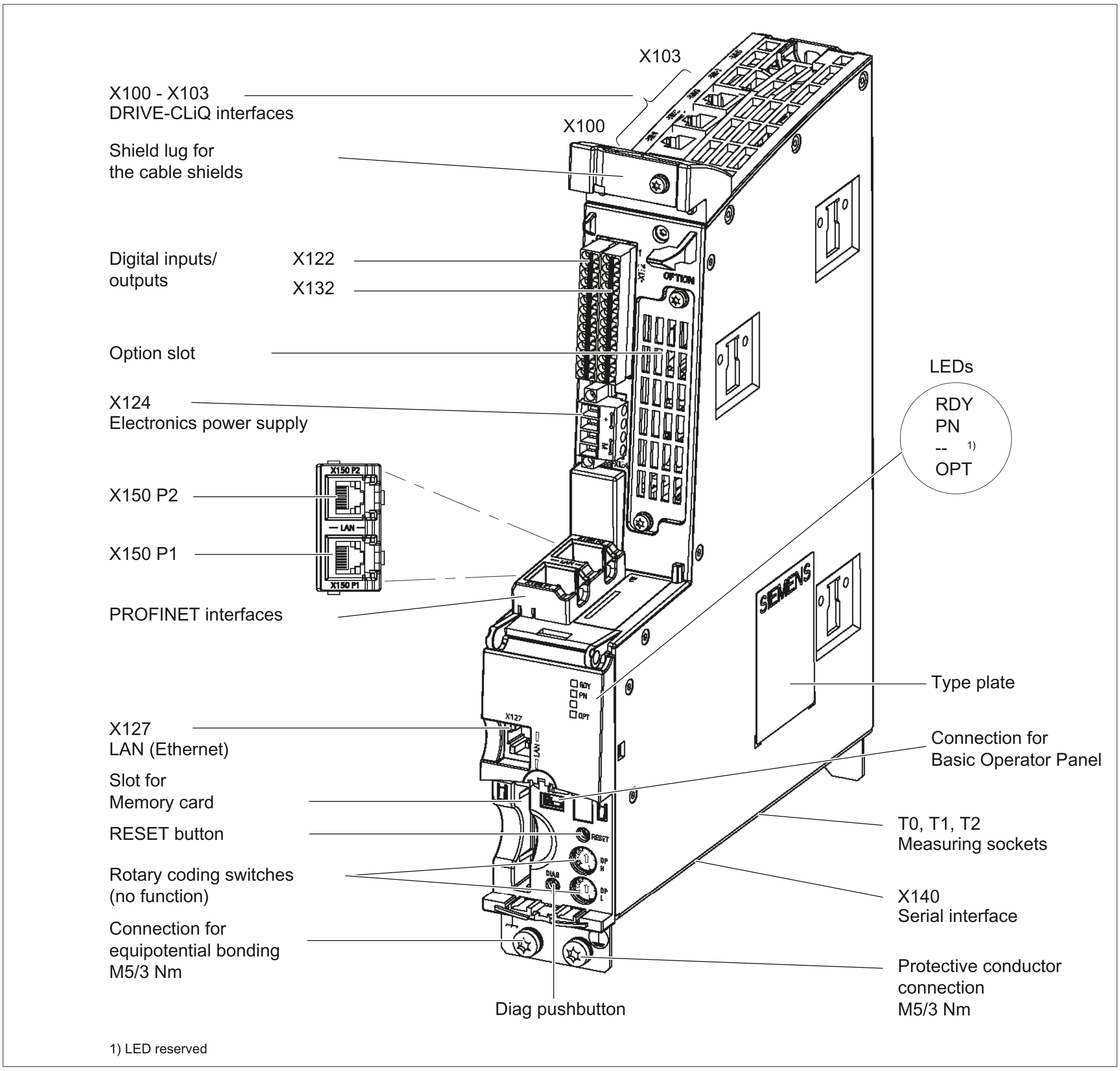


Figure 2-9 Interface description of the CU320-2 PN (covers removed)

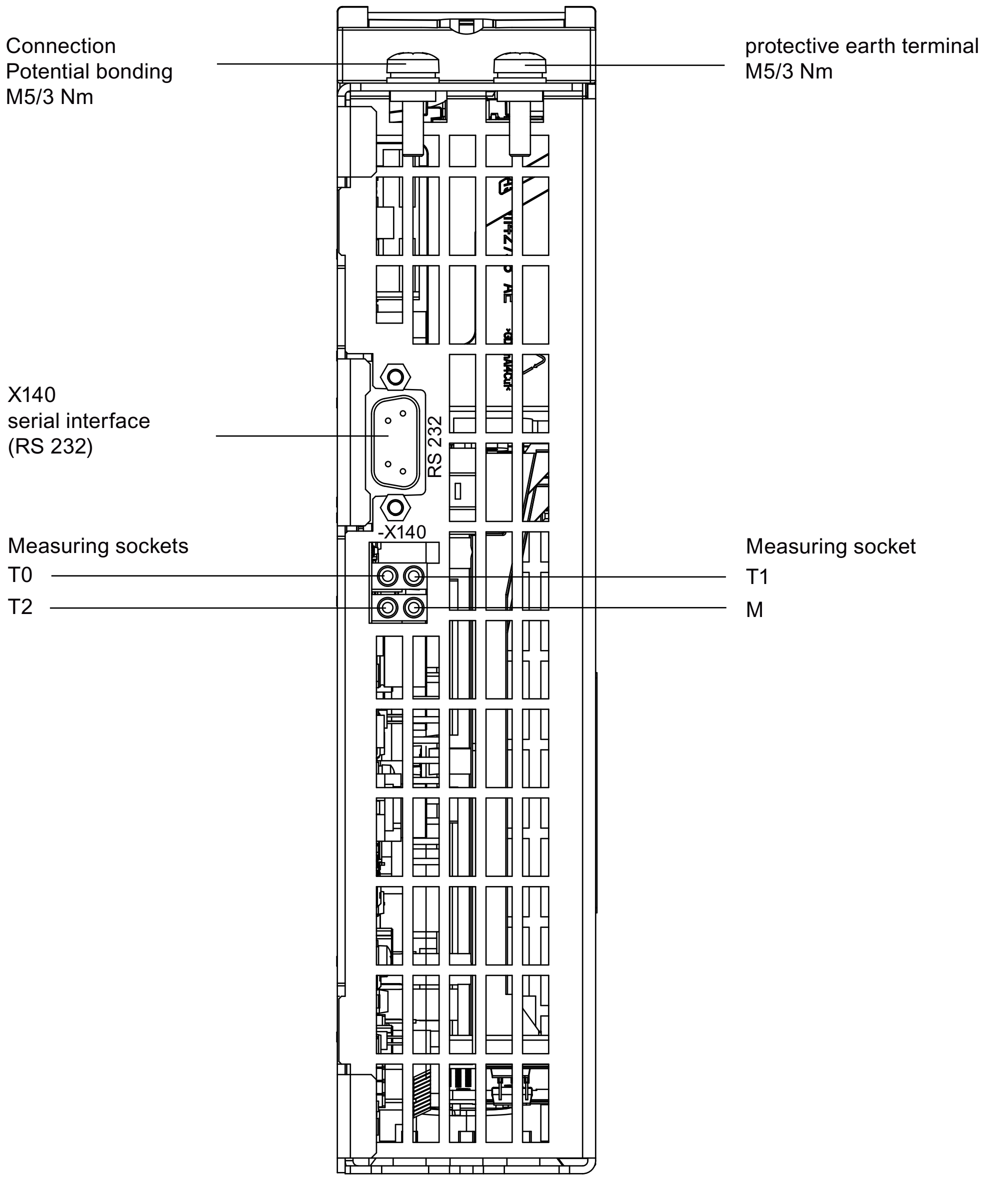
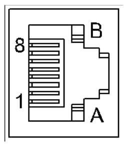


Figure 2-10 Interface X140 and measuring sockets T0 to T2 - CU320-2 PN (view from below)

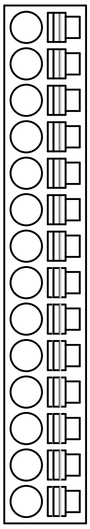
2.3.3.2 X100 - X103 DRIVE-CLiQ interface

Table 2- 17 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
Connector type: RJ45 socket; blanking plate for DRIVE-CLiQ interface included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

2.3.3.3 X122 Digital inputs/outputs

Table 2- 18 Terminal block X122

	Terminal	Designation [1)]	Technical specifications
1 	1	DI 0	Voltage (max.): -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Electrical 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 (typ.): For "0" → "1": 50 μs For "1" → "0": 150 μs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 to 6
	8	M	Ground
	9	DI/DO 8	**As input**: Voltage: -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V DI/DO 8, 9, 10, and 11 are "rapid inputs" [2)] Input delay (typ.): For "0" → "1": 5 μs For "1" → "0": 50 μs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continued-short-circuit-proof Output delay (typ./max.): [3)] For "0" → "1": 150 μs/400 μs For "1" → "0": 75 μs/100 μs Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: 1.5 mm² Type: Spring-loaded terminal 3 (see Appendix A)			

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

2) The rapid inputs can be used as probe inputs or as inputs for the external zero mark

3) Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

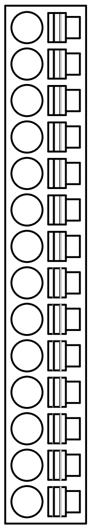
NOTICE
An open input is interpreted as "low". To enable the digital inputs (DI) to function, terminal M1 must be connected. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. A jumper to terminal M. Notice! This removes the electrical isolation for these digital inputs.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

2.3.3.4 X132 Digital inputs/outputs

Table 2- 19 Terminal block X132

	Terminal	Designation 1)	Technical specifications
1 	1	DI 4	Voltage (max.): -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Electrical isolation: The reference potential is terminal M2 Level (incl. ripple) High level: 15 to 30 V Low level: -3 V to +5 V Input delay (typ.): For "0" → "1": 50 μs For "1" → "0": 150 μs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 to 6
	8	M	Ground
	9	DI/DO 12	**As input**: Voltage: -30 V to +30 VDC Typical current consumption: 9 mA at 24 V Level (incl. ripple) High level: 15 to 30 V Low level: -3 V to +5 V DI/DO 12, 13, 14, and 15 are "rapid inputs" 2) Input delay (typ.): For "0" → "1": 5 μs For "1" → "0": 50 μs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continued-short-circuit-proof Output delay (typ./max.): 3) For "0" → "1": 150 μs/400 μs For "1" → "0": 75 μs/100 μs Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: 1.5 mm^2 Type: Spring-loaded terminal 3 (see Appendix A)			

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

2) The rapid inputs can be used as probe inputs or as inputs for the external zero mark

3) Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

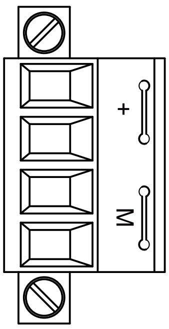
NOTICE
An open input is interpreted as "low". To enable the digital inputs (DI) to function, terminal M2 must be connected. This is achieved by: 1. Routing the ground reference of the digital inputs as well, or 2. A jumper to terminal M. Notice! This removes the electrical isolation for these digital inputs.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

2.3.3.5 X124 Electronics power supply

Table 2- 20 Terminal block X124

	Terminal	Designation	Technical specifications
	+	Electronics power supply	Voltage: 24 V DC (20.4 V to 28.8 V) Current consumption: Max. 1.0 A (without DRIVE-CLiQ or digital outputs) Max. current via jumper in connector: 20 A
	+	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.

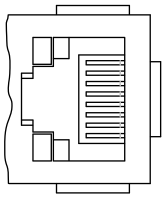
The current consumption increases by the value for the DRIVE-CLiQ node and digital outputs.

Note

The terminal block must be screwed on tightly using a flat-bladed screwdriver.

2.3.3.6 X127 LAN (Ethernet)

Table 2- 21 X127 LAN (Ethernet)

	Pin	Signal name	Technical specifications
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket			

Note

The LAN (Ethernet) interface supports commissioning and diagnostic functions. It is not permissible to set up a process data bus using this interface.

The LAN (Ethernet) interface does not support Auto MDI(X). For this reason, only crossed cables may be used to connect devices.

For diagnostic purposes, the X127 LAN interface features a green and a yellow LED. These LEDs indicate the following status information:

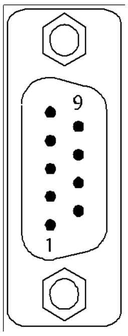
Table 2- 22 LED statuses for the X127 LAN interface

LED	Color	Status	Description
Link port	-	Off	Missing or faulty link
	Green	Continuous light	10 or 100 Mbit link available
Activity port	-	Off	No activity
	Yellow	Flashing light	Sending or receiving

2.3.3.7 X140 serial interface (RS232)

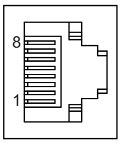
An external display and operator device for operator control/parameterization can be connected via the serial interface. The interface is located on the lower side of the Control Unit.

Table 2- 23 Serial interface (RS-232-C) X140

	Pin	Signal name	Technical data
	1	Reserved, do not use	
	2	RxD	Receive data
	3	TxD	Transmit data
	4	Reserved, do not use	
	5	Ground	Ground reference
	6	Reserved, do not use	
	7	Reserved, do not use	
	8	Reserved, do not use	
	9	Reserved, do not use	
Connector type: SUB-D, 9-pin			

2.3.3.8 X150 P1 / P2 PROFINET

Table 2- 24 X150 P1 and X150 P2 PROFINET

	Pin	Signal name	Technical specifications
	1	RXP	Receive data +
	2	RXN	Receive data -
	3	TXP	Transmit data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	TXN	Transmit data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket Cable type: PROFINET			

Note

The PROFINET interfaces support Auto MDI(X). For this reason, both crossed and uncrossed cables may be used to connect devices.

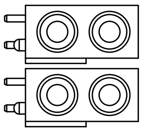
For diagnostic purposes, the two PROFINET interfaces are equipped with a green and a yellow LED. These LEDs indicate the following status information:

Table 2- 25 LED states on the X150 P1/P2 PROFINET interface

LED	Color	Status	Description
Link port	-	Off	Missing or faulty link
	Green	Continuous light	10 or 100 Mbit link available
Activity port	-	Off	No activity
	Yellow	Flashing light	Data is being received or sent at port x

2.3.3.9 Measuring sockets

Table 2- 26 Measuring sockets T0, T1, T2

	Socket	Function	Technical specifications
T0  T1	T0	Measuring 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	Measuring socket 1	
T2 M	T2	Measuring socket 2	
	M	Ground	
The measuring sockets are only suitable for bunch pin plugs with a diameter of 2 mm.			

Note

The measuring sockets support commissioning and diagnostic functions. It must not be connected for normal operation.

2.3.3.10 Diag pushbutton

The DIAG pushbutton is reserved for service functions.

2.3.3.11 Slot for memory card

Figure 2-11 Slot for memory card

CAUTION
The memory card may only be removed and inserted when the Control Unit is in a voltage-free state; doing this during operation instead could result in a loss of data and, where applicable, a plant standstill. The memory card may only be inserted as shown in the photo above (arrow at top right).

CAUTION
The memory card is an electrostatic sensitive component. ESD regulations must be observed when inserting and removing the card.

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

Note

Please note that only SIEMENS memory cards can be used to operate the Control Unit.

2.3.4 Connection example

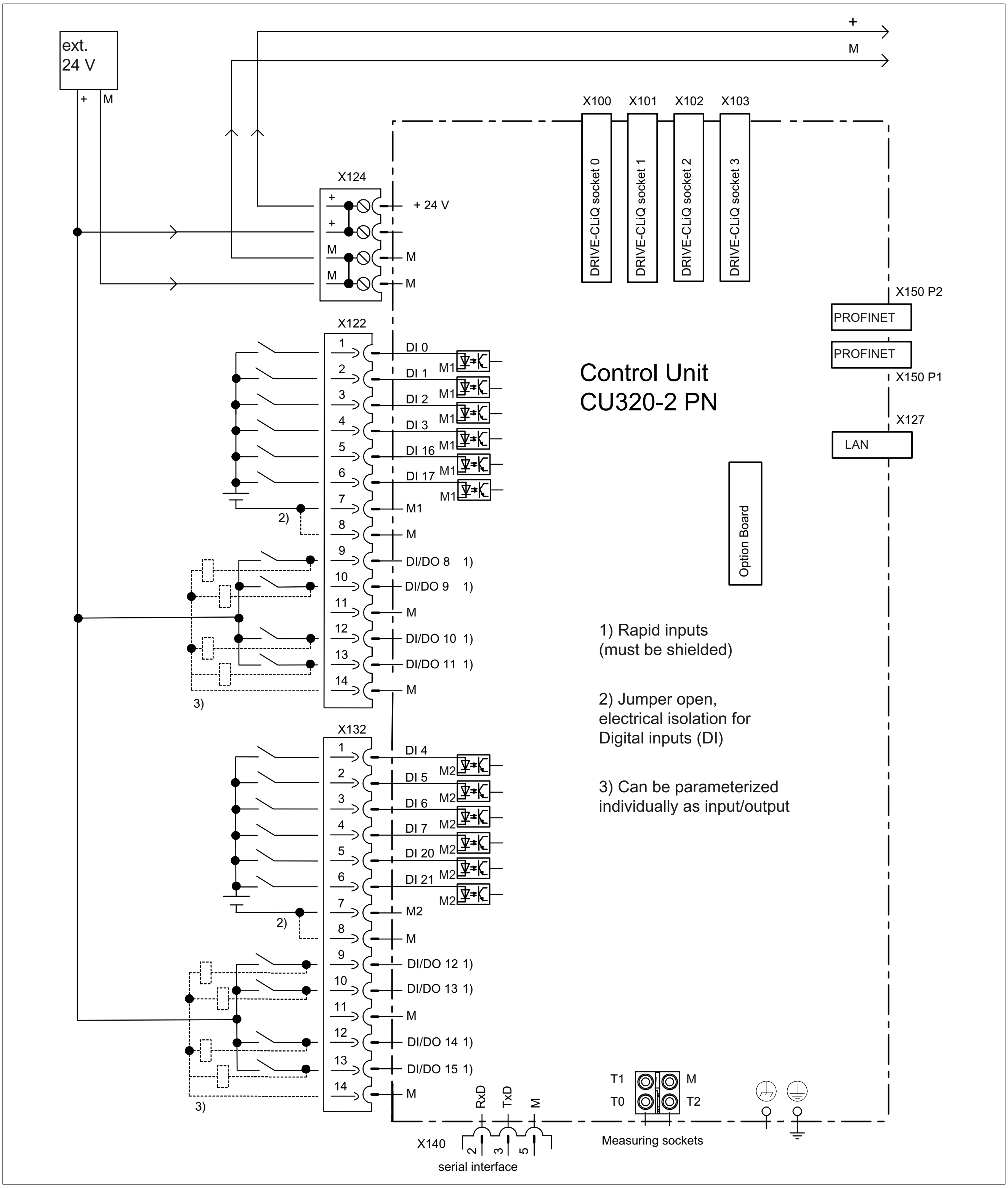


Figure 2-12 Connection example of a Control Unit CU320-2 PN

2.3.5 Meaning of LEDs

2.3.5.1 Description of the LED statuses

The different statuses that arise during the booting procedure are indicated by means of the LEDs on the Control Unit.

- The duration of the individual statuses varies.
- If an error occurs, the booting procedure is terminated and the cause is indicated accordingly via the LEDs.
- Once the unit has successfully booted up, all the LEDs are switched off briefly.
- Once the unit has booted up, the LEDs are controlled via the loaded software.

2.3.5.2 Behavior of the LEDs during booting

Table 2- 27 Load software

LED			Status	Comment
RDY	PN	OPT		
Red	Orange	Orange	Reset	Hardware reset RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red 2 Hz	Red 2 Hz	Off	File error	• Memory card not inserted or defective • Software on memory card not inserted or defective
Red	Orange Flashing light	Off	FW loading	RDY LED lights up red, PN LED flashes orange without fixed frequency
Red	Off	Off	FW loaded	–
Off	Red	Off	FW checked (no CRC error)	
Red 0.5 Hz	Red 0.5 Hz	Off	FW checked (CRC error)	• CRC invalid

Table 2- 28 Firmware

LED			Status	Comment
RDY	PN	OPT		
Orange	Off	Off	Initializing	–
Alternating			Running	See the table below

2.3.5.3 Behavior of the LEDs in the operating state

Table 2- 29 Control Unit CU320-2 PN – Description of the LEDs after booting

LED	Color	Status	Description, cause	Remedy
RDY (READY)	-	OFF	Electronics power supply is missing or outside permissible tolerance range.	Check power supply
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
		Flashing light 0.5 Hz	Commissioning/reset	–
		Flashing light 2 Hz	Writing to the memory card	–
	Red	Flashing light 2 Hz	General errors	Check parameterization/configuratio n data
	Red/ green	Flashing light 0.5 Hz	Control Unit is ready for operation. However there are no software licenses.	Obtain licenses
	Orange	Flashing light 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update complete. Wait for POWER ON for the components in question.	Turn POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 2 Hz	Component detection via LED is activated (p0124[0]). Note: Both options depend on the LED status when component detection is activated via p0124[0] = 1.	–
DP 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 light	Cyclic communication is taking place.	–
		Flashing light 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.	–

LED	Color	Status	Description, cause	Remedy
	Red	Flashing light 0.5 Hz	Bus error, incorrect parameter assignment/configuration	Adapt configuration between controller and devices
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Remedy fault
OPT (OPTION)	–	Off	Electronics power supply is missing or outside permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Continuous light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used.	–
	Red	Flashing light 2 Hz	At least one fault is present in this component. Option Board not ready (e.g. after power-on).	Remedy and acknowledge fault
RDY and DP	Red	Flashing light 2 Hz	Bus error - communication has been interrupted	Remedy fault
RDY and OPT	Orange	Flashing light 0.5 Hz	Firmware update in progress for connected Option Board CBE20	-

2.3.6 Dimension drawing

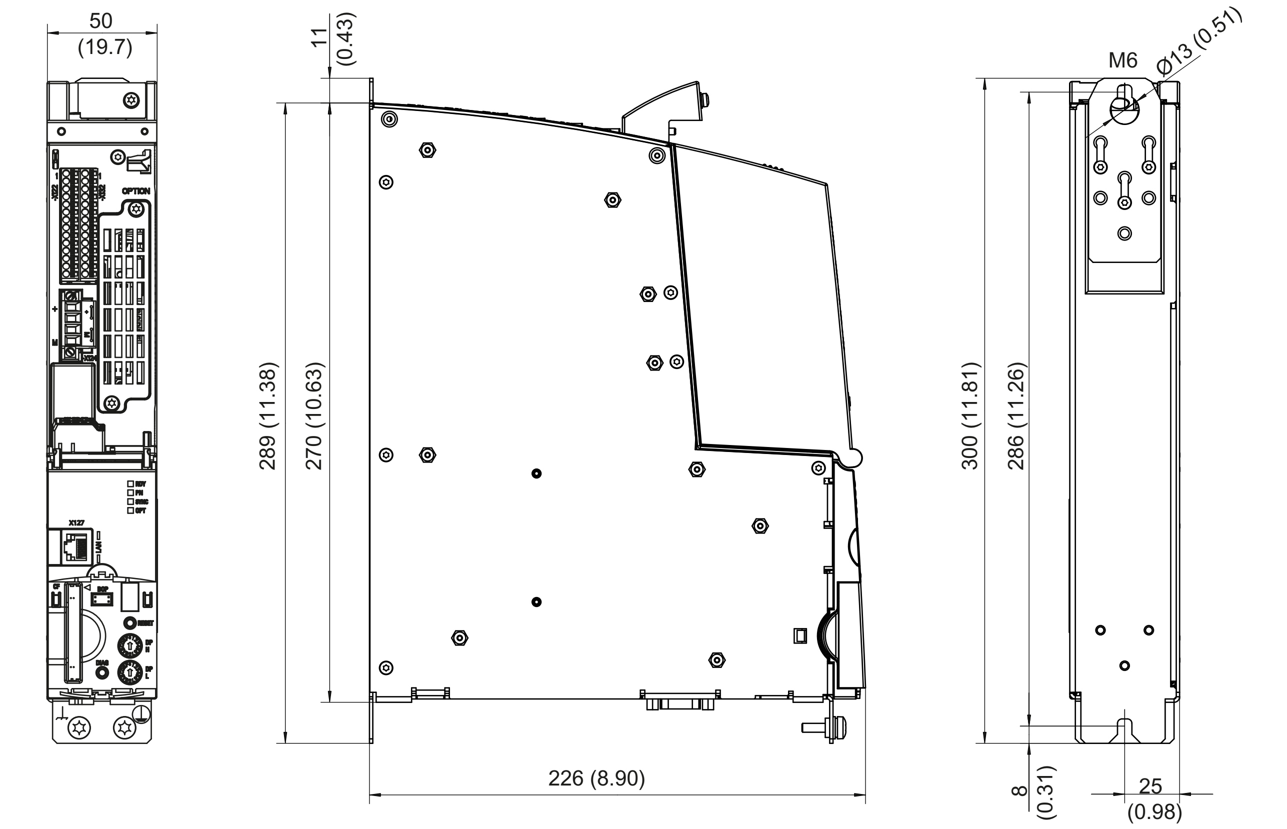


Figure 2-13 Dimension drawing of CU320-2 PN, all data in mm and (inches)

2.3.7 Technical data

Table 2- 30 Technical data

6SL3040-1MA01-0AA0	Unit	Value
Electronic power supply		
Voltage	V_{DC}	DC 24 (20.4 to 28.8)
Current (without DRIVE-CLiQ or digital outputs)	A_{DC}	1.0
Power loss	W	24
Total maximum permissible output currents	A	5.5
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). Additional information: SINAMICS S120/S150 List Manual, Chapter "Function block diagrams"	
Weight	kg	2.3

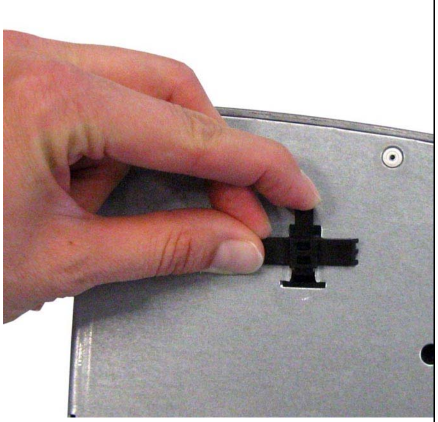
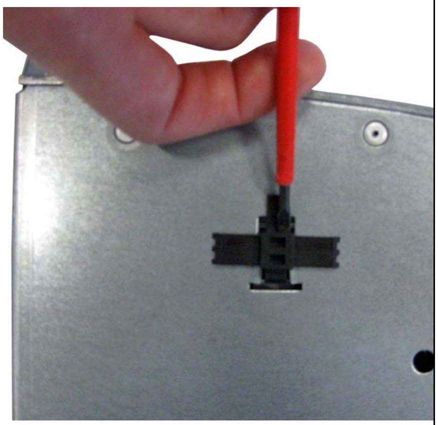
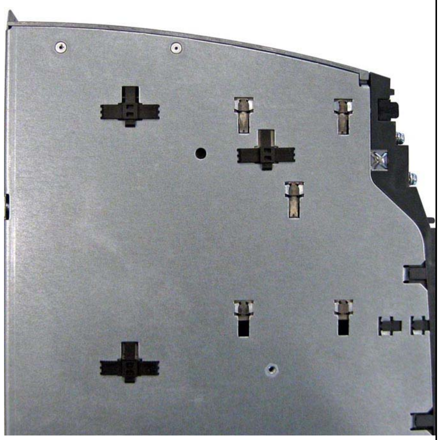
2.4 Installation

2.4.1 Mounting to a Line Module

Mounting a CU320-2 DP and CU320-2 PN Control Unit directly to a Line Module in Booksize or Chassis format

In order to install the Control Unit in a Line Module, first attach the three mounts to the Control Unit. They are included each Line Module accessories kit.

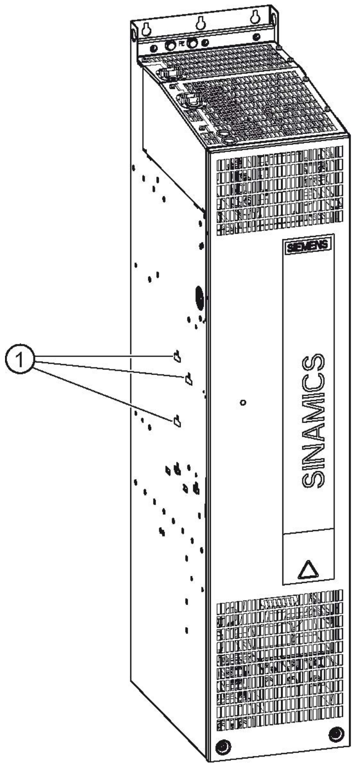
Table 2- 31 Fastening the mounts to a Control Unit

		
Insert the mount into the installation opening provided.	Use a suitable tool (such as a screwdriver) to push the mount in as far as it will go.	Attached mounts (x 3)

Then install the Control Unit on the Line Module.

Table 2- 32 Installing the Control Unit on a Line Module using the CU320-2 DP as an example

		
Attach the Control Unit to the Line Module using the three holders	Push the Control Unit downwards until it latches into place	Control Unit installed - the front is flush to the Line Module



① Opening on the Line Module Chassis for fastening the Control Unit

Figure 2-14 Installing a Control Unit on a Power Unit Chassis format

2.4.2 Mounting on the mounting surface

Installing a CU320-2 DP and CU320-2 PN directly onto a mounting surface

To install the Control Unit directly onto the mounting surface, move the fixing lug on the back of the Control Unit up.

Table 2- 33 Moving the fixing lug using a CU320-2 DP as an example

	
1. Unscrew the screws ① with Torx T10 2. Push up the fixing lug	3. Tighten the screws (M3) with Torx T10, tightening torque 0.8 Nm
	4. Installing the Control Unit on a mounting surface with M6 screws, tightening torque 6 Nm

Installing a CU320-2 DP and CU320-2 PN directly onto a mounting surface with spacer elements

To increase the mounting depth of the Control Unit to the 270 mm mounting depth of a Line Module in booksize format, spacer elements (2 pieces: 6SL3064-1BB00-0AA0) can be installed.

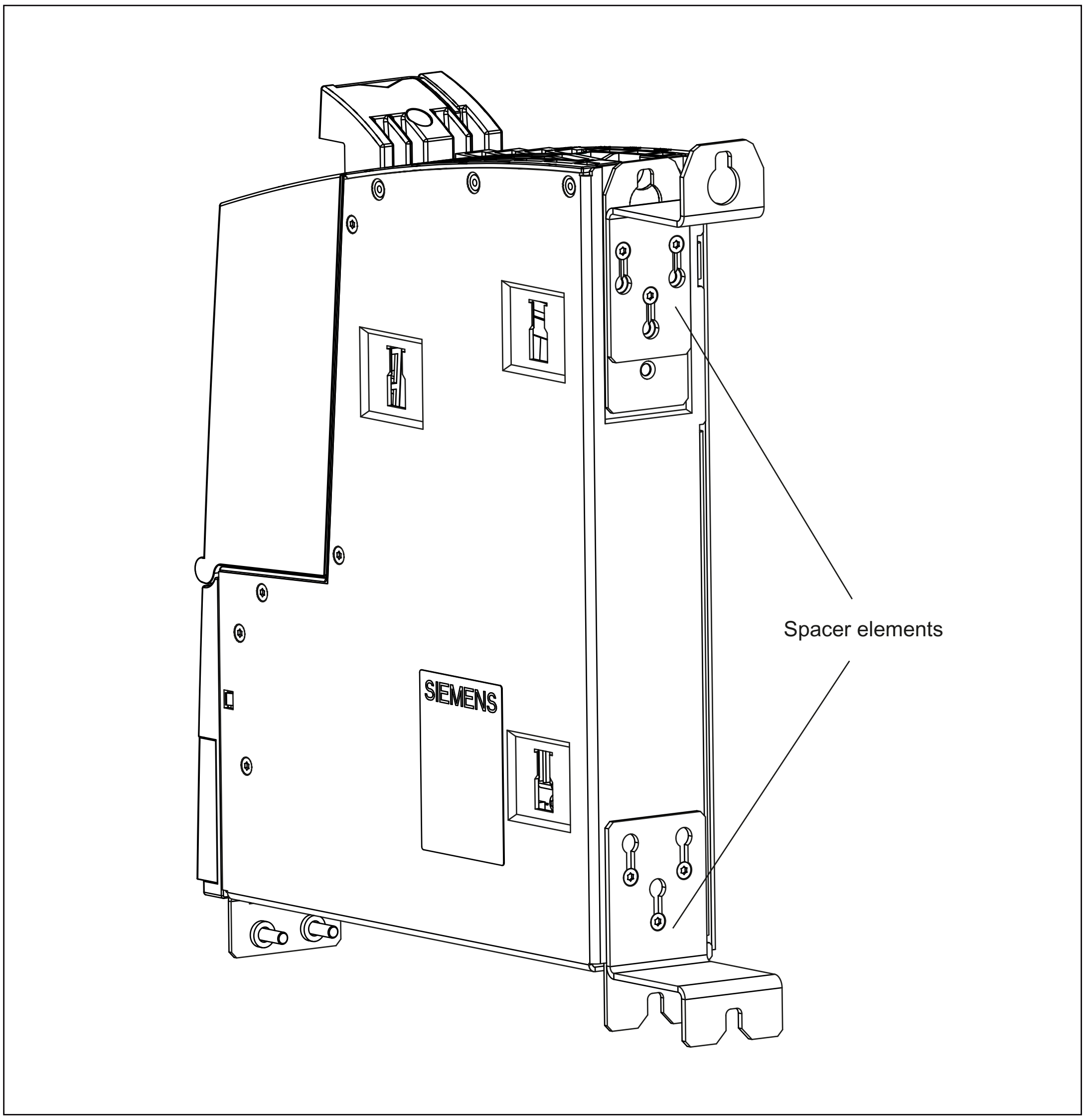


Figure 2-15 Installing the CU320-2 DP on a mounting surface using spacer elements

2.4.3 Opening and removing the cover

Table 2- 34 Opening and lifting the cover using the CU320-2 as an example

		
Press the release lug lightly to unlock the cover	Open the cover and swing it out to the front	Control Unit with cover open

Table 2- 35 Removing the cover using a CU320-2 DP as an example

	
Press the side of the joint lightly to unlock the cover	Swing the cover out to the side to remove

3 Additional system components

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 a SINAMICS Control Unit and operated.

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

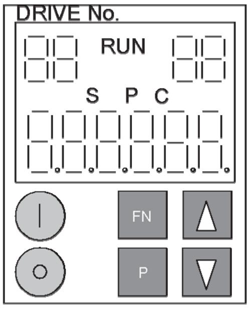


Figure 3-2 Overview of displays and keys

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
I	ON	Powering-up the drives for which the command "ON/OFF1", "OFF2" or "OFF3" should come from the BOP.
O	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.
FN	Functions	The meaning 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.
P	Parameter	The meaning 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	

Display and operator controls of the BOP20

For information about display and operator controls of the BOP20, refer the SINAMICS S120 Commissioning Manual.

3.1.3 Installation

NOTICE
Make sure that you insert and withdraw the BOP20 straight into/out of the Control Unit and that it is not tilted up or down. This prevents damage to the interface for the BOP20 at the Control Unit.

Table 3- 3 Installing a Basic Operator Panel BOP20 using the CU320-2 DP as an example

	
1. Remove the cover by pressing the latching cams together	2. Insert the memory card
	
3. Press the latching cams on the BOP20 together and insert the BOP20 straight until you hear it latch into position	CU320-2 DP with BOP20 installed

3.1.4 Removal

Please note the following information when removing the BOP20 from the Control Unit:

1. The latching cams on the BOP20 must be pressed together simultaneously.
2. The BOP20 must be pulled out straight (i.e. not at an angle). The bottom edge of the BOP20 must never be pulled forwards to remove the device, as this could damage the interface on the rear.

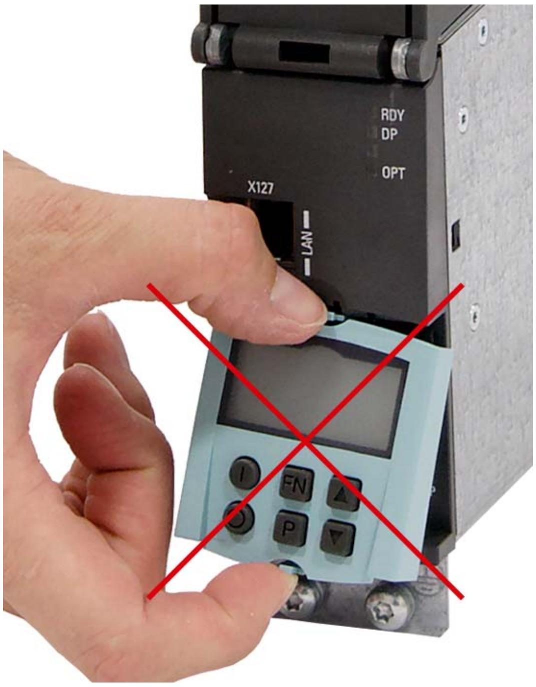


Figure 3-3 Incorrect removal of the BOP20 from a CU320-2 DP (example)

3.2 Option Board: CAN Communication Board CBC10

3.2.1 Description

The Communication Board CBC10 is a communication module for linking to CAN.

3.2.2 Safety information

CAUTION
The Option Board should only be inserted and removed when the Control Unit and Option Board are at zero current.

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

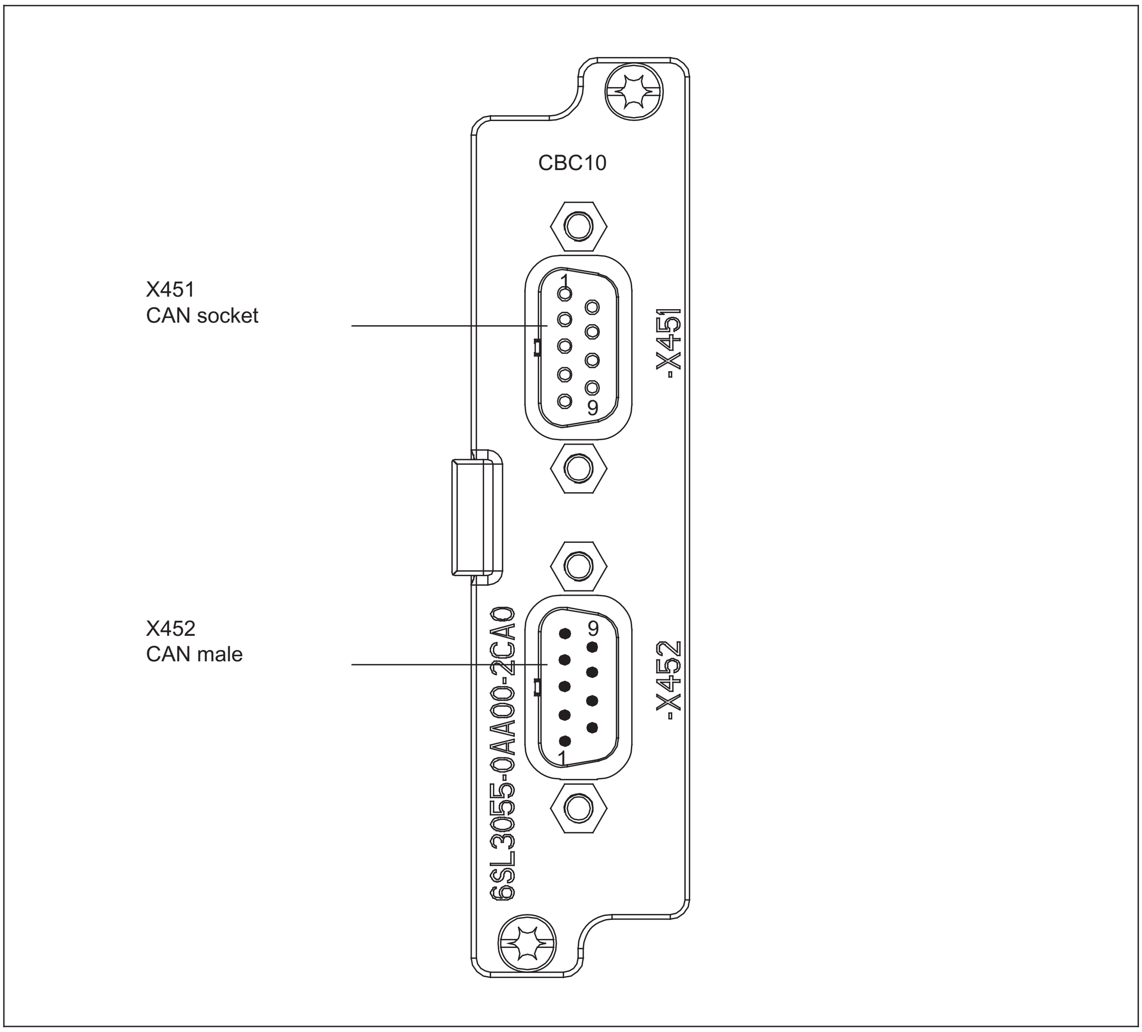
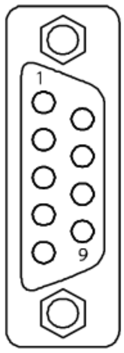


Figure 3-4 Interface description of the CBC10

3.2.3.2 CAN bus interface X451

Table 3- 4 CAN bus interface X451

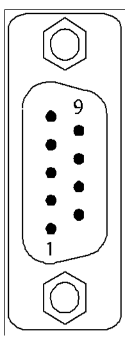
	Pin	Designation	Technical specifications
	1	Reserved, do not use	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved, do not use	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved, do not use	
	9	Reserved, do not use	
Type: SUB-D female, 9-pin			

⚠ 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

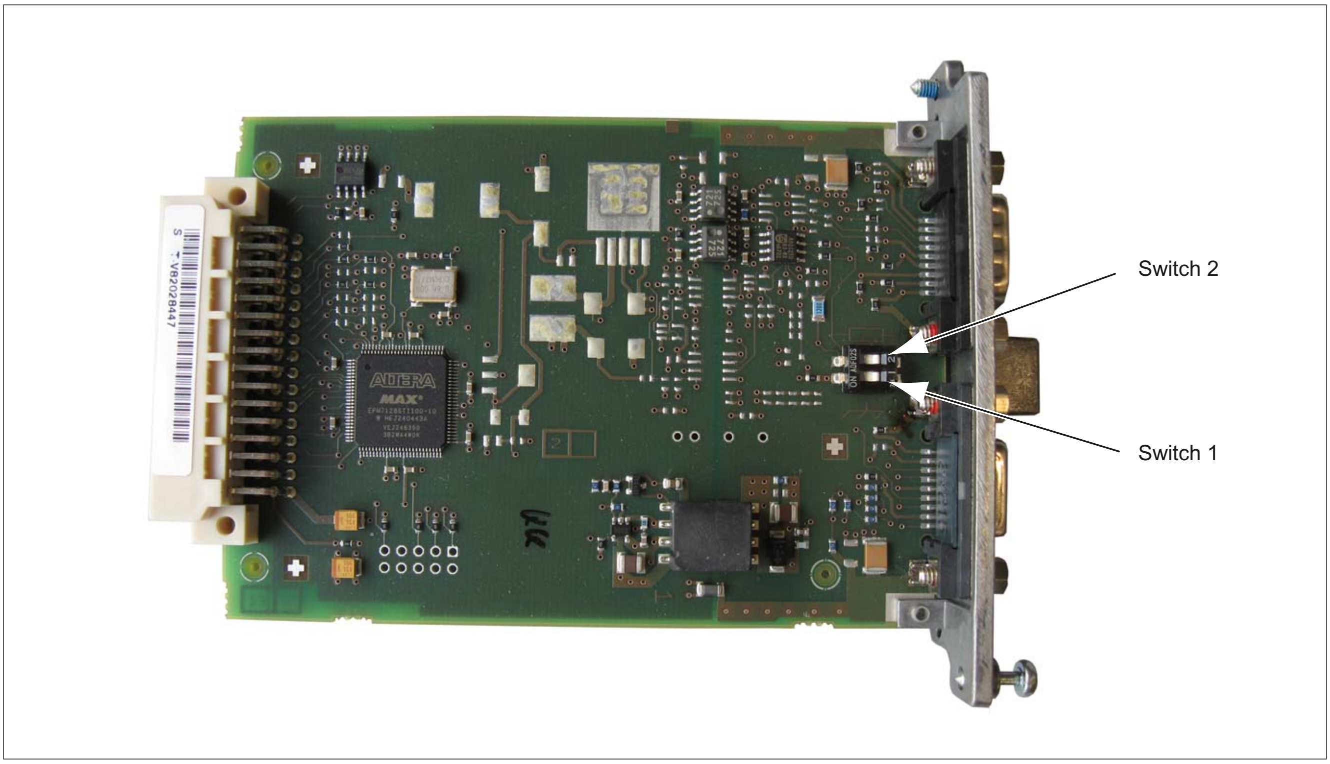


Figure 3-5 Switch 2/1

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	

3.2.4 Meaning of the LED

Table 3- 7 Meaning of the LEDs on the Communication Board CAN CBC10

LED	Color	Status	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 light	OPERATIONAL	–
		Flashing light	PREOPERATIONAL No PDO communication possible	–
		Single flash	STOPPED Only NMT communication possible	
	Red	Continuous light	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

3.2.5 Installation/Mounting

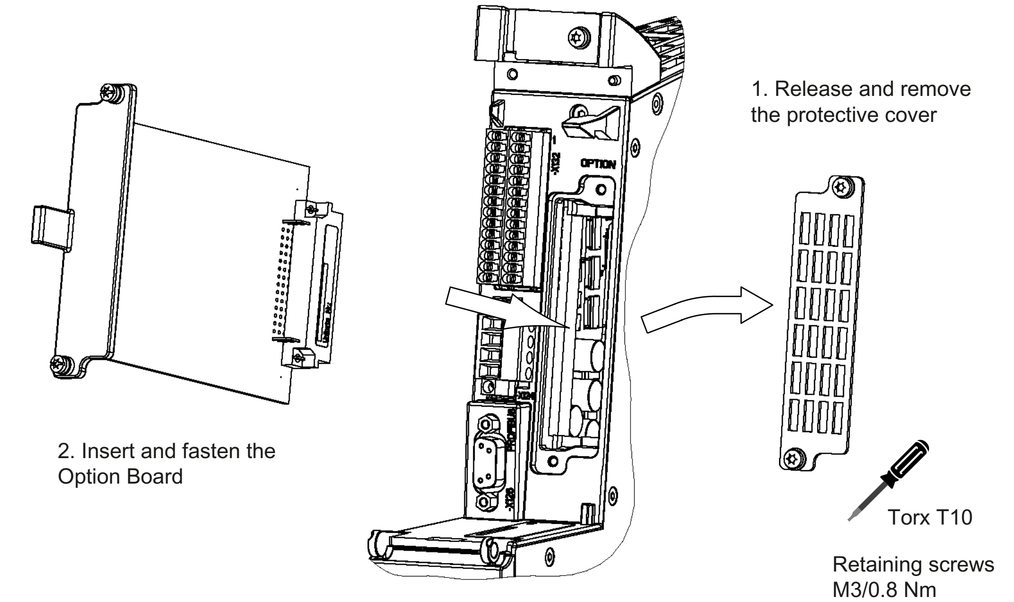


Figure 3-6 Installing an Option Board on a CU320-2 DP

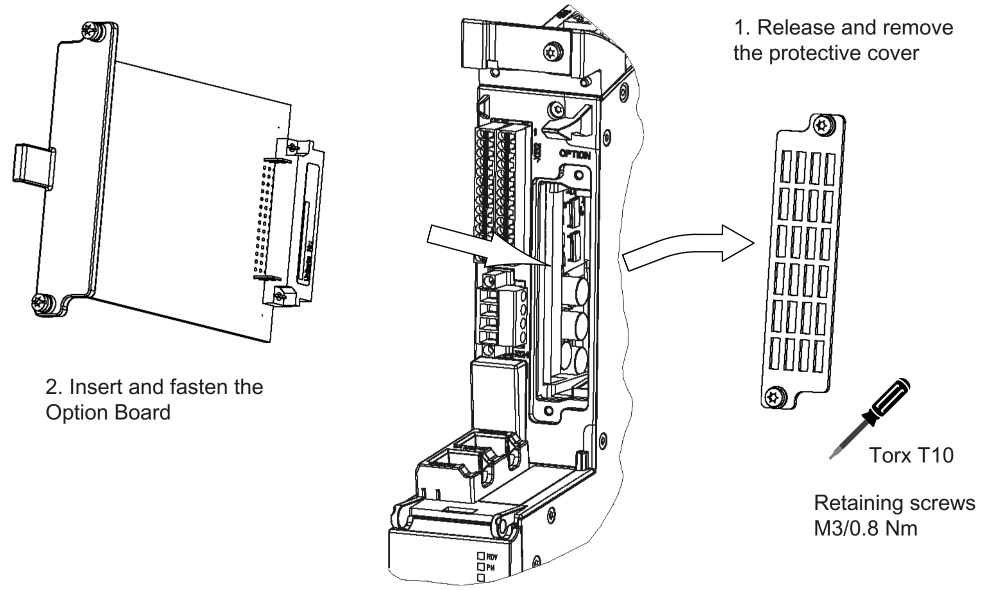


Figure 3-7 Installing an Option Board on a CU320-2 PN

3.2.6 Technical data

Table 3- 8 Technical data

6SL3055-0AA00-2CAx	Unit	Value
Max. current requirements (at 24 V DC) Power loss	A_{DC} W	0.1 <10
Weight, approx.	kg	0.1

3.3 Option Board: Communication Board Ethernet CBE20

3.3.1 Description

The SINAMICS S120 system can be connected to PROFINET using the Communication Board CBE20 interface board. The module supports PROFINET IO with Isochronous Realtime Ethernet (IRT), PROFINET IO with RT. Mixed operation is not permissible! PROFINET CBA is not supported.

The option board has an X1400 interface with 4 ports for communication.

Note

Only one communication interface can be used in isochronous operation when operating the Option Board CBE20 in a Control Unit CU320-2. For the CU320-2 DP, this is either the DP interface of the Control Unit or the PN interfaces of the CBE20.
For the CU320-2 PN, either the internal PN interfaces or the external PN interfaces of the CBE20 are used in isochronous operation.

3.3.2 Safety information

CAUTION
The Option Board should only be inserted and removed when the Control Unit and Option Board are at zero current.

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

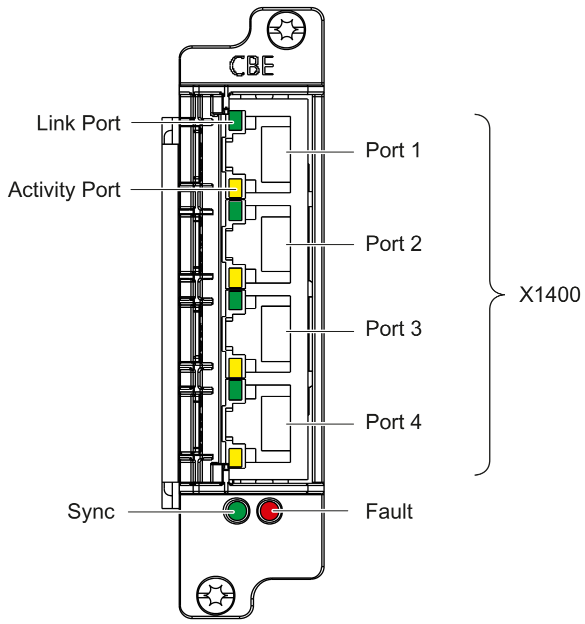
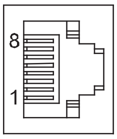


Figure 3-8 Interface description CBE20

3.3.3.2 X1400 Ethernet interface

Table 3- 9 X1400 Ethernet, ports 1-4

	Pin	Signal name	Technical specifications
	1	RXP	Receive data +
	2	RXN	Receive data -
	3	TXP	Transmit data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	TXN	Transmit data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	Screened backshell	M_EXT	Screen, permanently connected
Connector type: RJ45 socket			

For diagnostic purposes, the ports have one green and one yellow LED (refer to "Meaning of the LEDs" for descriptions)

Cable and connector types

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

Industrial Communication
Catalog IK PI, 2009 edition

3.3.4 Meaning of LEDs

Meaning of the LEDs on the CBE20 Communication Board Ethernet

Table 3- 10 Meaning of the LEDs at ports 1 to 4 of the X1400 interface

LED	Color	Status	Description
Link port	-	Off	Electronics power supply is missing or outside permissible tolerance range (link missing or defective).
	Green	Continuous light	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 (no activity).
	Yellow	Flashing light	Data is being received or sent at port x.

Table 3- 11 Meaning of the Sync and Fault LEDs on the CBE20

LED	Color	Status	Description
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 light	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 light	Control Unit task system has synchronized with the IRT clock and data is being exchanged.
		Continuous light	Task system and MC-PLL have synchronized with the IRT clock.

Table 3- 12 Meaning of the OPT LED on the Control Unit

LED	Color	Status	Description, cause	Remedy
OPT	–	OFF	Electronics power supply is missing or outside permissible tolerance range. Communication Board either defective or not inserted.	–
	Green	Continuous light	Communication Board is ready and cyclic communication is taking place.	–
		Flashing light 0.5 Hz	The Communication Board is ready, but cyclic communications is not running. Possible causes: • At least one fault is present. • Communication is being established.	–
	Red	Continuous light	Cyclic communication via PROFINET has not yet been established. However, non-cyclic communications are possible. SINAMICS waits for a parameterizing/configuring telegram	–
		Flashing light 0.5 Hz	The firmware update into the CBE20 has been completed with an error. Possible causes: • The CBE20 is defective. • The memory card for the Control Unit is defective. In this state CBE20 cannot be used.	–
		Flashing light 2 Hz	There is a communications error between the Control Unit and the CBE20. Possible causes: • Board was withdrawn after booting. • The board is defective	Correctly insert the board, if required, replace.
	Orange	Flashing light 0.5 Hz	Firmware is being updated.	–

3.3.5 Installation

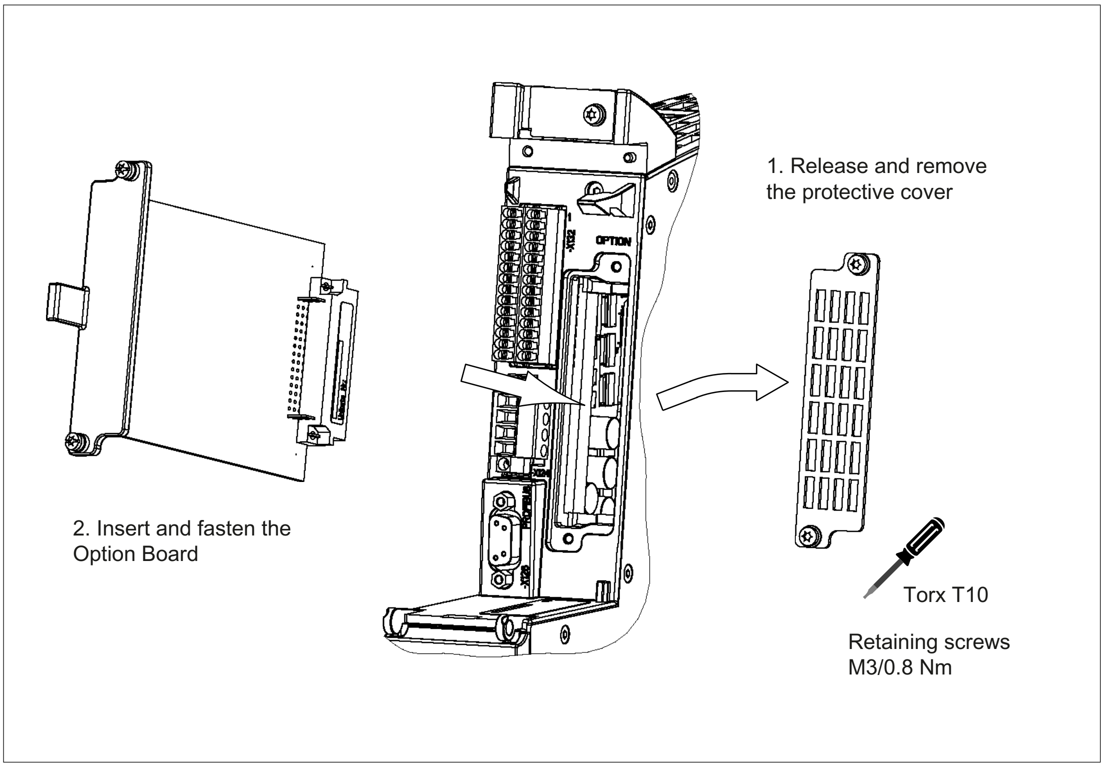


Figure 3-9 Installing the Option Board on a CU320-2 DP

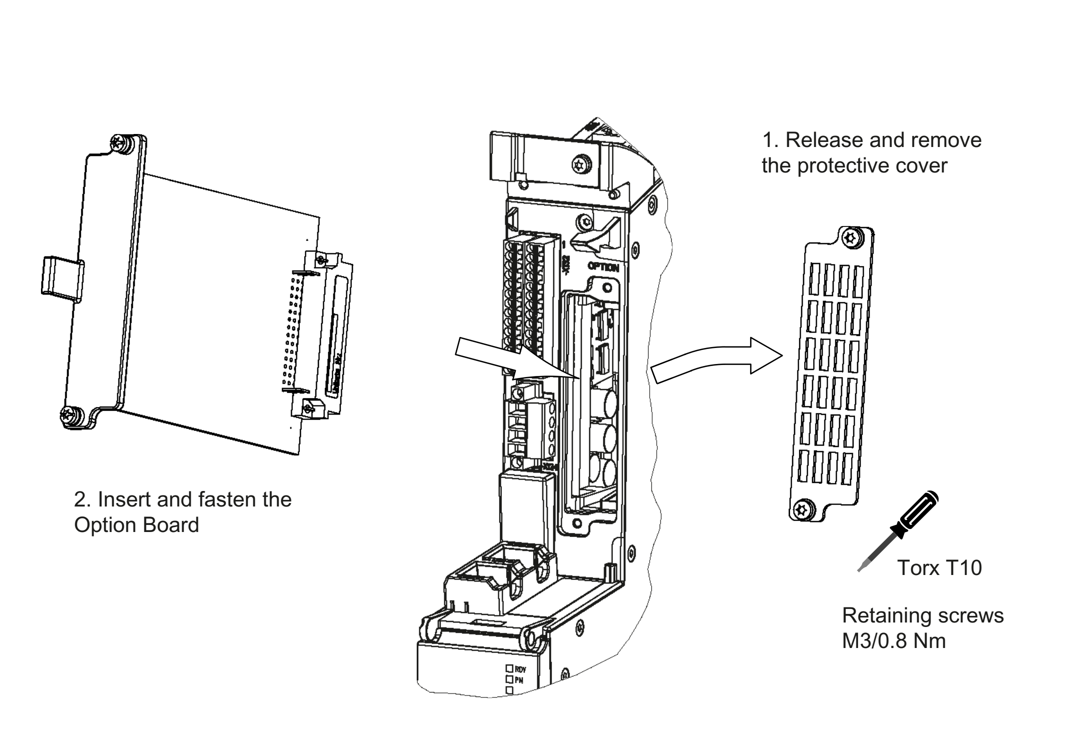


Figure 3-10 Installing an Option Board on a CU320-2 PN

3.3.6 Technical specifications

Table 3- 13 Technical data

Communication Board CBE20 6SL3055-0AA00-2EBx	Unit	Value
Max. current requirements (at 24 V DC)	A_{DC}	0.1
Power loss	W	2.4
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- 14 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 should only be inserted and removed when the Control Unit and Option Board are at zero current.

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

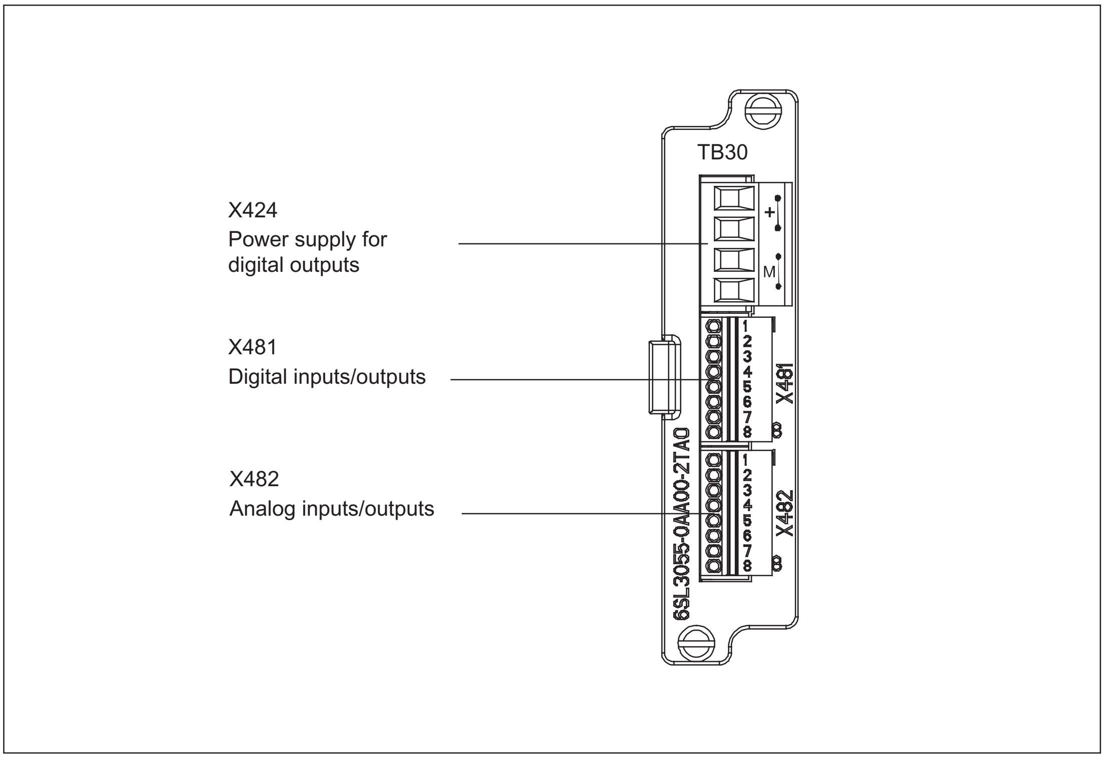
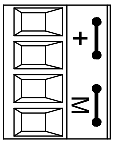


Figure 3-11 Interface description of the TB30

3.4.3.2 X424 power supply, digital outputs

Table 3- 15 Terminal block X424

	Terminal	Designation	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
	+	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 that 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

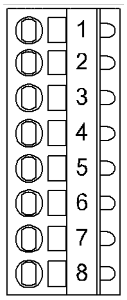
The power supply of the digital outputs and the electronics power supply of the Control Unit are isolated.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

3.4.3.3 X481 Digital inputs/outputs

Table 3- 16 Terminal block X481

	Terminal	Designation 1)	Technical specifications
	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 VDC 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 Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	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".

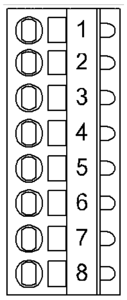
The power supply and the digital inputs/outputs are isolated from the Control Unit.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

3.4.3.4 Analog inputs/outputs X482

Table 3- 17 Terminal block X482

	Terminal	Designation 1)	Technical specifications
	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 mm² 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 document contains more information about analog inputs:

SINAMICS S120 Commissioning Manual (IH1)

3.4.4 Connection example

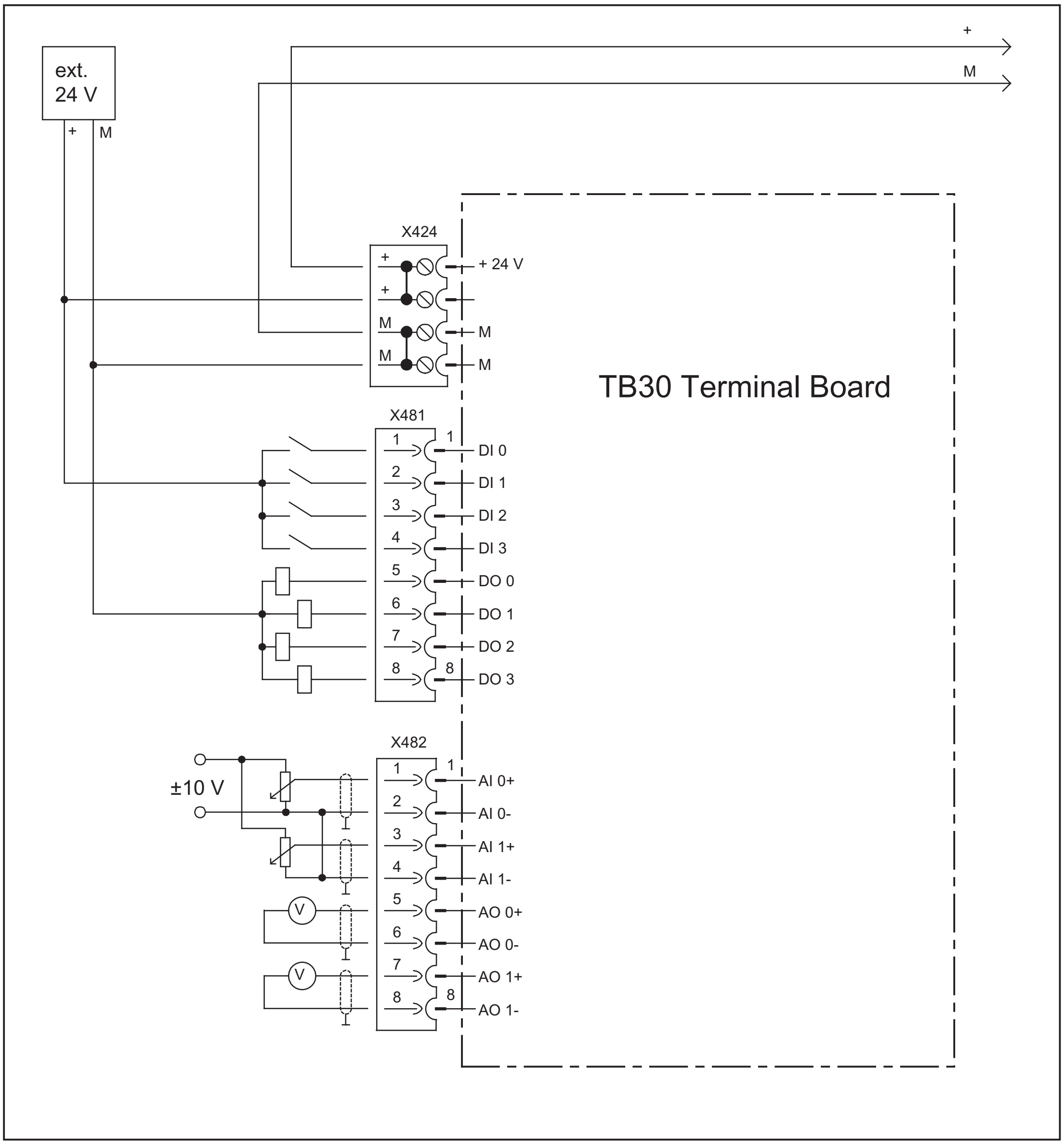


Figure 3-12 Example connection of TB30

3.4.5 Installation

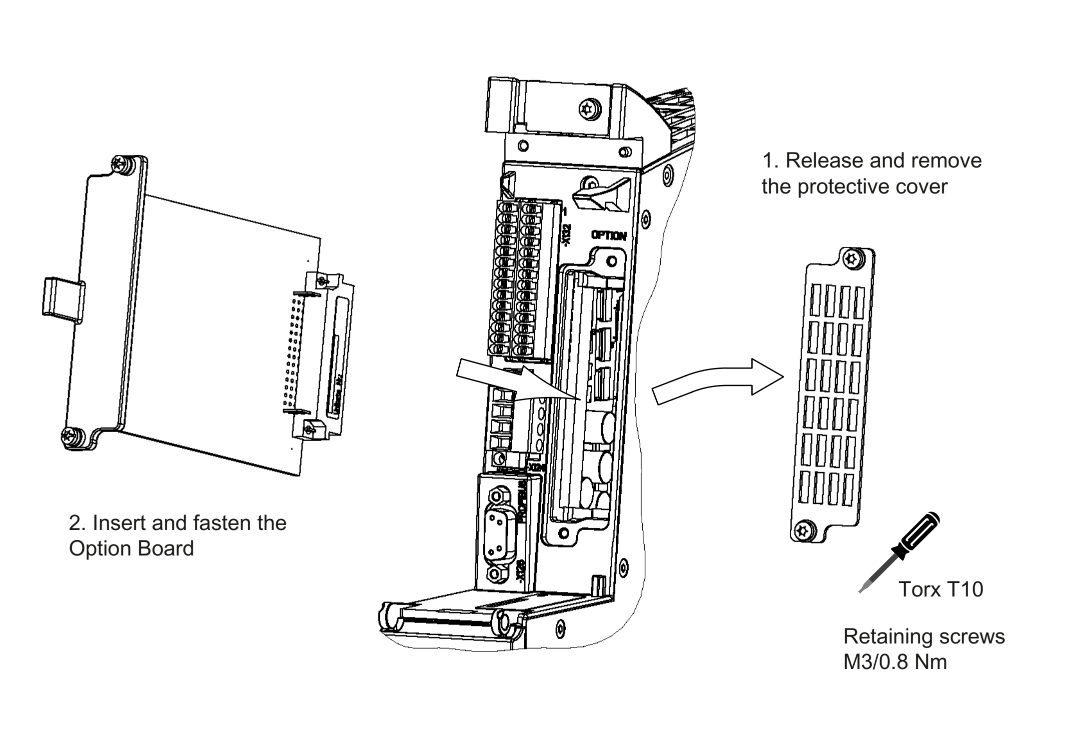


Figure 3-13 Installing an Option Board using a CU320-2 DP as an example

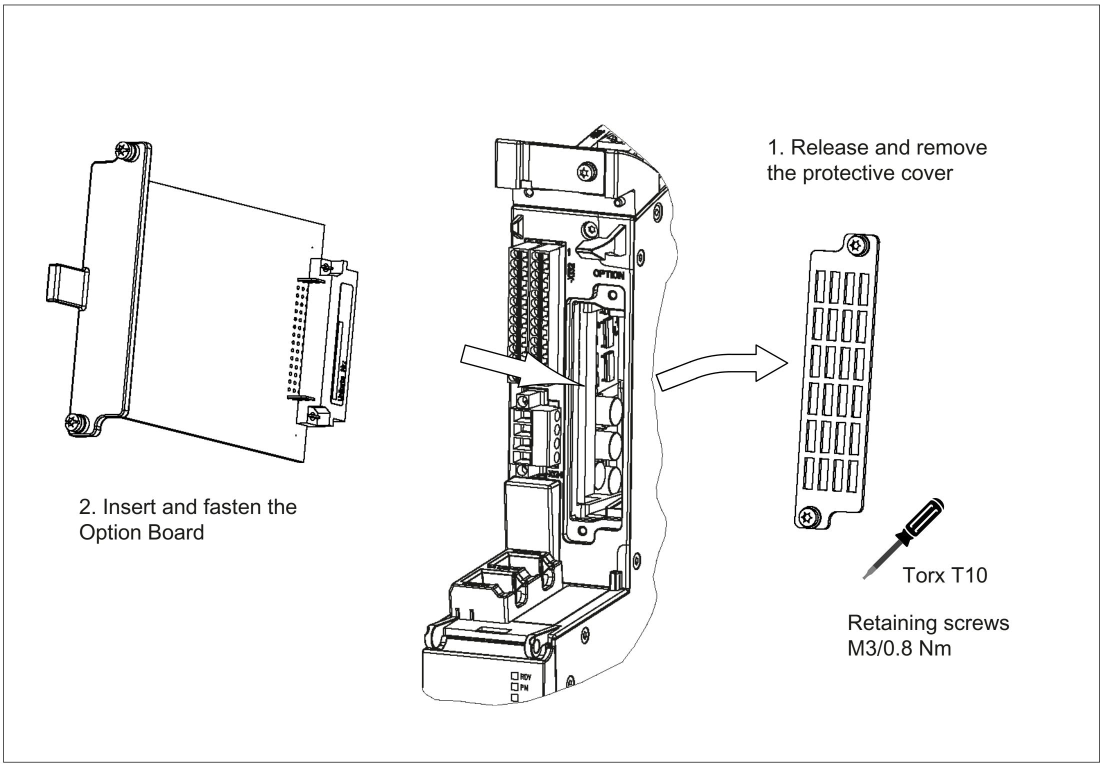


Figure 3-14 Installing an Option Board on a CU320-2 PN

3.4.6 Electrical Connection

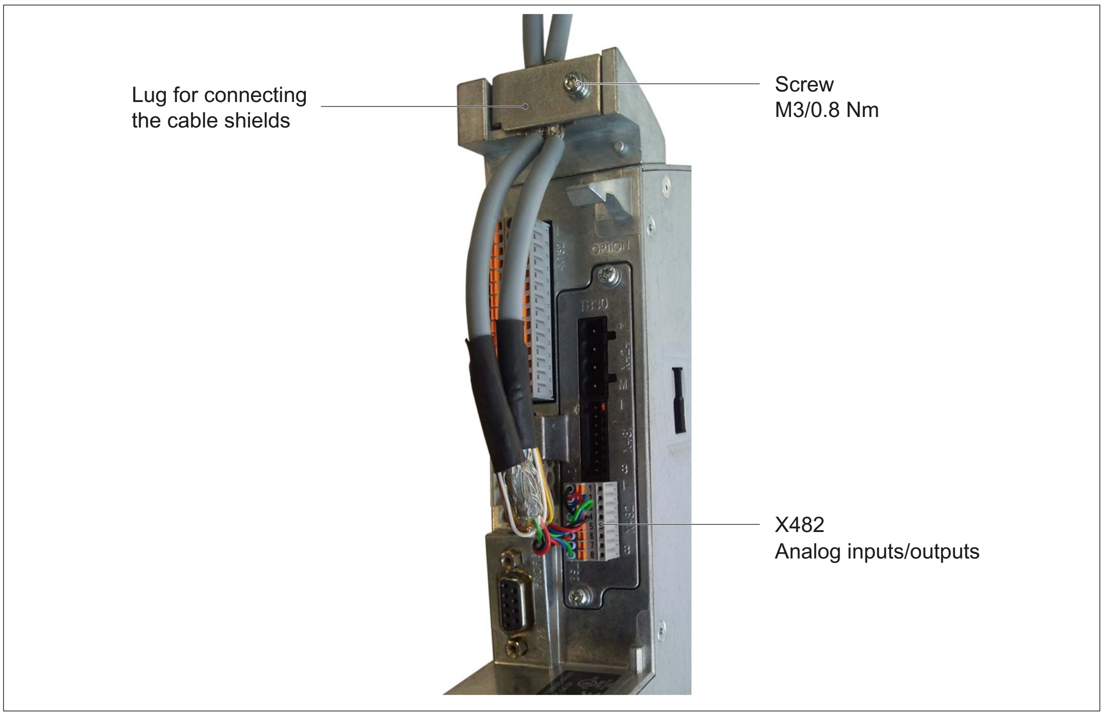


Figure 3-15 Shield support for TB30 on the CU320-2 DP

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

3.4.7 Technical Specifications

Table 3- 18 Technical data

3SL3055-0AA00-2TAx	Unit	Value
Electronics power supply Voltage Current via the option slot of the CU (without digital outputs) Power loss	 V_{DC} A_{DC} W	 24 DC (20.4 – 28.8) 0.05 <3
Response time	The response time of digital inputs/outputs and of analog inputs/outputs depends on the evaluation on the Control Unit (see function diagram). Additional information: SINAMICS S120/S150 List Manual (LH1), Chapter "Function block diagrams"	
Weight	kg	0.1

3.5 Terminal Module TM15

3.5.1 Description

The Terminal Module TM15 is a terminal expansion for snapping on to an EN 60715 DIN rail. The TM15 can be used to increase the number of available digital inputs/outputs within a drive system.

Table 3- 19 Interface overview of the TM15

Type	Quantity
Digital inputs/outputs	24 (electrical isolation in 3 groups each with 8 DI/O)

3.5.2 Safety information

⚠ WARNING
The ventilation spaces of 50 mm above and below the component must be observed.

3.5.3 Interface description

3.5.3.1 Overview

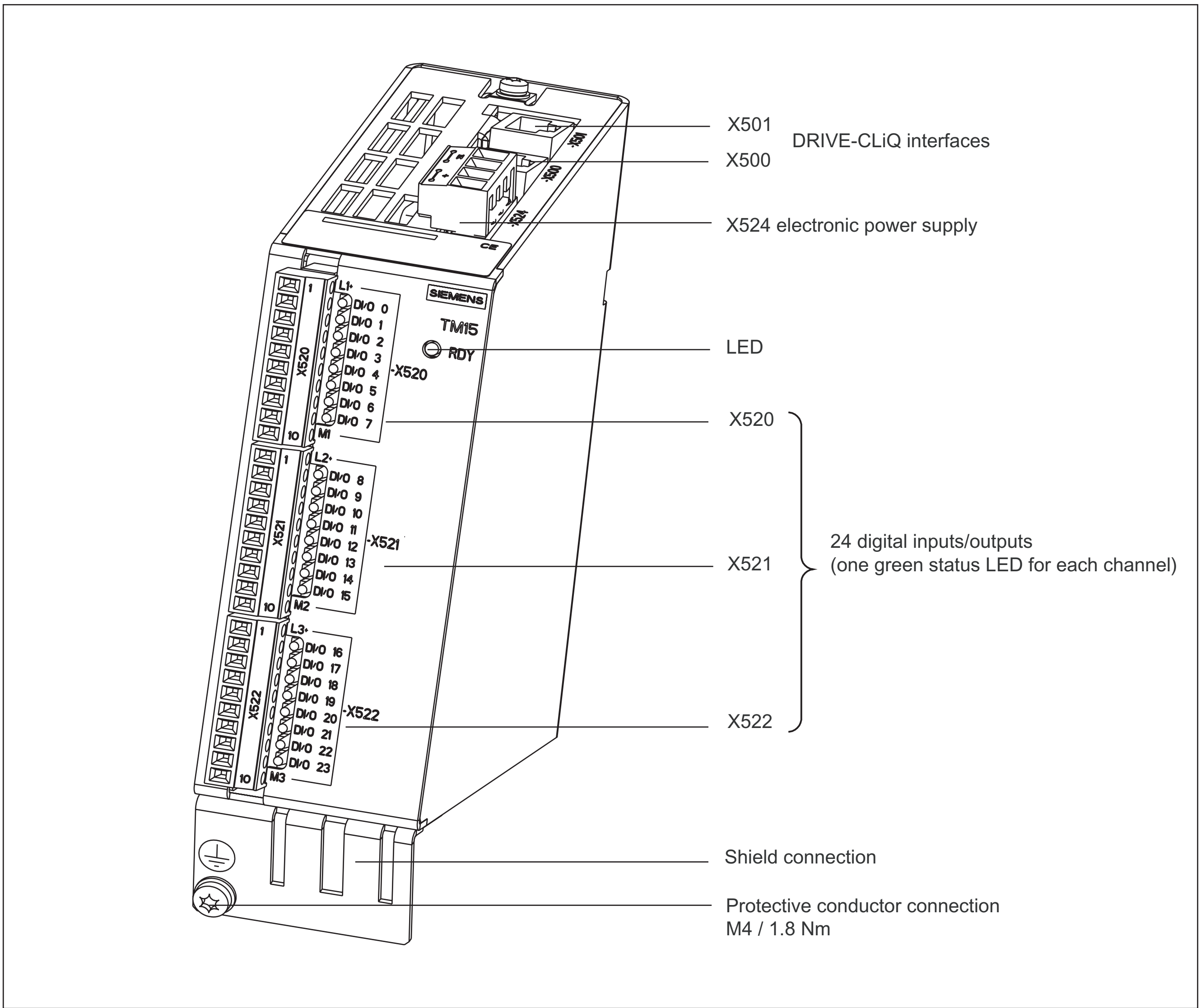
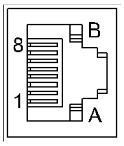


Figure 3-16 Interface description TM15

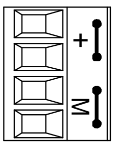
3.5.3.2 X500 and X501 DRIVE-CLiQ interface

Table 3- 20 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 for DRIVE-CLiQ interfaces included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

3.5.3.3 X524 Electronics power supply

Table 3- 21 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. 0.15 A Max. current via jumper in connector: 20 A
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

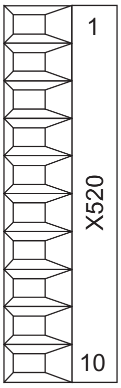
Note

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. The digital outputs are supplied via terminals X520, X521 and X522.

3.5.3.4 X520 digital inputs/outputs

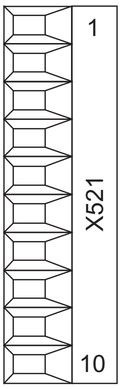
Table 3- 22 Screw terminal X520

	Terminal	Designation 1)	Technical specifications
	1	L1+	See the section titled "Technical data"
	2	DI/DO 0	
	3	DI/DO 1	
	4	DI/DO 2	
	5	DI/DO 3	
	6	DI/DO 4	
	7	DI/DO 5	
	8	DI/DO 6	
	9	DI/DO 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/DO 0 to 7 (first potential group) must always be connected if at least one DI/DO of the potential group is used as output.
M1: A reference ground for DI/D 0 to 7 (first potential group) must always be connected if at least one DI/DO of the potential group is used as either input or output.
DI/DO: Digital input/output

3.5.3.5 X521 digital inputs/outputs

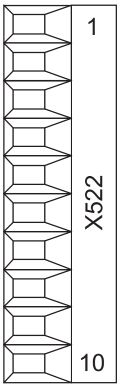
Table 3- 23 Screw terminal X521

	Terminal	Designation 1)	Technical specifications
	1	L2+	See the section titled "Technical data"
	2	DI/DO 8	
	3	DI/DO 9	
	4	DI/DO 10	
	5	DI/DO 11	
	6	DI/DO 12	
	7	DI/DO 13	
	8	DI/DO 14	
	9	DI/DO 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/DO 8 to 15 (second potential group) must always be connected if at least one DI/DO of the potential group is used as output.
M2: A reference ground for DI/DO 8 to 15 (second potential group) must always be connected if at least one DI/DO of the potential group is used as either input or output.
DI/DO: Digital input/output

3.5.3.6 X522 digital inputs/outputs

Table 3- 24 Screw terminal X522

	Terminal	Designation 1)	Technical specifications
	1	L3+	See the section titled "Technical data"
	2	DI/DO 16	
	3	DI/DO 17	
	4	DI/DO 18	
	5	DI/DO 19	
	6	DI/DO 20	
	7	DI/DO 21	
	8	DI/DO 22	
	9	DI/DO 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/DO 16 to 23 (third potential group) must always be connected if at least one DI/DO of the potential group is used as output.
M3: A reference ground for DI/D 16 to 23 (third potential group) must always be connected if at least one DI/DO of the potential group is used as either input or output.
DI/DO: Digital input/output

3.5.4 Connection example

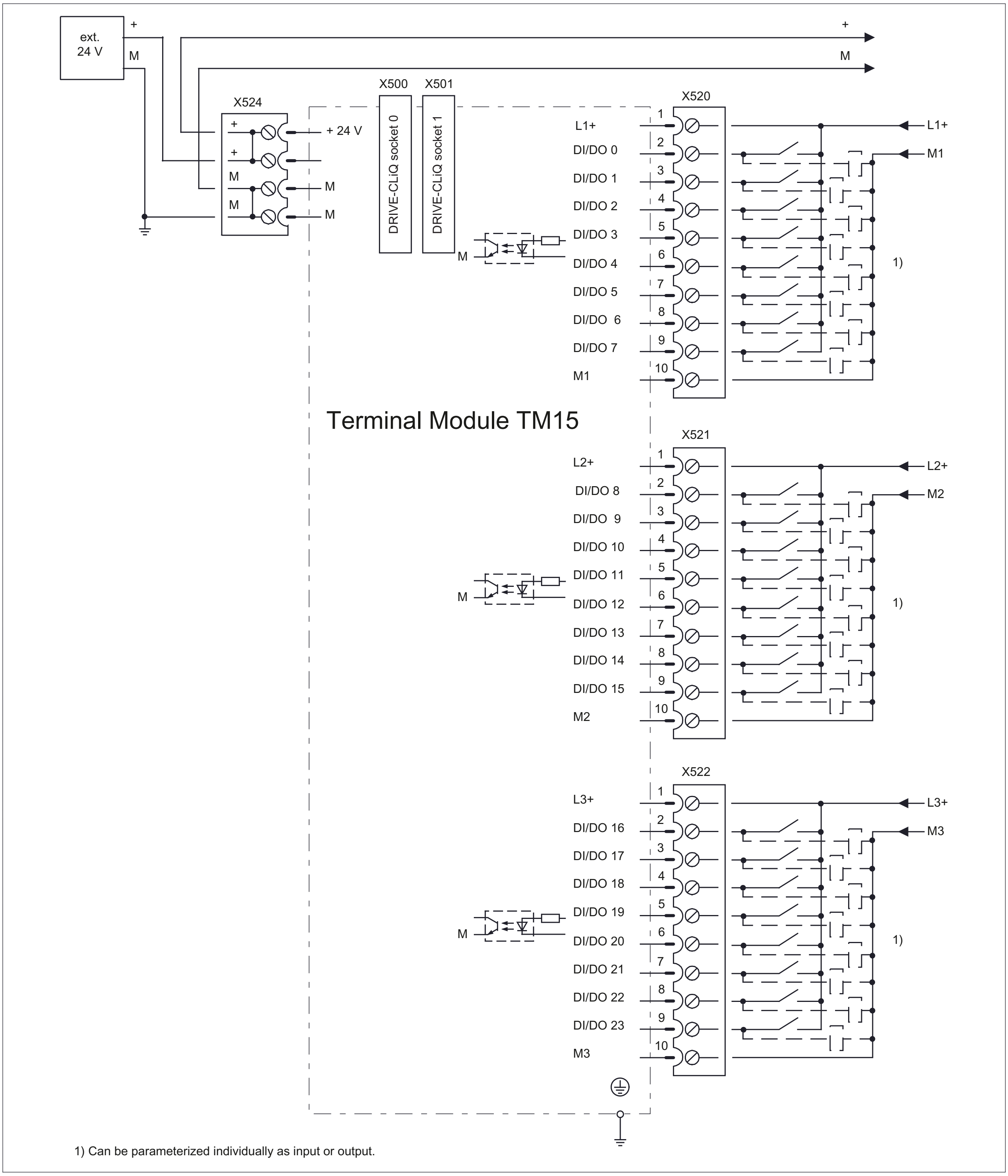


Figure 3-17 Example connection of TM15

3.5.5 Meaning of the LED

Table 3- 25 Meanings of the LEDs on the Terminal Module TM15

LED	Color	Status	Description, cause	Remedy
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 light	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 documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

3.5.6 Dimension drawing

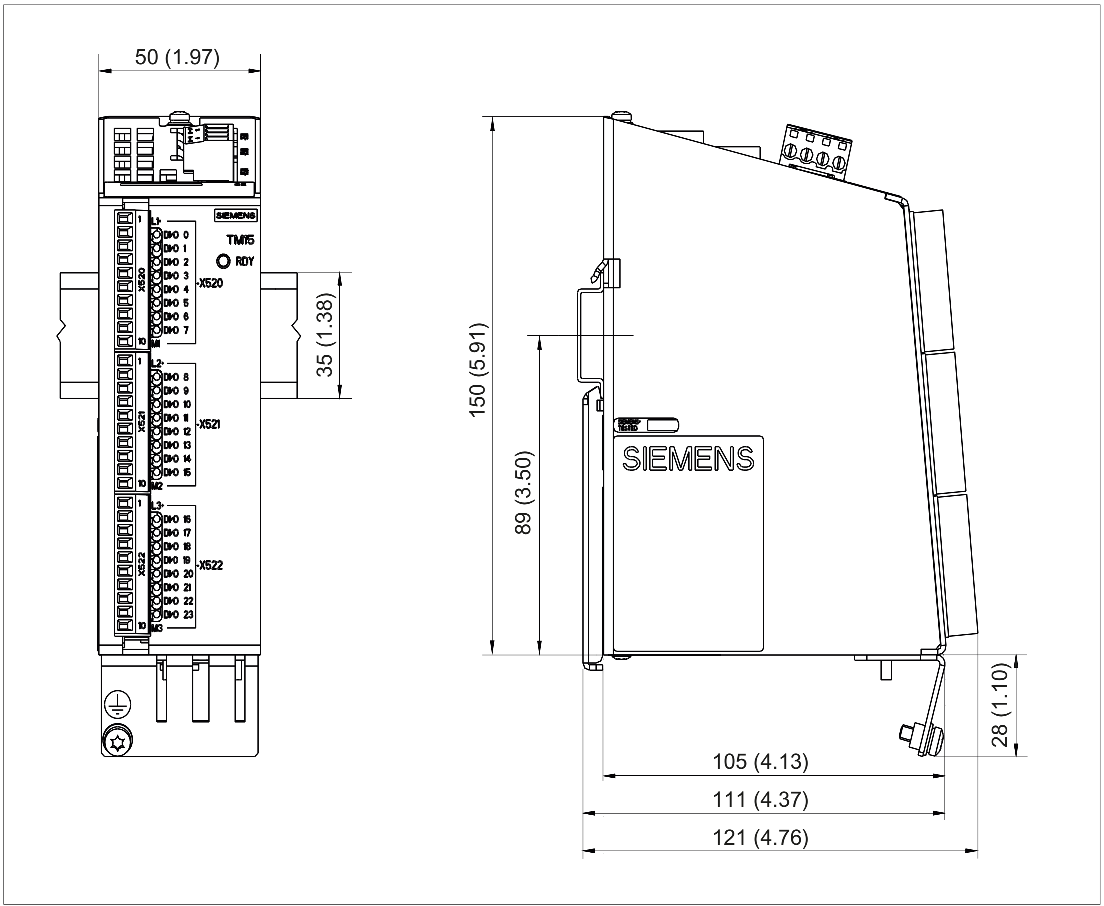


Figure 3-18 Dimension drawing of Terminal Module TM15, all data in mm and (inches)

3.5.7 Installation

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

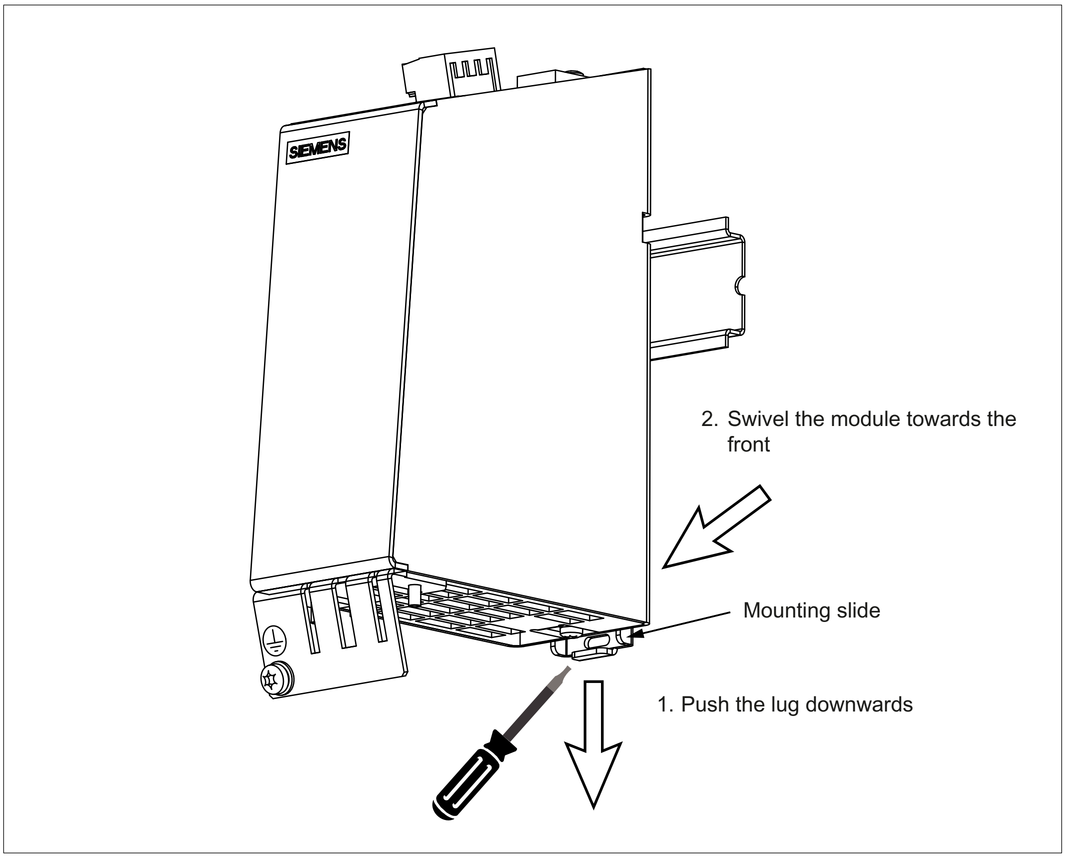


Figure 3-19 Removal of a component from a DIN rail

3.5.8 Protective conductor connection and shield support

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

The following figure shows typical Weidmüller shield connection clamps for the shield supports.

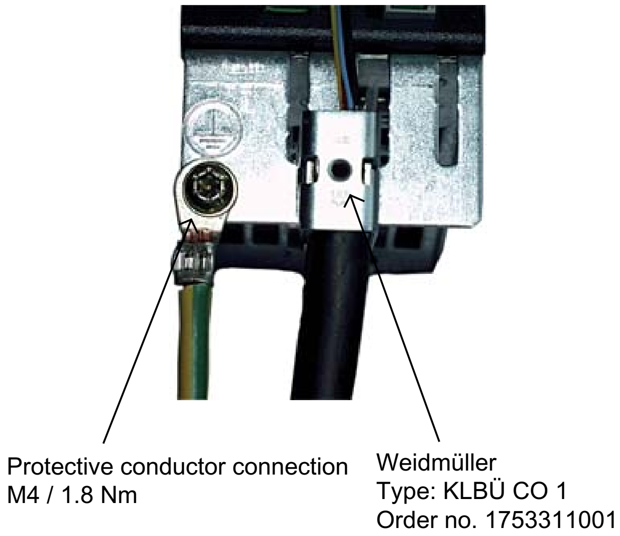


Figure 3-20 Shield supports and protective conductor connection

Weidmüller website address: 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 use screws with a permissible mounting depth of 4 - 6 mm.

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).

3.5.9 Connector coding

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:

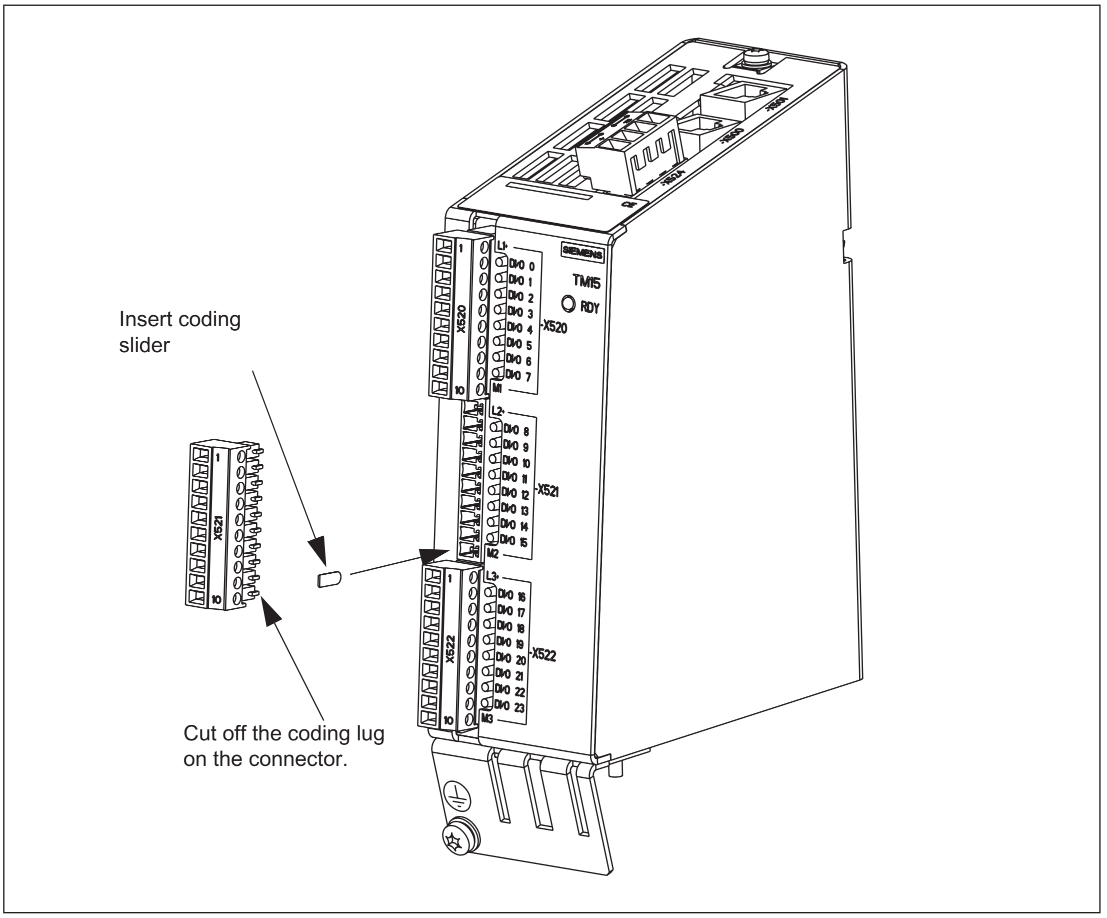


Figure 3-21 Procedure for encoding a connector

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).

3.5.10 Technical specifications

Table 3- 26 Technical data

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 2,000 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	
Electrical 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 V DC)	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	"0" → "1": 50 "1" → "0": 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	"0" → "1": 50 "1" → "0": 150
maximum	μs	"0" → "1": 100 "1" → "0": 225
Min. output pulse (100% amplitude, 0.5 A with resistive load)	μs	125 (typ.) 350 (max.)
Switching frequency For resistive load For inductive load For lamp load Maximum lamp load	 Hz Hz Hz W	 Max. 100 Max. 0.5 Max. 10 5
Max. switching frequency (100% amplitude, 50%/50% duty cycle; with 0.5 A and a resistive load)	kHz	1 (typ.)

6SL3055-0AA00-3FAx	Unit	Value
Voltage drop in ON state	V_{DC}	0.75 (max.) for maximum load in all circuits
Leakage current in OFF state	μA	max. 10 per channel
Voltage drop, output (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) Further information: SINAMICS S120/S150 List Manual (LH1), Chapter "Function block diagrams"	
Weight	kg	0.86
Approbation	UL and cULus http://www.ul.com File: E164110, Vol. 2, Sec. 9	

3.6 Terminal Module TM31

3.6.1 Description

The Terminal Module TM31 is a terminal expansion for snapping on to an EN 60715 DIN 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 interfaces:

Table 3- 27 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

3.6.2 Safety information

⚠ WARNING

The ventilation spaces of 50 mm above and below the component must be observed.

⚠ CAUTION

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

3.6.3 Interface description

3.6.3.1 Overview

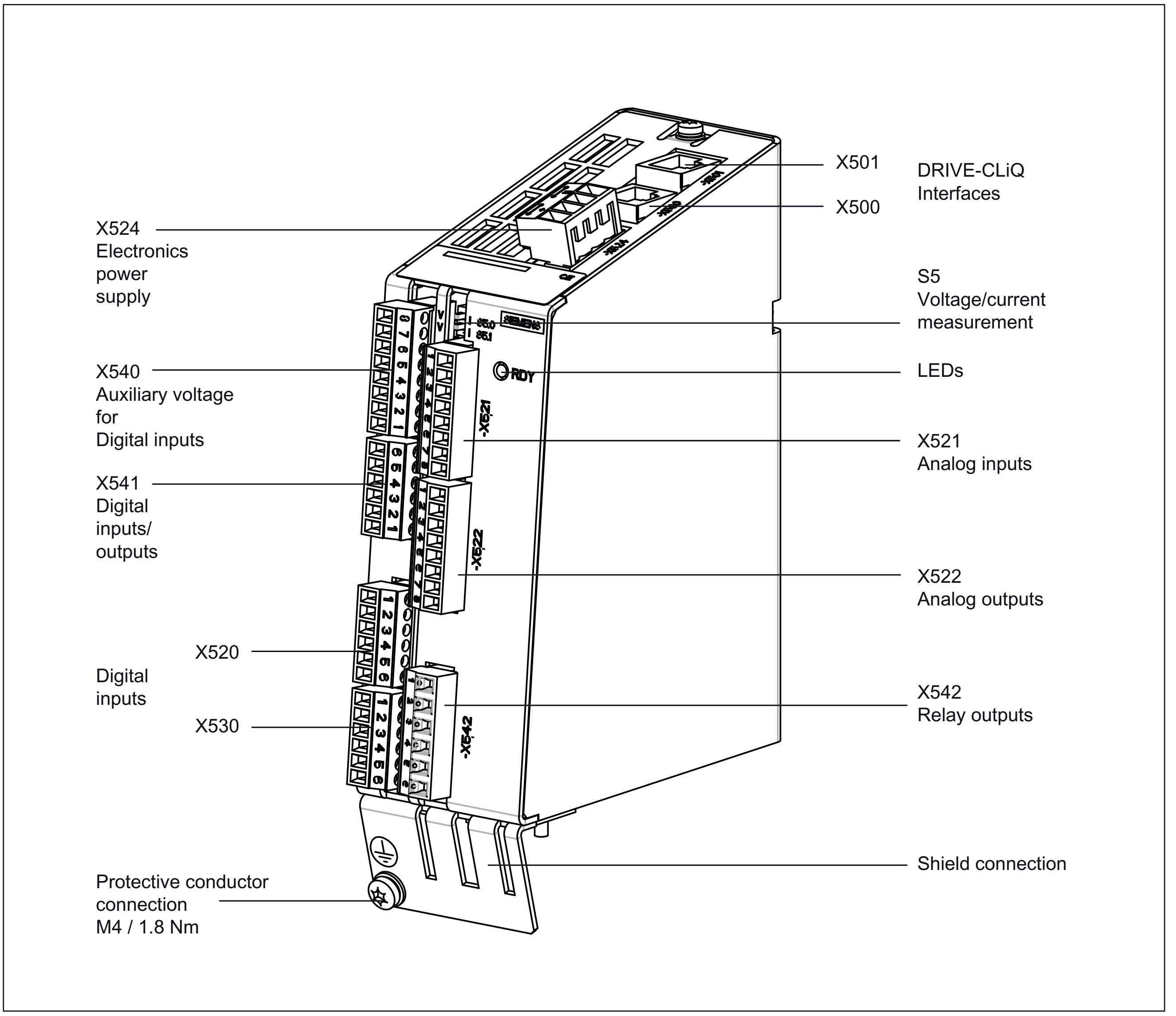
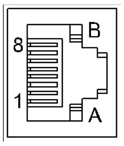


Figure 3-22 Interface description TM31

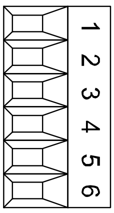
3.6.3.2 X500 and X501 DRIVE-CLiQ interface

Table 3- 28 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 for DRIVE-CLiQ interfaces included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

3.6.3.3 Digital inputs X520

Table 3- 29 Screw terminal X520

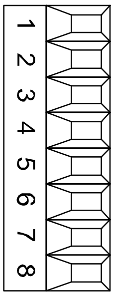
	Terminal	Designation 1)	Technical specifications
	1	DI 0	Voltage: - 3 V to +30 V Typical current consumption: 10 mA at 24 V DC Input delay: - for "0" to "1": Typ. 50 μs max. 100 μs - For "1" to "0": Typ. 130 μs max. 150 μs Electrical isolation: Reference potential is Terminal M1 Level (incl. ripple) 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 (DI) to function, terminal M1 must be connected. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. A jumper to terminal M (Notice! This removes the electrical isolation for these digital inputs.)

3.6.3.4 X521 analog inputs

Table 3- 30 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

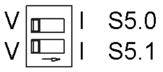
CAUTION
If more than ±35 mA flows through the analog current input, then the component could be destroyed. Permissible input voltage ±30 V (destruction limit). Permissible common-mode voltage ±10 V, more errors if exceeded. Permissible back-EMF at the auxiliary voltage outputs ±15 V.

Note

The power supply for the analog inputs can be taken internally or from an external power supply unit.

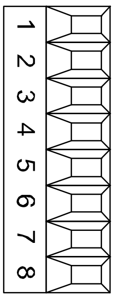
3.6.3.5 S5 current/voltage changeover switch for analog inputs

Table 3- 31 Current/voltage selector S5

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

3.6.3.6 X522 analog outputs/temperature sensor

Table 3- 32 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

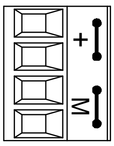
CAUTION
Permissible back-EMF at the outputs: ±15 V

NOTICE
The KTY temperature sensor must be connected with the correct polarity.

> ⚠ DANGER
>
> **Risk of electric shock!**
>
> Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) or Terminal Module TM120 must be used.
>
> If these instructions are not complied with, there is a risk of electric shock!

3.6.3.7 X524 Electronics power supply

Table 3- 33 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. 0.5 A Max. current via jumper in connector: 20 A
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

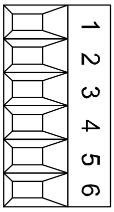
Note

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 and digital outputs.

3.6.3.8 Digital inputs X530

Table 3- 34 Screw terminal X530

	Terminal	Designation 1)	Technical specifications
	1	DI 4	Voltage: -3 V to +30 V Typical power 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 (DI) to function, terminal M2 must be connected.

This is achieved by:

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

3.6.3.9 Auxiliary voltage for the digital inputs X540

Table 3- 35 Screw terminal X540, for order number: 6SL3055-0AA00-3AA1

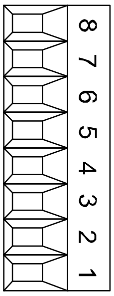
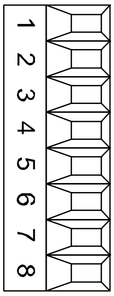
	Terminal	Designation	Technical specifications
	8	+24 V	Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage for terminals X540 and X541 combined: 150 mA
	7	+24 V	
	6	+24 V	
	5	+24 V	
	4	+24 V	
	3	+24 V	
	2	+24 V	
	1	+24 V	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1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

Table 3- 36 Screw terminal X540, for order number: 6SL3055-0AA00-3AA0

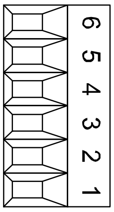
	Terminal	Designation	Technical specifications
	1	+24 V	Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage for terminals X540 and X541 combined: 150 mA
	2	+24 V	
	3	+24 V	
	4	+24 V	
	5	+24 V	
	6	+24 V	
	7	+24 V	
	8	+24 V	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1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

Note

This voltage supply is only for powering the digital inputs.

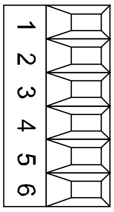
3.6.3.10 X541 bidirectional digital inputs/outputs

Table 3- 37 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 to the inputs): 100 mA/1 A (can be parameterized) Continued-short-circuit-proof Output delay: - For "0" to "1": Typ. 150 μs at 0.5 A resistive load (500 μs maximum) - For "1" to "0": Typ. 50 μs at 0.5 A resistive load Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	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- 38 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 to 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 Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	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

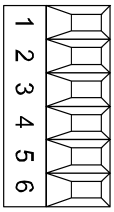
An open input is interpreted as "low".

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

3.6.3.11 Relay outputs X542

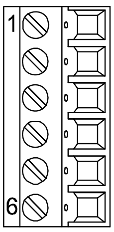
Table 3- 39 Terminal block X542, for order number: 6SL3055-0AA00-3AA1

	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 (resistive load) Required minimum current: 100 mA Output delay: ≤ 20 ms 2) Overvoltage category: Class III to EN 60664-1
	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 mm² Type: Screw terminal 3 (see Appendix A)			

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

2) depending on the parameters assigned and the supply voltage (P24) of the TM31

Table 3- 40 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 (resistive load) Required minimum current: 100 mA Output delay: ≤ 20 ms 2) Overvoltage category: Class III to EN 60664-1
	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 mm² Type: Screw terminal 3 (see Appendix A)			

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

2) depending on the parameters assigned and the supply voltage (P24) of the TM31

3.6.4 Connection example

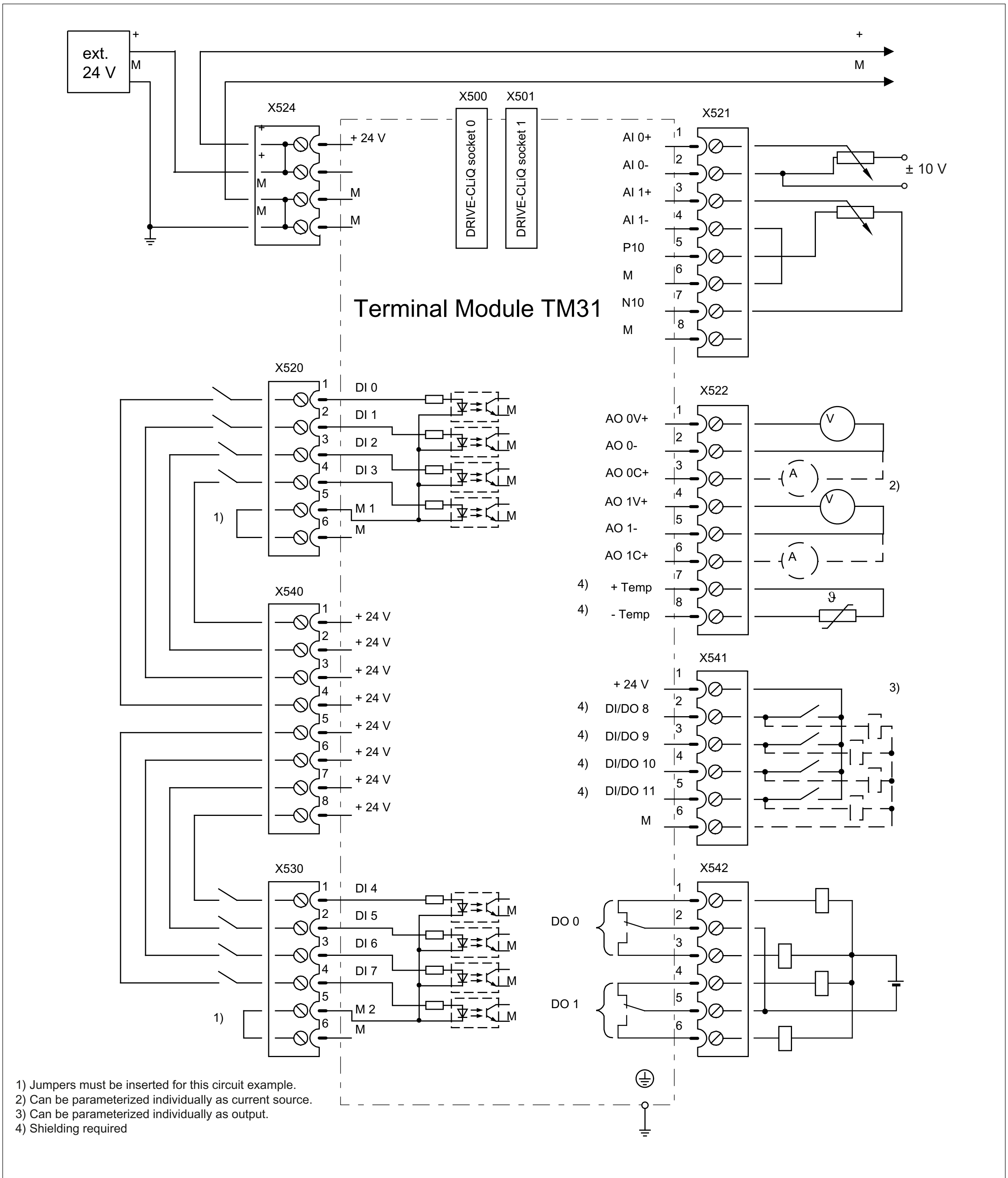


Figure 3-23 Connection example of TM31

3.6.5 Meaning of the LED

Table 3- 41 Meanings of the LEDs on the Terminal Module TM31

LED	Color	Status	Description, cause	Remedy
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 light	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 documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

3.6.6 Dimension drawing

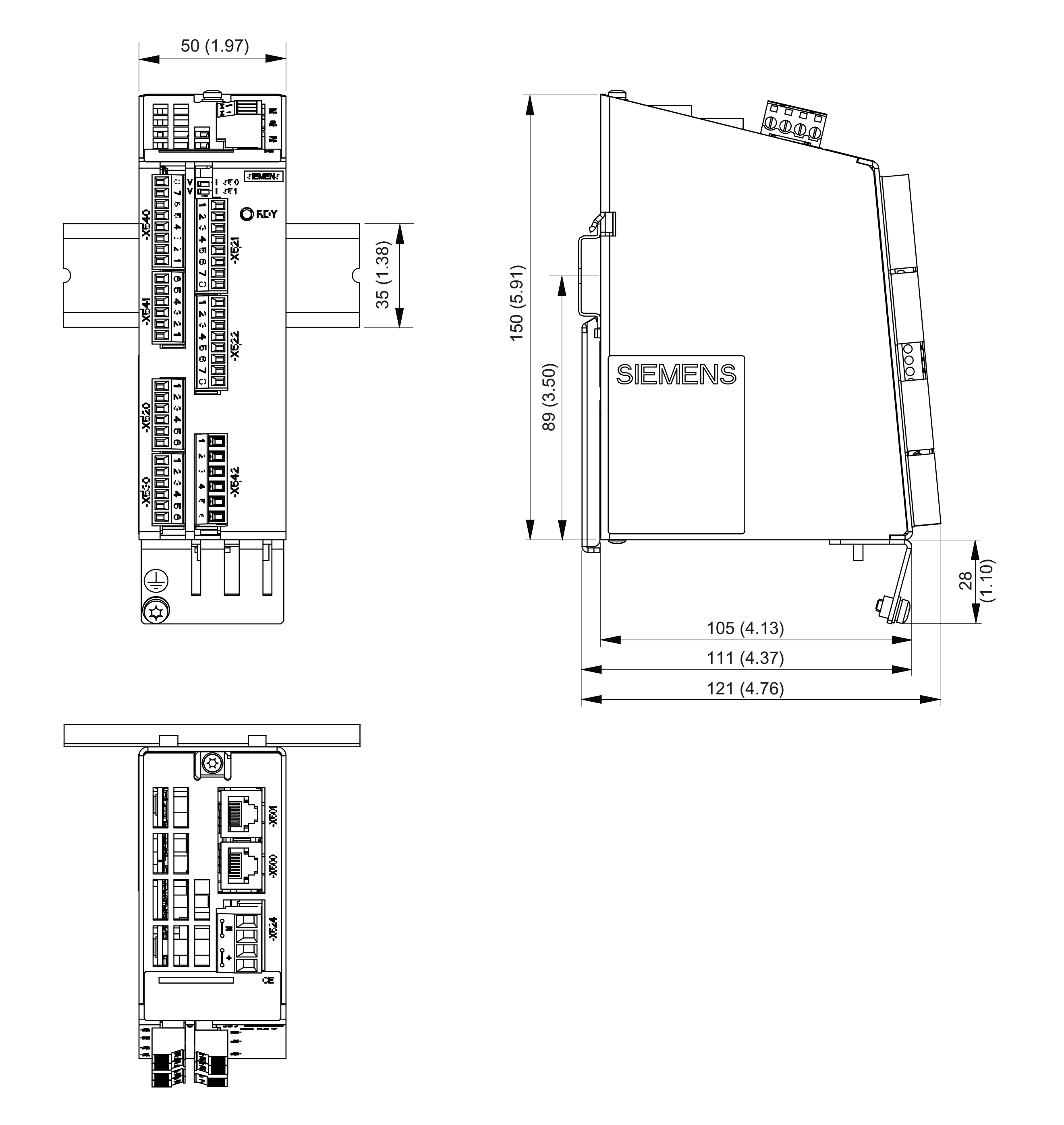


Figure 3-24 Dimension drawing of Terminal Module TM31, all data in mm and (inches)

3.6.7 Installation

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

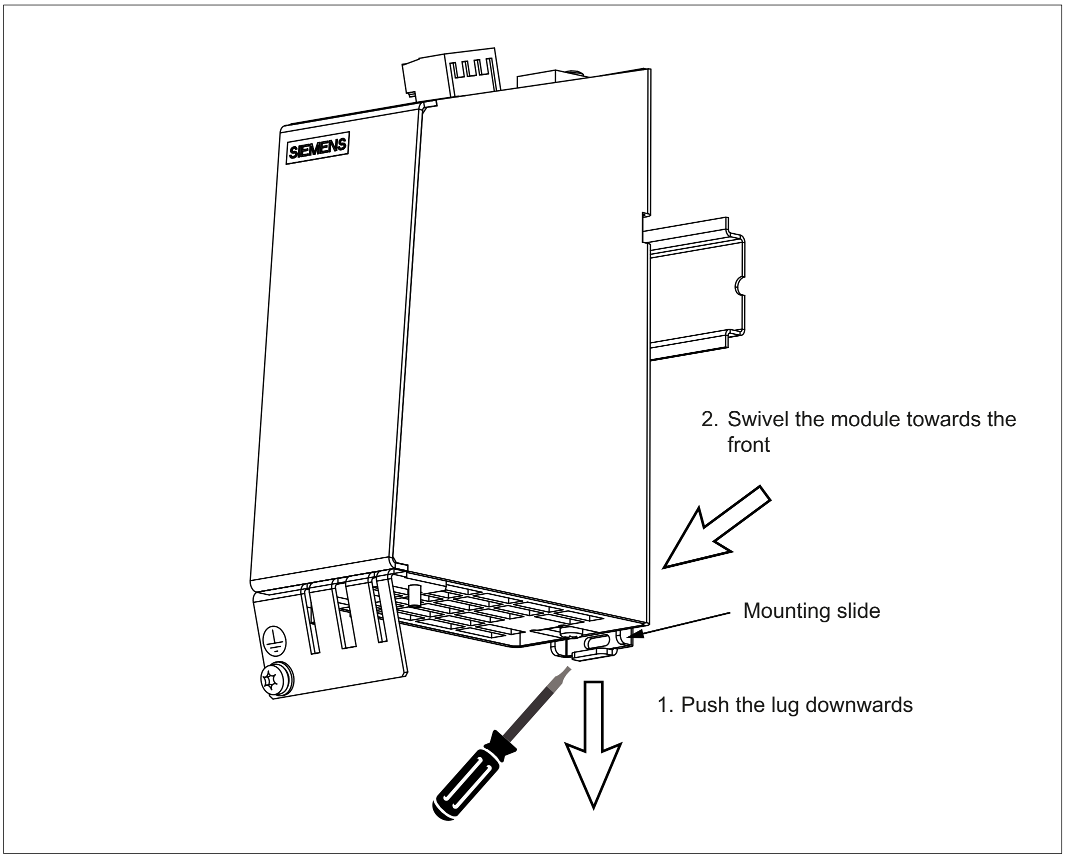


Figure 3-25 Removal of a component from a DIN rail

3.6.8 Protective conductor connection and shield support

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

The following figure shows typical Weidmüller shield connection clamps for the shield supports.

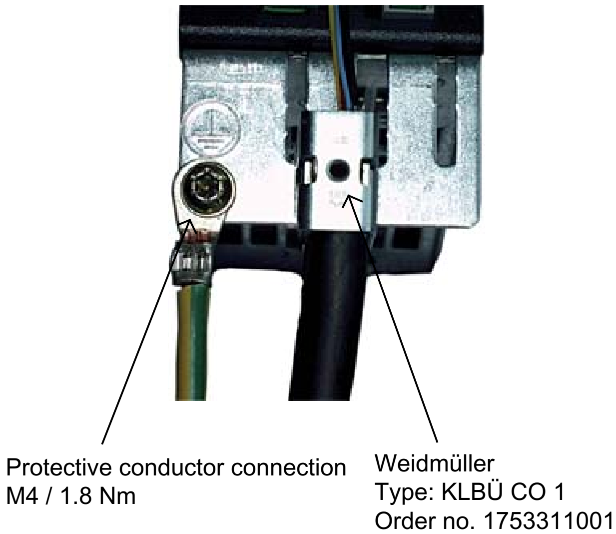


Figure 3-26 Shield supports and protective conductor connection

Weidmüller website address: 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 use screws with a permissible mounting depth of 4 - 6 mm.

3.6.9 Connector coding

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

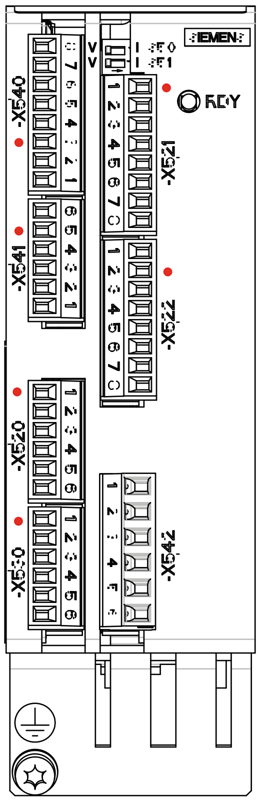


Figure 3-27 Connector codes of the TM31

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

3.6.10 Technical Specifications

Table 3- 42 Technical data

6SL3055-0AA00-3AAx	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 DC (20.4 – 28.8)
Current (without DRIVE-CLiQ or digital outputs)	A_{DC}	0.5
Power loss	W	<10
PE/ground connection	On housing with M4/1.8 Nm screw	
Response time	The response time for the digital inputs/outputs and for 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). Additional information: SINAMICS S120/S150 List Manual (LH1), Chapter "Function block diagrams"	
Weight	kg	1

3.7 Terminal Module TM41

3.7.1 Description

The Terminal Module TM41 is an expansion module for snapping on to a DIN rail (EN 60715) in the control 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.

The TM41 contains the following interfaces:

Table 3- 43 Interface overview of the TM41

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

3.7.2 Safety information

⚠ WARNING
The ventilation spaces of 50 mm above and below the component must be observed.

3.7.3 Interface description

3.7.3.1 Overview

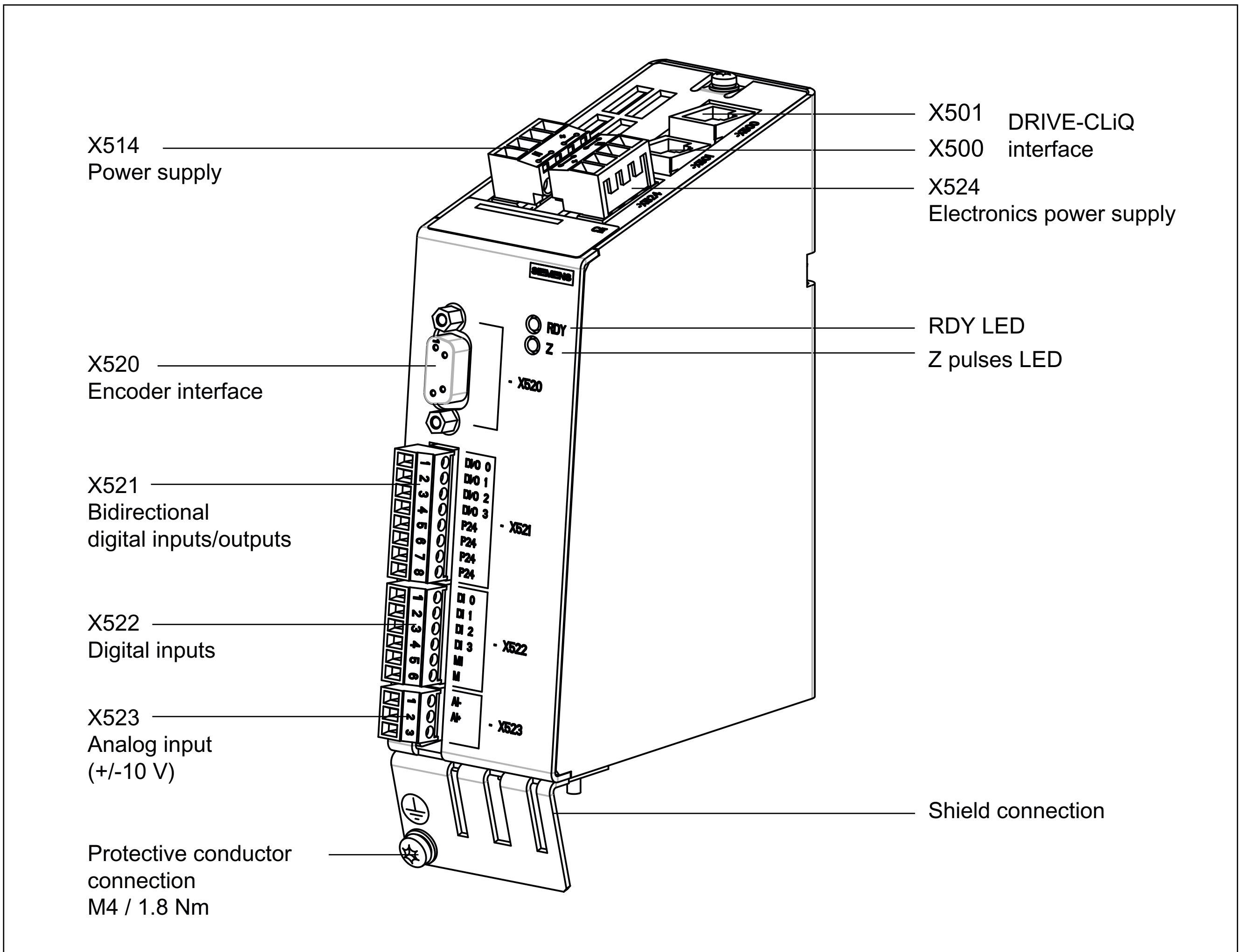
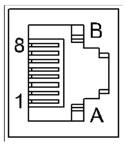


Figure 3-28 Interface description TM41

3.7.3.2 X500 and X501 DRIVE-CLiQ interface

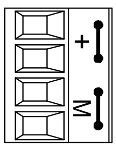
Table 3- 44 DRIVE-CLiQ interfaces X500 and X501

	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 for DRIVE-CLiQ interfaces included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

3.7.3.3 X514 and X524 Power supply

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

Table 3- 45 Power supply terminals X514 and X524

	Terminal	Designation	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
	+	Power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

Note

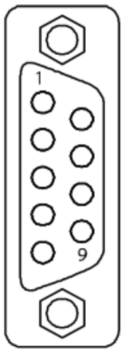
The two "+" and "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.

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

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

3.7.3.4 Sensor interface X520

Table 3- 46 X520 interface

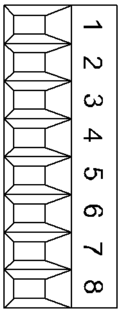
	Pin	Signal name	Technical specifications
	1	A	Incremental signal A
	2	R	Reference signal R
	3	B	Incremental signal B
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	A*	Inverted incremental signal A
	7	R*	Inverted reference signal R
	8	B*	Inverted incremental signal B
	9	M	Ground
TTL encoder (RS485) 100 m max. cable length Type: 9-pin SUB-D female			

Note

The X520 encoder interface produces signals acc. to RS485 standard.

3.7.3.5 X521 Bidirectional digital inputs/outputs

Table 3- 47 Terminal block X521

	Terminal	Designation	Technical specifications
	1	DI/DO 0	**As input**: Voltage: -3 V to +30 V DC Typical current consumption: 10 mA at 24 V Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: For "0" → "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" → "1": typ. 150 µs at 0.5 A resistive load (500 µs maximum) For "1" → "0": Typ. 150 µs at 0.5 A resistive load Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	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

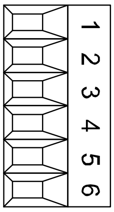
An open input is interpreted as "low".

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

3.7.3.6 X522 digital inputs / floating (isolated)

Table 3- 48 Terminal block X522

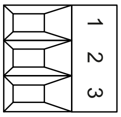
	Terminal	Designation [1)]	Technical specifications
	1	DI 0	Voltage: 3 V to +30 V DC Typical current consumption: 6.5 mA at 24 V Electrical isolation: The reference potential is terminal M1 Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: For "0" → "1": typ. 50 μs max. 100 μs - For "1" to "0": typ. 110 μs, max. 150 μs
	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 is achieved by: 1. Routing the ground reference of the digital inputs as well, or 2. A jumper to terminal M (Notice! This removes electrical isolation for these digital inputs).

3.7.3.7 X523 Analog input

Table 3- 49 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 bits (13 bits + sign) [2)] Resolution: 13 bits (12 bits + sign) [3)]
	2	AI 0+	
	3	Reserved, do not use	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) AI: analog input

2) Component order numbers that end with ..-3PA0

3) 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

3.7.4 Connection example

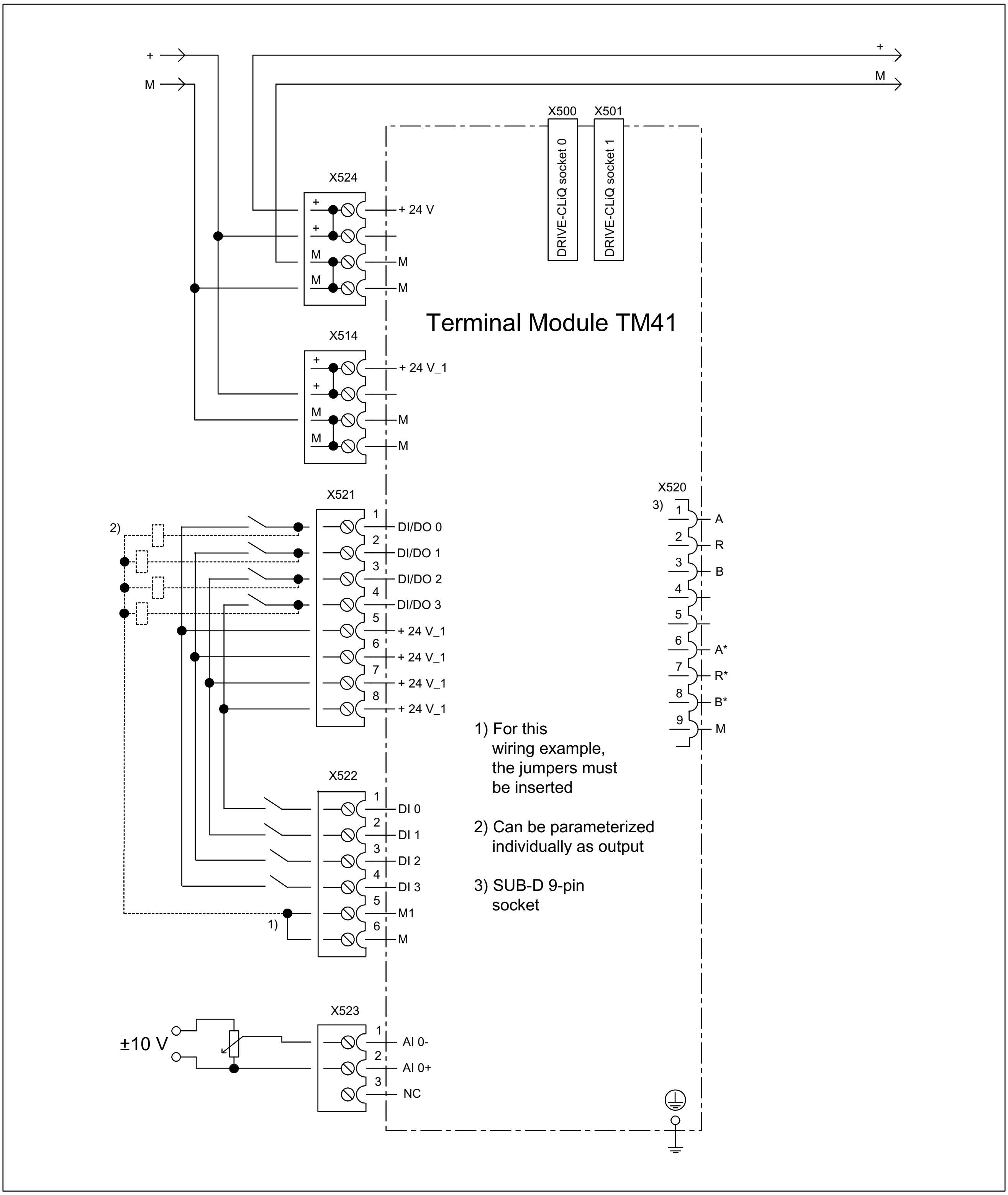


Figure 3-29 Sample connection of TM41

3.7.5 Meaning of LEDs

Table 3- 50 Meaning of the LEDs on the Terminal Module TM41

LED	Color	Status	Description, cause	Remedy
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 light	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 light	Zero mark not enabled or zero mark search.	–
	Green	Continuous light	Stopped at zero mark.	–
		Flashing light	Zero mark is output at each virtual revolution.	–

Cause and rectification of faults

The following documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

3.7.6 Dimension drawing

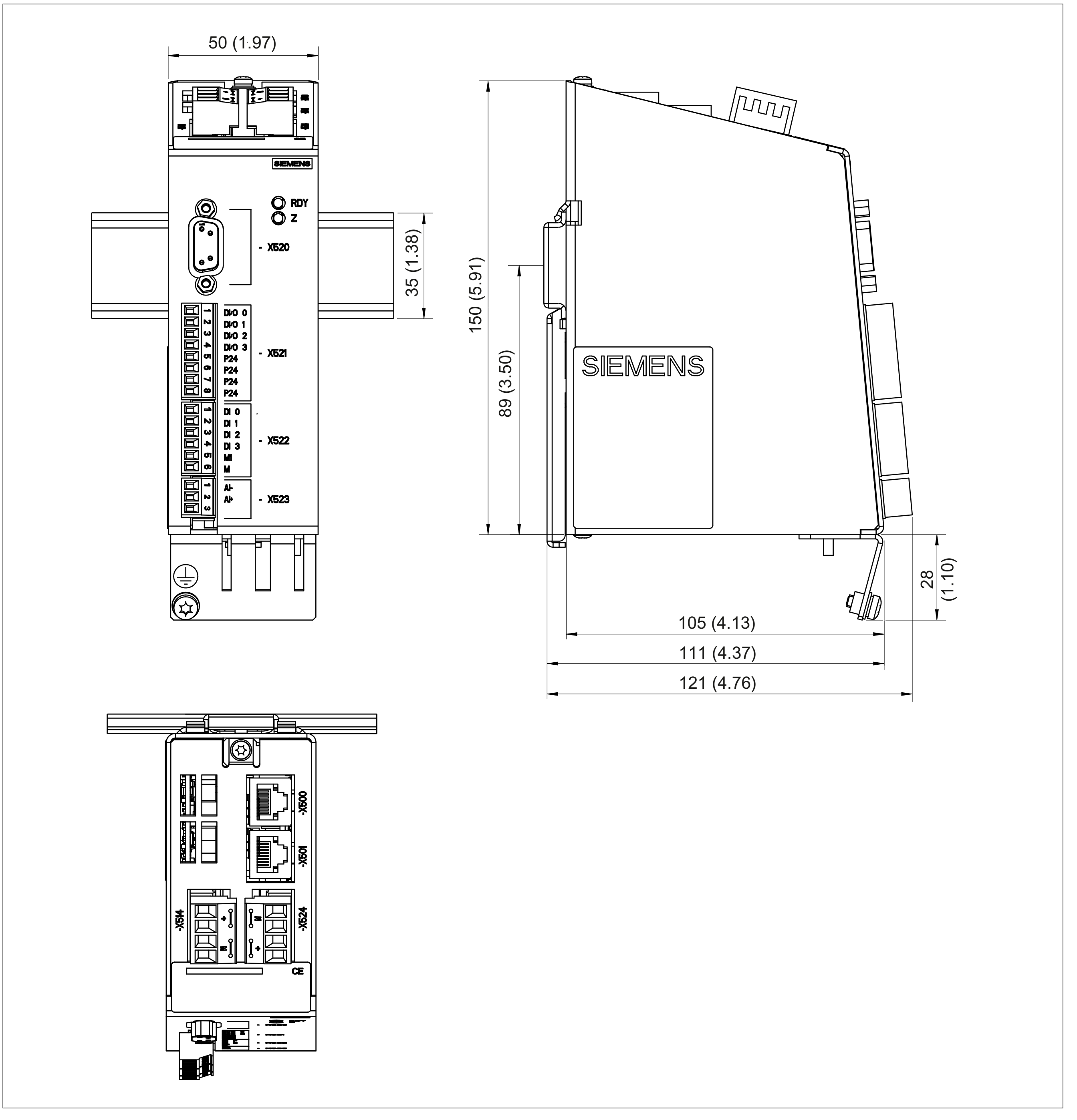


Figure 3-30 Dimension drawing of Terminal Module TM41, all data in mm and (inches)

3.7.7 Installation

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

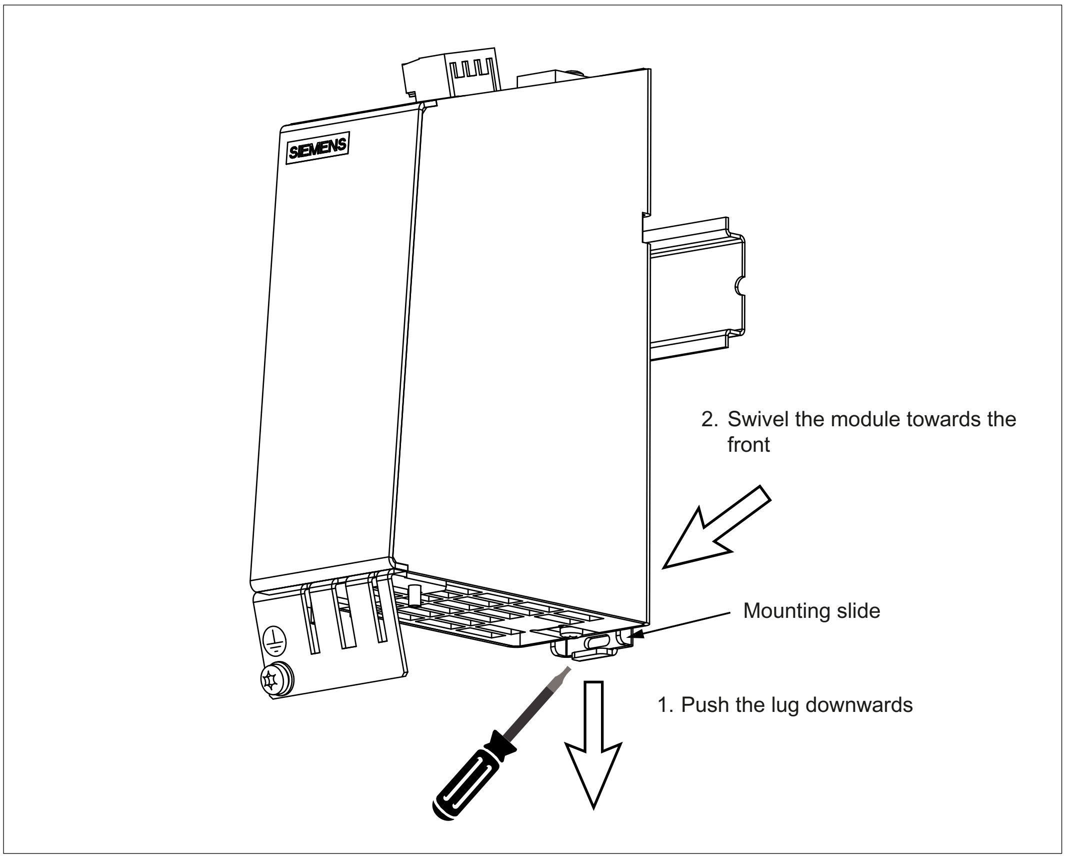


Figure 3-31 Removal of a component from a DIN rail

3.7.8 Protective conductor connection and shield support

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

The following figure shows typical Weidmüller shield connection clamps for the shield supports.

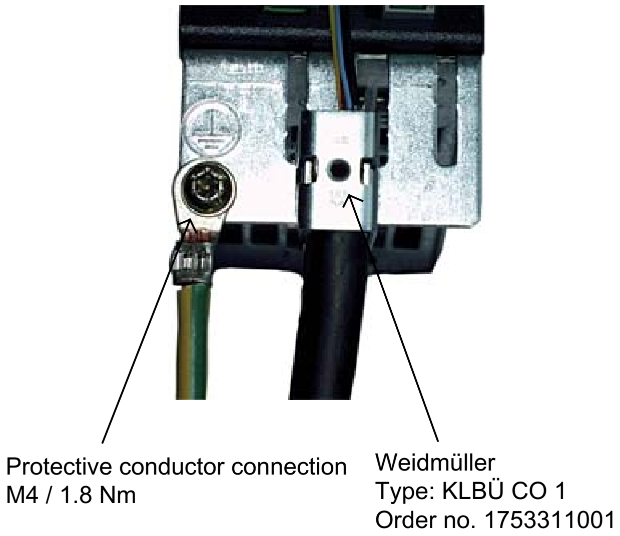


Figure 3-32 Shield supports and protective conductor connection

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

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

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

NOTICE
Only use screws with a permissible mounting depth of 4 - 6 mm.

3.7.9 Technical Specifications

Table 3- 51 Technical data

6SL3055-0AA00-3PAx	Unit	Value
Electronic power supply Voltage Current (without DRIVE-CLiQ or digital outputs) Power loss	 V_{DC} A_{DC} W	 DC 24 (20.4 to 28.8) 0.5 12
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). Further information: SINAMICS S120/S150 List Manual (LH1), Chapter "Function block diagrams"	
Weight	kg	0.85

3.8 Terminal Module TM54F

3.8.1 Description

The Terminal Module TM54F is a terminal expansion for snapping on to an EN 60715 DIN rail. The TM54F offers safe digital inputs and outputs for controlling SINAMICS Safety Integrated functions.

The TM54F connection should be established via the DRIVE-CLiQ directly at a Control Unit. Only one TM54F can be assigned to each Control Unit.
Additional DRIVE-CLiQ nodes can be operated at the TM54F, such as Sensor Modules and Terminal Modules (excluding an additional TM54F). Motor Modules and Line Modules should not be connected to a TM54F.

TM54F features the following interfaces:

Table 3- 52 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, dynamization supported [2)]	2
Sensor[1)] power supply, no dynamization	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, position switches and light arrays/light curtains.

2) Dynamization: The sensor power supply is cycled on and off by the TM54F when the forced checking procedure is active for the sensors, cable routing, and the evaluation electronics.

The TM54F has 4 fail-safe digital outputs and 10 fail-safe digital inputs. A fail-safe digital output consists of a 24 V DC switching output, a ground switching output, and a digital input for checking the switching state. A fail-safe digital input comprises two digital inputs.

Note

The rated values of the F-DO meet the requirements of EN 61131-2 for digital DC outputs with 0.5 A rated current.

The operating ranges of the F-DI meet the requirements of EN 61131-2 for Type 1 digital inputs.

Note

Please note that the F-DIs must take the form of shielded cables if they are > 30 m in length.

3.8.2 Safety information

⚠ WARNING
The ventilation spaces of 50 mm above and below the component must be observed.

3.8.3 Interface description

3.8.3.1 Overview

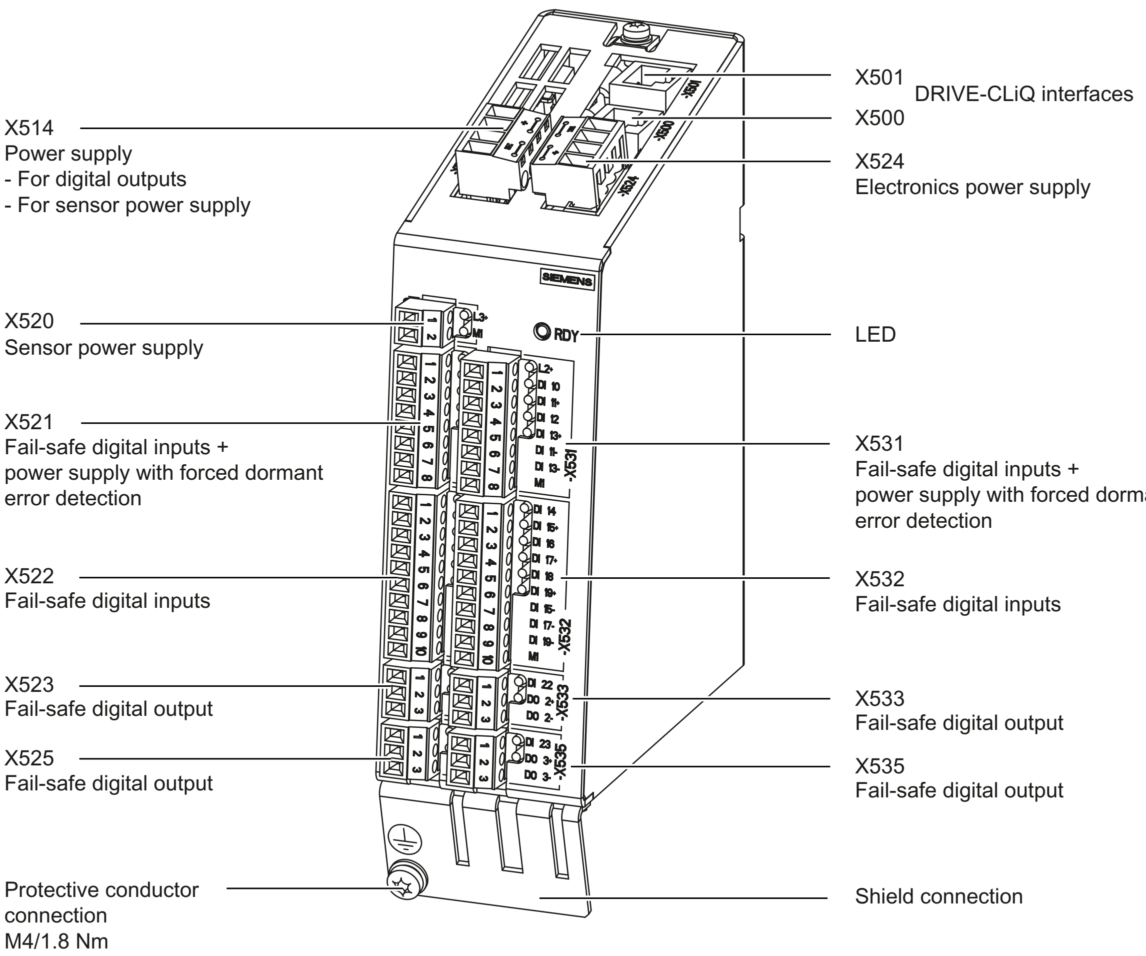
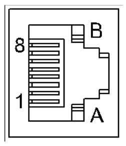


Figure 3-33 Interface description of the TM54F

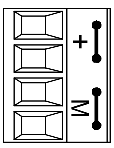
3.8.3.2 X500 and X501 DRIVE-CLiQ interface

Table 3- 53 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 for DRIVE-CLiQ interfaces included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

3.8.3.3 X514 power supply for digital outputs and sensors

Table 3- 54 Terminals for the power supply X514

	Terminal	Designation	Technical specifications
	+	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
	+	Power supply	
	M1	Electronics ground	
	M1	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

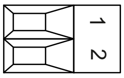
Note

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

1) including the current consumption for the digital outputs and to supply the sensor.

3.8.3.4 X520 sensor power supply

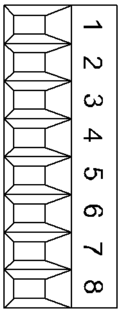
Table 3- 55 Terminal X520

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

Without forced dormant error detection

3.8.3.5 X521 fail-safe digital inputs + power supply with forced dormant error detection

Table 3- 56 Terminal block X521

	Terminal	Designation [1]		Technical specifications
	1	L1+		Voltage: +24 V DC Max. total load current: 500 mA
	2	DI 0	F-DI 0	Voltage: -3 V to +30 V DC Typical current consumption: 3.2 mA at 24 V Electrical isolation: Reference potential, refer to terminals 6, 7, 8 All digital inputs are electrically isolated. Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: [2] For "0" → "1": 30 μs (100 Hz) For "1" to "0": 60 μs (100 Hz)
	3	DI 1+		
	4	DI 2	F-DI 1	
	5	DI 3+		
	6	DI 1-	F-DI 0	Reference potential for DI 1+
	7	DI 3-	F-DI 1	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)				

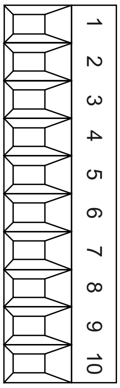
1) DI: Digital input, F-DI: Fail-safe digital input

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 is achieved by: 1) Routing the ground reference of the digital inputs as well, or 2) A jumper between DIx and terminal M1.

3.8.3.6 X522 fail-safe digital inputs

Table 3- 57 Terminal block X522

	Terminal	Designation 1)		Technical specifications
	1	DI 4	F-DI 2	Voltage: -3 V to +30 V DC Typical current consumption: 3.2 mA at 24 V Electrical isolation: Reference potential, refer to terminals 7, 8, 9, 10 All digital inputs are electrically isolated.
	2	DI 5+		
	3	DI 6	F-DI 3	
	4	DI 7+		
	5	DI 8	F-DI 4	Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: 2) For "0" → "1": 30 µs (100 Hz) For "1" to "0": 60 µs (100 Hz)
	6	DI 9+		
	7	DI 5-	F-DI 2	Reference potential for DI 5+
	8	DI 7-	F-DI 3	Reference potential for DI 7+
	9	DI 9-	F-DI 4	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, F-DI: Fail-safe digital input

2) Pure hardware delay

NOTICE

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

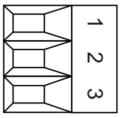
This is achieved by:

1) Routing the ground reference of the digital inputs as well, or

2) A jumper between DIx and terminal M1.

3.8.3.7 X523 fail-safe digital output

Table 3- 58 Terminal block X523

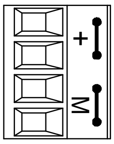
<table>
<tr><th></th><th>Terminal</th><th colspan="2">Designation [1)]</th><th>Technical specifications</th></tr>
<tr><td rowspan="3">
</td><td>1</td><td>DI 20</td><td rowspan="3">F-DO 0</td><td>Voltage: -3 V to +30 V DC
Typical current consumption: 3.2 mA at 24 V
Electrical isolation: Reference potential is terminal M1
The digital input is electrically isolated.
Level (incl. ripple)
High level: 15 V to 30 V
Low level: -3 V to +5 V
Input delay: [2)]
For "0" → "1": 30 μs (100 Hz)
For "1" to "0": 60 μs (100 Hz)</td></tr>
<tr><td>2</td><td>DO 0+</td><td rowspan="2">0.5 A
Reference potential is terminal M1
0.5 A
Reference potential is terminal L1+, L2+ or L3+
Output delay: [2)]
For "0" → "1": 300 μs
For "1" → "0": 350 μs
Total current consumption of all DOs: 2 A
Max. leakage current: < 0.5 mA
Switching frequency:
For resistive load: Max. 100 Hz
For inductive load: Max. 0.5 Hz
For lamp load: Max. 10 Hz
Maximum lamp load: 5 W</td></tr>
<tr><td>3</td><td>DO 0-</td></tr>
<tr><td colspan="5">An F-DO comprises two digital outputs and a digital input for the feedback signal
F-DO 0 = terminals 1, 2 and 3
Max. connectable cross-section: 1.5 mm²
Type: Screw terminal 1 (see Appendix A)</td></tr>
</table>

1) DI: digital input; DO: digital output F-DO: Fail-safe digital output

2) Pure hardware delay

3.8.3.8 X524 Electronics power supply

Table 3- 59 Terminals for the electronics power supply

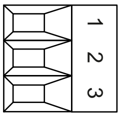
	Terminal	Designation	Technical specifications
	+	Electronics power supply	Voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: Max. 0.7 A Max. current via jumper in connector: 20 A
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: 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.

3.8.3.9 X525 fail-safe digital output

Table 3- 60 Terminal block X525

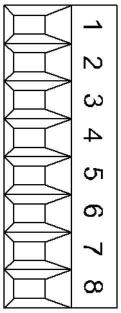
	Terminal	Designation 1)		Technical specifications
	1	DI 21	F-DO 1	Voltage: -3 V to +30 V DC Typical current consumption: 3.2 mA at 24 V Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: 2) For "0" → "1": 30 μs (100 Hz) For "1" to "0": 60 μs (100 Hz)
	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: 2) For "0" → "1": 300 μs For "1" → "0": 350 μs Total current consumption of all DOs: 2 A Max. leakage current: < 0.5 mA Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
An F-DO comprises two digital outputs and a digital input for the feedback signal F-DO 1 = terminals 1, 2 and 3 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)				

1) DI: digital input; DO: digital output F-DO: Fail-safe digital output

2) Pure hardware delay

3.8.3.10 X531 fail-safe digital inputs + power supply with forced dormant error detection

Table 3- 61 Terminal block X531

	Terminal	Designation [1]		Technical specifications
	1	L 2+		Voltage: 24 V DC Max. total load current: 500 mA
	2	DI 10	F-DI 5	Voltage: -3 V to +30 V DC Typical current consumption: 3.2 mA at 24 V Electrical isolation: Reference potential, refer to terminals 6, 7, 8 All digital inputs are electrically isolated. Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: [2] For "0" → "1": 30 μs (100 Hz) - For "1" to "0": 60 μs (100 Hz)
	3	DI 11+		
	4	DI 12	F-DI 6	
	5	DI 13+		
	6	DI 11-	F-DI 5	Reference potential to DI 11+
	7	DI 13-	F-DI 6	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)				

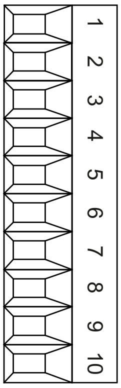
1) DI: Digital input, F-DI: Fail-safe digital input

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 is achieved by: 1) Routing the ground reference of the digital inputs as well, or 2) A jumper between DIx and terminal M1.

3.8.3.11 X532 fail-safe digital inputs

Table 3- 62 Terminal block X532

	Terminal	Designation 1)		Technical specifications
	1	DI 14	F-DI 7	Voltage: -3 V to +30 V DC Typical current consumption: 3.2 mA at 24 V Electrical isolation: Reference potential, refer to terminals 7, 8, 9, 10 All digital inputs are electrically isolated. Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: 2) For "0" → "1": 30 µs (100 Hz) For "1" to "0": 60 µs (100 Hz)
	2	DI 15+		
	3	DI 16	F-DI 8	
	4	DI 17+		
	5	DI 18	F-DI 9	
	6	DI 19+		
	7	DI 15-	F-DI 7	Reference potential for DI 15+
	8	DI 17-	F-DI 8	Reference potential for DI 17+
	9	DI 19-	F-DI 9	Reference potential for DI 19+
	10	M1		Reference potential for DI 14, DI 16 and DI 18
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)				

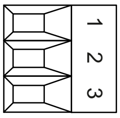
1) DI: Digital input, F-DI: Fail-safe digital input

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 is achieved by:
>
> 1) Routing the ground reference of the digital inputs as well, or
>
> 2) A jumper between DIx and terminal M1.

3.8.3.12 X533 fail-safe digital output

Table 3- 63 Terminal block X533

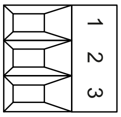
	Terminal	Designation 1)		Technical specifications
	1	DI 22	F-DO 2	Voltage: -3 V to +30 V DC Typical current consumption: 3.2 mA at 24 V Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: 2) For "0" → "1": 30 µs (100 Hz) For "1" to "0": 60 µs (100 Hz)
	2	DO 2+		0.5 A Reference potential is terminal M1
	3	DO 2-		0.5 A Reference potential is terminal L1+, L2+ or L3+ Output delay: 2) For "0" → "1": 300 µs For "1" → "0": 350 µs Total current consumption of all DOs: 2 A Max. leakage current: < 0.5 mA Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
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) DI: digital input; DO: digital output F-DO: Fail-safe digital output

2) Pure hardware delay

3.8.3.13 X535 fail-safe digital output

Table 3- 64 Terminal block X535

	Terminal	Designation [1]		Technical specifications
	1	DI 23	F-DO 3	Voltage: -3 V to +30 V DC Typical current consumption: 3.2 mA at 24 V Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V Input delay: [2] For "0" → "1": 30 µs (100 Hz) For "1" to "0": 60 µs (100 Hz)
	2	DO 3+		0.5 A Reference potential is terminal M1
	3	DO 3-		0.5 A Reference potential is terminal L1+, L2+ or L3+ Output delay: [2] For "0" → "1": 300 µs For "1" → "0": 350 µs Total current consumption of all DOs: 2 A Max. leakage current: < 0.5 mA Switching frequency: For resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
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) DI: digital input; DO: digital output F-DO: Fail-safe digital output

2) Pure hardware delay

3.8.4 Connection example

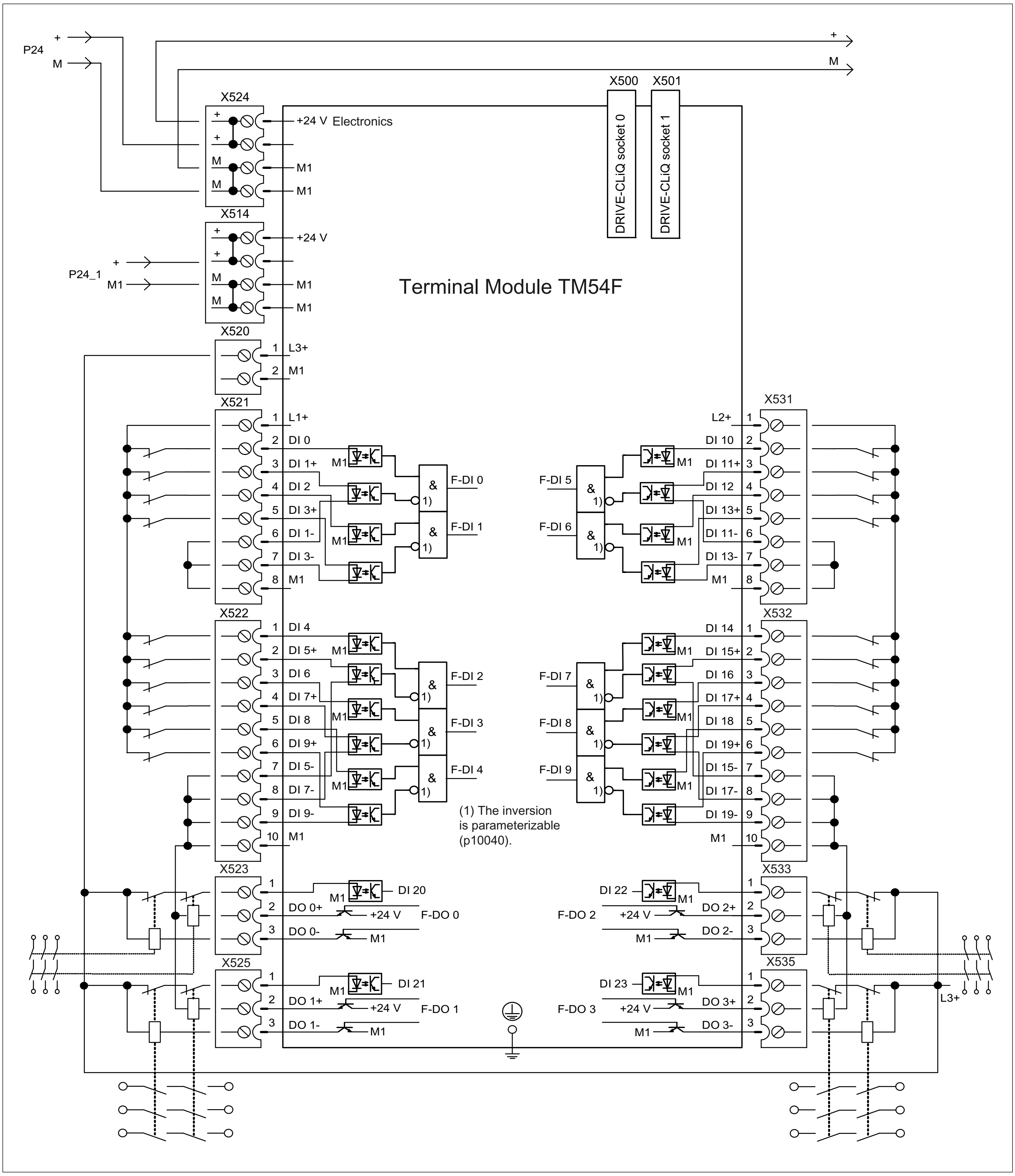


Figure 3-34 Connection example off TM54F

Additional circuit examples are included in:

- SINAMICS S120 Safety Integrated Function Manual
- System Manual: The safety program for world industry, order number: 6ZB5000-0AA01-0BA1, 5 Edition, Supplement: 6ZB5000-0AB01-0BA0

3.8.5 Meaning of LEDs

Table 3- 65 Meaning of the LEDs on the Terminal Module TM54F

LED	Color	Status	Description, cause	Remedy
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 irrespective of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
		Flashing light 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/orange or Red/orange	Flashing light	Component recognition via LED is activated (p0154). **Note:** Both options depend on the LED status when component recognition is activated via p0154 = 1.	–
L1+, L2+,	–	ON	The controllable sensor power supply is functioning fault-free.	–
	Red	Continuous light	There is a fault in the controllable sensor power supply.	–
L3+	–	ON	Sensor power supply is functioning fault-free.	
	Red	Continuous light	There is a fault in the sensor power supply.	

LED	Color		Status	Description, cause	Remedy
Fail-safe inputs / double inputs					
F_DI z (input x, (x+1)+, (x+1)-)	LED x – – – –	LED x+1 Red – Red –	 Continuous light – Continuous light –	**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 **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 Green	LED x+1 Green Green	 Continuous light Continuous light	**NC contact / NC contact** [1]**: (z = 0..9, x = 0, 2, ..18)** A signal at input x and a signal at input x+1 **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 (TM54F). p10040 (TM54F) = 0: Input x+1 is an NC contact. p10040 (TM54F) = 1: Input x+1 is NO contact. Factory setting: p10040 (TM54F) = 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 light	Signal at digital input x	–
Fail-safe digital outputs with associated readback channel					
F_DO y (0+..3+, 0-..3-)	Green		Continuous light	Output y (y=0 .. 3) carries a signal	–
Readback input DI 2y for output F_DO y (y = 0..3) at test stop. The status 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 light	Both output lines y+ and y- carry no signal	–

Cause and rectification of faults

The following documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

3.8.6 Dimension drawing

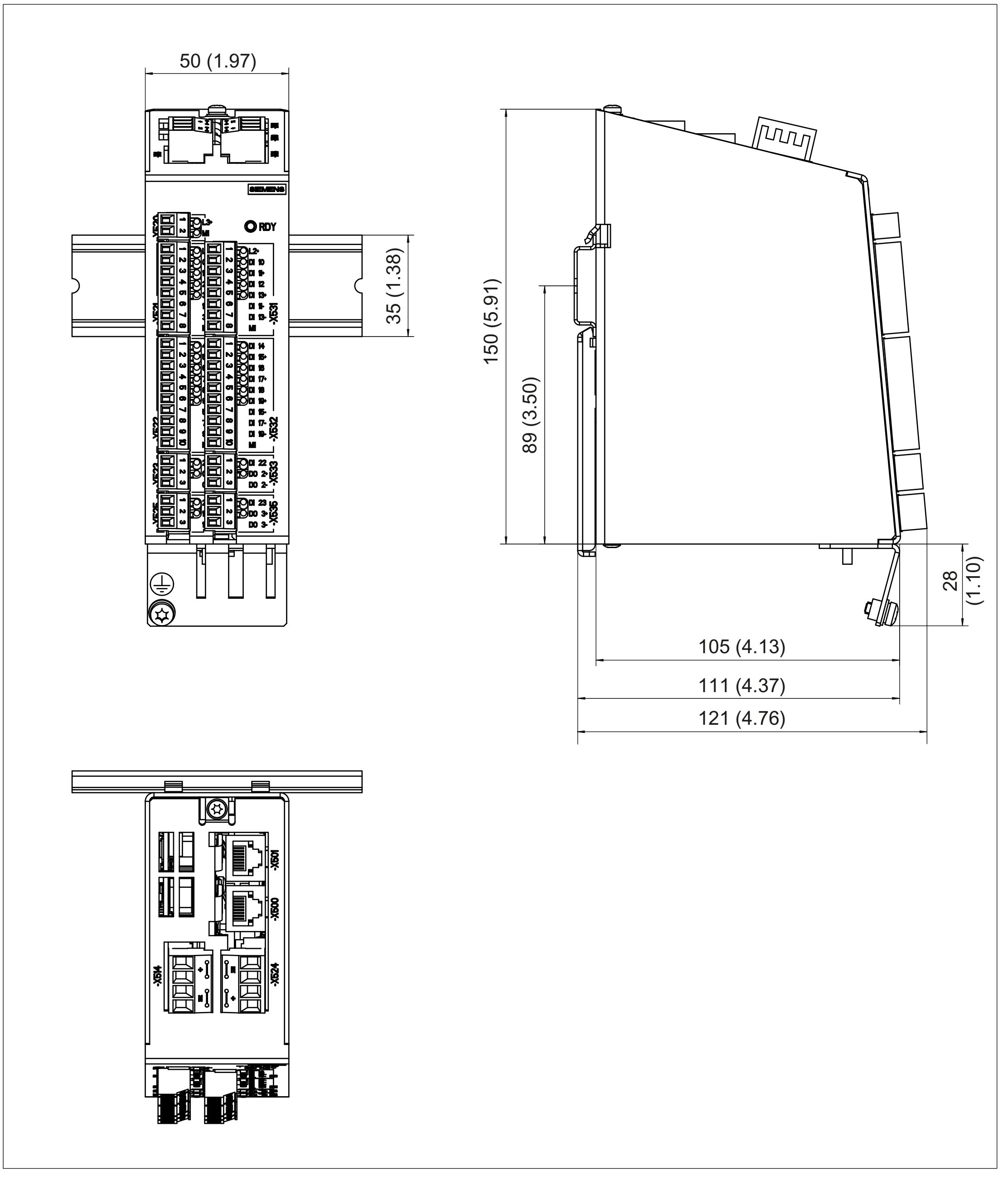


Figure 3-35 Dimension drawing of Terminal Module TM54F, all data in mm and (inches)

3.8.7 Installation

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

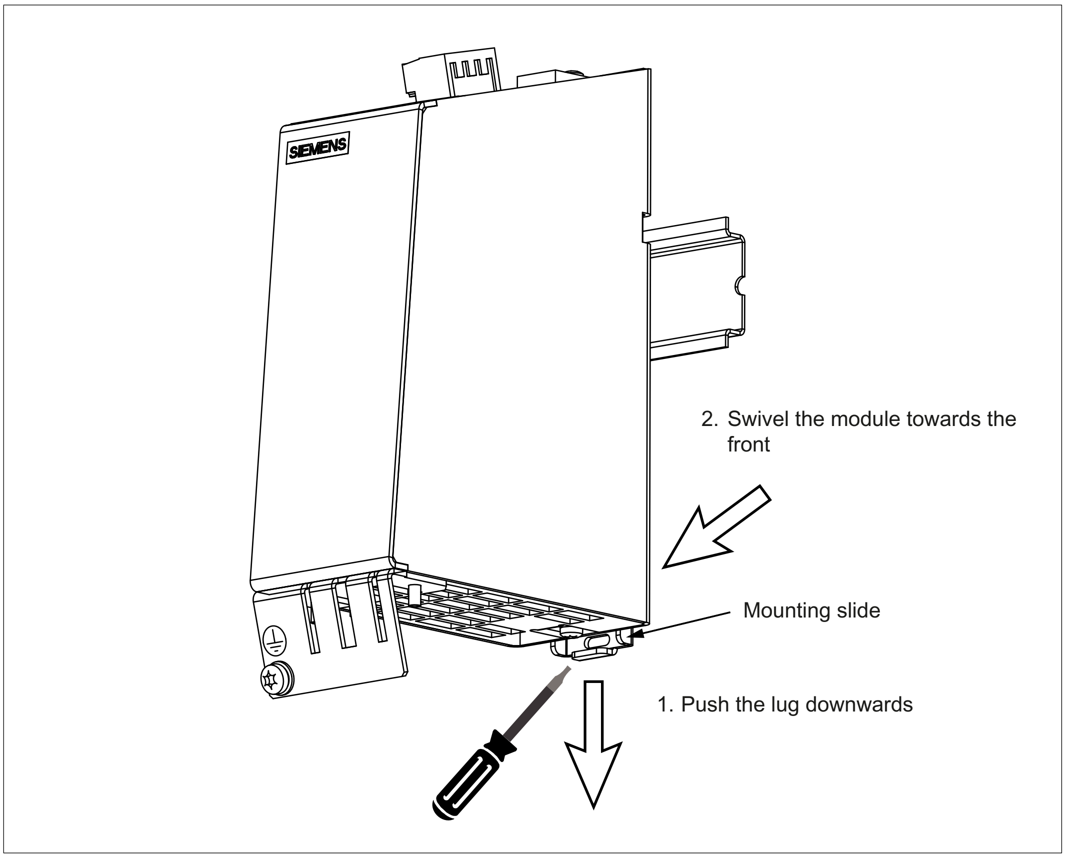


Figure 3-36 Removal of a component from a DIN rail

3.8.8 Protective conductor connection and shield support

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

The following figure shows typical Weidmüller shield connection clamps for the shield supports.

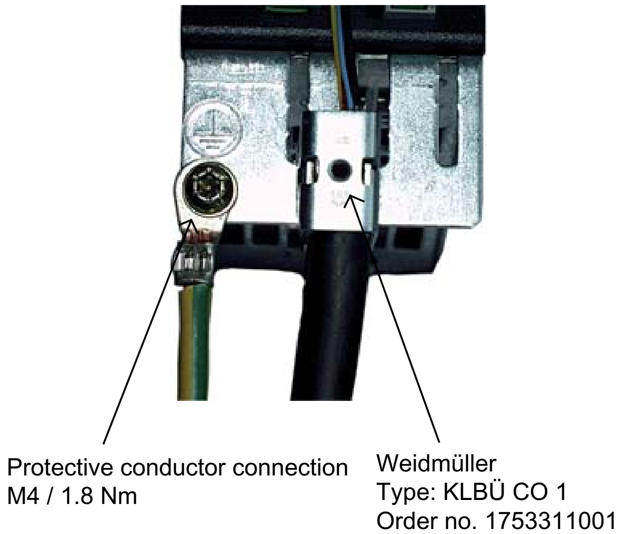


Figure 3-37 Shield supports and protective conductor connection

Weidmüller website address: 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 use screws with a permissible mounting depth of 4 - 6 mm.

3.8.9 Technical data

Table 3- 66 Technical data

6SL3055-0AA00-3BAx	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	38
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 to 30 -3 to +5 15 to 30 >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 enclosure with M4 screw
Weight	kg	approx. 0.9

[1)] Pure hardware delay

3.9 Terminal Module TM120

3.9.1 Description

The Terminal Module TM120 is a DRIVE-CLiQ component for safe electrically isolated temperature evaluation. It can be used for 1FN, 1FW6, and third-party motors in which the temperature sensors cannot be installed with safe electrical separation. The TM120 is installed in the control cabinet and can be snapped on to a DIN rail (EN 60715).

When a TM120 is being used, temperature evaluation and encoder evaluation functions are separated off from one another. The TM120 can detect the motor temperature via four channels with different temperature sensors. Encoder evaluation functions are performed via Sensor Modules (e.g. SMCxx, SMExx). This means that, when connected to a Sensor Module SMCxx, the TM120 represents an alternative control cabinet to the SME120/SME125.

The TM120 contains the following interfaces:

Table 3- 67 Overview of the TM120 interfaces

Type	Quantity
DRIVE-CLiQ interfaces	2
Temperature sensor inputs	4

3.9.2 Safety information

⚠ WARNING
The ventilation spaces of 50 mm above and below the component must be observed.

⚠ CAUTION
Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the ground 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.

NOTICE
If sensors other than those specified are connected, this may result in incorrect measured values.

3.9.3 Interface description

3.9.3.1 Overview

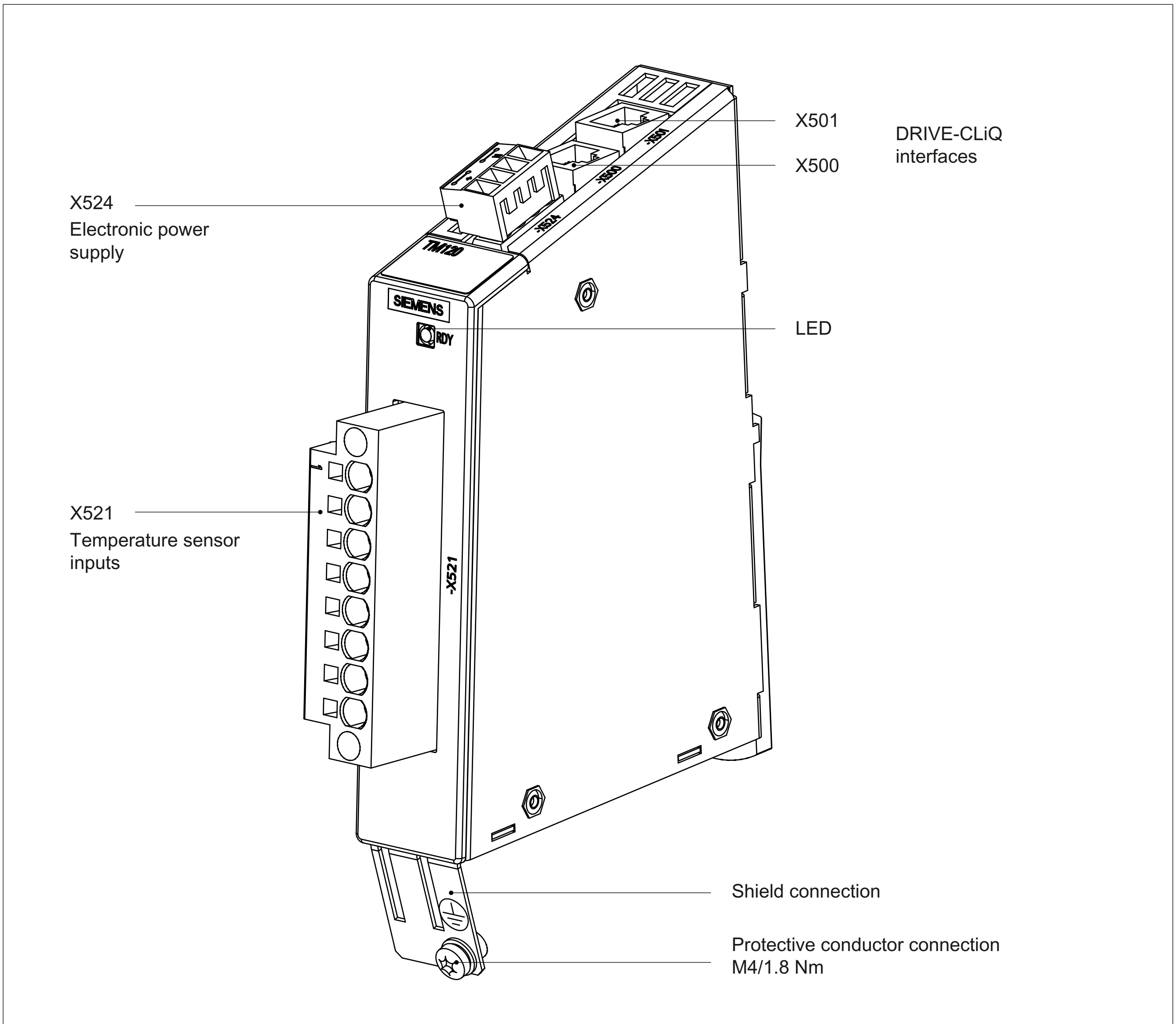
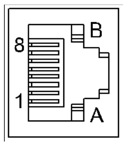


Figure 3-38 Interface description of the TM120

3.9.3.2 X500 and X501 DRIVE-CLiQ interface

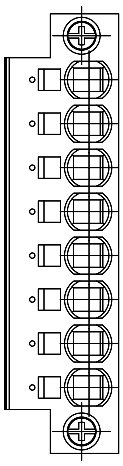
Table 3- 68 DRIVE-CLiQ interfaces X500 and X501

	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
Connector type: RJ34plus socket; blanking plate for DRIVE-CLiQ interfaces included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

NOTICE
The maximum DRIVE-CLiQ cable length is 100 m.

3.9.3.3 X521 temperature sensor input

Table 3- 69 X521 temperature sensor input

	Terminal	Function	Technical specifications
	1	- Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic 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 switch with NC contact In linear motor applications, connect the PTC triple element 1 or bimetallic switch here
	4	+ Temp	
	5	- Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In linear motor applications, connect the PTC triple element 2 here
	6	+ Temp	
	7	- Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In linear motor applications, connect the PTC triple element 3 here
	8	+ Temp	
Max. connectable cross-section: 6 mm² Type: Spring-loaded terminal 5 (see Appendix A) Constant current per sensor approx. 2 mA			

NOTICE
When connecting several temperature sensors, the individual sensors must be separately connected to "+ Temp" and "- Temp". It is not permissible that the "+ Temp" and "- Temp" signals are interconnected with one another!

The table below shows the preferable assignment of the connecting terminal for the temperature sensor input:

Table 3- 70 Preferable assignment, X521 temperature sensor input

	Signal name				Meaning
Terminal	1FW6	1FN3 (2x1FN3)	1FN1	Segment motor 4 segments	
1	KTY N	KTY N	KTY N	1 PTC 120 °C	KTY, negative pole
2	KTY P	KTY P	KTY P	1 PTC 120 °C	KTY, positive pole
3	PTC 130 °C	PTC 120 °C	Bimetallic switch with NC contact	2_PTC 120 °C	PTC triple element 1 or bimetallic switch with NC contact
4	PTC 130 °C	PTC 120 °C	Bimetallic switch with NC contact	2_PTC 120 °C	
5	PTC 150 °C	(2_KTY_N)		3_PTC 120 °C	PTC triple element 2
6	PTC 150 °C	(2_KTY_P)		3_PTC 120 °C	
7		(2 PTC 120 °C)		4 PTC 120 °C	PTC triple element 3
8		(2 PTC 120 °C)		4 PTC 120 °C	

Note

The interconnection given is a suggestion (software default setting). Which sensor is connected to which input can be freely configured.

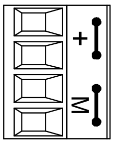
NOTICE
The maximum length of the sensor cable is 100 m. The cables must feature shielding.

Note

A 6FX7008-1BCx1 power cable is recommended for connecting the KTY temperature sensors.

3.9.3.4 X524 Electronics power supply

Table 3- 71 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./typ.): 0.5 A/0.1 A Max. current via jumper in connector: 20 A
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

NOTICE
The maximum length of the power supply cable is 10 m.

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.

3.9.4 Connection examples

Each TM120 is directly connected to an encoder evaluation unit (SMCxx or SMExx) by looping the corresponding DRIVE-CLiQ channel via the TM120. This ensures that encoders are automatically assigned to the temperature signals and, consequently, to the correct axis. The assignment can also be performed manually.

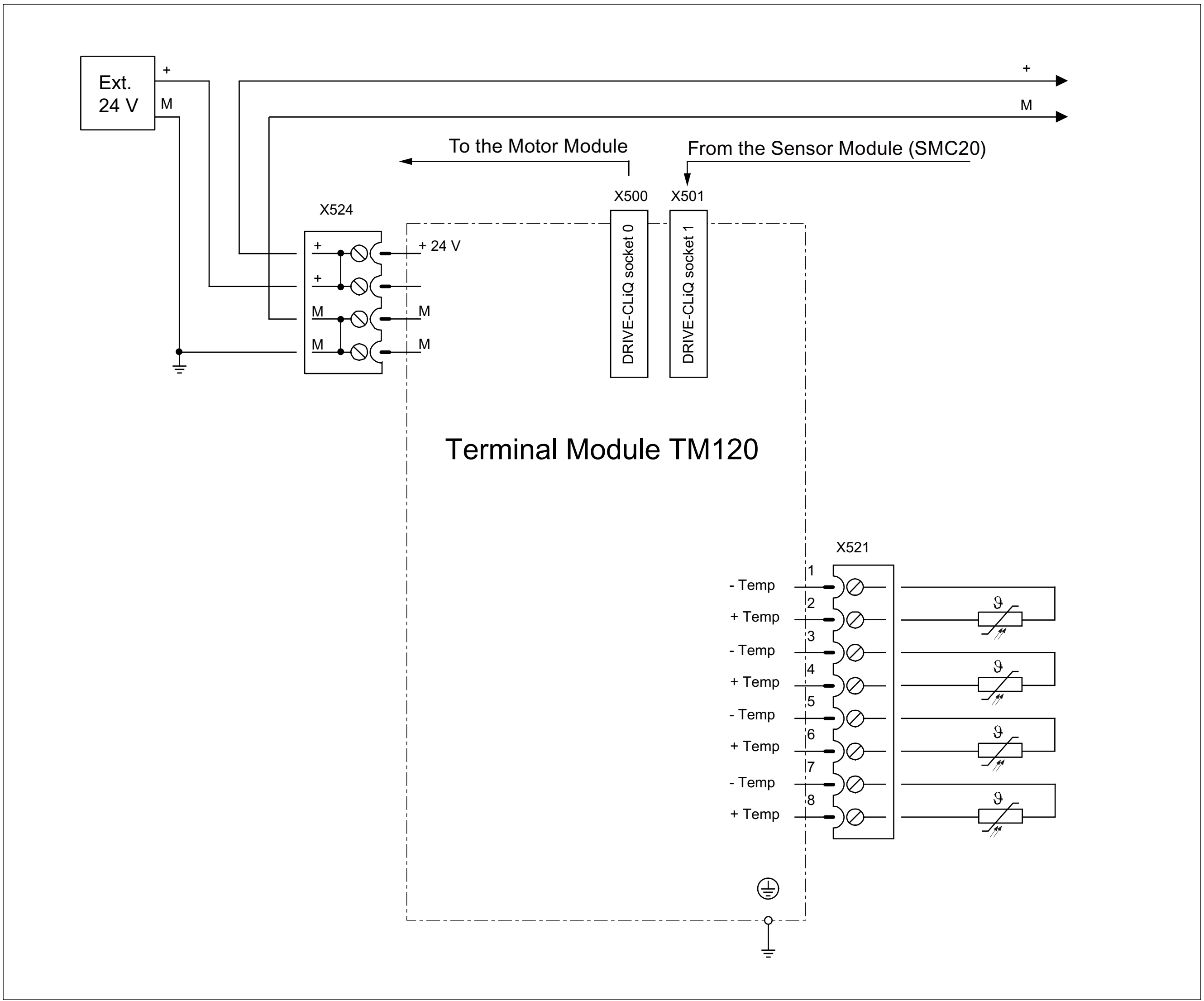


Figure 3-39 Connection example of TM120

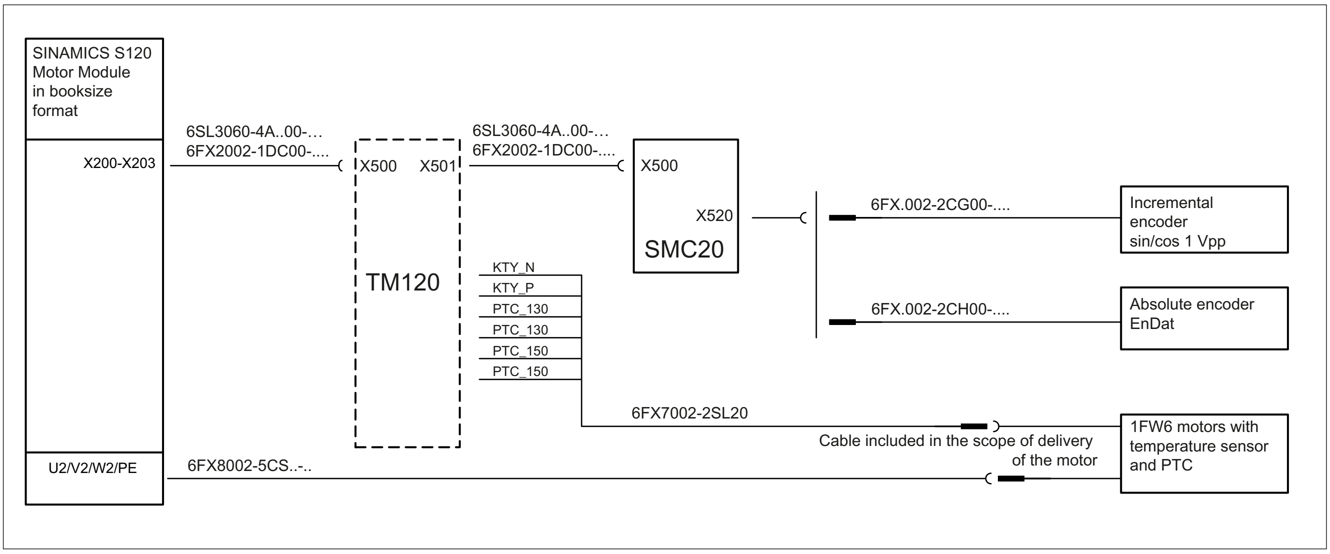


Figure 3-40 Connection example of TM120 with Motor Module and SMC20 (encoder evaluation)

3.9.5 Meaning of the LED

Table 3- 72 Meaning of the LEDs on the Terminal Module TM120

LED	Color	Status	Description, cause	Remedy
READY	-	Off	Electronics power supply is missing or outside permissible tolerance range.	Check power supply
	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 2 Hz	Detection of the components via LED is activated (p0154). **Note:** Both options depend on the LED status when module recognition is activated via p0154 = 1.	-

Cause and rectification of faults

The following documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

3.9.6 Dimension drawing

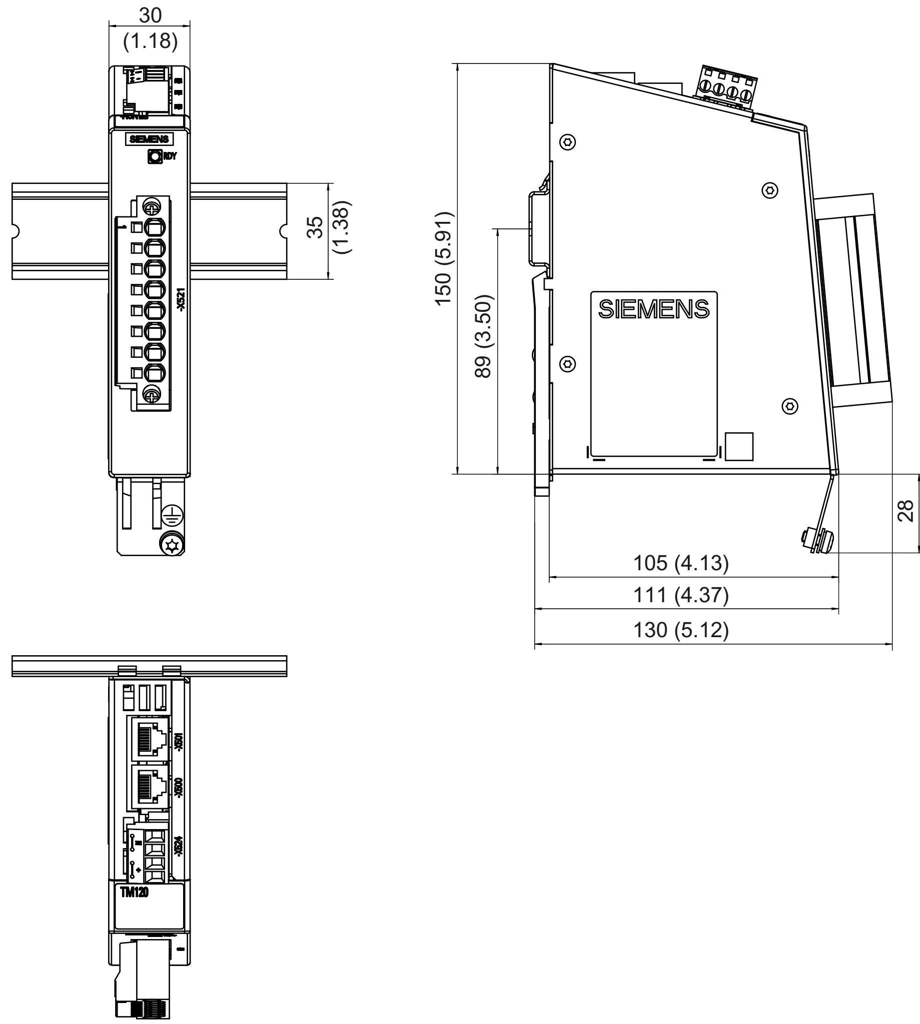


Figure 3-41 Dimension drawing of Terminal Module TM120, all data in mm and (inches)

3.9.7 Installation

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

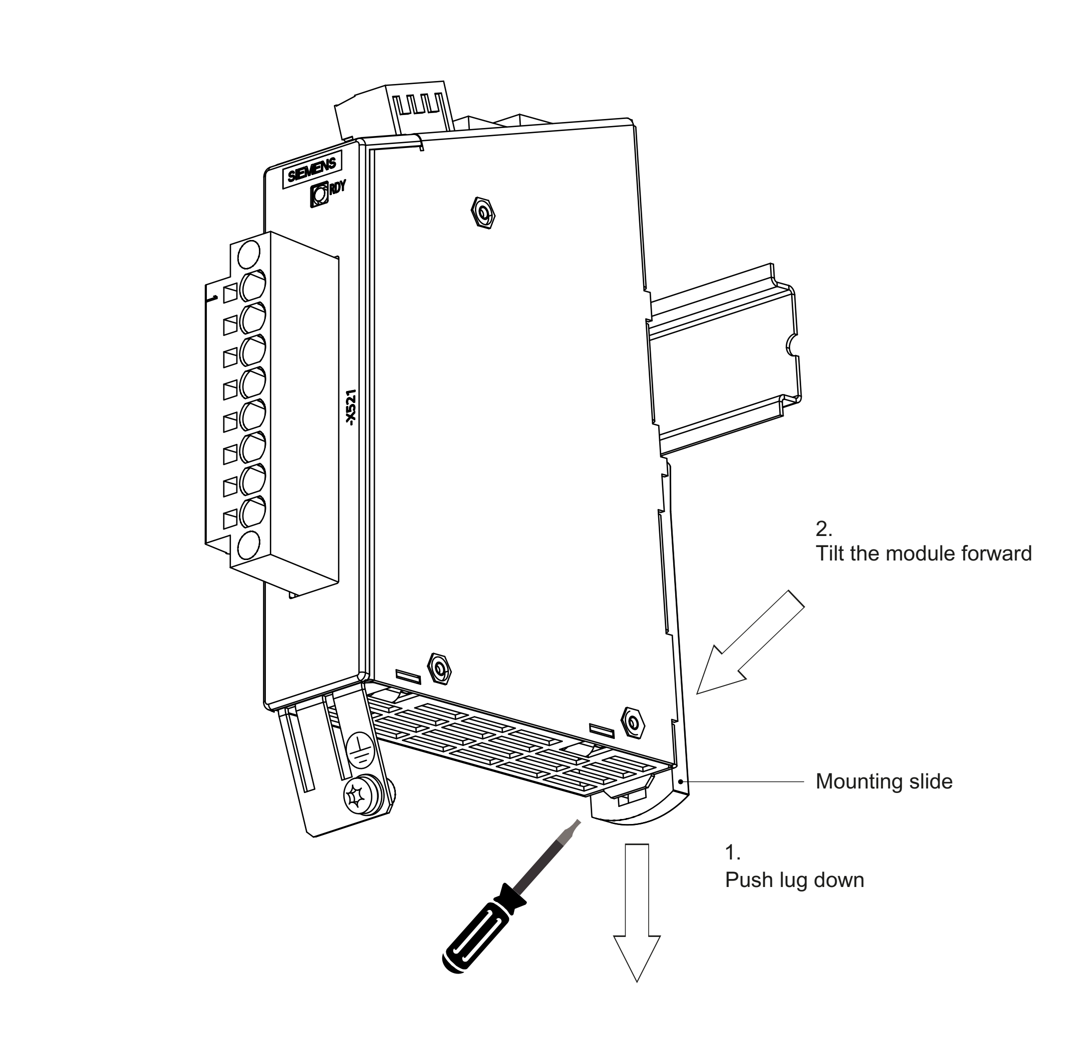


Figure 3-42 Removal of a TM120 from a DIN rail

3.9.8 Protective conductor connection and shield support

The following figure shows a typical Weidmüller shield connection clamp for the shield supports.

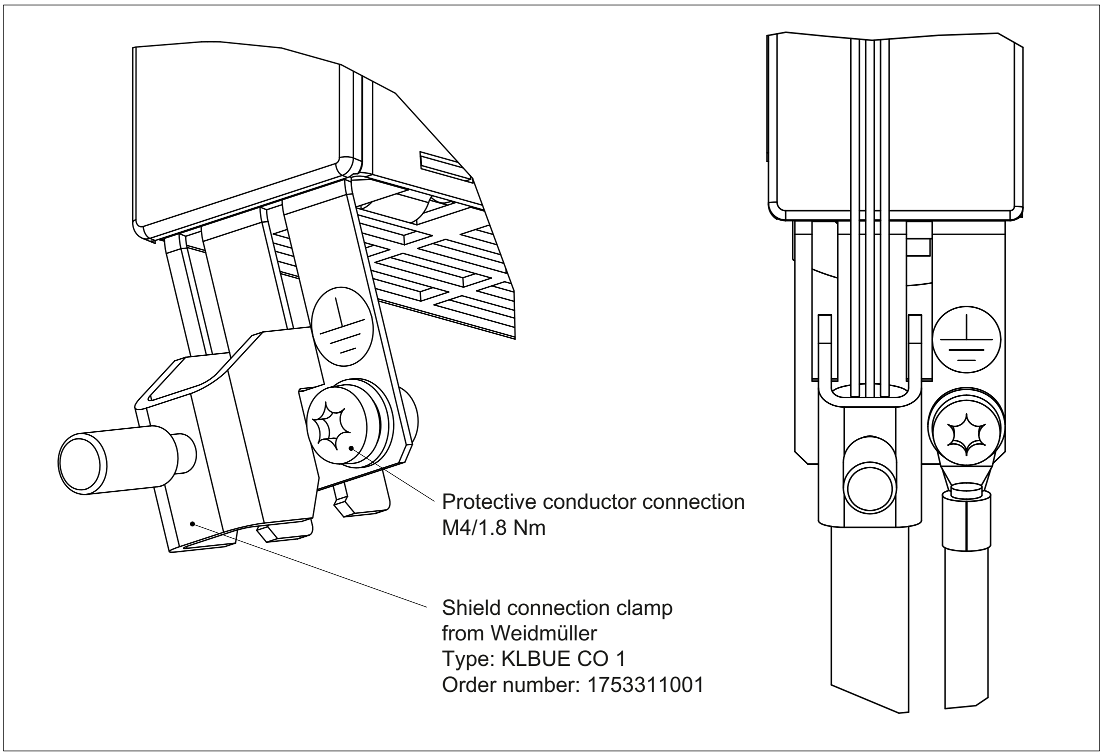


Figure 3-43 Shield support and protective conductor connection of the TM120

Weidmüller website address: 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 use screws with a permissible mounting depth of 4 - 6 mm.

3.9.9 Technical data

Table 3- 73 Technical data

6SL3055-0AA00-3KAx	Unit	Value
Electronics power supply Voltage Current (without DRIVE-CLiQ) Power loss	 V_{DC} A_{DC} W	 24 DC (20.4 – 28.8) 0.20/0.1 (typ.) 2.4 (typ.)
PE/ground connection	On housing with M4/1.8 Nm screw	
Weight	kg	0.41
Degree of protection	IP20	

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

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 5 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 process.

3.10.2 Safety information

⚠ WARNING
The ventilation spaces of 50 mm above and below the component must be observed.

3.10.3 Interface description

3.10.3.1 Overview

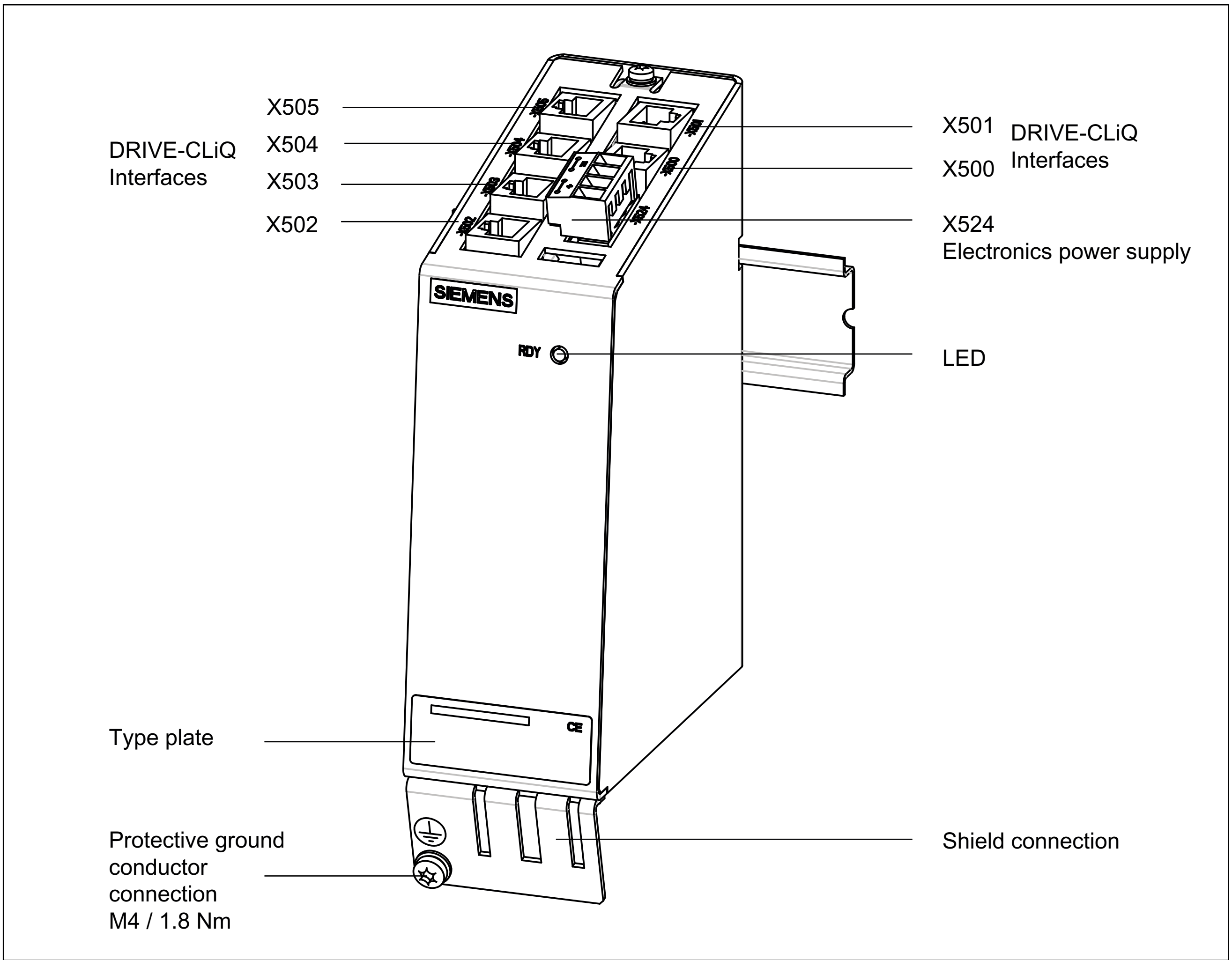
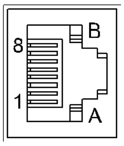


Figure 3-44 Interface description of the DMC20

3.10.3.2 X500 - X505 DRIVE-CLiQ interfaces

Table 3- 74 DRIVE-CLiQ interfaces X500 - X505

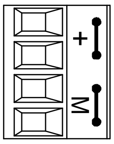
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Connector type: RJ45 socket DRIVE-CLiQ port rubber plug included in the scope of delivery; rubber plug (50 pieces) Order number: 6SL3066-4CA00-0AA0			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used to establish connections. The maximum length of MOTION-CONNECT 500 cables is 100 m and of MOTION-CONNECT 800 cables 50 m.

3.10.3.3 X524 Electronics power supply

Table 3- 75 Terminals for the electronics power supply

<table>
<tr><th></th><th>Terminal</th><th>Designation</th><th>Technical specifications</th></tr>
<tr><td rowspan="4">
</td><td>+</td><td>Electronics power supply</td><td rowspan="4">Voltage: 24 V DC (20.4 V – 28.8 V)
Current consumption: Max. 0.5 A

Max. current via jumper in connector: 20 A</td></tr>
<tr><td>+</td><td>Electronics power supply</td></tr>
<tr><td>M</td><td>Electronics ground</td></tr>
<tr><td>M</td><td>Electronics ground</td></tr>
<tr><td colspan="4">Max. connectable cross-section: 2.5 mm^2
Type: Screw terminal 2 (see Appendix A)</td></tr>
</table>

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 participants.

3.10.4 Meaning of the LED

Table 3- 76 Description of the LEDs on the DRIVE-CLiQ Hub Module DMC20

LED	Color	Status	Description, cause	Remedy
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 light	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 documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

3.10.5 Dimension drawing

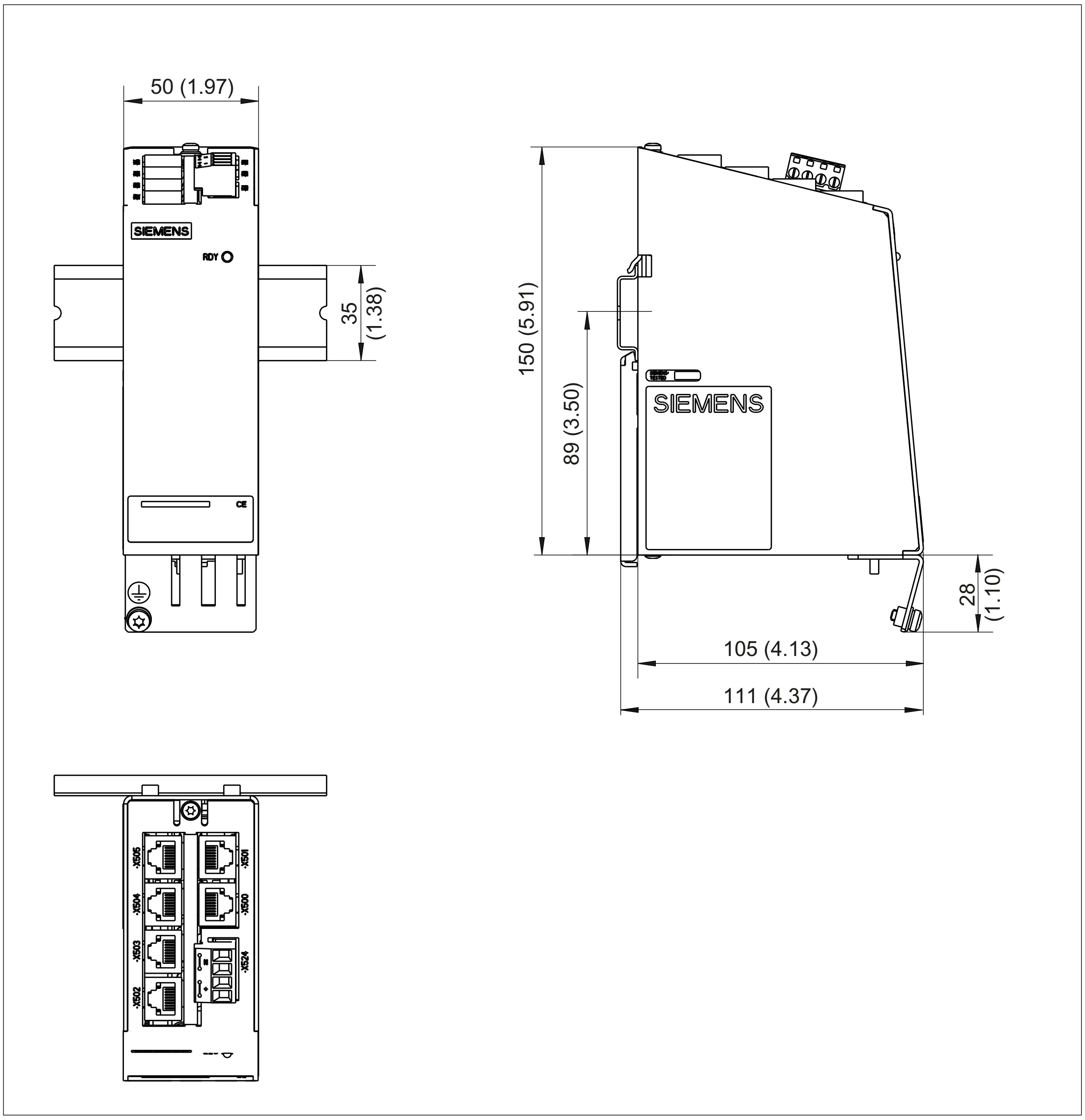


Figure 3-45 Dimension drawing of the DRIVE-CLiQ Hub Module DMC20, all data in mm and (inches)

3.10.6 Installation

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

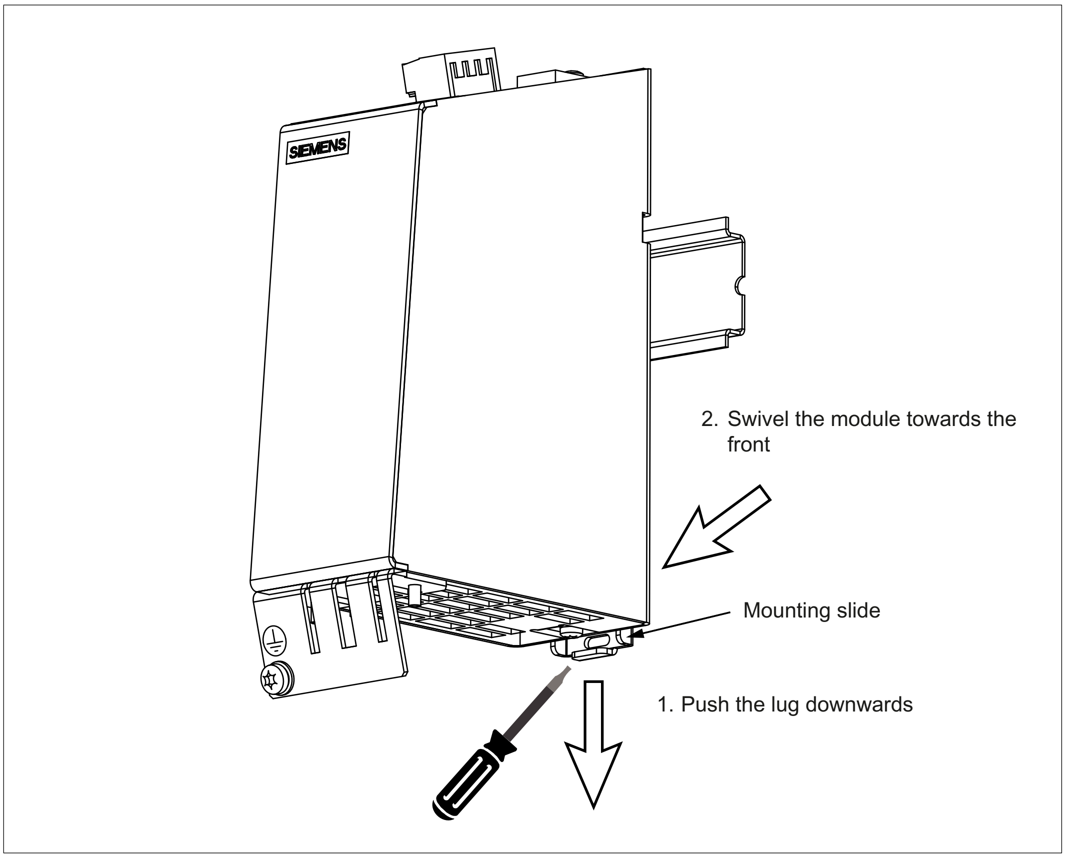


Figure 3-46 Removal of a component from a DIN rail

3.10.7 Technical data

Table 3- 77 Technical data of the DMC20

6SL3055-0AA00-6AAx	Unit	Value
Electronics power supply Voltage Current (without DRIVE-CLiQ consumer)	 V_{DC} A_{DC}	 24 DC (20.4 – 28.8) 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.

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.

Note

All components operated on the DRIVE-CLiQ must be integrated into the equipotential bonding concept.
They should preferably be connected by installing them on bright machine parts and devices, which are all bonded to one another in an equipotential manner.
Alternatively, equipotential bonding can be achieved by means of a conductor (min. 6 mm²), which should be routed parallel to the DRIVE-CLiQ where possible. This applies to all distributed DRIVE-CLiQ nodes such as DM20, SME2x, SM12x, etc.
For the DME20, this also applies to the 24 V power supply.

3.11.3 Interface description

3.11.3.1 Overview

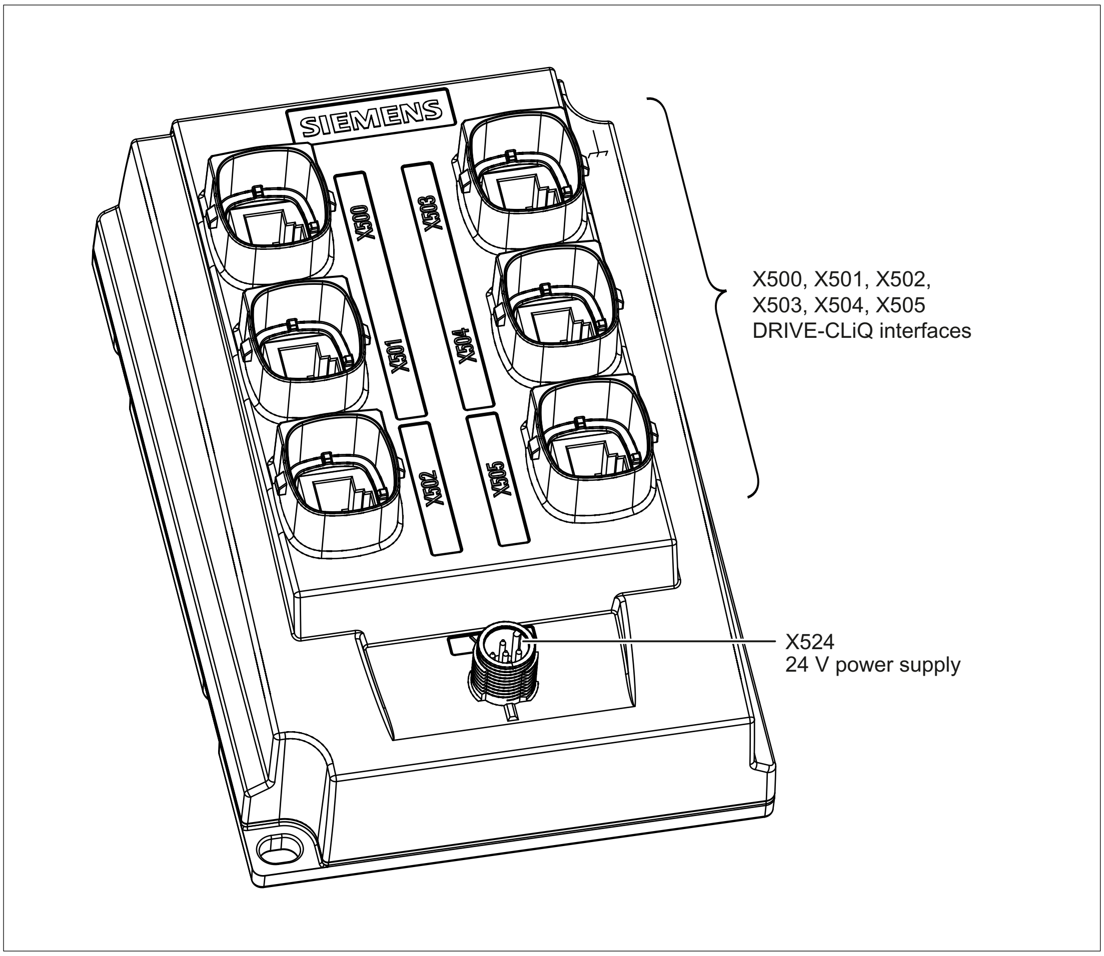
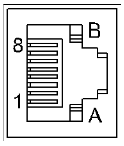


Figure 3-47 Interface description of the DME20

3.11.3.2 X500 - X505 DRIVE-CLiQ interfaces

Table 3- 78 DRIVE-CLiQ interfaces X500 - X505

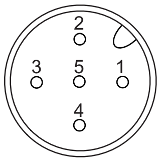
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Connector type: RJ45 socket; blanking plate for DRIVE-CLiQ interfaces included in the scope of delivery; blanking plate (50 pieces) order number: 6SL3066-4CA00-0AA0			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used to establish connections.
The maximum length of MOTION-CONNECT 500 cables is 100 m and of MOTION-CONNECT 800 cables 50 m.

3.11.3.3 X524 Electronics power supply

Table 3- 79 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. Pins 1 and 2: jumpered internally Pins 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- 80 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
T_a = 55 °C 100 m DRIVE-CLiQ					

1) Connected motors with DRIVE-CLiQ encoder, DRIVE CLiQ mounted encoder SME

3.11.4 Dimension drawing

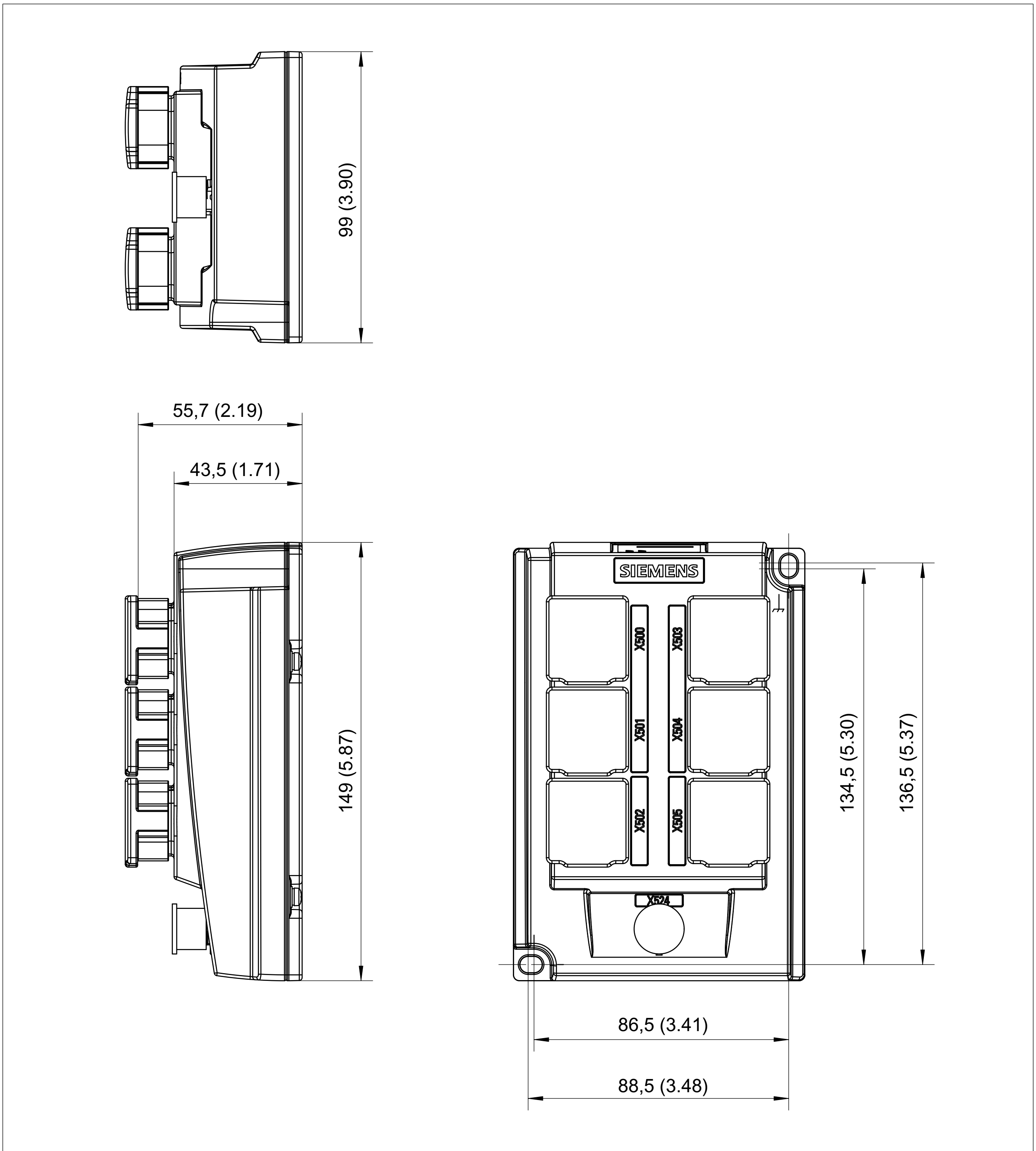


Figure 3-48 Dimension drawing of the DRIVE-CLiQ Hub Module External DME20, all data in mm and (inches)

3.11.5 Installation

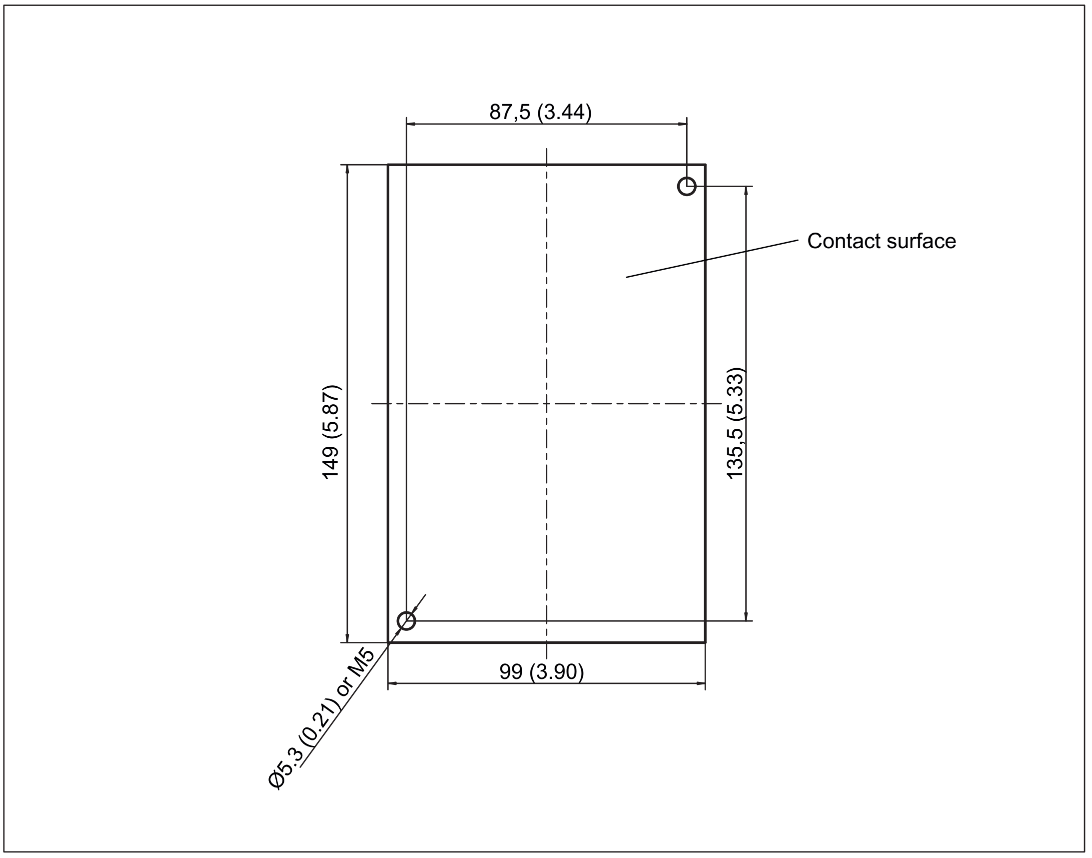


Figure 3-49 DME20 installation

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- 81 Technical data of the DME20

6SL3055-0AA00-6ABx	Unit	Value
Electronics power supply Voltage Current (without DRIVE-CLiQ node)	 V_{DC} A_{DC}	 24 DC (20.4 – 28.8) 0.15
PE/ground connection	Fastened to housing M5 / 6 Nm	
Degree of protection	IP67	
Weight	kg	0.8

3.11.7 Specifications for use with UL approval

Pre-assembled cables

Sensor/actuator cable, 5-pin, variable cable,
free cable end at straight socket M12-SPEEDCON,
cable length: 2, 5, 10, 15 m
SAC-5P-xxx-186/FS SCO
Up to 100 m on request

Phoenix Contact, www.phoenixcontact.com

Cables to be assembled by the user

Cable	Connector
Cable coil, black PUR/PVC, 5-pin Conductor colors: brown/white/blue/black/gray Cable length: 100 m SAC-5P-100.0-186/0.75 Order number: 1535590	Sensor/actuator connector, socket, straight, 5-pin, M12, A-coded Screw connection, metal knurl, cable gland Pg9 SACC-M12FS-5CON-PG9-M Order number: 1681486
Phoenix Contact, www.phoenixcontact.com	

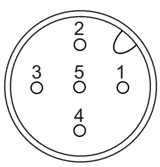
Power supply

The DME20 must be connected to a 24 V power supply with voltage limitation.

- SITOP 6EP1x.. or 6ES7307..
- SINAMICS Control Supply Module 6SL3100-1DE22-0Axx

Pin assignment of the cable

Table 3- 82 Connection to X524 electronics power supply

	Pin	Designation	Technical specifications
	1 (brown) 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. Pins 1 and 2: jumpered internally Pins 3 and 4: jumpered internally
	2 (white) 1)	Electronics power supply	
	3 (black) 1)	Electronics ground	
	4 (blue) 1)	Electronics ground	
	5 (gray) 1)	Not connected internally	

1) The colors stated refer to the cable specified above

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 of the line voltage. The Voltage Sensing Module is used to sense the three-phase line supply voltage, which is then provided to the closed-loop control. The phase difference is measured ungrounded.

The Voltage Sensing Module can be used for the following line types:

- Up to 600 V 3-ph. AC for all line types
- Up to 690 V 3-ph. AC for networks with grounded start point and IT networks

A 100 V 3-ph. AC input is available for transducer transformers. It is not permissible to use both line voltage connections simultaneously!

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

A VSM is permanently installed for Active Interface Modules Chassis and Smart Line Modules Chassis.

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. All data recorded are transferred to the higher-level system via DRIVE-CLiQ.

The Voltage Sensing Module achieves radio interference category C2 with limit classes A1 for interference voltage and A for emitted interference.

Table 3- 83 Interface overview of the VSM10

Type	Quantity
Analog inputs	2
Line supply voltage connection (690 V)	1 (3-phase), ungrounded
Line supply voltage connection (100 V)	1 (3-phase), ungrounded
Temperature senor input (KTY/PTC)	1
DRIVE-CLiQ interface	1

3.12.2 Safety information

⚠ WARNING
The ventilation spaces of 50 mm above and below the component 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 ground 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

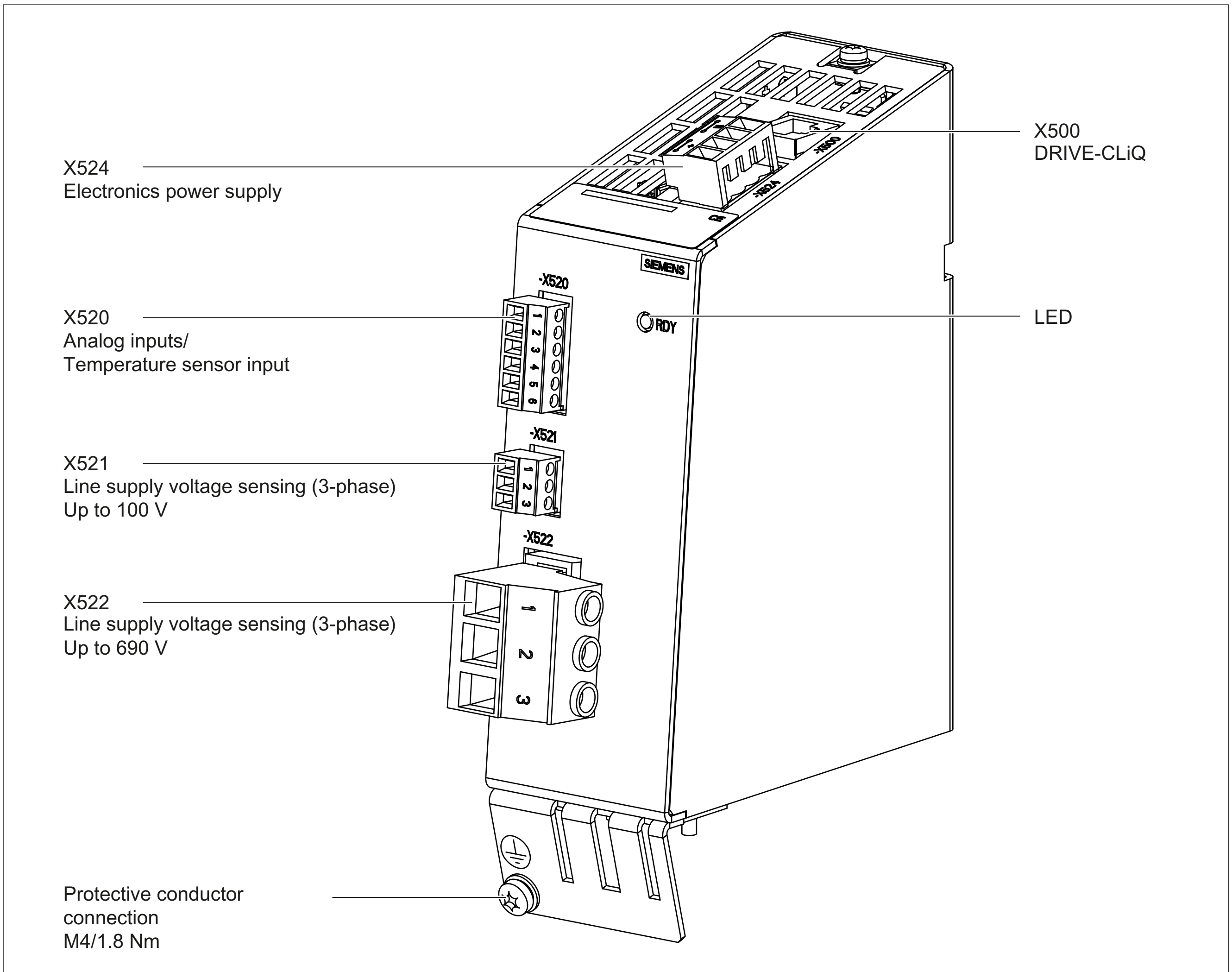
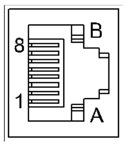


Figure 3-50 Interface description of the VSM10

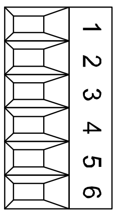
3.12.3.2 X500 DRIVE-CLiQ interface

Table 3- 84 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
Connector type: RJ45plus socket blanking plate for DRIVE-CLiQ interface included in the scope of delivery; blanking plate (50 pieces) Order number: 6SL3066-4CA00-0AA0			

3.12.3.3 X520 analog inputs/temperature sensor

Table 3- 85 Terminal block X520

	Terminal	Designation	Technical specifications
	1	AI 0-	2 analog differential inputs voltage range: ±10 V resolution: 13 bits common mode range: ± 30 V with respect to the ground potential
	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)			

NOTICE

The KTY temperature sensor must be connected with the correct polarity.

Note

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

Note

The maximum cable length for a shielded cable applied on both sides to the temperature sensor and to the analog inputs is 30 m.

⚠ **DANGER**

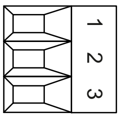
Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp".

If these instructions are not complied with, there is a risk of electric shock!

3.12.3.4 X521 three-phase line supply voltage sensing up to 100 V 3-ph. AC

Table 3- 86 Terminal block X521

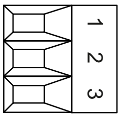
	Terminal	Designation	Technical specifications
	1	Phase voltage U	Connection to the voltage sensing for medium-voltage networks via a safe electrically isolated transformer
	2	Phase voltage V	
	3	Phase voltage W	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

NOTICE

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

3.12.3.5 X522 three-phase line supply voltage sensing up to 690 V 3-ph. AC

Table 3- 87 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 5 (see Appendix A)			

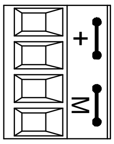
NOTICE
Only one of the two terminals X521 and X522 may be used. Nothing may be connected to the unused terminal.

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).

3.12.3.6 Electronics power supply X524

Table 3- 88 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
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 3 (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.

3.12.4 Connection example

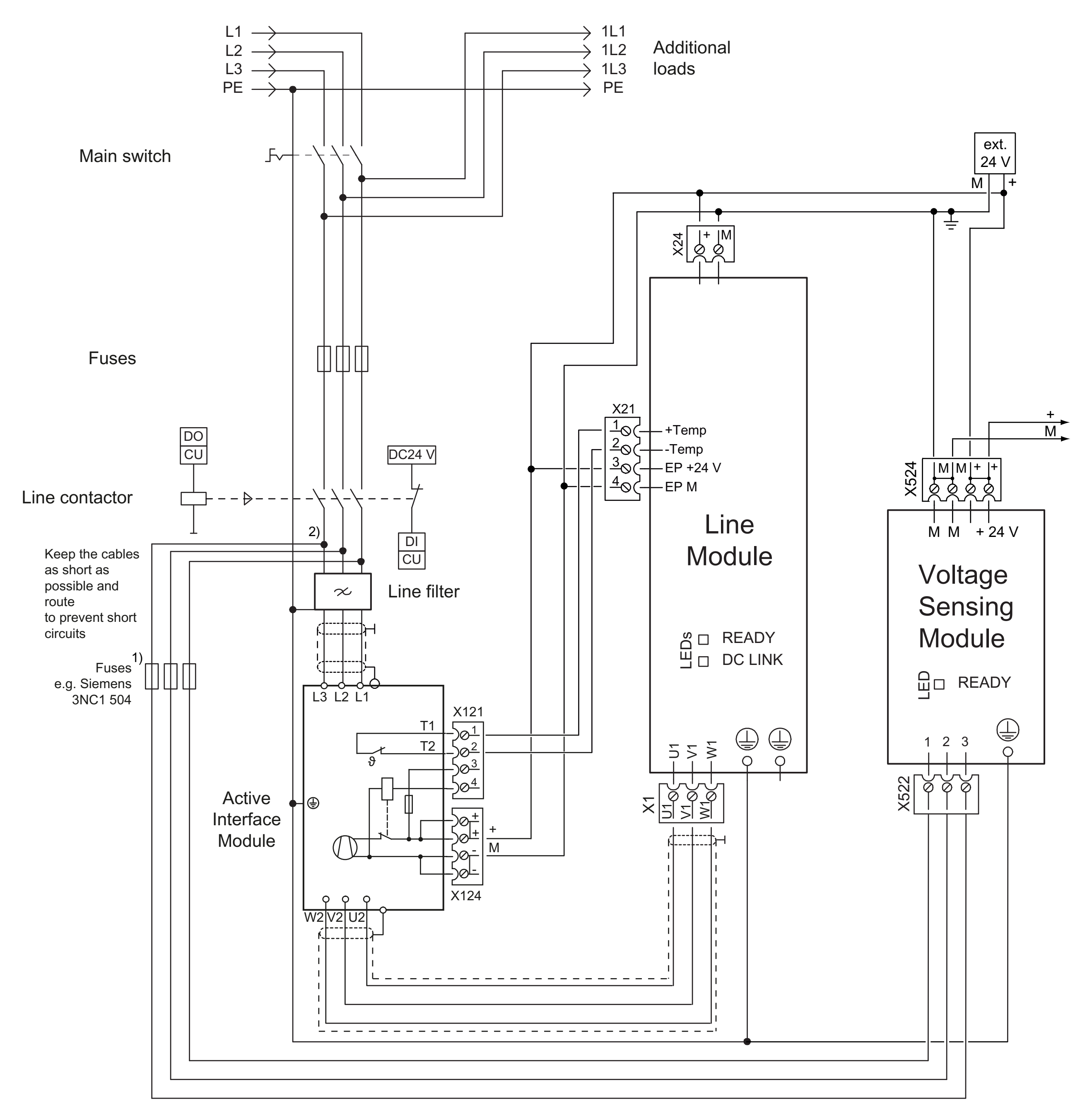


Figure 3-51 Connection example, VSM10

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 supply voltage is tapped as an actual value for the Voltage Sensing Module VSM10 in accordance with the system design; for examples see the table.

Table 3- 89 Suggestions for terminals and cable lugs which can be used to connect a VSM10 to the line

Conductor cross-section	VSM connection	Example components
Up to 6 mm²	Direct connection possible	Smart Line Modules 5 kW and 10 kW
6 mm² to 16 mm²	ST16-TWIN terminal blocks, if required with a reducing comb and ST4-TWIN or ST2.5-TWIN Phoenix Contact	Active Line Modules 16 kW Smart Line Modules 16 kW Active Interface Module 16 kW
16 mm² to 50 mm²	AGK10 UKH tap-off terminals with UKH terminals Phoenix Contact	Active Line Modules 36 kW and 55 kW Smart Line Modules 36 kW and 55 kW Active Interface Module 36 kW and 55 kW
> 50 mm²	Ring cable lug DIN 46234-8-2.5	Components with M8 connection bolt Active Line Modules 55 kW, 80 kW, and 120 kW Active Interface Module 80 kW and 120 kW
	Intermediate high-current connector, type UHV (Phoenix Contact) and ring cable lug DIN 46234-8-2.5	

3.12.5 Meaning of the LED

Table 3- 90 Meanings of the LEDs on the Voltage Sensing Module VSM10

LED	Color	Status	Description, cause	Remedy
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 light	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 documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

3.12.6 Dimension drawing

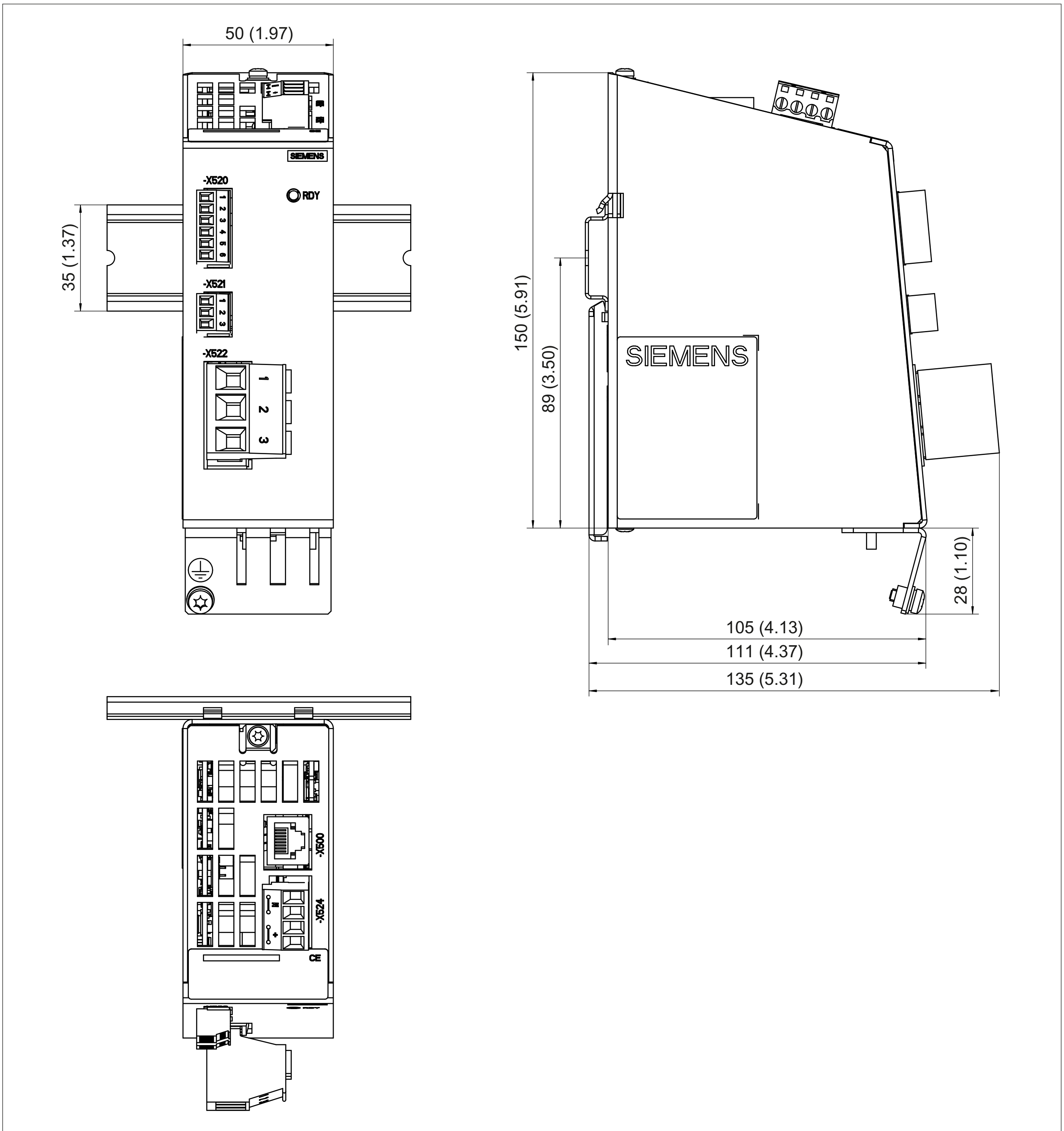


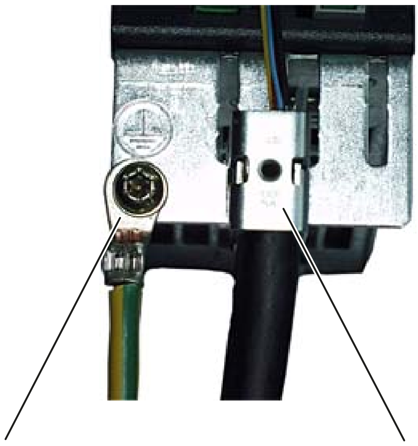
Figure 3-52 Dimension drawing of the Voltage Sensing Module VSM10, all data in mm and (inches)

3.12.7 Protective conductor connection and shield support

The following shield connection clamps can be used on the bottom part of the component housing for shield connection of the analog inputs:

Shield connection clamp		Order number
Phoenix Contact	SK8	3025163
Phoenix Contact	SK14	3025176
Phoenix Contact	SK20	3025189
Weidmüller	KLBÜ CO1	1753311001

The following pictures show the shield contacts with a shield connection clamp from Weidmüller.



Protective conductor connection
M4/1.8 Nm

Shield connection clamp
KLBÜ CO1 (Weidmüller)

Figure 3-53 Shield contact on VSM10

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

Internet address for Phönix Contact: http://www.phoenixcontact.com

⚠ DANGER

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

NOTICE

Only use screws with a permissible mounting depth of 4 - 6 mm.

3.12.8 Technical data

Table 3- 91 Technical data

6SL3053-0AA00-3AAx	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
Degree of protection		IP20

4 Encoder system connection

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 simplify commissioning and diagnostics because the motor and encoder type are identified automatically.

Motors and external encoders without DRIVE-CLiQ interface

Motors without DRIVE-CLiQ interfaces, as well as external encoders, must be connected via Sensor Modules to enable the encoder and temperature signals to be evaluated. Sensor Modules Cabinet-Mounted (SMC) are available for installation in control cabinets and Sensor Modules External (SME) for installation outside 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

Motors with DRIVE-CLiQ interfaces can be connected to the associated Motor Module directly via the MOTION-CONNECT DRIVE-CLiQ cables available. 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 VDC 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, etc.) directly to the Control Unit. Different encoder cable are therefore no longer required for the various encoder types, e.g. resolvers or absolute encoders. Wiring can be effected throughout with a MOTION-CONNECT DRIVE-CLiQ cable.

DRIVE-CLiQ encoder

The DRIVE-CLiQ encoder is an absolute encoder with integrated DRIVE-CLiQ interface (see the section titled "DRIVE-CLiQ encoder").

NOTICE
The encoder cables to Siemens motors may only disconnected and connected when the system is in a no-voltage condition. For direct measuring systems (third-party encoders), ask the manufacturer whether it is permissible to disconnected/connect under voltage.

4.2 Description

Sensor Modules Cabinet-Mounted (SMC)

Sensor Modules Cabinet-Mounted SMC10, SMC20 and SMC30 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 SMCs evaluate these measuring systems and convert the calculated values to DRIVE-CLiQ. Neither motor nor encoder data are saved.

Note

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

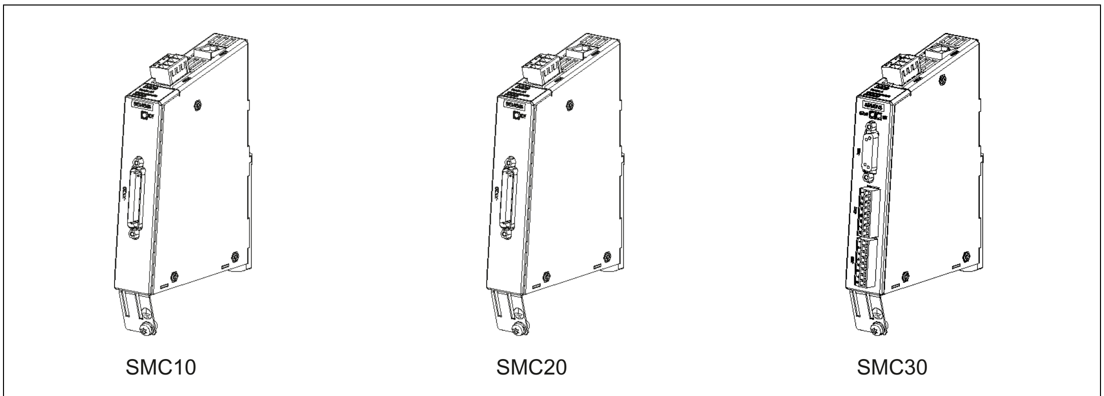


Figure 4-1 Overview of Sensor Modules Cabinet-Mounted (SMC)

Sensor Modules External (SME)

The Sensor Modules External SME20, SME25, SME120, and SME125 are only intended for use on machines (in North America, in accordance with the NFPA 79 "Electrical Standard for Industrial Machinery") and may only be connected to the DRIVE-CLiQ interfaces of the components.

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.

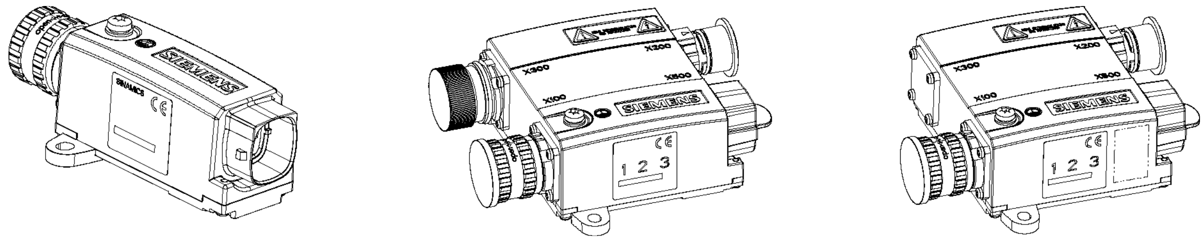


Figure 4-2 Overview of Sensor Modules External (SME)

Connectable encoder systems

Table 4- 1 Connectable encoder systems

	SMC			SME			
Encoder systems	**SMC10**	**SMC20**	**SMC30**	**SME20**	**SME25**	**SME120**	**SME125**
Resolver	Yes	-	-	-	-	-	-
Incremental encoder sin/cos (1 Vpp) with/without reference signal	-	Yes	-	Yes	-	Yes	-
Absolute encoder EnDat 2.1	-	Yes	-	-	Yes	-	Yes
Incremental encoder TTL / HTL	-	-	Yes	-	-	-	-
Absolute encoder SSI	-	Yes 1)	Yes 2)	-	Yes 1)	-	Yes 1)
Temperature evaluation	Yes	Yes	Yes	Yes 3)	-	Yes (electri-cally isolated)	Yes (electri-cally isolated)

1) Only possible for SSI encoders with 5 V supply

2) Possible for SSI encoders with 5 V or 24 V supply

3) With prescribed adapter cable 6FX8002-2CA88

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 ventilation spaces of 50 mm above and below the component 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 signal cables, or the encoder system electronics. If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

⚠ CAUTION

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the ground 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

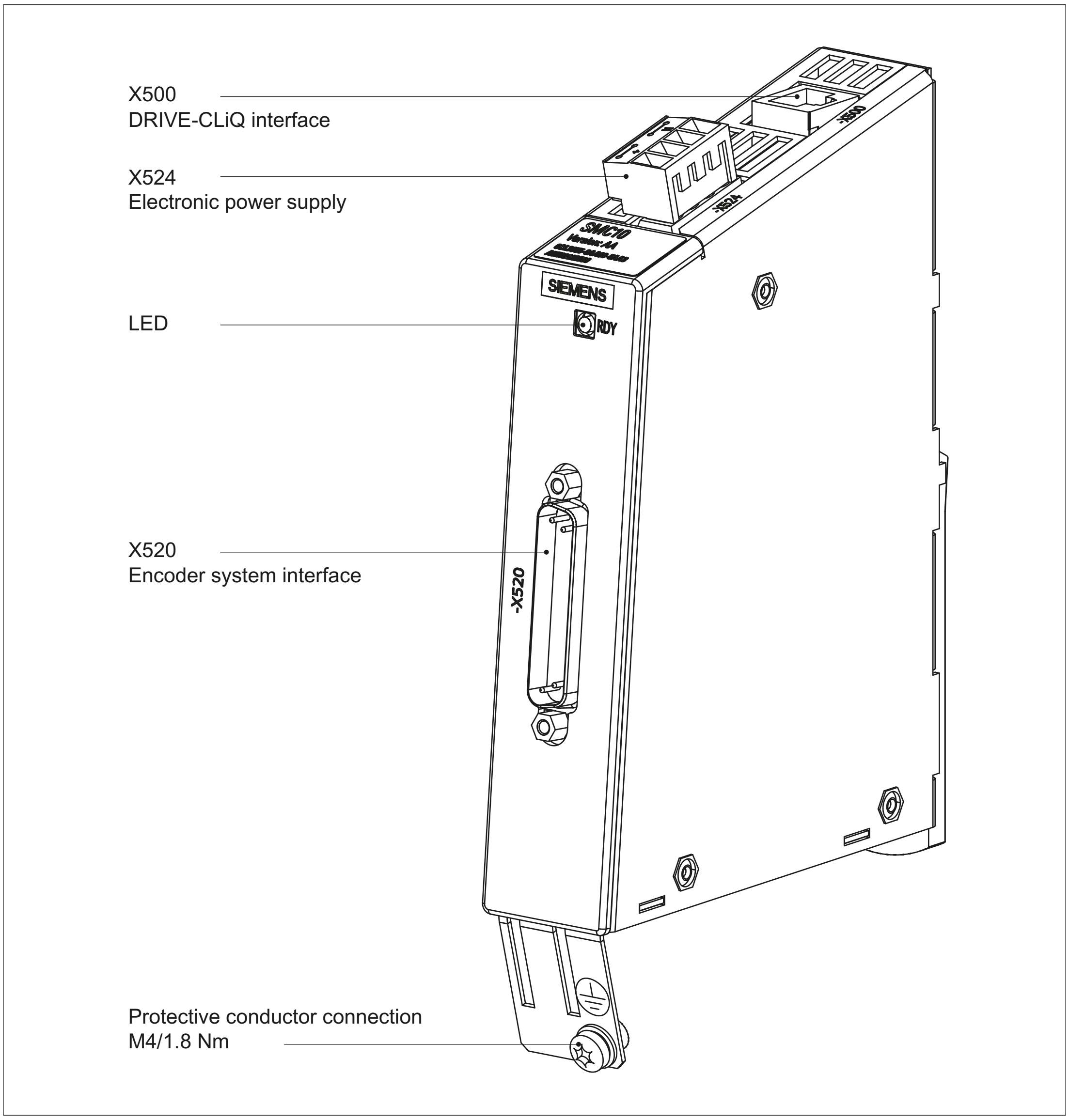
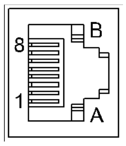


Figure 4-3 Interface description of the SMC10

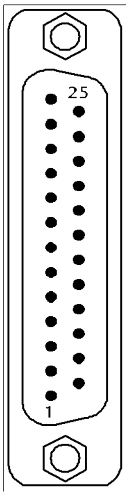
4.3.3.2 DRIVE-CLiQ interface X500

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)	Electronic ground
Connector type: RJ45 socket; blanking plate for DRIVE-CLiQ interface included in the scope of delivery; blanking plate (50 pieces) Order no.: 6SL3066-4CA00-0AA0			

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	Inverted resolver signal A (sin-)
	5	Ground	Ground (for internal shield)
	6	S1	Resolver signal B (cos+)
	7	S3	Inverted 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
Connector type: SUB-D, 25-pole			

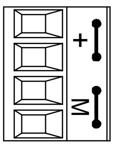
NOTICE

The KTY temperature sensor must be connected with the correct polarity.

> **DANGER**
>
> **Risk of electric shock!**
>
> Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) or Terminal Module TM120 must be used.
>
> If these instructions are not complied with, there is a risk of electric shock!

4.3.3.4 X524 Electronics power supply

Table 4- 4 X524 terminal block

	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
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics 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 that the supply voltage is looped through.

4.3.4 Connection example

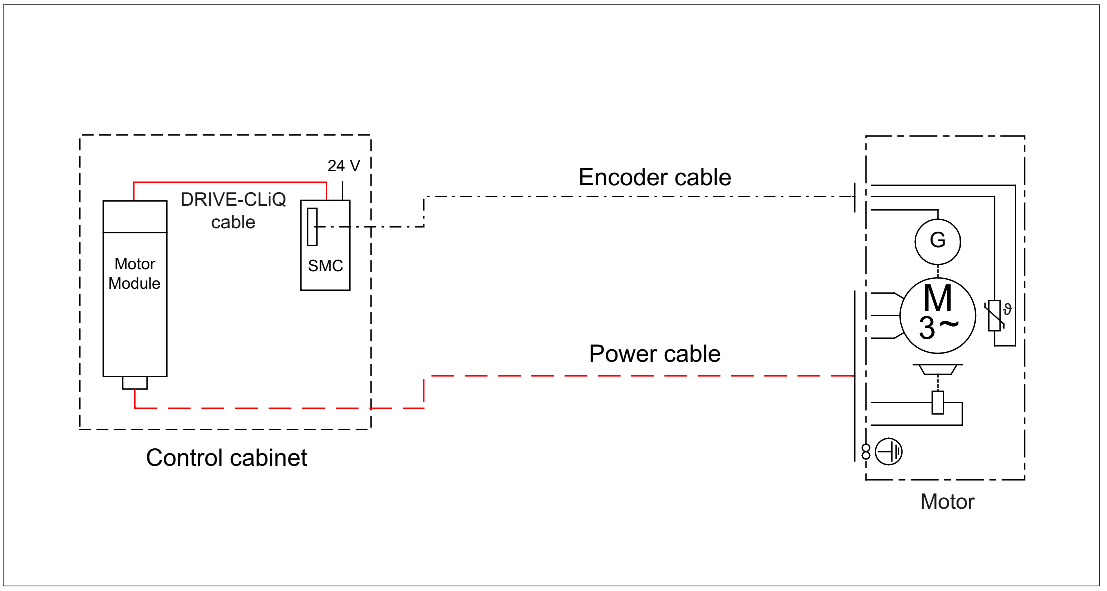


Figure 4-4 Connection of an encoder system via a Sensor Module Cabinet-Mounted (SMC) for a motor without a DRIVE-CLiQ interface

4.3.5 Meaning of the LED

Table 4- 5 Meaning of LEDs on the Sensor Module Cabinet-Mounted SMC10

LED	Color	Status	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 light	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 documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

4.3.6 Dimension drawing

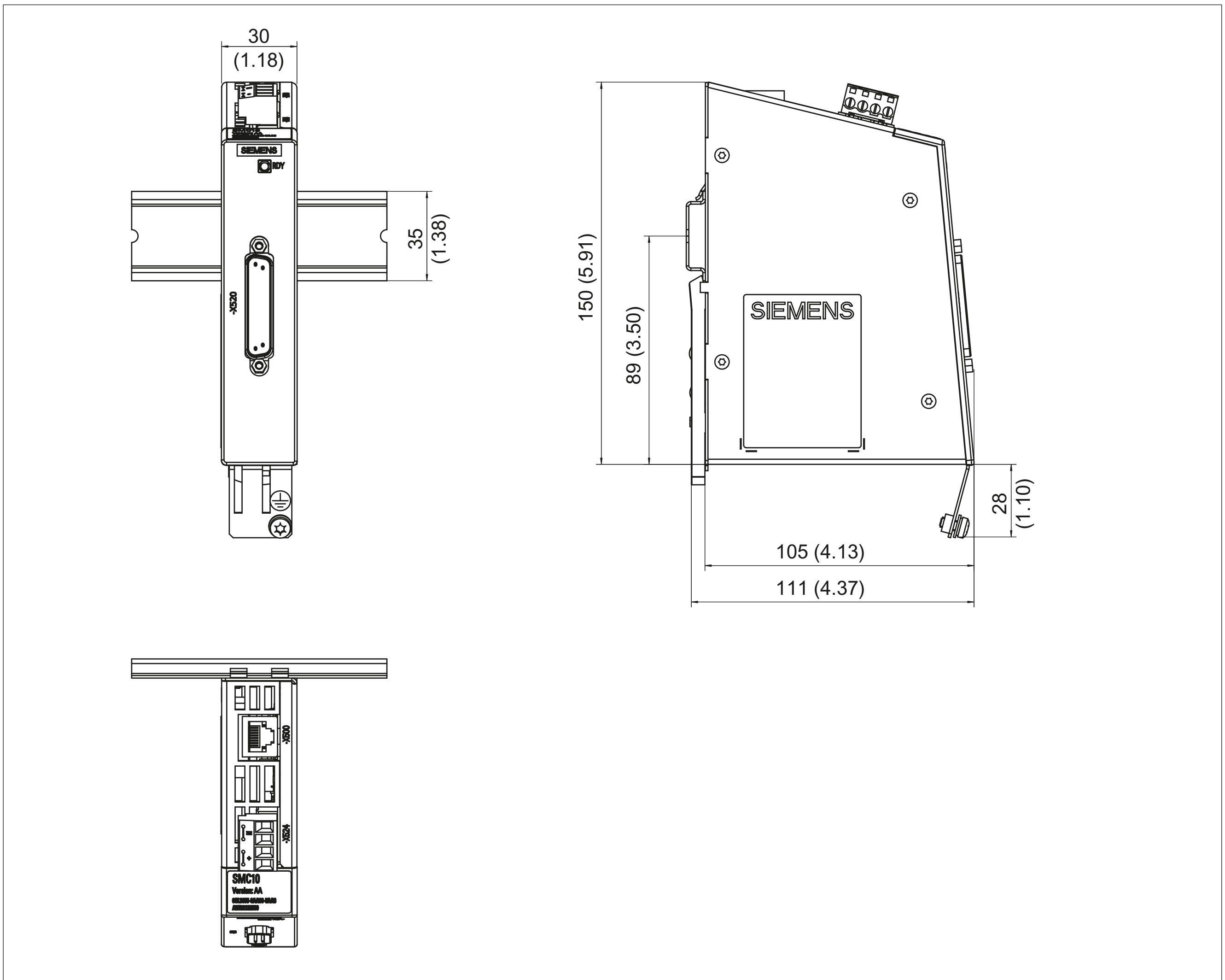


Figure 4-5 Dimension drawing of the Sensor Module Cabinet SMC10, all dimensions in mm and (inches)

4.3.7 Mounting

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

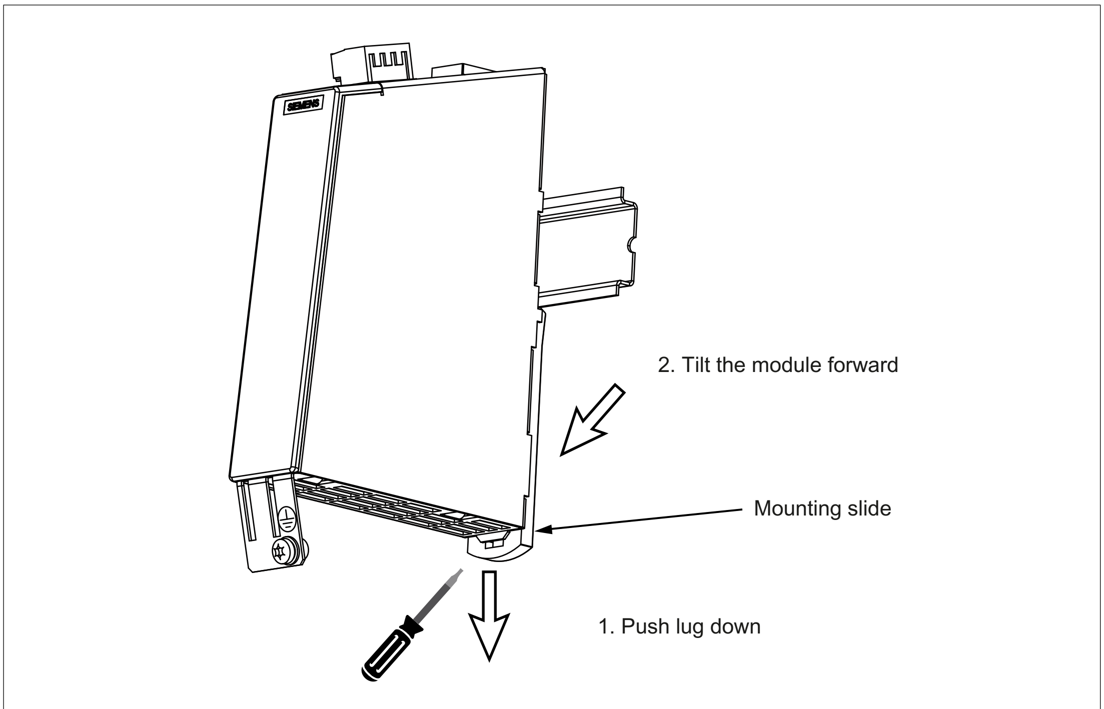


Figure 4-6 Removal of a component from a DIN rail

4.3.8 Technical data

Table 4- 6 Technical data

6SL3055-0AA00-5AAx	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.35 ≤ 10
Specification Transformation ratio of the resolver (ü) Excitation voltage on the SMC10 when ü=0.5 Amplitude monitoring threshold (secondary tracks) of the SMC10	 V_{rms} V_{rms}	 0.5 4.1 1
Excitation voltage (cannot be parameterized)	V_{rms}	4.1
Excitation frequency (synchronized to the current controller clock cycle)	kHz	5 to 16
PE/ground connection		On housing with M4/1.8 Nm screw
Max. encoder cable length	m	130
Weight	kg	0.45
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:

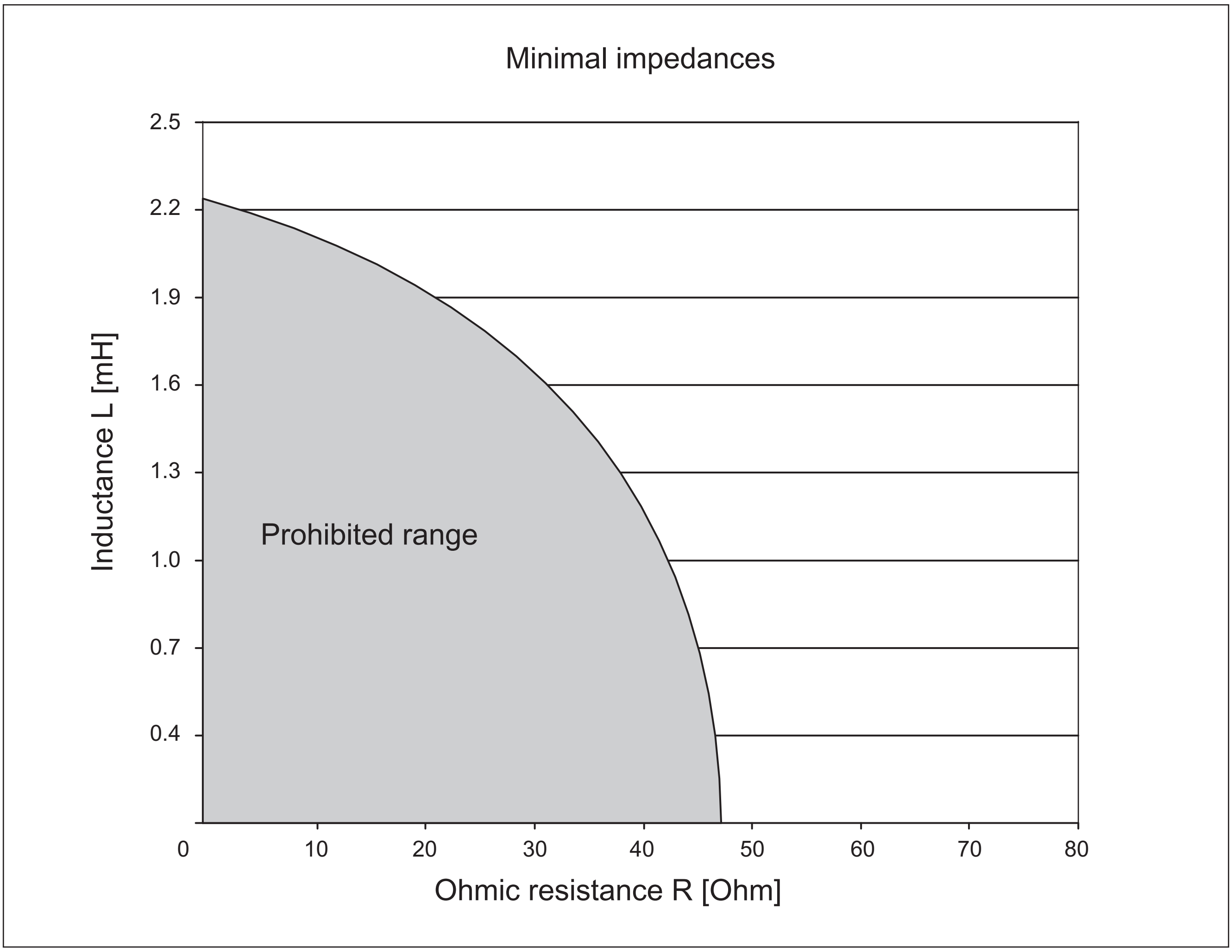


Figure 4-7 Connectable impedances with an excitation frequency f = 5000 Hz

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 ventilation spaces of 50 mm above and below the component 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 signal cables, or the encoder system electronics. If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

⚠ CAUTION
Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the ground 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

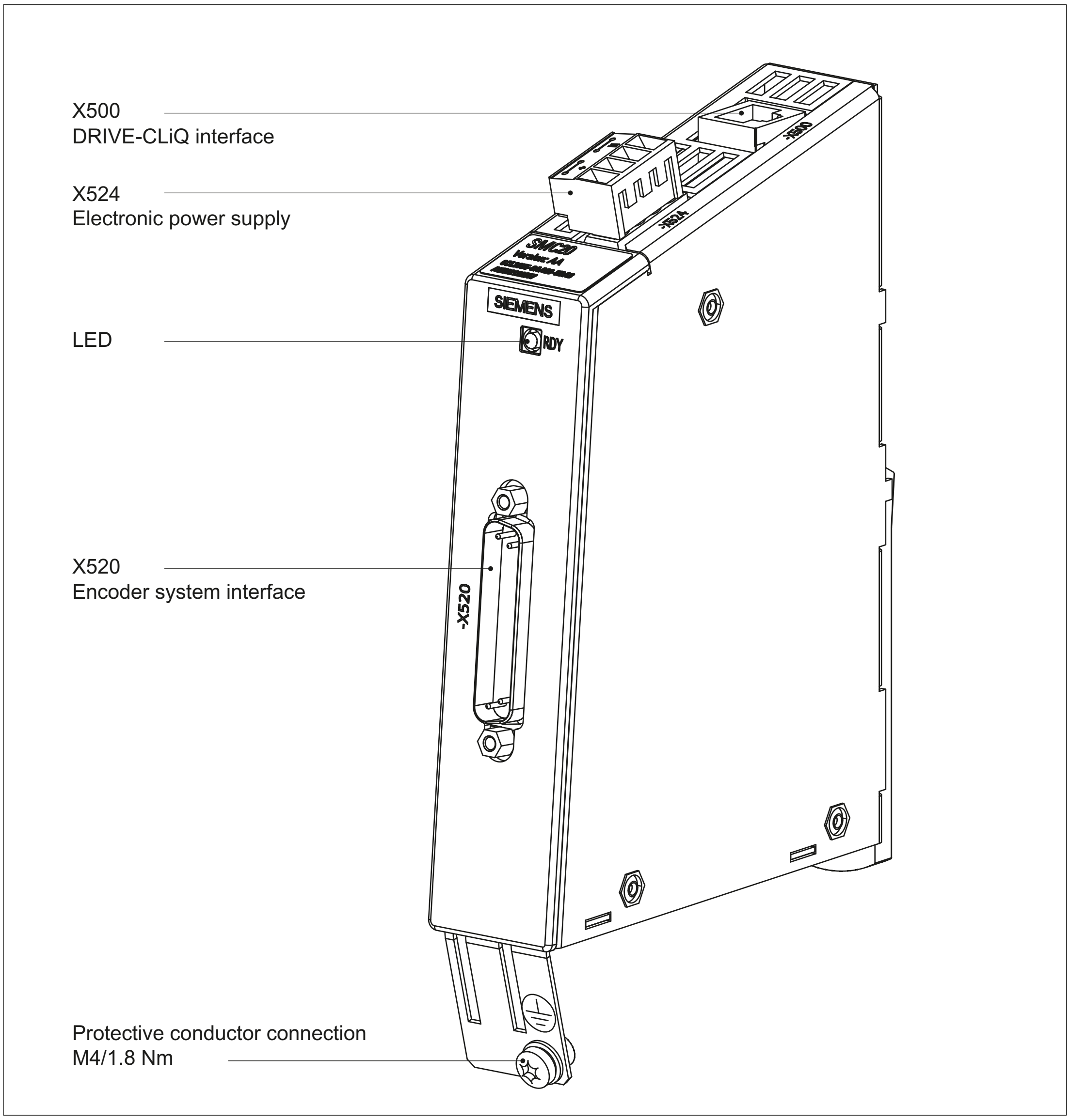
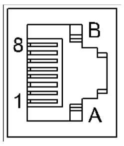


Figure 4-8 Interface description of the SMC20

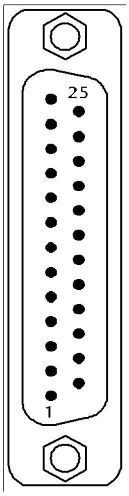
4.4.3.2 DRIVE-CLiQ interface X500

Table 4- 8 DRIVE-CLiQ interface X500

	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	Reserved, do not use	
	B	GND (0 V)	Electronic ground
Connector type: RJ45 socket; blanking plate for DRIVE-CLiQ interface included in the scope of delivery; blanking plate (50 pieces) Order no.: 6SL3066-4CA00-0AA0			

4.4.3.3 X520 encoder system interface

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*	Inverse 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

NOTICE
The KTY temperature sensor must be connected with the correct polarity.

⚠ DANGER

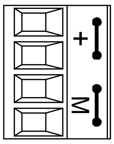
Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) or Terminal Module TM120 must be used.

If these instructions are not complied with, there is a risk of electric shock!

4.4.3.4 X524 Electronics power supply

Table 4- 10 X524 terminal block

	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
	+	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.

4.4.4 Connection example

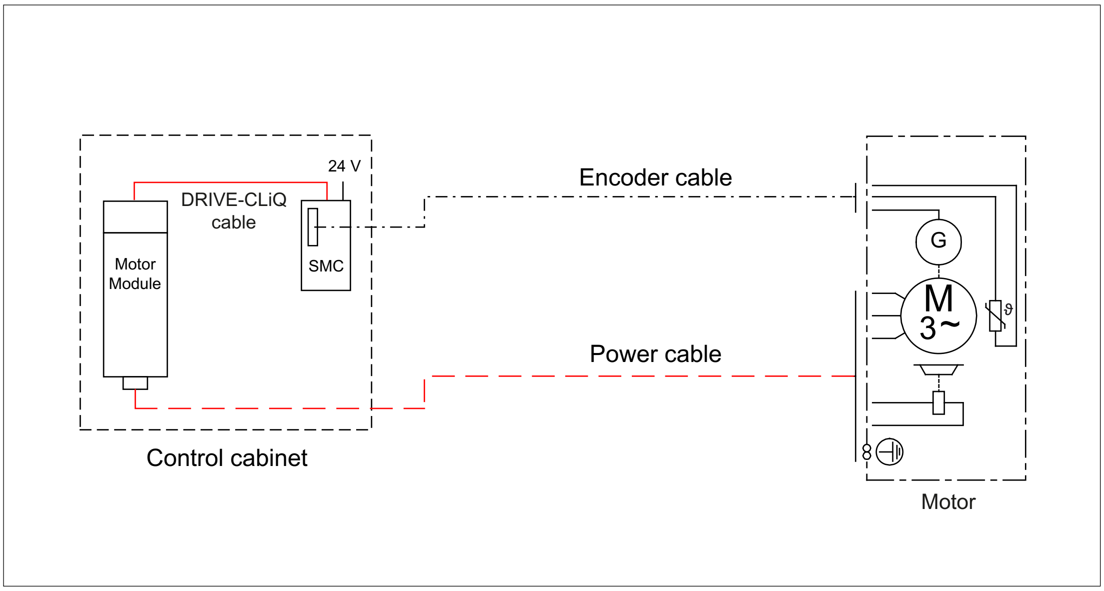


Figure 4-9 Connection of an encoder system via a Sensor Module Cabinet-Mounted (SMC) for a motor without a DRIVE-CLiQ interface

4.4.5 Meaning of the LED

Table 4- 11 Meaning of LEDs on the Sensor Module Cabinet-Mounted SMC20

LED	Color	Status	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 light	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 documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

4.4.6 Dimension drawing

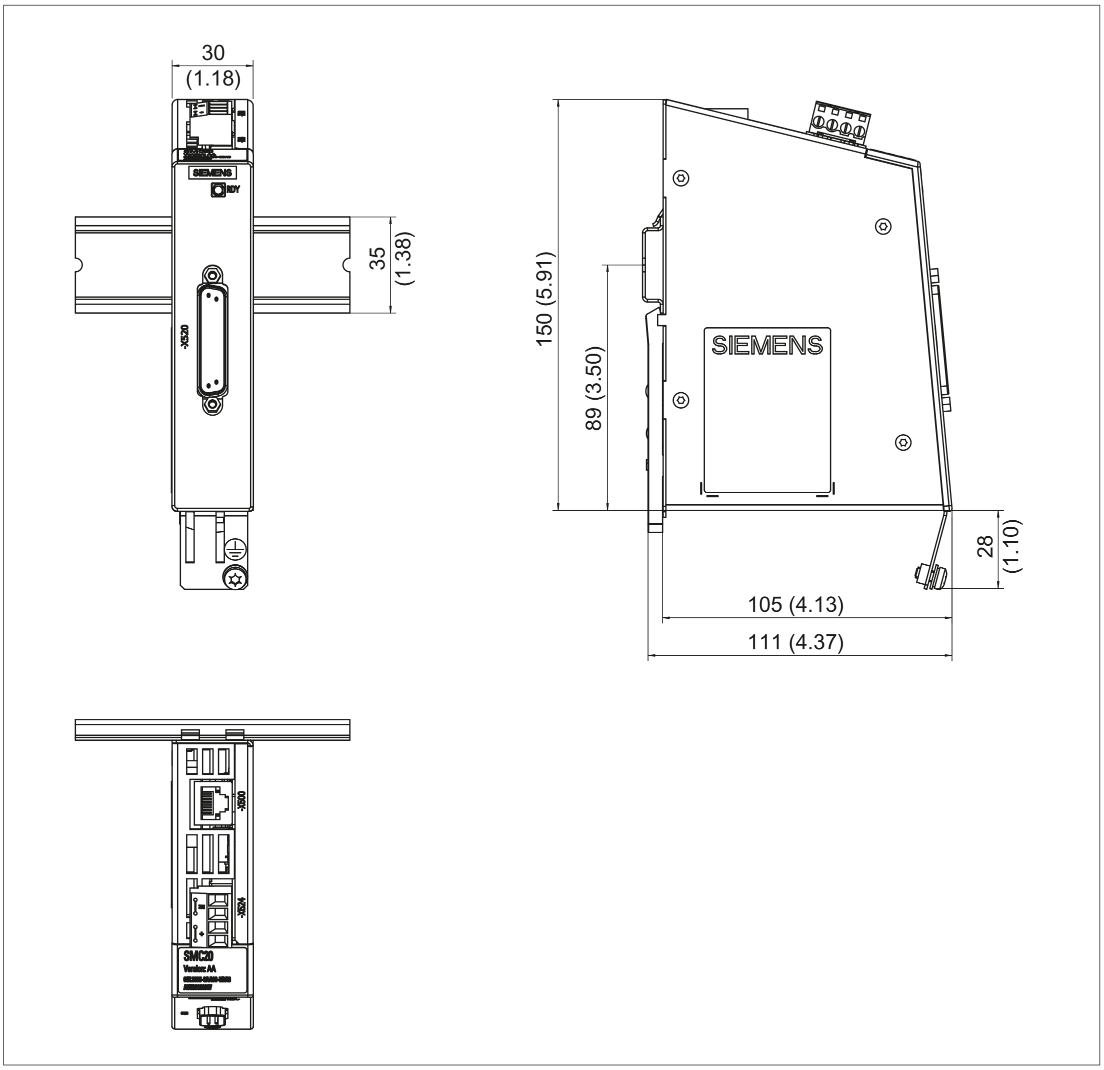


Figure 4-10 Dimension drawing of the Sensor Module Cabinet SMC20, all data in mm and (inches)

4.4.7 Mounting

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

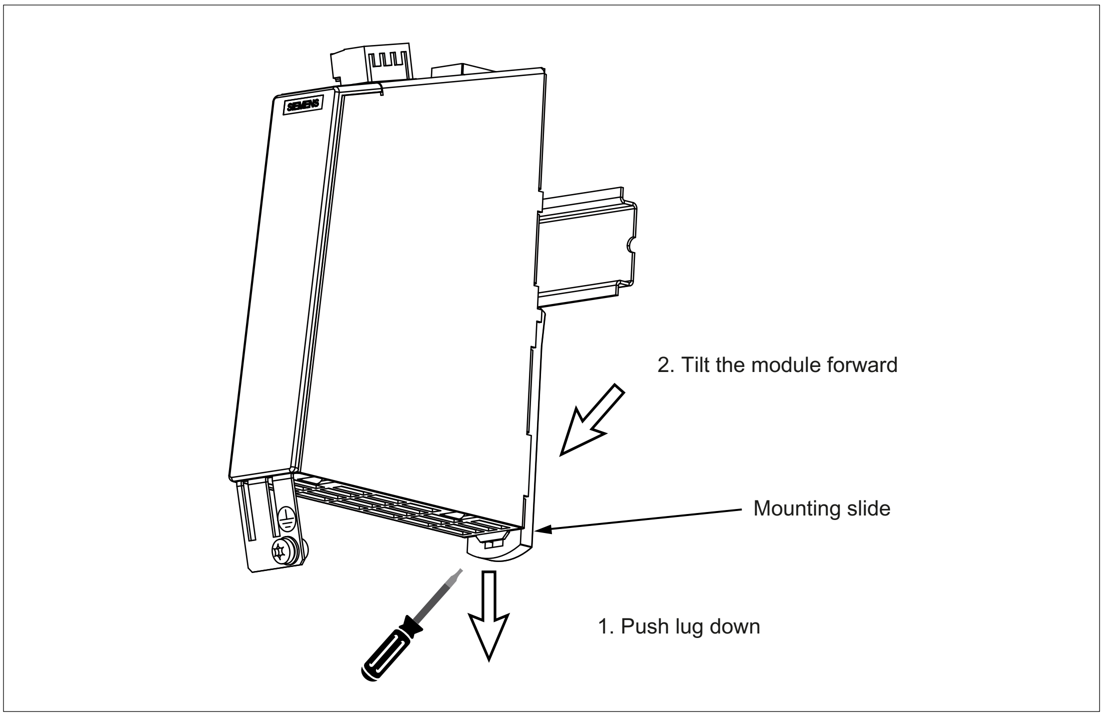


Figure 4-11 Removal of a component from a DIN rail

4.4.8 Technical data

Table 4- 12 Technical data

6SL3055-0AA00-5BAx	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.35 ≤ 10
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 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 (6SL3055-0AA00-5BA2) 100 - 250 (6SL3055-0AA00-5BA3)
Max. encoder cable length	m	100
PE/ground connection		On housing with M4/1.8 Nm screw
Weight	kg	0.45
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).

2) Only possible for SSI encoders with 5 V supply

NOTICE
Current controller clock cycle When a current controller clock cycle of 31.25 µs is used, a SMC20 with MLFB 6SL3055-0AA00-5BA3 must be used.

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 encoder signals from encoders with TTL, HTL, or SSI 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 ventilation spaces of 50 mm above and below the component 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 signal cables, or the encoder system electronics. If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics 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 ground 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

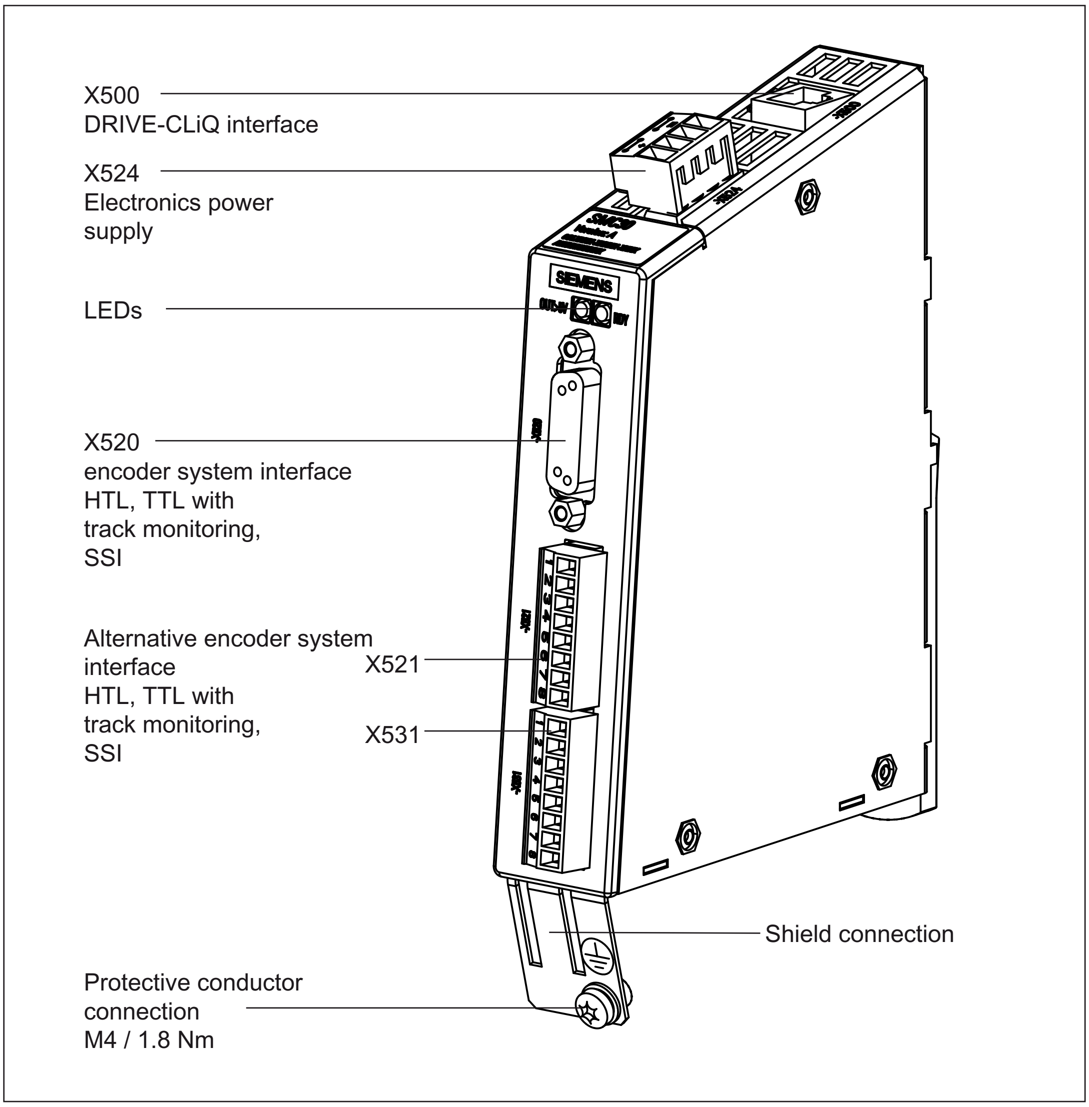
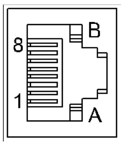


Figure 4-12 Interface description of the SMC30

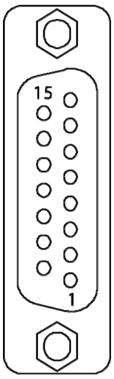
4.5.3.2 DRIVE-CLiQ interface X500

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)	Electronic ground
Connector type: RJ45 socket; blanking plate for DRIVE-CLiQ interface included in the scope of delivery; blanking plate (50 pieces) Order no.: 6SL3066-4CA00-0AA0			

4.5.3.3 X520 encoder system interface

Table 4- 14 X520 encoder system interface

	Pin	Signal name	Technical specifications
	1	Reserved, do not use + Temp	 Motor temperature sensing KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130/PTC/bimetallic switch with NC contact
	2	Clock	SSI clock
	3	Clock*	Inverse SSI clock
	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	 Motor temperature sensing KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130/PTC/bimetallic switch with NC contact
	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
	15	A / data	Incremental signal A/SSI data
Connector type: SUB-D female, 15-pin			

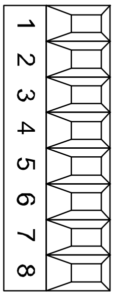
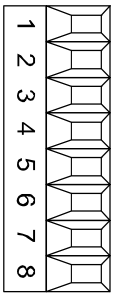
CAUTION
The encoder supply can be parameterized to 5 V or 24 V. The sensor may be destroyed if you enter the wrong parameters.

NOTICE
The KTY temperature sensor must be connected with the correct polarity. For details of how to parameterize the KTY temperature sensors, refer to the SINAMICS S120 Function Manual (FH1) in the Chapter "Monitoring and protective functions/Thermal motor monitoring".

> **DANGER**
>
> **Risk of electric shock!**
>
> Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) or Terminal Module TM120 must be used.
>
> If these instructions are not complied with, there is a risk of electric shock!

4.5.3.4 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 sensing KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130/PTC/bimetallic switch with NC contact
	4	+ Temp	Motor temperature sensing KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130/PTC/bimetallic switch with NC contact
	5	Clock	SSI clock
	6	Clock*	Inverse SSI clock
	7	Data	SSI data
	8	Data*	Inverse SSI data
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.

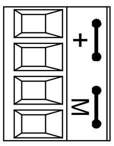
CAUTION
When the encoder system is connected via terminals, make sure that the cable shield is connected to the component. Refer to the Chapter "Electrical connection".

NOTICE
The KTY temperature sensor must be connected with the correct polarity. For details of how to parameterize the KTY temperature sensors, refer to the SINAMICS S120 Function Manual (FH1) in the Chapter "Monitoring and protective functions/Thermal motor monitoring".

⚠ DANGER
Risk of electric shock! Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) or Terminal Module TM120 must be used. If these instructions are not complied with, there is a risk of electric shock!

4.5.3.5 Electronics power supply X524

Table 4- 16 X524 terminal block

	Terminal	Function	Technical specifications
	+	Electronics power supply	Voltage: 24 V (20.4 V – 28.8 V) Current consumption: max. 0.55 A Max. current via jumper in connector: 20 A
	+	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.

4.5.4 Connection examples

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

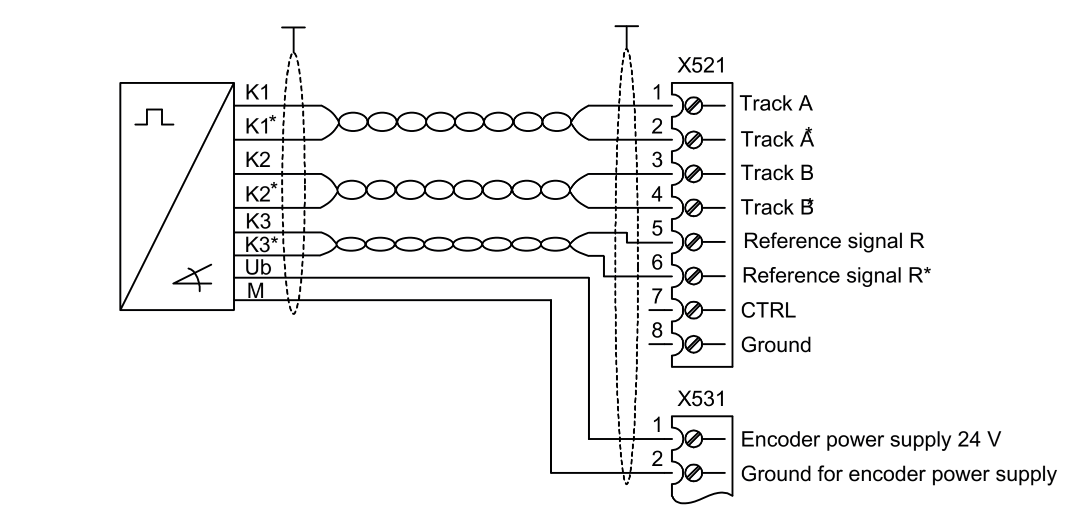


Figure 4-13 Connection example 1: HTL encoder, bipolar, with reference signal

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

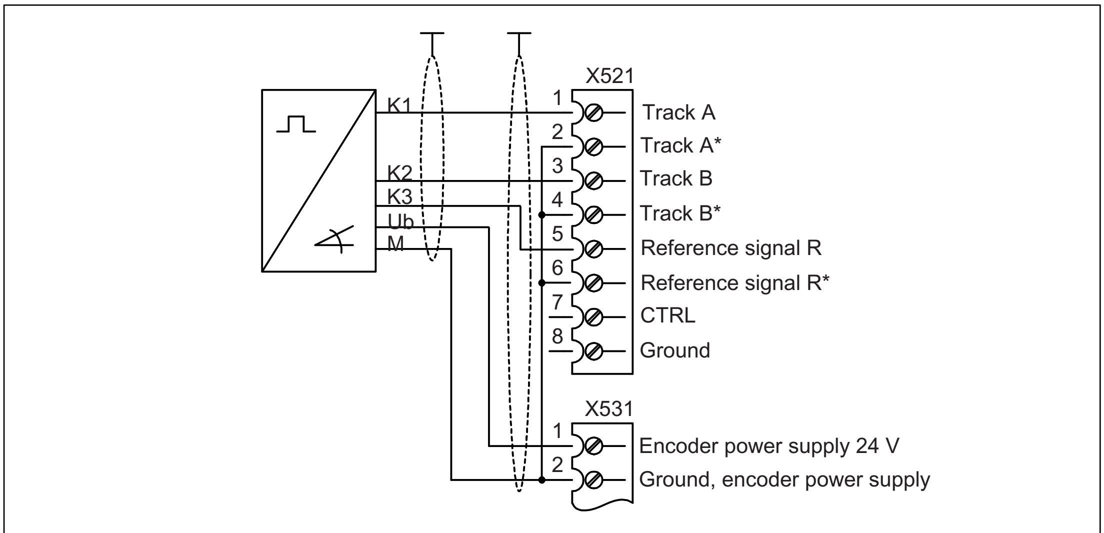


Figure 4-14 Connection example 2: HTL encoder, unipolar, with reference signal[1)]

[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.

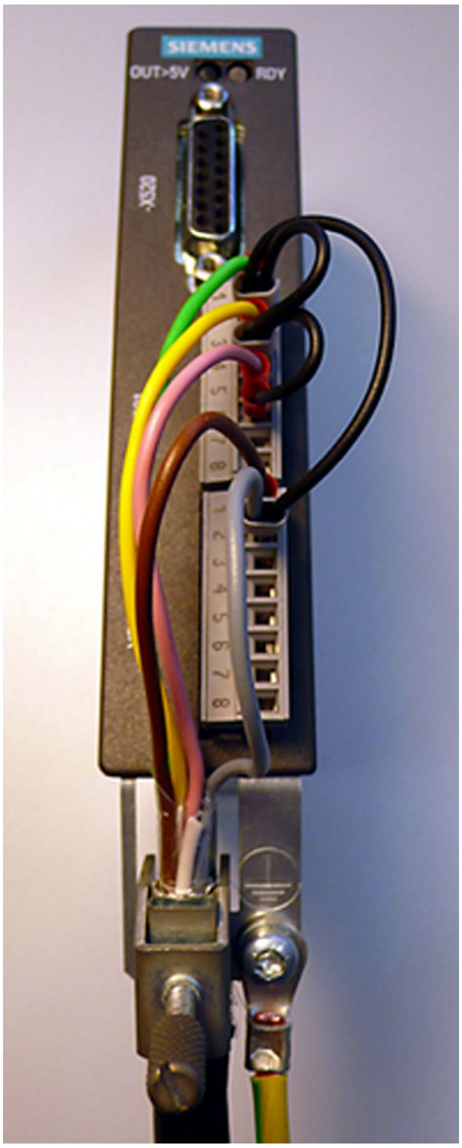


Figure 4-15 Photo of connection example 2: SMC30, 30 mm wide

Note: Diagram of the wire jumpers to connect unipolar HTL encoders with reference signal

4.5.5 Meaning of LEDs

Table 4- 17 Meaning of LEDs on the Sensor Module Cabinet SMC30

LED	Color	Status	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 light	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.	–

Cause and rectification of faults

The following documents contain information about the cause of faults and how they can be rectified:

SINAMICS S120 Commissioning Manual (IH1)

SINAMICS S120/S150, List Manual (LH1)

4.5.6 Dimension drawing

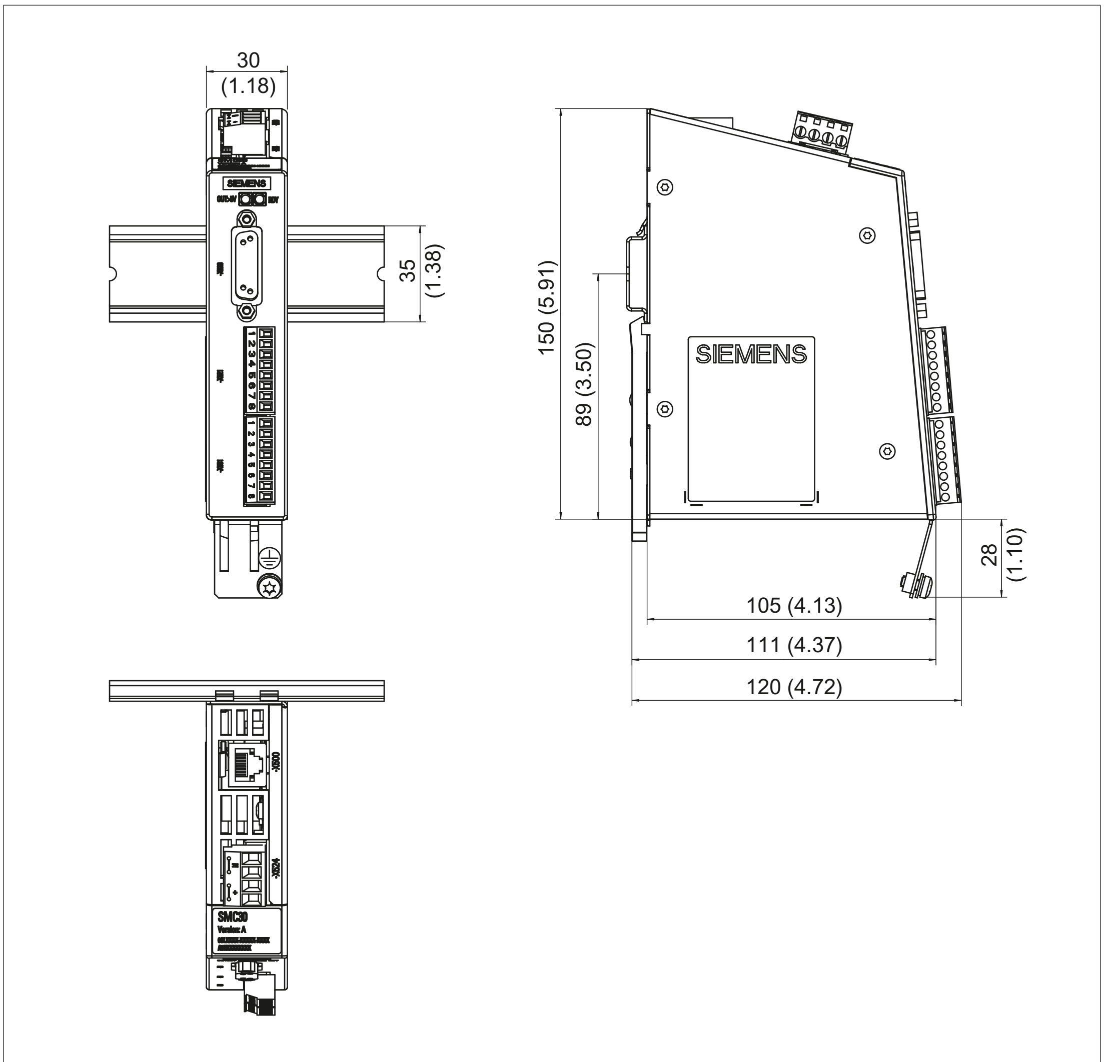


Figure 4-16 Dimension drawing of the Sensor Module Cabinet SMC30, all data in mm and (inches)

4.5.7 Mounting

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hook.
2. Push the component towards the DIN rail until you hear the mounting slide at the rear latch into position.
3. You can now move the component to the left or right along the DIN rail, until it reaches its final position.

Removal

1. The lug on the mounting slide first needs to be pushed down to unlock the slide from the DIN rail.
2. The component can now be tilted forwards and pulled up and off the DIN rail.

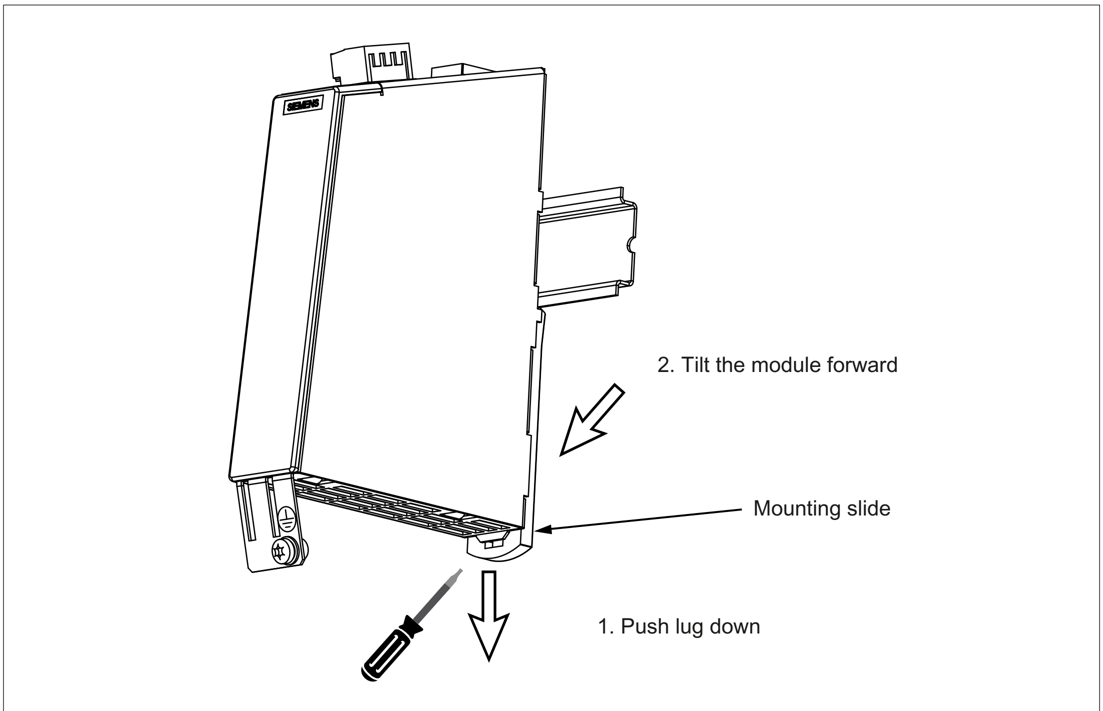


Figure 4-17 Removal of a component from a DIN rail

4.5.8 Protective conductor connection and shield support

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

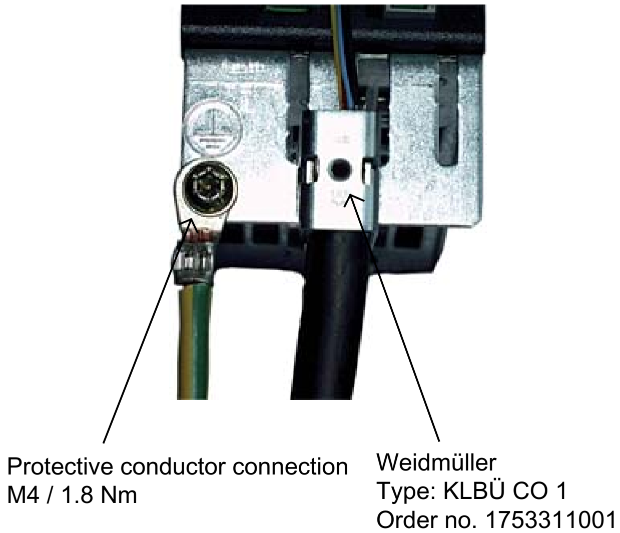


Figure 4-18 Shield contacts for the SMC30

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

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

NOTICE
Only use screws with a permissible mounting depth of 4 - 6 mm.

4.5.9 Technical Specifications

Table 4- 18 Technical data

6SL3055-0AA00-5CAx	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.55 ≤ 10
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 5 VDC (with or without Remote Sense) 1) or V_{DC} - 1 V 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		0.45
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[3)]	High	17	V_{CC}	V
		Low	10	V_{CC}	V
Signal level low (HTL unipolar)	U_L[3)]	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)]	U_{Hdiff}		2	5	V
Low signal level (SSI bipolar at X520 or X521/X531)[1)]	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}		640	$(t_{ALo\text{-}BHi} - t_{Hi})/2$ [4)]	ns
"Zero pulse active time" (while A=B=high and beyond) [5)]	t_{Hi}		640	$t_{ALo\text{-}BHi} - 2{*}t_{Lo}$ [4)]	ns

1) Other signal levels according to the RS 422 standard.

2) The absolute level of the individual signals varies between 0 V and VCC of the encoder system.

3) Only with order number 6SL3055-0AA00-5CA2 and firmware version 2.5 SP1 or higher can this value be configured using software. For older firmware releases and Order Nos. less than 6SL3055-0AA00-5CA2 then the "low" threshold applies.

4) $t_{ALo\text{-}BHi}$ 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.

5) Further information on setting the "Zero pulse active time" can be found in the manual: SINAMICS S120, Function Manual, tolerant encoder monitoring for SMC30

Table 4- 20 Encoders that can be connected

	X520 (SUB-D)	X521 (terminal)	X531 (terminal)	Track monitoring	Remote Sense[2)]
HTL bipolar 24 V	No/yes	Yes		No/yes	No
HTL unipolar 24 V [1)]	No/yes	Yes (however, a bipolar connection is recommended) [1)]		No	No
TTL bipolar 24 V	Yes	Yes		Yes	No
TTL bipolar 5 V	Yes	Yes		Yes	To X520
SSI 24 V/5 V	Yes	Yes		No	No
TTL unipolar	No				

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) 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).

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	100

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

2) Because the physical transmission properties are 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.

For encoders with a 5 V supply at X521/X531, the cable lengths depend on the encoder current (for 0.5 mm² cable cross-sections):

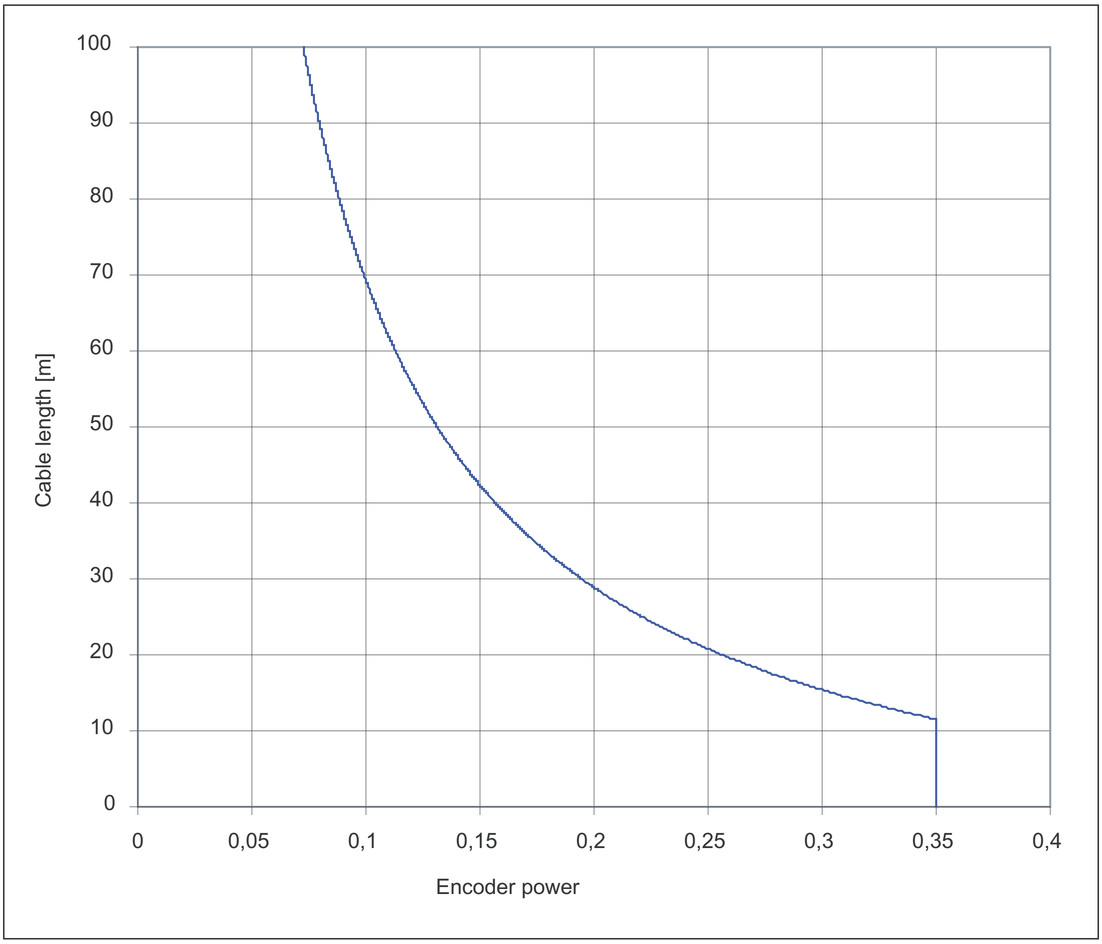


Figure 4-19 Max. cable length as a function of the encoder current drawn

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).

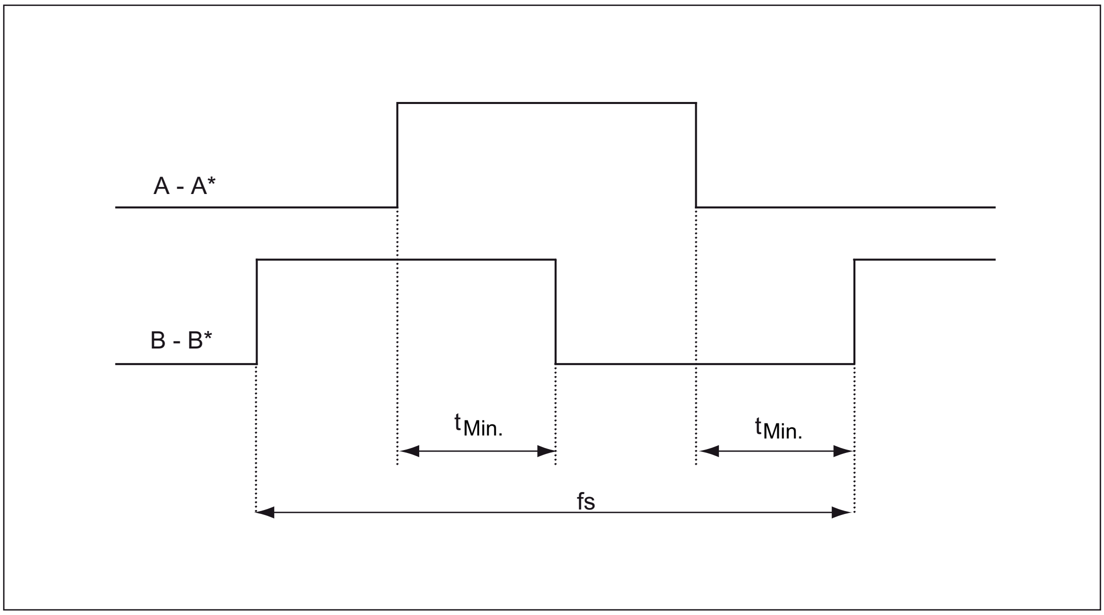


Figure 4-20 Signal characteristic of track A and track B between two edges: Time between two edges with pulse encoders

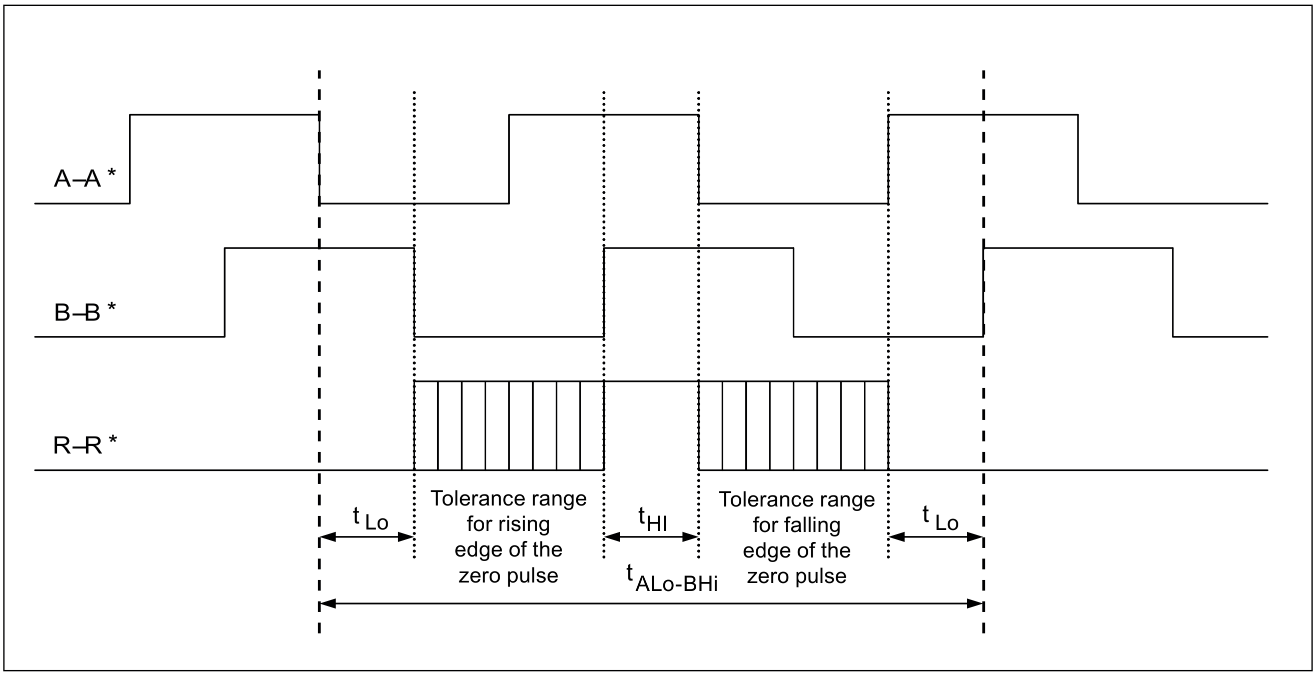


Figure 4-21 Position of the zero pulse to the track signals

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.

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

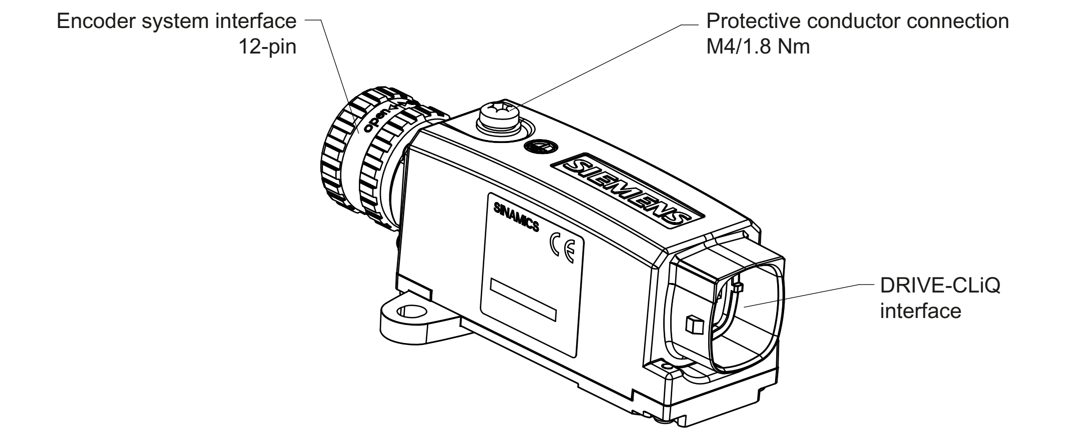
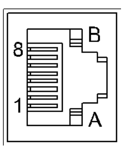


Figure 4-22 Interface description SME20

4.6.3.2 DRIVE-CLiQ interface

Table 4- 22 DRIVE-CLiQ interface

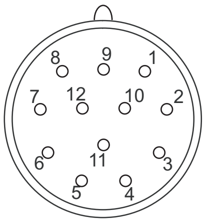
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
DRIVE-CLiQ port rubber plug included in the scope of delivery; rubber plug (50 pieces) Order number: 6SL3066-4CA00-0AA0 Current consumption: max. 0.25 A			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. The maximum cable length for MOTION-CONNECT 500 cables is 100 m and for MOTION-CONNECT 800 cables, 50 m.

4.6.3.3 Encoder system interface

Table 4- 23 Encoder system interface SME20

	Pin	Signal name	Technical specifications
	1	B*	Inverted incremental signal B
	2	P5	Encoder power supply
	3	R	Reference signal R
	4	R*	Inverted reference signal R
	5	A	Incremental signal A
	6	A*	Inverted 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

NOTICE
The KTY temperature sensor must be connected with the correct polarity.

⚠ DANGER

Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) or Terminal Module TM120 must be used.

If these instructions are not complied with, there is a risk of electric shock!

4.6.4 Connection example

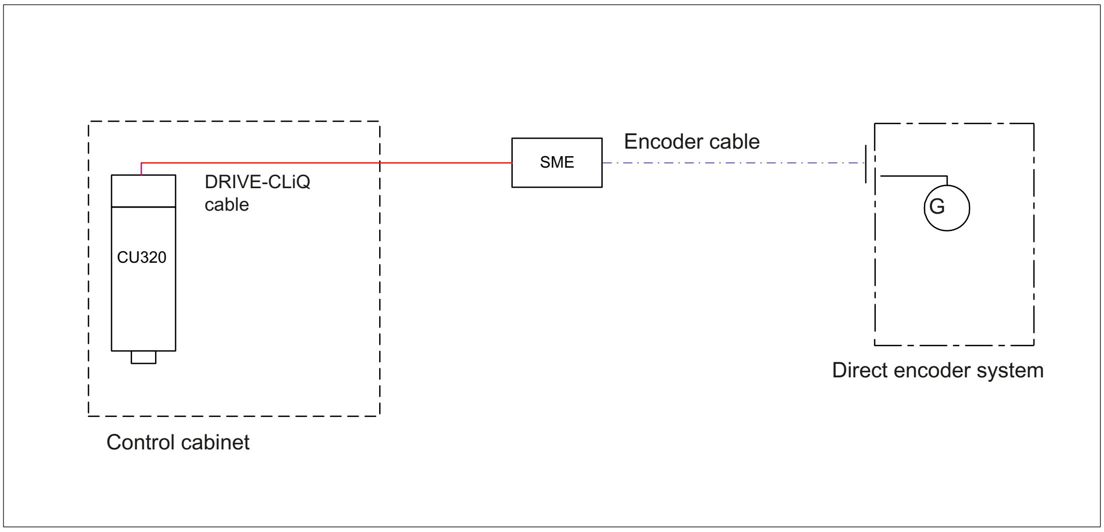


Figure 4-23 Connection of a direct encoder system via a Sensor Module External (SME)

4.6.5 Dimension drawings

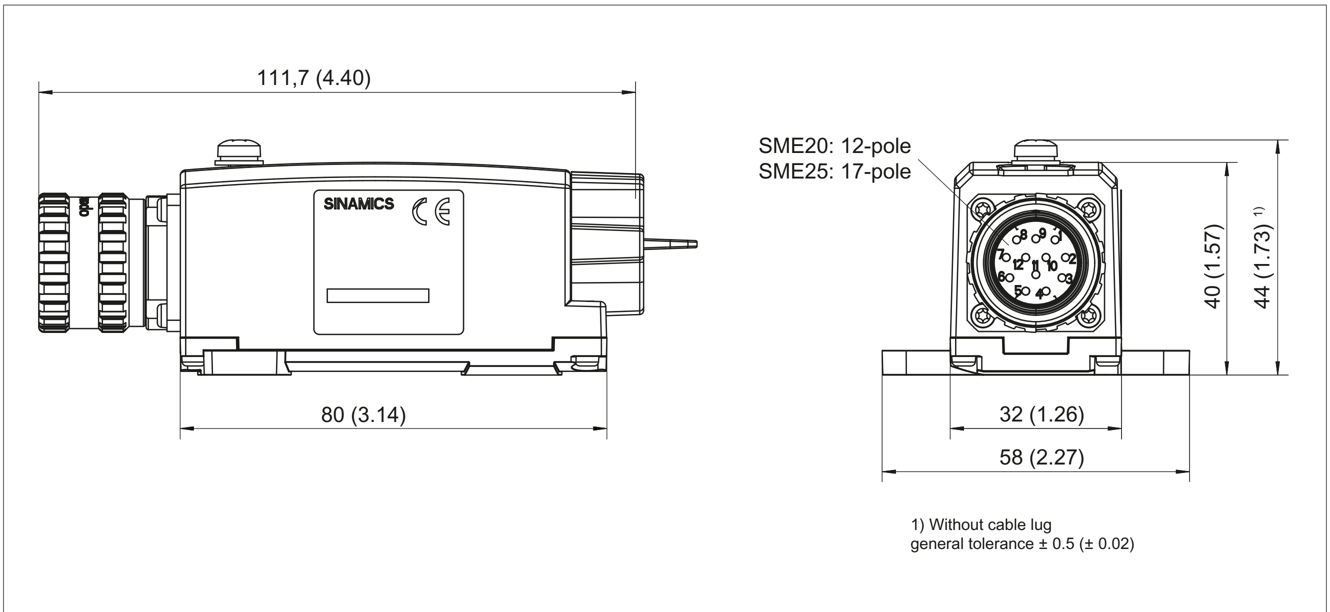


Figure 4-24 Dimension drawing of Sensor Module External SME20, all data in mm and (inches), order number 6SL3055-0AA00-5EA3

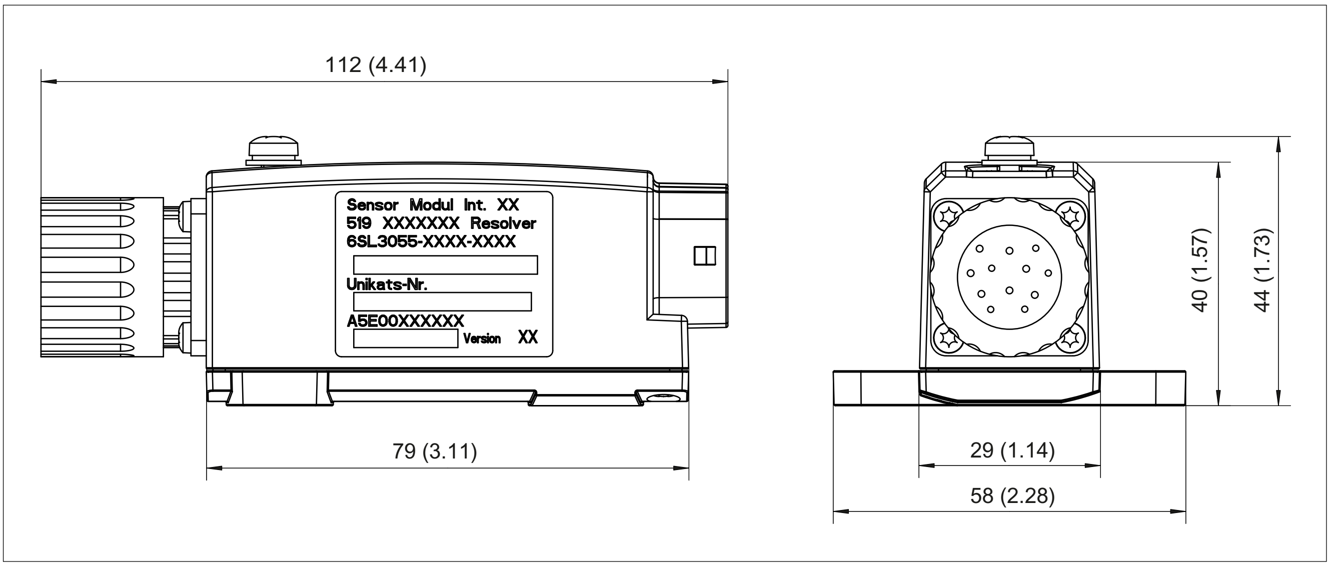


Figure 4-25 Dimension drawing of Sensor Module External SME20, all data in mm and (inches), order number 6SL3055-0AA00-5EA0

Note

Sensor Module External SME20 with order number 6SL3055-0AA00-5EA0 **cannot** be operated with version 4.x drive runtime software.

4.6.6 Installation

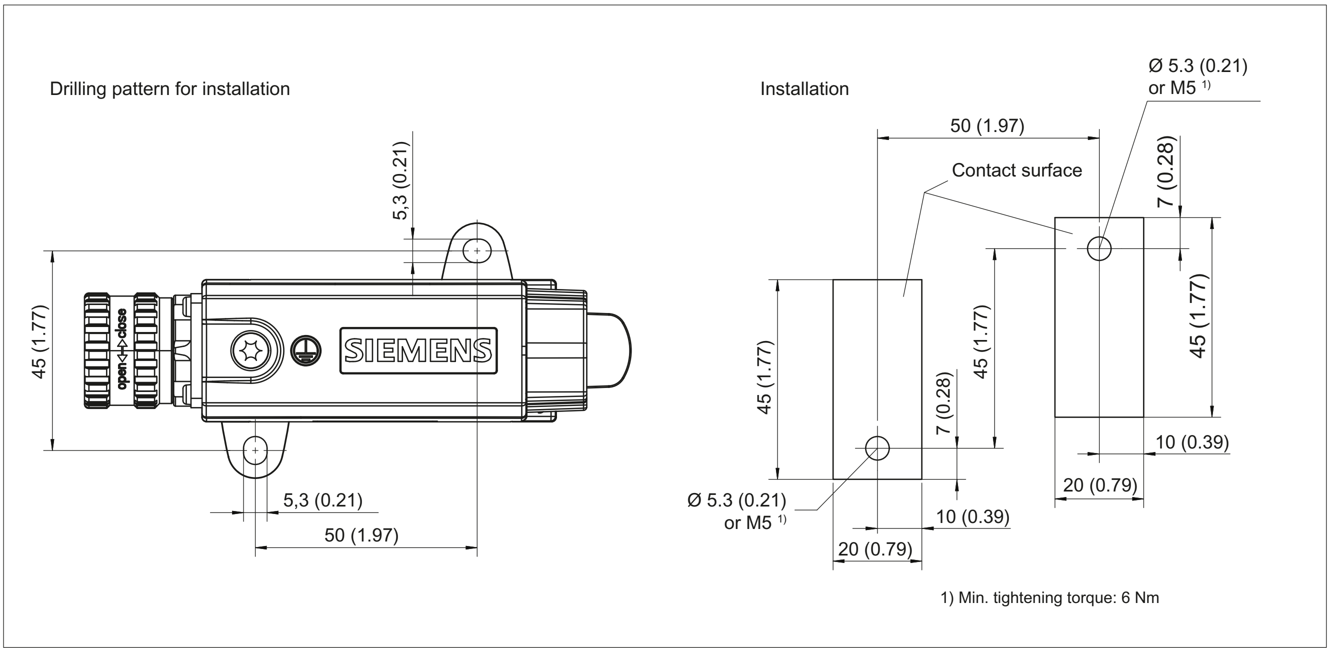


Figure 4-26 SME20/SME25 installation

Procedure

1. Place the drilling pattern on the bright contact surface
2. Holes Ø 5.3 or threads M5
3. Tighten with a min. torque of 6 Nm.

4.6.7 Technical data

Table 4- 24 Technical data

6SL3055-0AA00-5EAx	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 24 DC (20.4 – 28.8) ≤ 0.15 ≤ 0.25 ≤ 4
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 5 VDC 0.35
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 (order number 6SL3055-0AA00-5EA0) 0.31 (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).

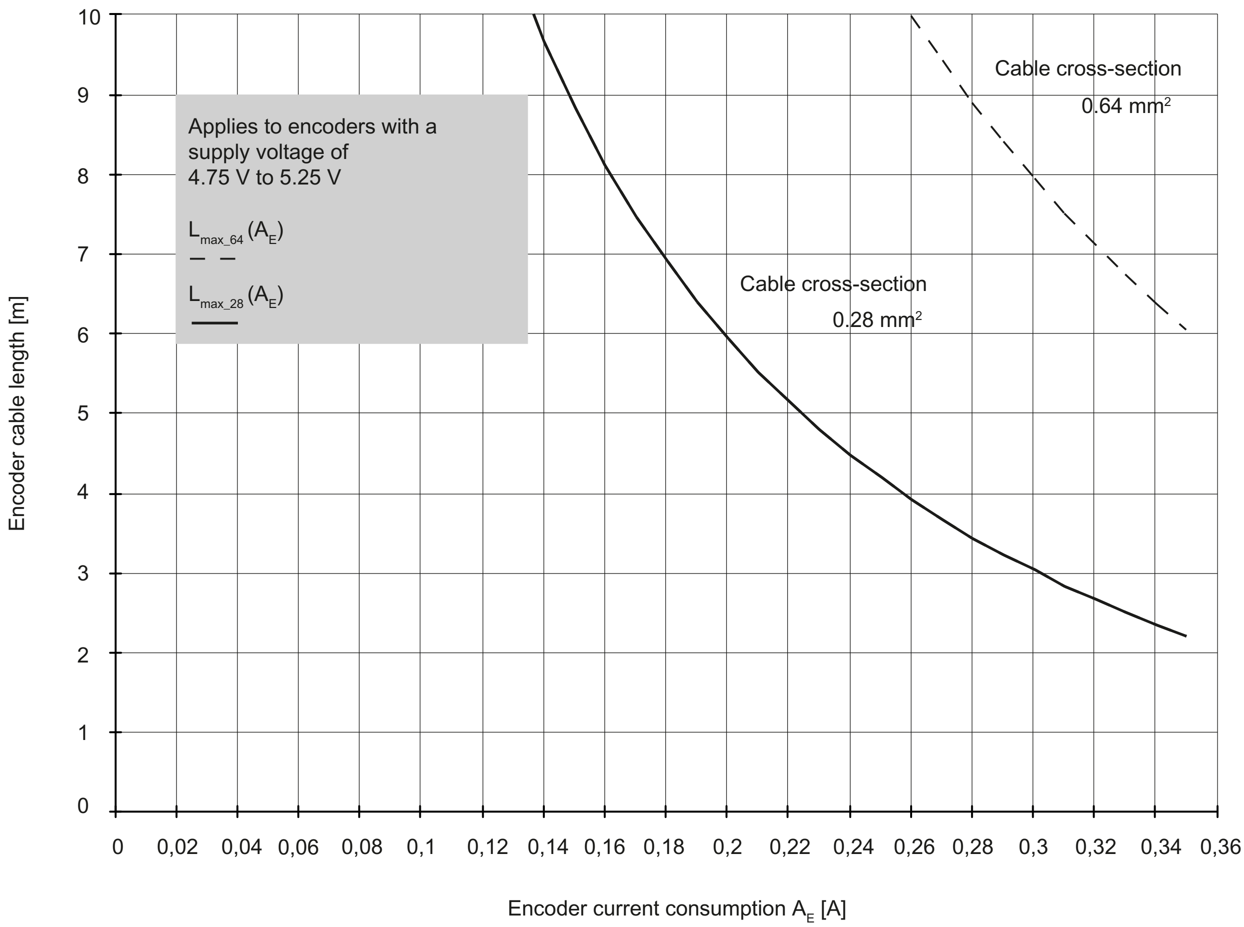


Figure 4-27 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range of 4.75 V to 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 fall below 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 with SIN/COS (1 Vpp) incremental signals can be connected, however without reference signal.

Neither motor nor encoder data are saved in the SME25.

4.7.2 Interface description

4.7.2.1 Overview

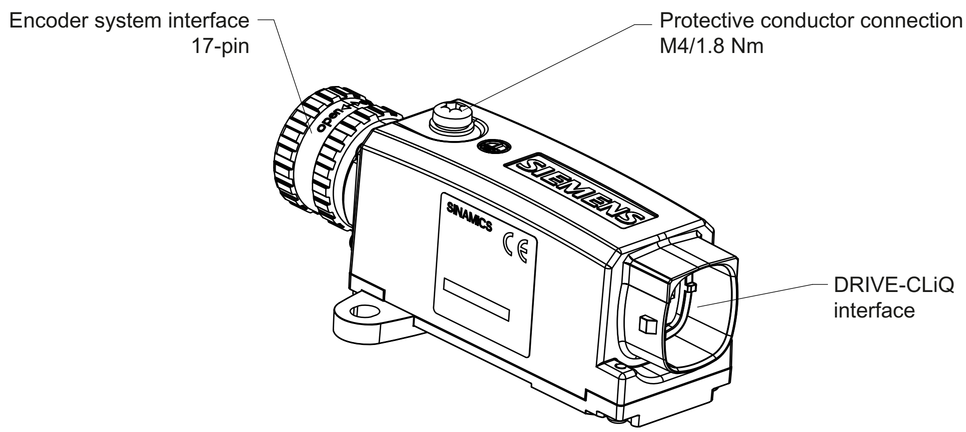
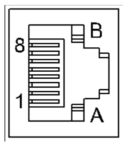


Figure 4-28 Interface description SME25

4.7.2.2 DRIVE-CLiQ interface

Table 4- 25 DRIVE-CLiQ interface

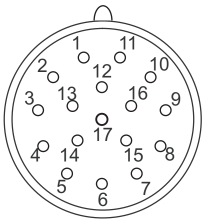
	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
DRIVE-CLiQ port rubber plug included in the scope of delivery; rubber plug (50 pieces) Order number: 6SL3066-4CA00-0AA0 Current consumption: max. 0.25 A			

Note

Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. The maximum cable length for MOTION-CONNECT 500 cables is 100 m and for MOTION-CONNECT 800 cables, 50 m.

4.7.2.3 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
	9	Clock*	Inverted clock, EnDat interface, inverted SSI clock
	10	M	Ground for encoder power supply
	11	Housing potential	
	12	B	Incremental signal B
	13	B*	Inverted incremental signal B
	14	Data	Data, EnDat interface, SSI data
	15	A	Incremental signal A
	16	A*	Inverted incremental signal A
	17	Data*	Inverted data, EnDat interface, Inverted SSI data
Blanking plate for encoder system interface: Pöppelmann GmbH & Co. KG, Lohne, Order No.: GPN 300 F211 connector kits, 17-pin, Order No.: 6FX2003-0SA17			

4.7.3 Connection example

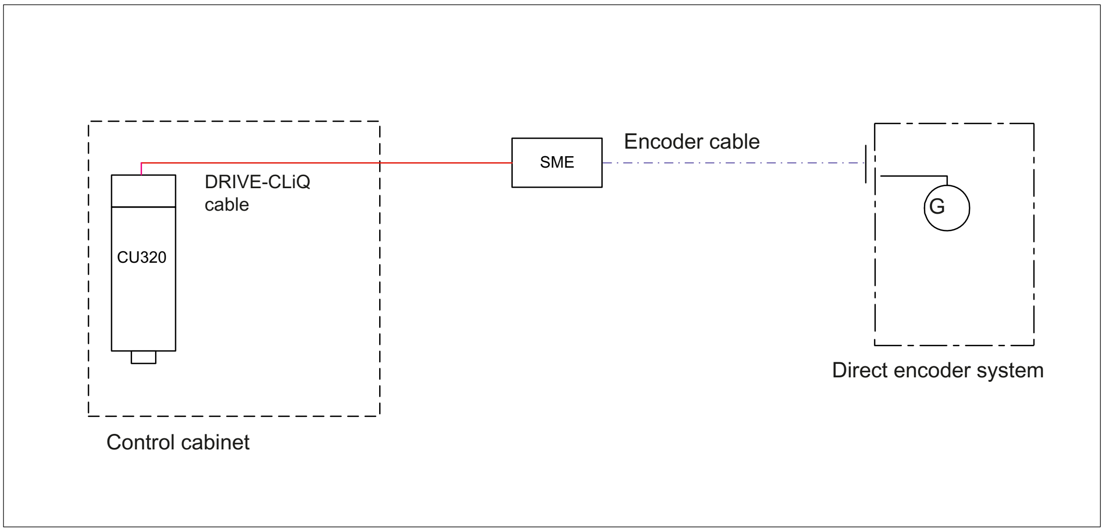


Figure 4-29 Connection of a direct encoder system via a Sensor Module External (SME)

4.7.4 Dimension drawings

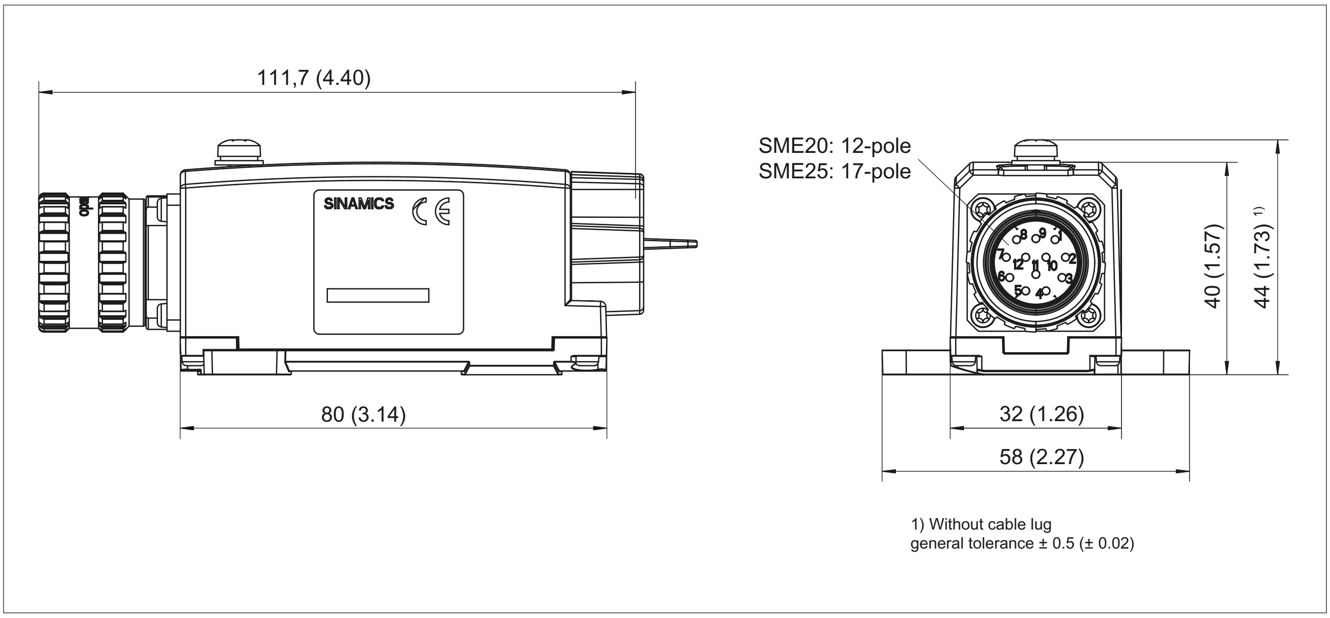


Figure 4-30 Dimension drawing of Sensor Module External SME25, all data in mm and (inches), order number 6SL3055-0AA00-5HA3

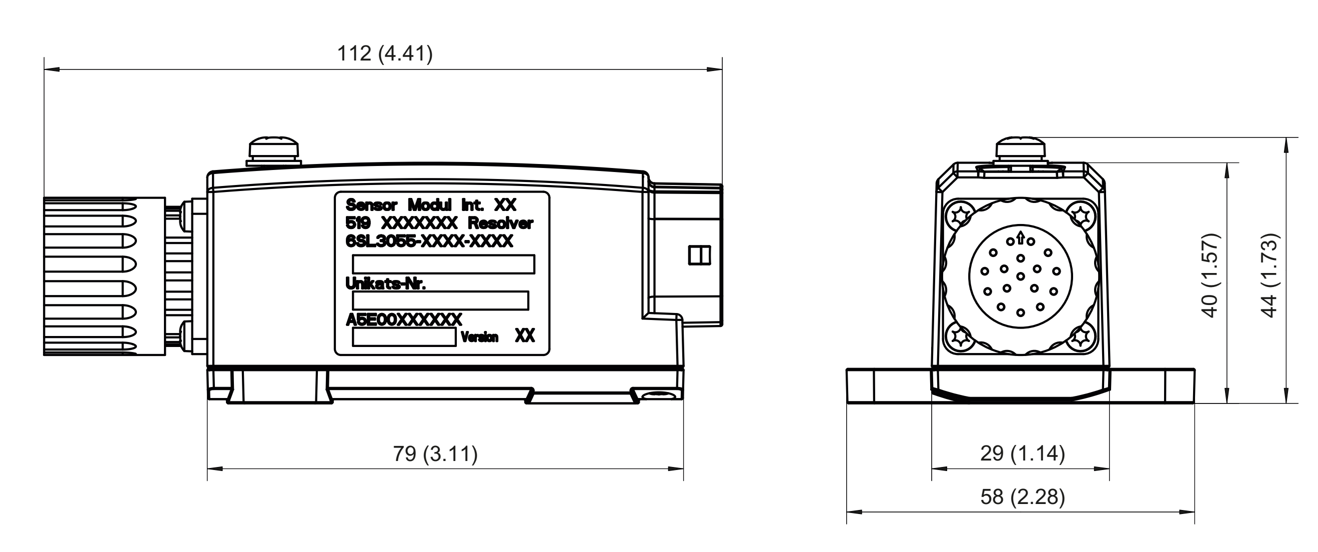


Figure 4-31 Dimension drawing of Sensor Module External SME25, all data in mm and (inches), order number 6SL3055-0AA00-5HA0

Note

Sensor Module External SME25 with order number 6SL3055-0AA00-5HA0 **cannot** be operated with version 4.x drive runtime software.

4.7.5 Installation

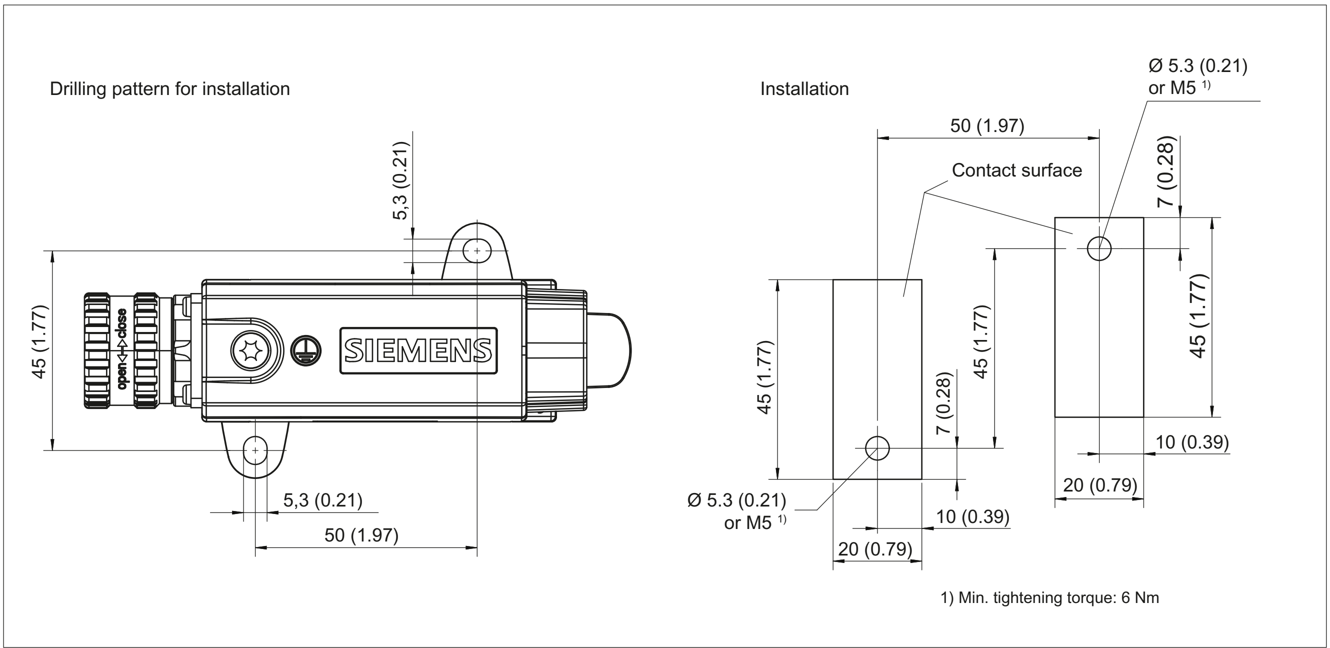


Figure 4-32 SME20/SME25 installation

Procedure

1. Place the drilling pattern on the bright contact surface
2. Holes Ø 5.3 or threads M5
3. Tighten with a min. torque of 6 Nm.

4.7.6 Technical data

Table 4- 27 Technical data

6SL3055-0AA00-5HAx	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 24 DC (20.4 – 28.8) ≤ 0.15 ≤ 0.25 ≤ 4
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 5 VDC 0.35
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 (order number 6SL3055-0AA00-5HA0) 0.31 (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).

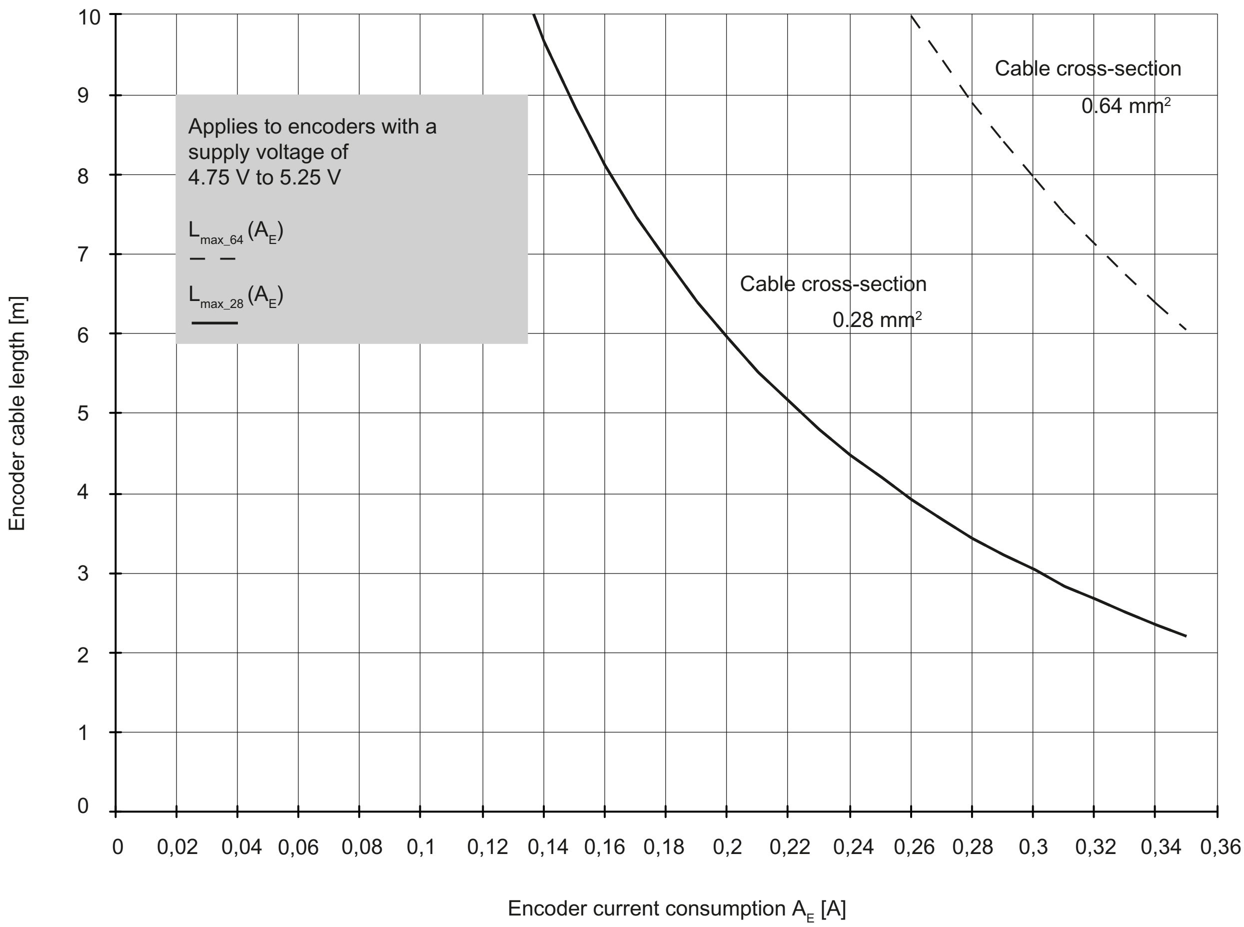


Figure 4-33 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range of 4.75 V to 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 fall below 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.

4.8.2 Safety information

Sensor Module External SME120 is a device of safety class I.

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

⚠ DANGER

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 electrical 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 devices! This may result in the units no longer being 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

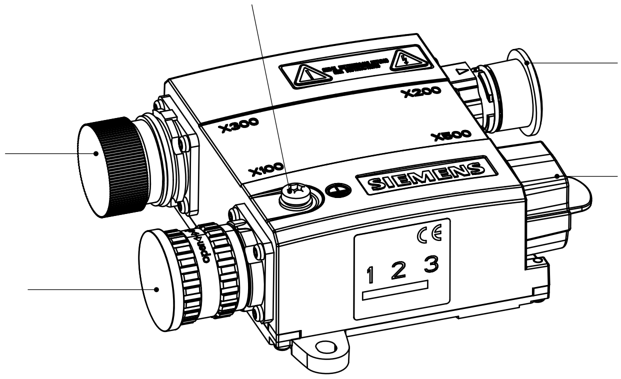
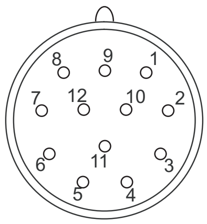


Figure 4-34 Interface description, SME120

4.8.3.2 X100 encoder system interface

Table 4- 28 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 kit, 12-pin, Order No.: 6FX2003-0SA12			

4.8.3.3 X200 thermistor sensor input

Table 4- 29 X200 thermistor sensor input

Pin	Function	Technical specifications
1	-Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In linear and torque motor applications, connect the KTY84-1C130 motor temperature sensor here
2	+Temp	
3	+Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In linear and torque motor applications, connect the PTC triple element 1 or bimetallic switch here
4	-Temp	
5	+Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In torque motor applications, connect the PTC triple element 2 here
6	-Temp	
Connector kit, 6+1-pin, order number: 6FX2003-0SU07		

NOTICE

When connecting several temperature sensors, the individual sensors must be separately connected to "+ Temp" and "- Temp".

It is not permissible that the "+ Temp" and "- Temp" signals are interconnected with one another!

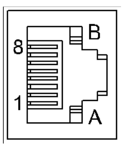
4.8.3.4 X300 Hall sensor input

Table 4- 30 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)

4.8.3.5 X500 DRIVE-CLiQ interface

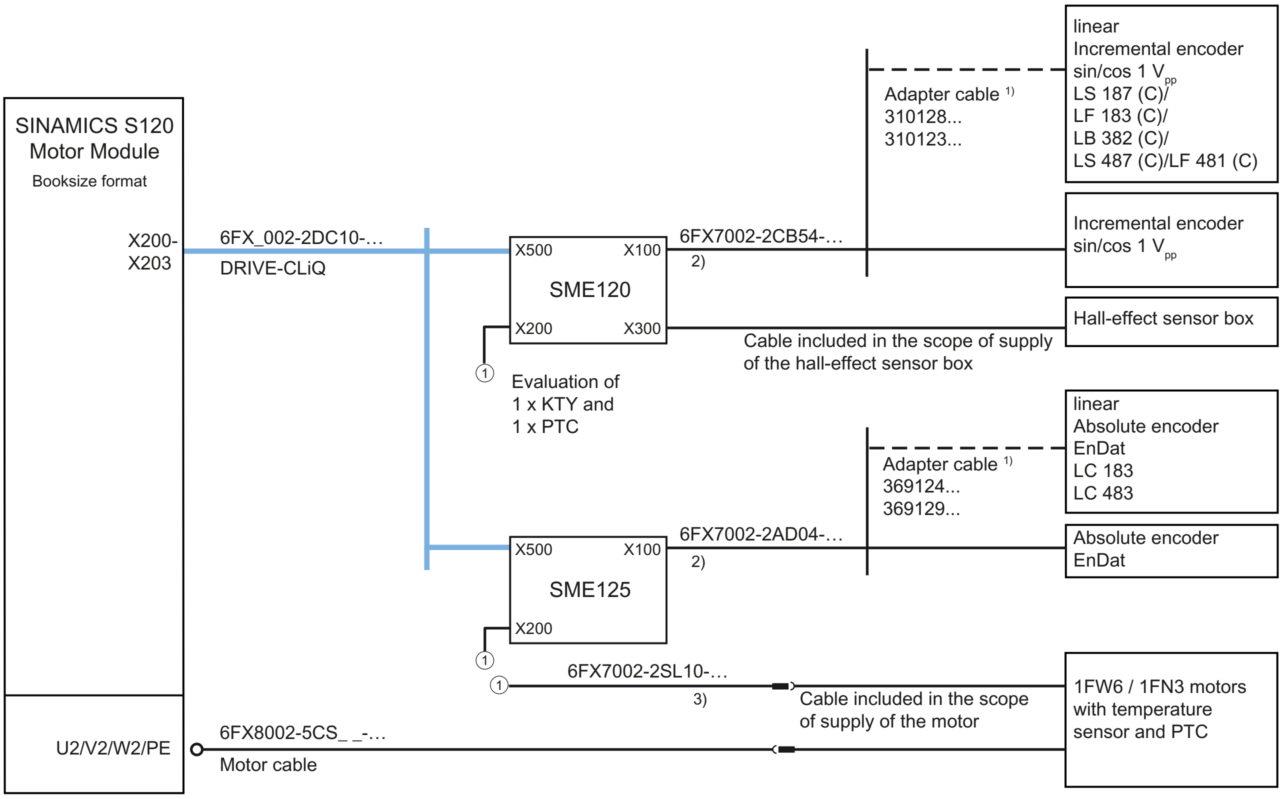
Table 4- 31 DRIVE-CLiQ interface

	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

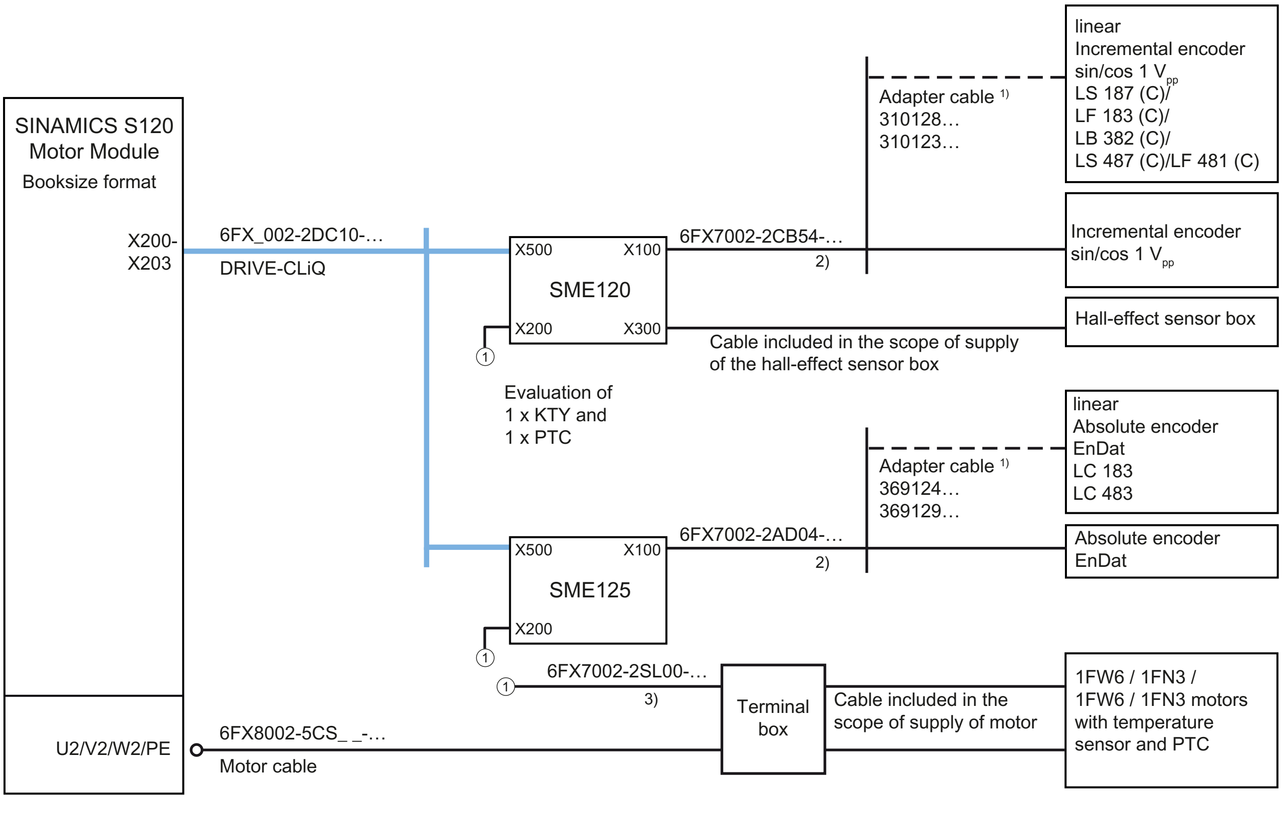
Only MOTION-CONNECT DRIVE-CLiQ cables may be used for connections. With MOTION-CONNECT 500, the maximum cable length is 100 m; with MOTION-CONNECT 800, it is 50 m.

4.8.4 Connection example



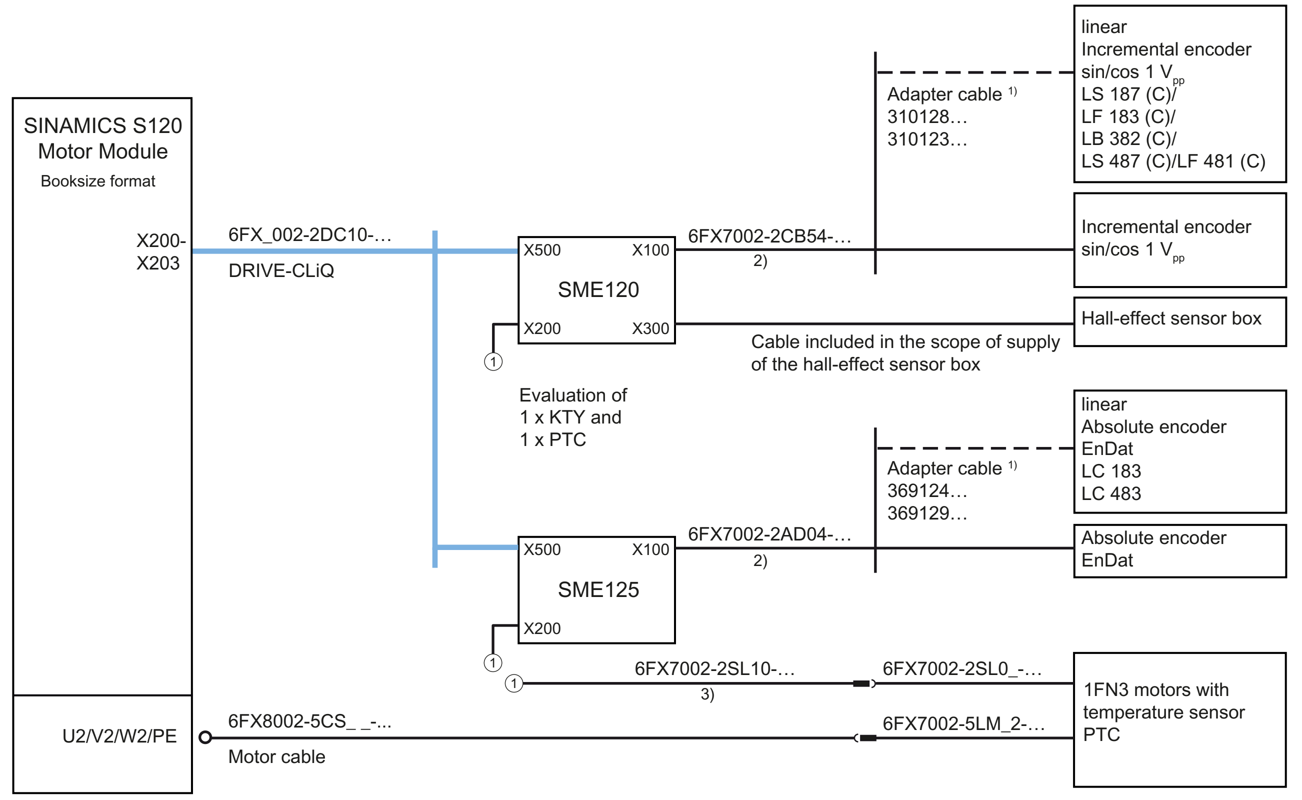
1) Cable can be ordered from supplier of linear scale.
2) max. length of encoder cable, see diagram in Chapter "Technical Data"
3) max. cable length between SME and motor connection: 10 m

Figure 4-35 Connecting motor encoders via SME for motors without a DRIVE-CLiQ interface and molded connecting cables with terminated cable ends



1) Cable can be ordered from supplier of linear scale.
2) max. length of encoder cable, see diagram in Chapter "Technical Data"
3) max. cable length between SME and motor connection: 10 m

Figure 4-36 Connecting motor encoders via SME for motors without a DRIVE-CLiQ interface and molded connecting cables with open cable ends



1) Cable can be ordered from supplier of linear scale.
2) max. length of encoder cable, see diagram in Chapter "Technical Data"
3) max. cable length between SME and motor connection: 10 m

Figure 4-37 Connecting motor encoders via SME for motors without a DRIVE-CLiQ interface, with an integrated 2-hole terminal box

Connection examples for motors connected in parallel

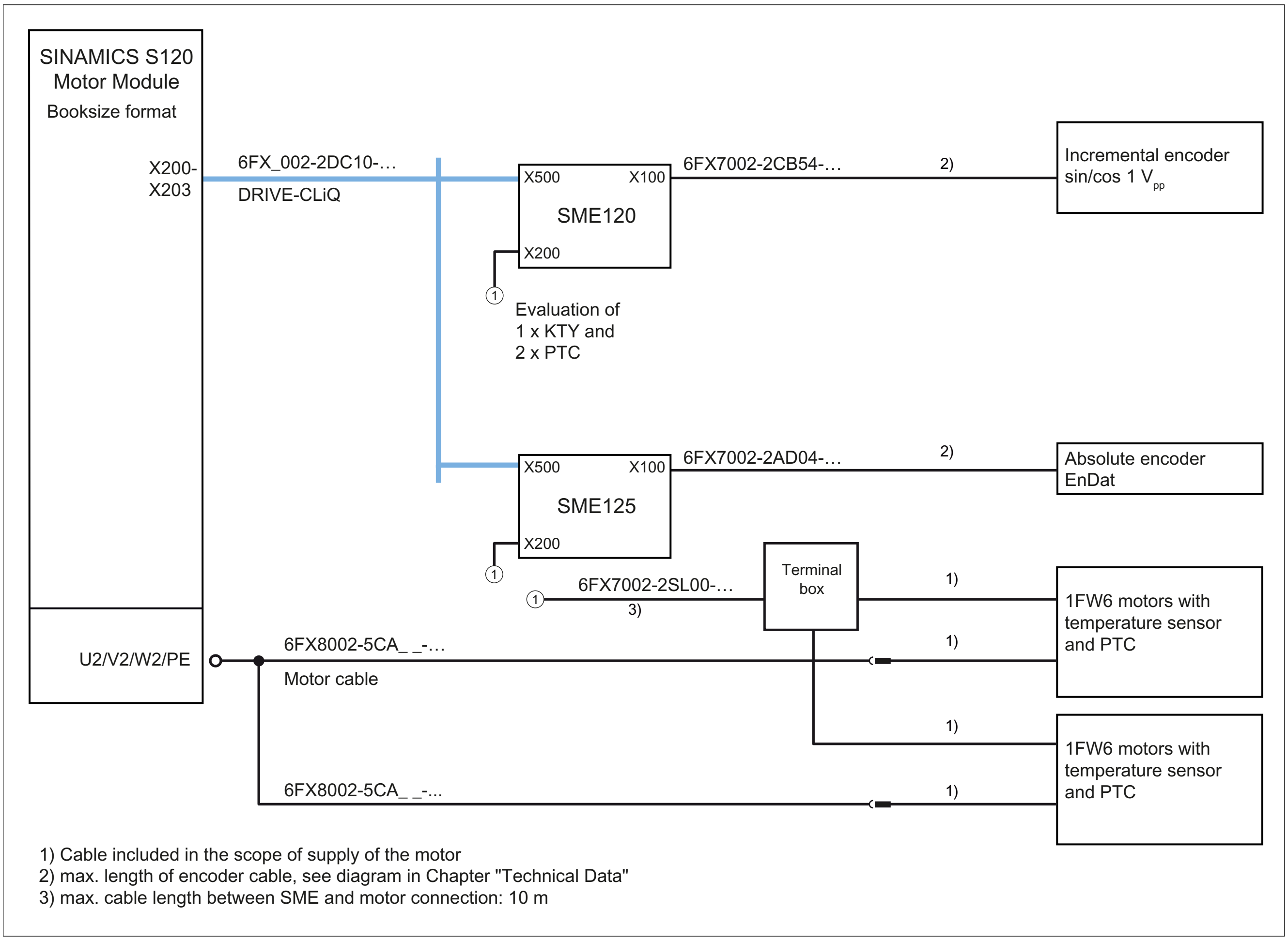


Figure 4-38 Connecting motor encoders via SME for torque motors connected in parallel without a DRIVE-CLiQ interface

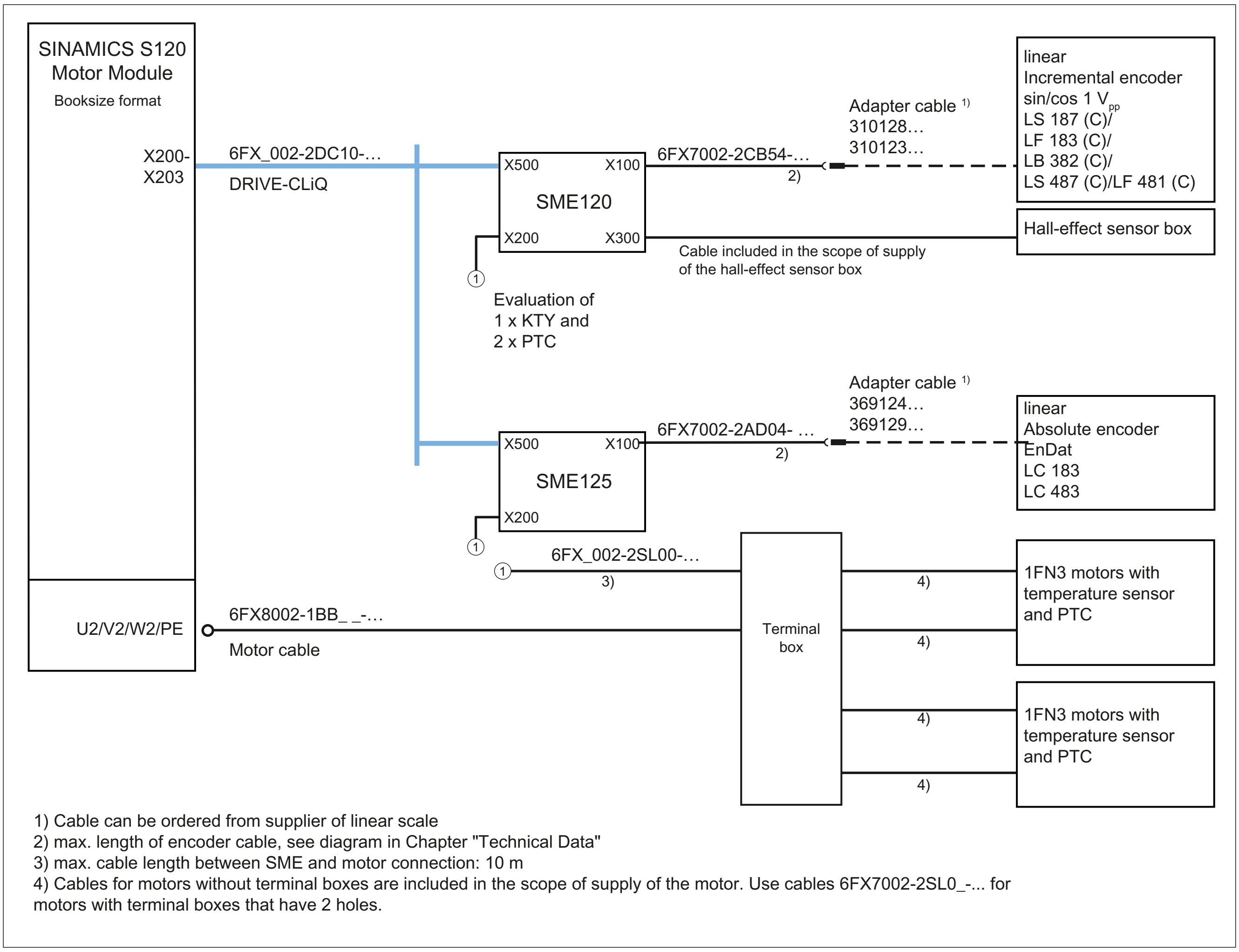


Figure 4-39 Connecting motor encoders via SME for linear motors connected in parallel without a DRIVE-CLiQ interface

4.8.5 Dimension drawing

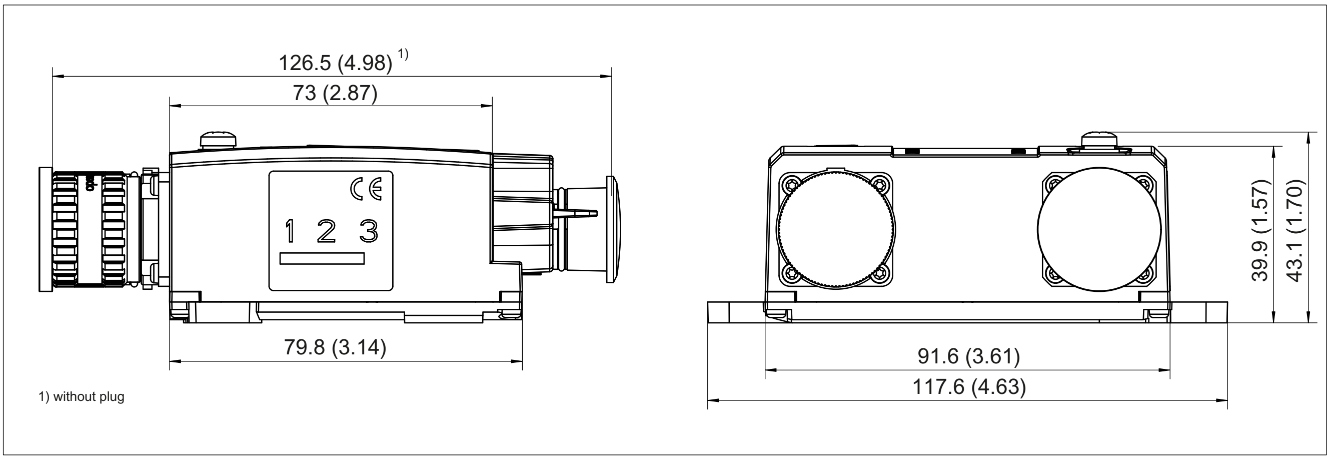


Figure 4-40 Dimension drawing of Sensor Module External SME120, all data in mm and (inches) order number 6SL3055-0AA00-5JA3

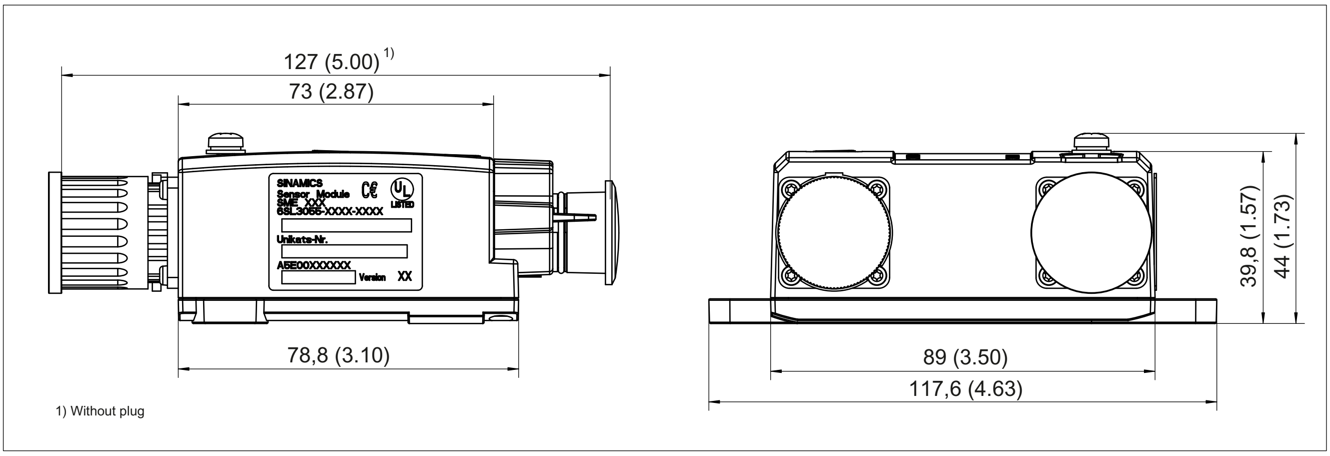
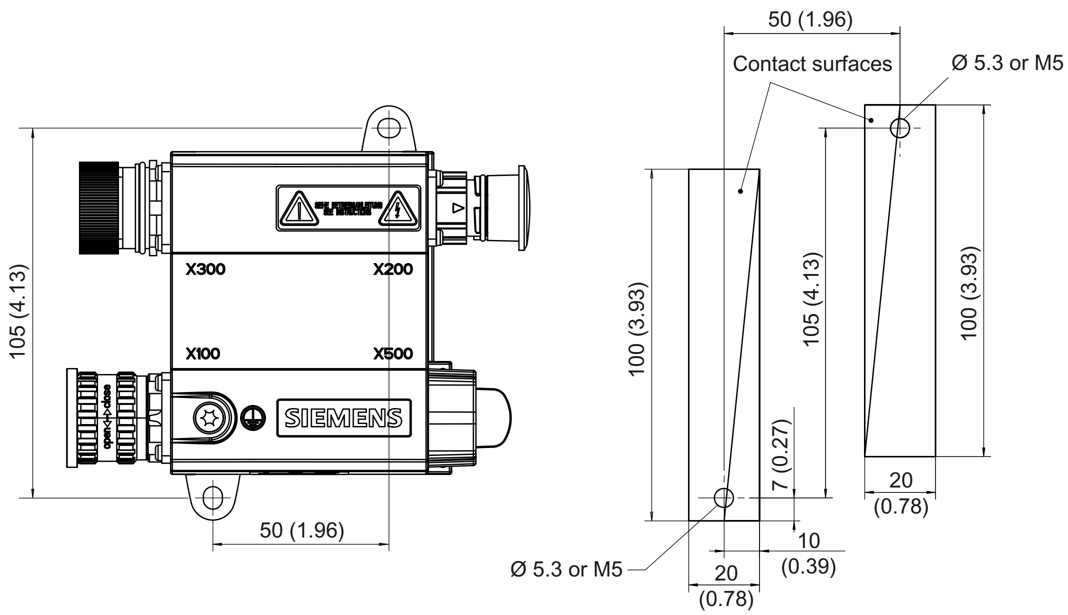


Figure 4-41 Dimension drawing of Sensor Module External SME120, all data in mm and (inches) order number 6SL3055-0AA00-5JA0

4.8.6 Mounting

Drilling pattern for installation



Installation
1. Place the drilling template on the contact surface
2. Contact surfaces must be bright
3. Holes Ø 5.3 or M5 threads
4. Tighten with a tightening torque of 6.0 Nm

Figure 4-42 SME120 installation

4.8.7 Technical data

Table 4- 32 Technical data

6SL3055-0AA00-5JAx	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.30 ≤ 4.5
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 5 VDC 0.35
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 (order number 6SL3055-0AA00-5JA0) 0.7 (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).

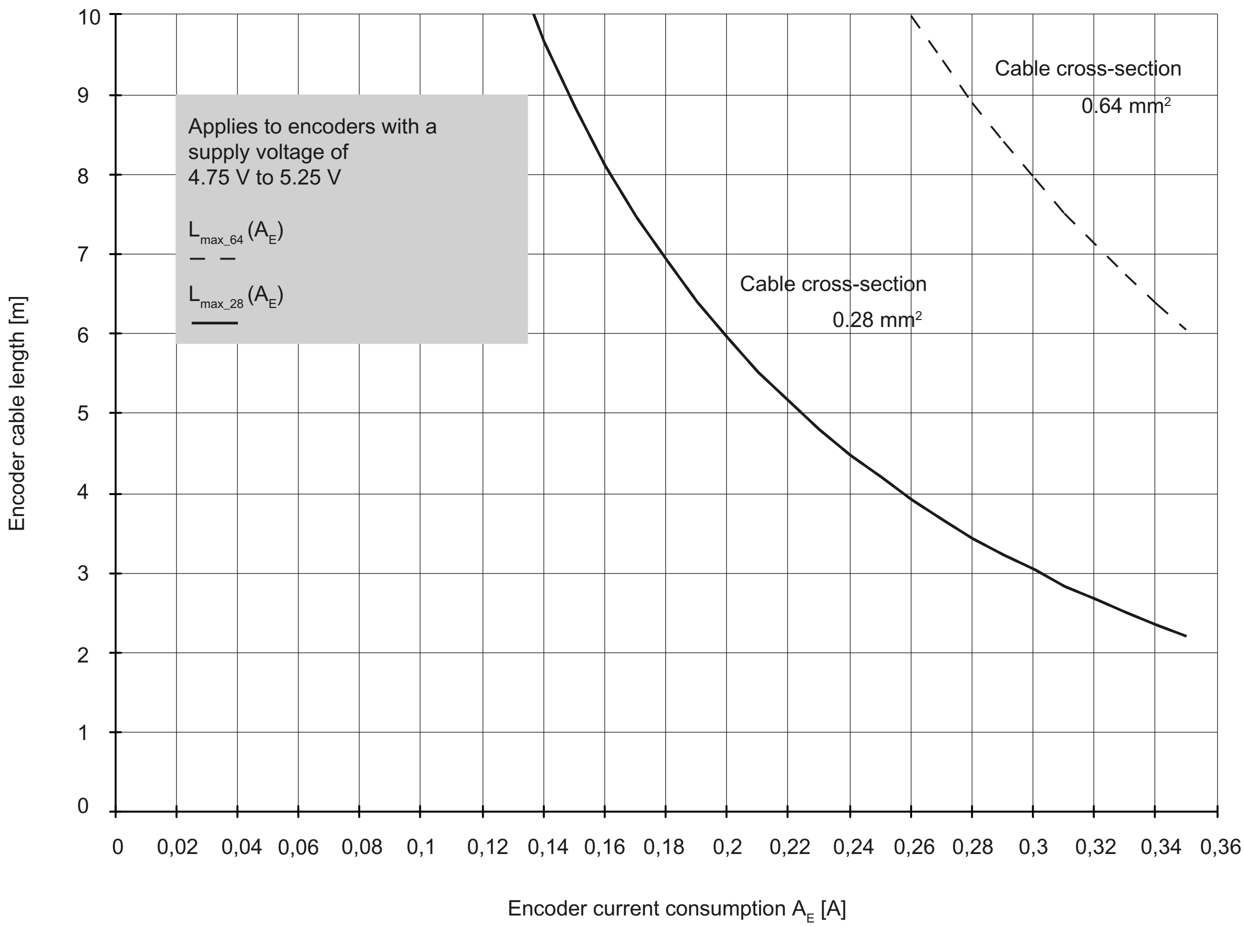


Figure 4-43 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range of 4.75 V to 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 fall below 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.

4.9.2 Safety information

Sensor Module External SME125 is a device of safety class I.

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

DANGER

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 electrical 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 devices! This may result in the units no longer being 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

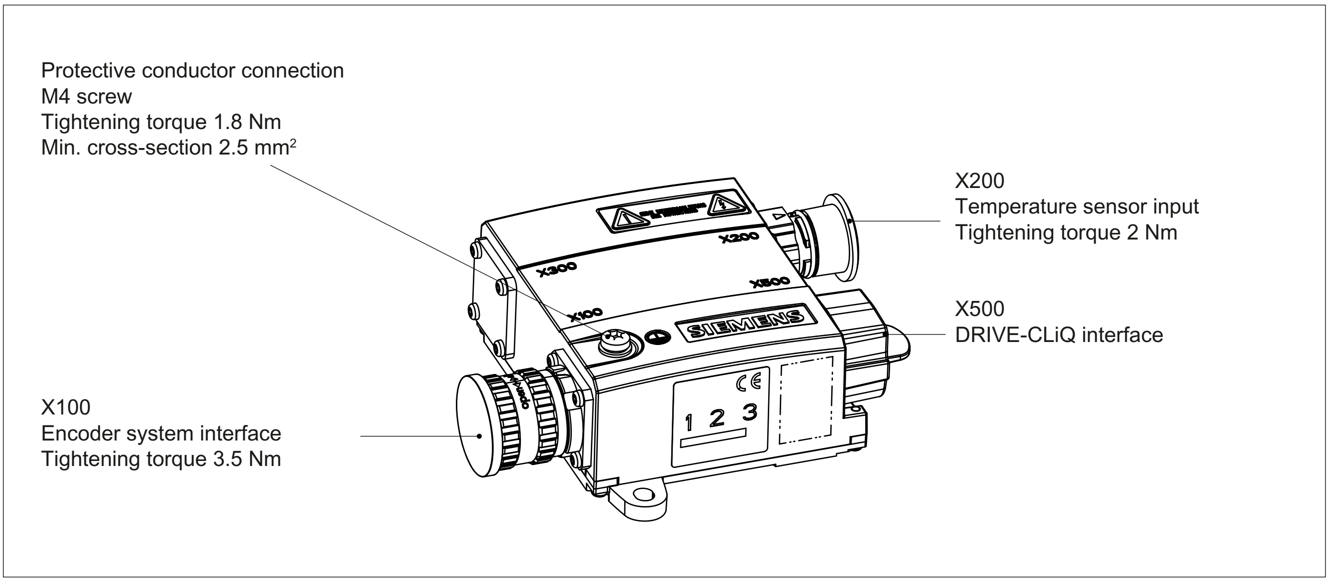
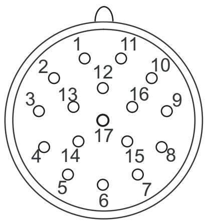


Figure 4-44 Interface description, SME125

4.9.3.2 X100 encoder system interface

Table 4- 33 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	Housing 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 kit, 17-pin, Order No.: 6FX2003-0SA17			

* These connections do not have safe separation!

4.9.3.3 X200 thermistor sensor input

Table 4- 34 X200 thermistor sensor input

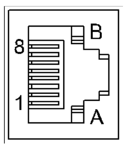
Pin	Function	Technical specifications
1	-Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In linear and torque motor applications, connect the KTY84-1C130 motor temperature sensor here
2	+Temp	
3	+Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In linear and torque motor applications, connect the PTC triple element 1 or bimetallic switch here
4	-Temp	

Pin	Function	Technical specifications
5	+Temp	Temperature sensor connection KTY84-1C130/PTC/bimetallic switch with NC contact In torque motor applications, connect the PTC triple element 2 here
6	-Temp	
Connector kit, 6+1-pin, order number: 6FX2003-0SU07		

NOTICE
When connecting several temperature sensors, the individual sensors must be separately connected to "+ Temp" and "- Temp". It is not permissible that the "+ Temp" and "- Temp" signals are interconnected with one another!

4.9.3.4 X500 DRIVE-CLiQ interface

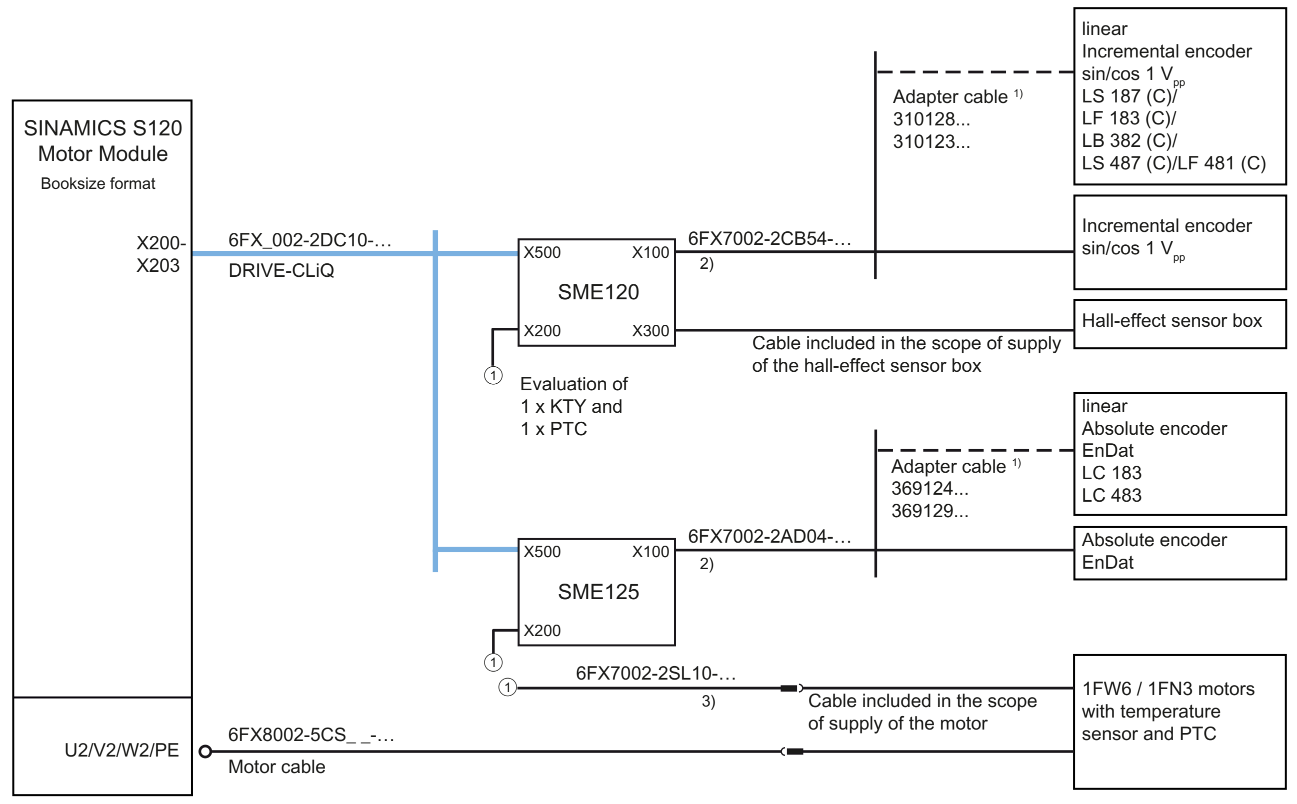
Table 4- 35 DRIVE-CLiQ interface

	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.

4.9.4 Connection example



1) Cable can be ordered from supplier of linear scale.
2) max. length of encoder cable, see diagram in Chapter "Technical Data"
3) max. cable length between SME and motor connection: 10 m

Figure 4-45 Connecting motor encoders via SME for motors without a DRIVE-CLiQ interface and molded connecting cables with terminated cable ends

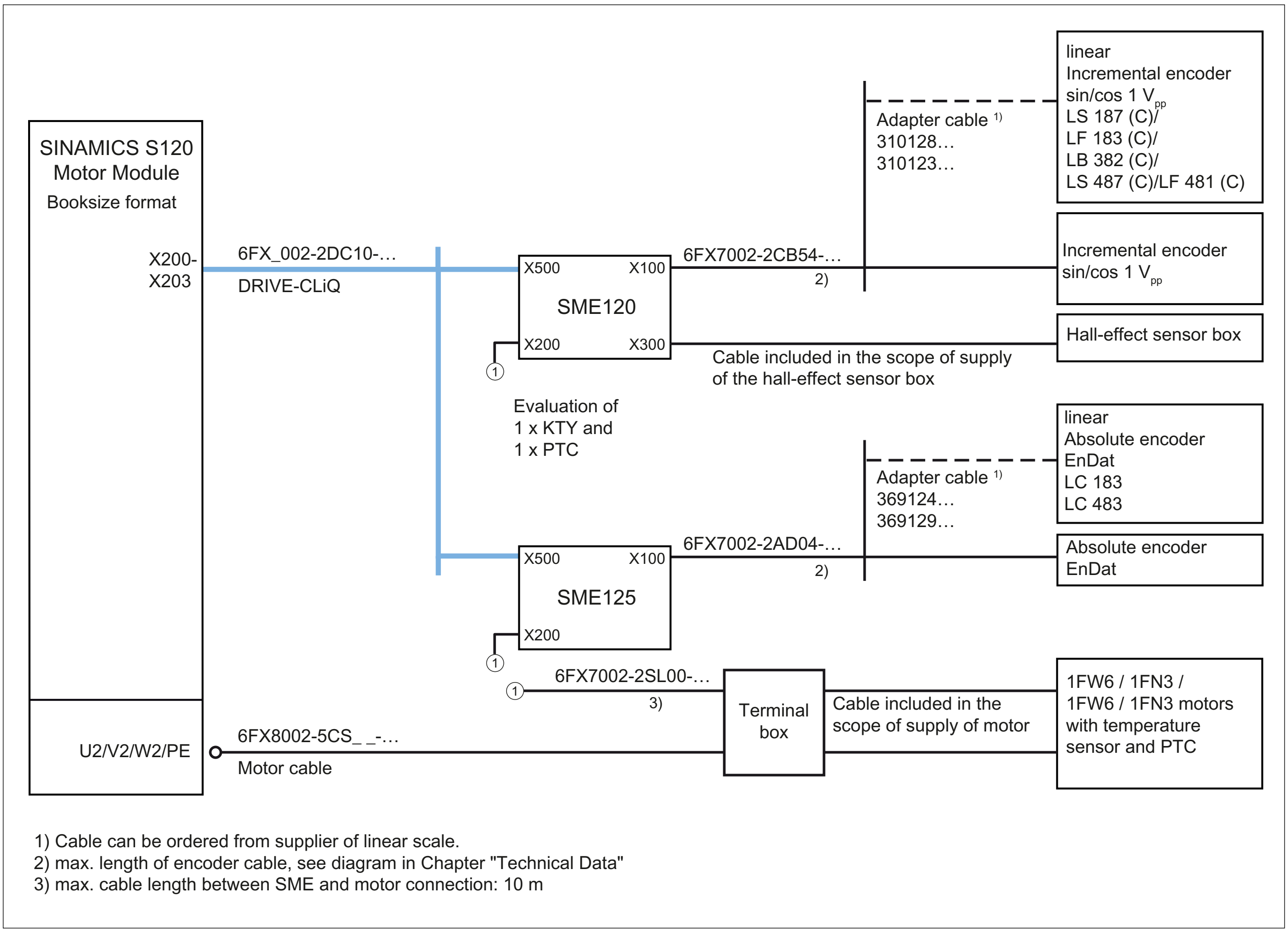


Figure 4-46 Connecting motor encoders via SME for motors without a DRIVE-CLiQ interface and molded connecting cables with open cable ends

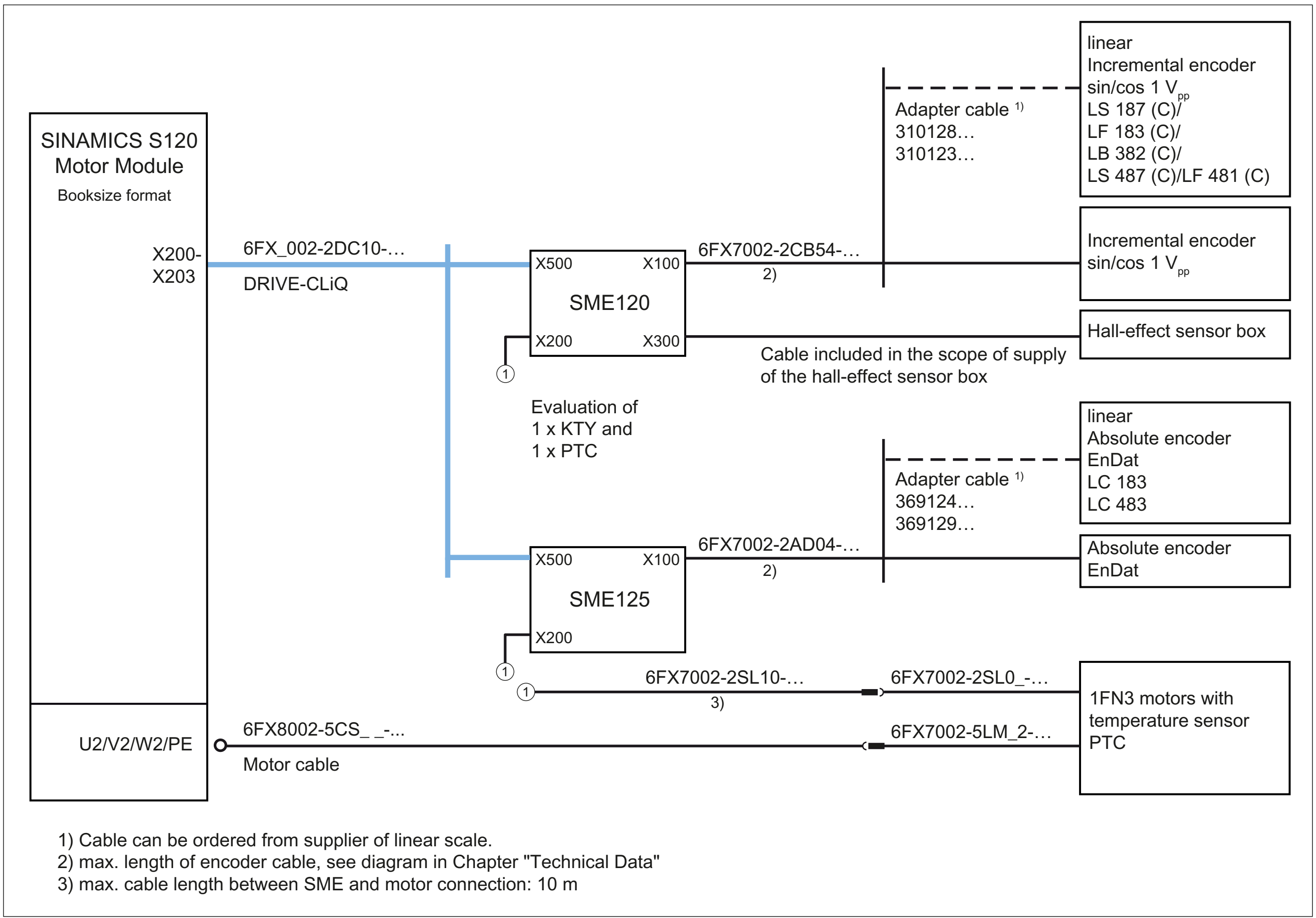


Figure 4-47 Connecting motor encoders via SME for motors without a DRIVE-CLiQ interface, with an integrated 2-hole terminal box

Connection examples for motors connected in parallel

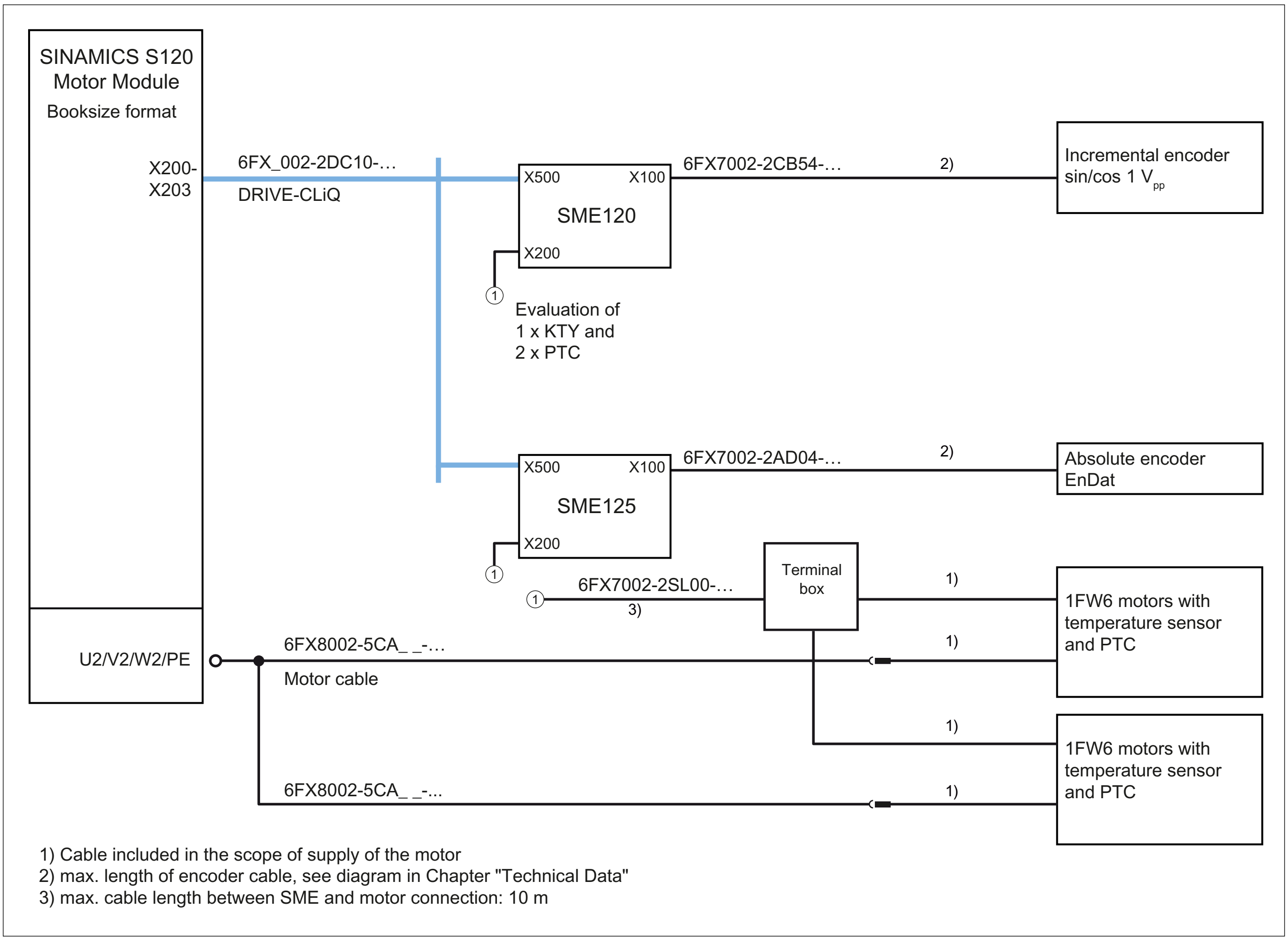
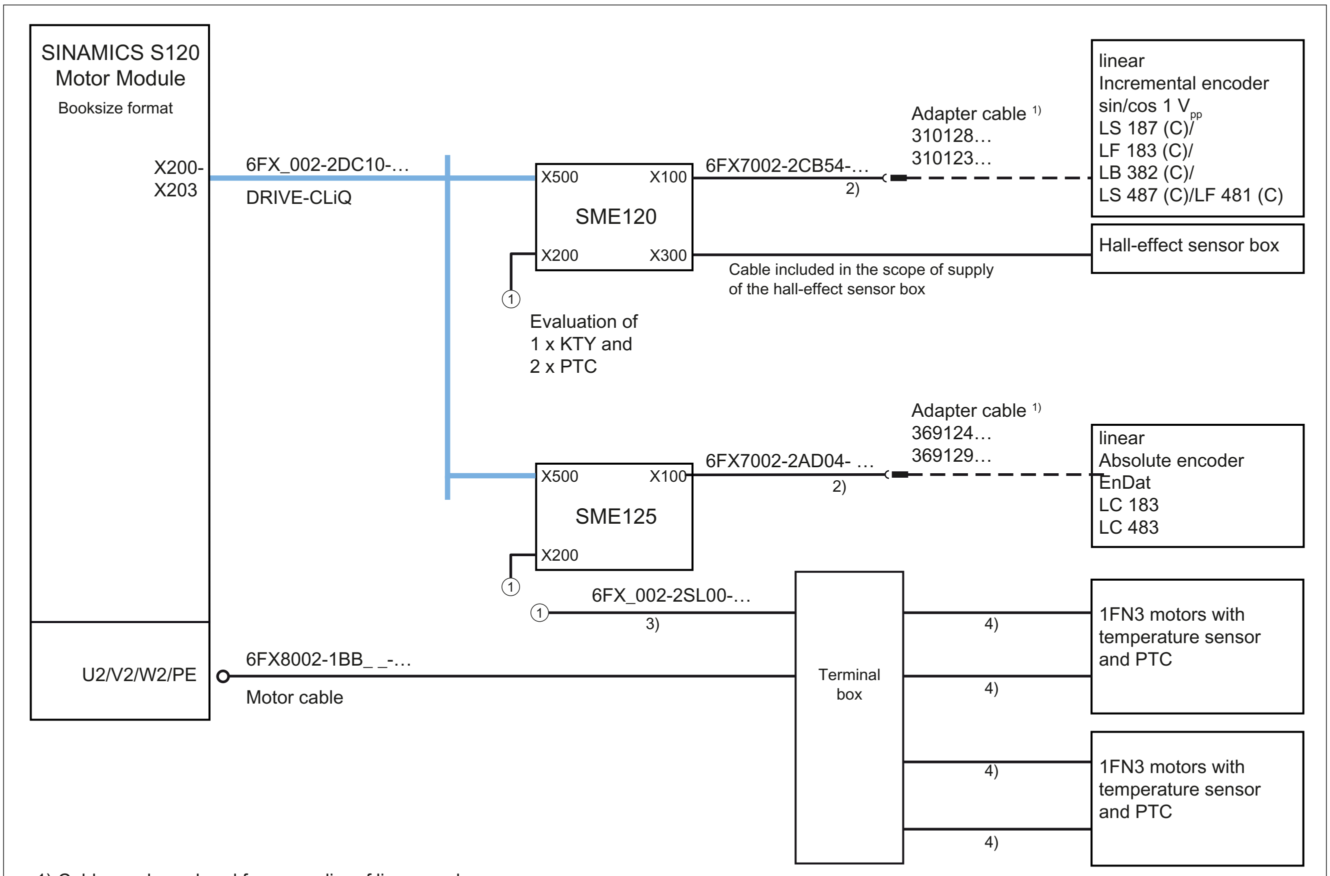


Figure 4-48 Connecting motor encoders via SME for torque motors connected in parallel without a DRIVE-CLiQ interface



1) Cable can be ordered from supplier of linear scale
2) max. length of encoder cable, see diagram in Chapter "Technical Data"
3) max. cable length between SME and motor connection: 10 m
4) Cables for motors without terminal boxes are included in the scope of supply of the motor. Use cables 6FX7002-2SL0_-... for motors with terminal boxes that have 2 holes.

Figure 4-49 Connecting motor encoders via SME for linear motors connected in parallel without a DRIVE-CLiQ interface

4.9.5 Dimension drawings

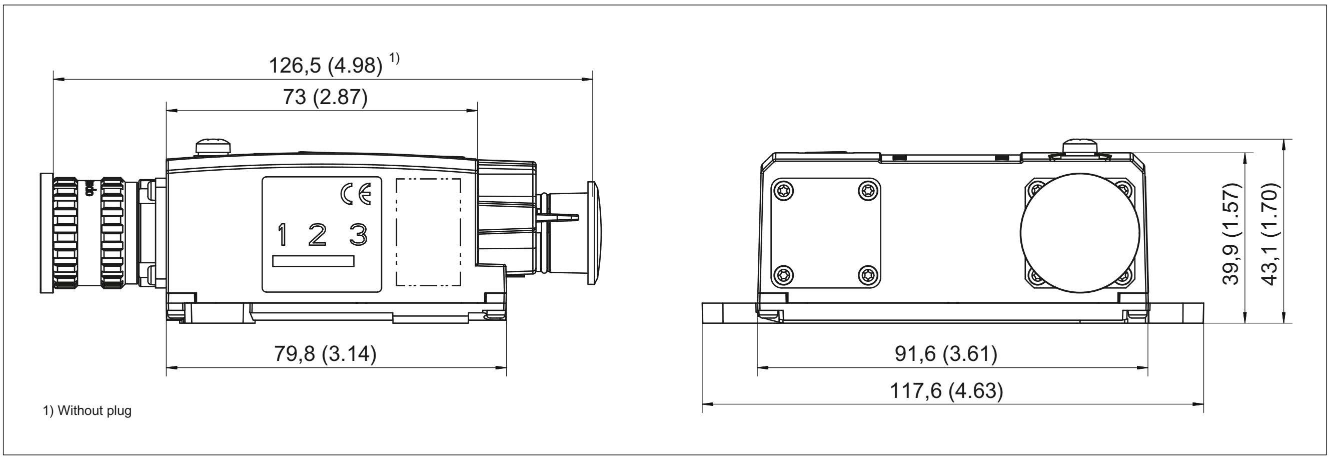


Figure 4-50 Dimension drawing of Sensor Module External SME125, all data in mm and (inches) order number 6SL3055-0AA00-5KA3

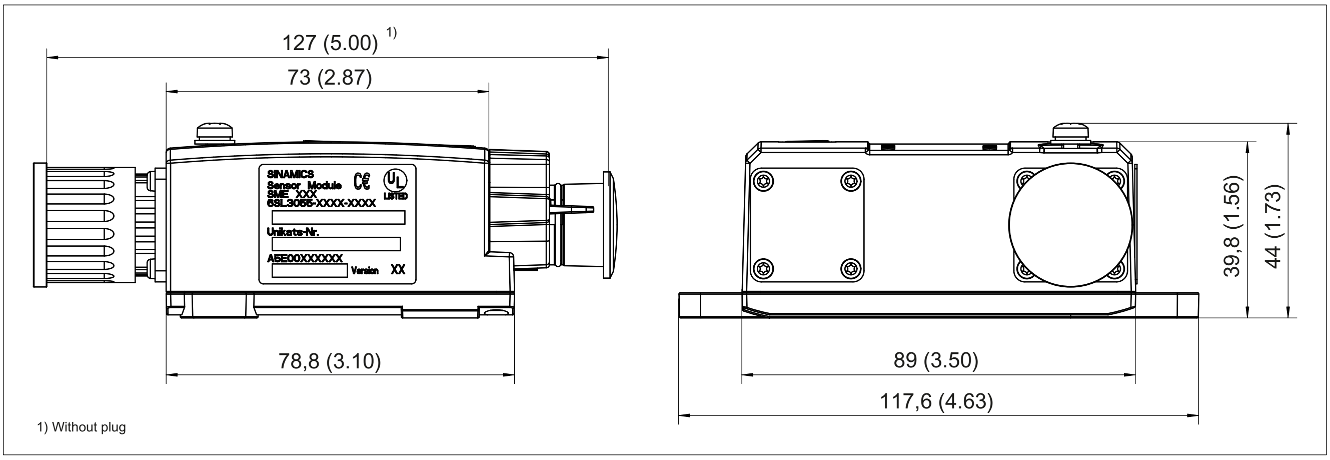
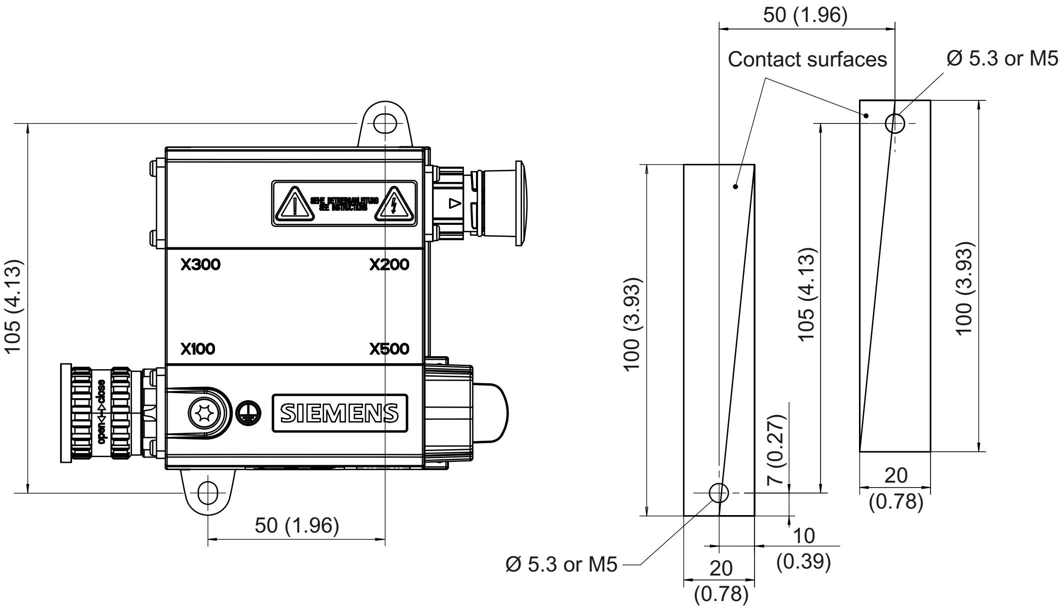


Figure 4-51 Dimension drawing of Sensor Module External SME125, all data in mm and (inches) order number 6SL3055-0AA00-5KA0

4.9.6 Mounting

Drilling pattern for installation



Installation
1. Place the drilling template on the contact surface
2. Contact surfaces must be bright
3. Holes Ø 5.3 or M5 threads
4. Tighten with a tightening torque of 6.0 Nm

Figure 4-52 SME125 installation

4.9.7 Technical data

Table 4- 36 Technical data

6SL3055-0AA00-5KAx	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.30 ≤ 4.5
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 5 VDC 0.35
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 (order number 6SL3055-0AA00-5KA0) 0.7 (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).

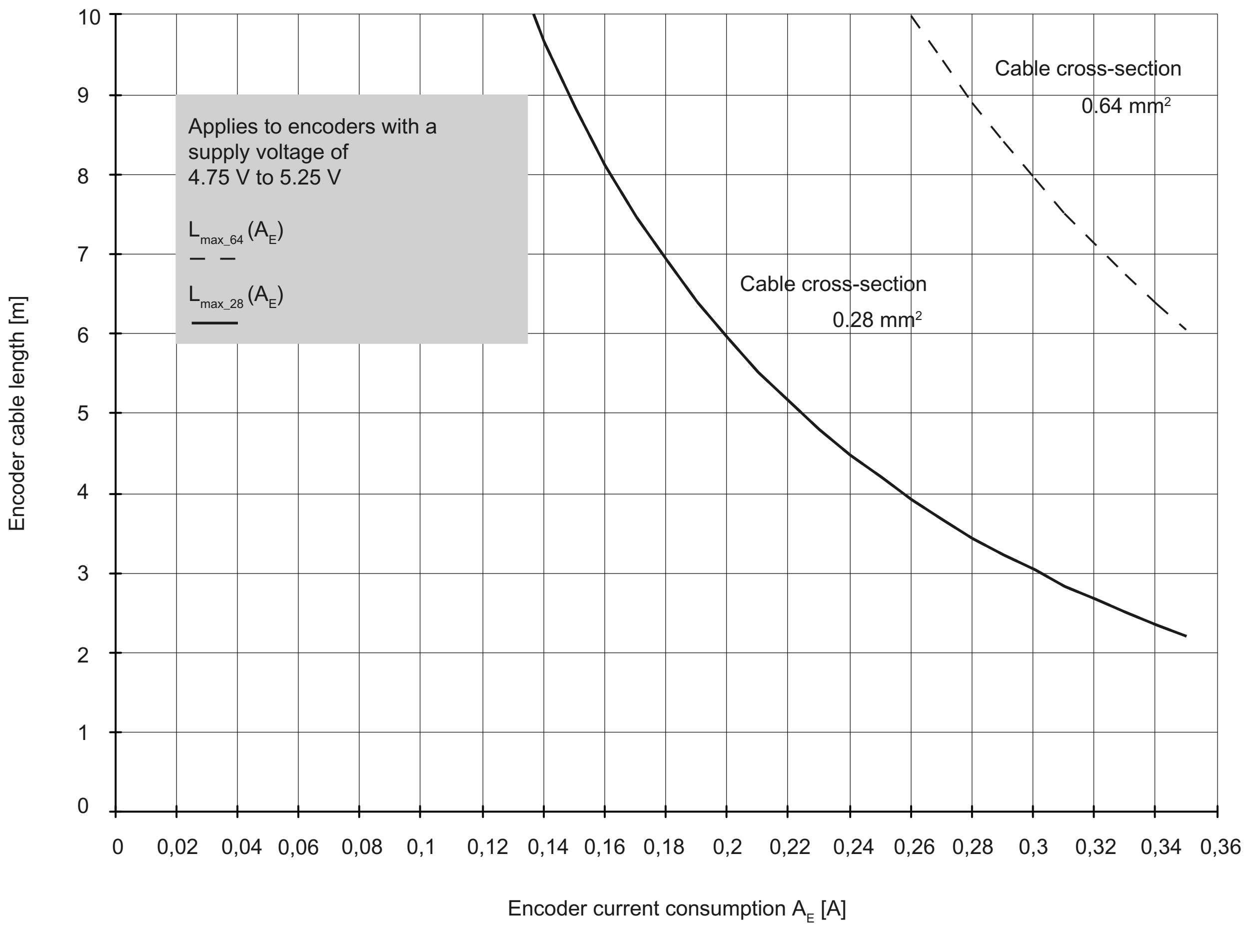


Figure 4-53 Max. cable length as a function of the current drawn by the encoder system

Besides the encoder systems for the supply voltage range of 4.75 V to 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 fall below 0.14 mm².

4.10 DRIVE-CLiQ encoder

4.10.1 Description

The DRIVE-CLiQ encoder is available as an absolute encoder with integrated DRIVE-CLiQ interface. The multiturn design of the encoder senses absolute position values extending over 4096 revolutions. The singleturn design senses the absolute position within a revolution.

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 should come into contact with the connections.

NOTICE

The encoder cables to Siemens motors may only disconnected and connected when the system is in a no-voltage condition.

4.10.3 Interface description

4.10.3.1 Overview

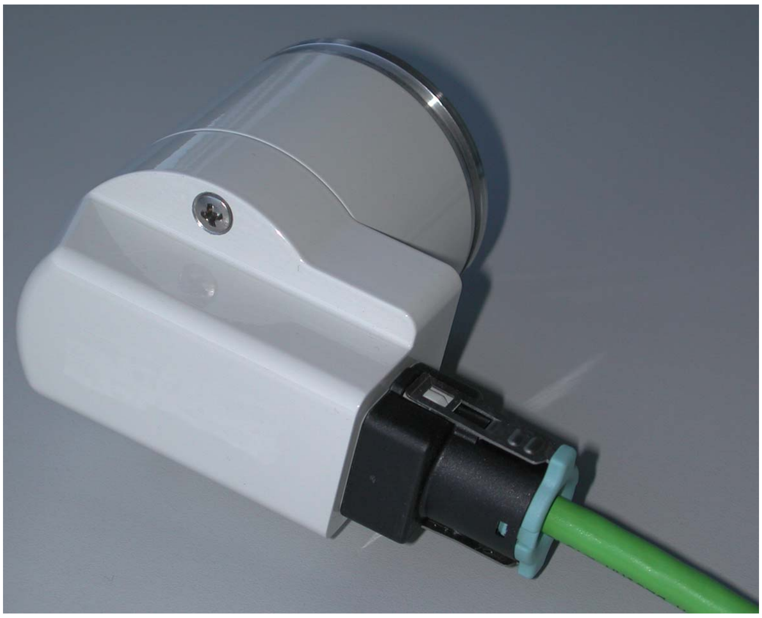
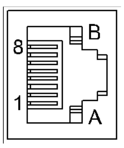


Figure 4-54 DRIVE-CLiQ encoder

4.10.3.2 DRIVE-CLiQ interface

Table 4- 38 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	Reserved, do not use	
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface included in the scope of delivery; blanking plug (50 pieces) order number: 6SL3066-4CA00-0AA0			

4.10.4 Dimension drawings

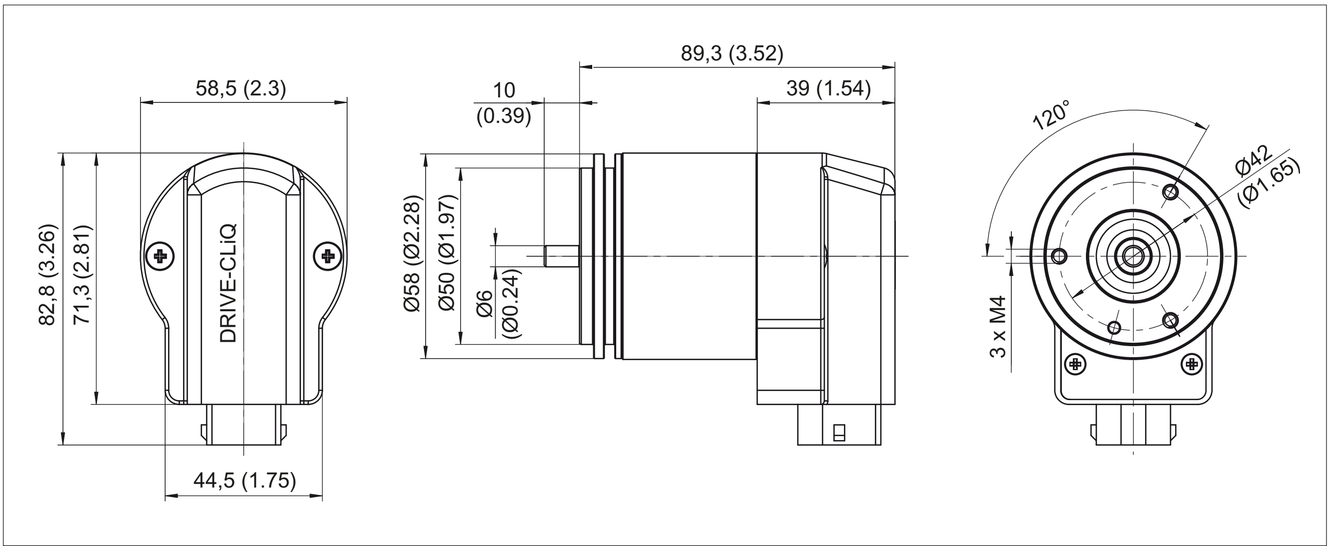


Figure 4-55 Dimension drawing of synchronous flange, all data in mm and (inches)

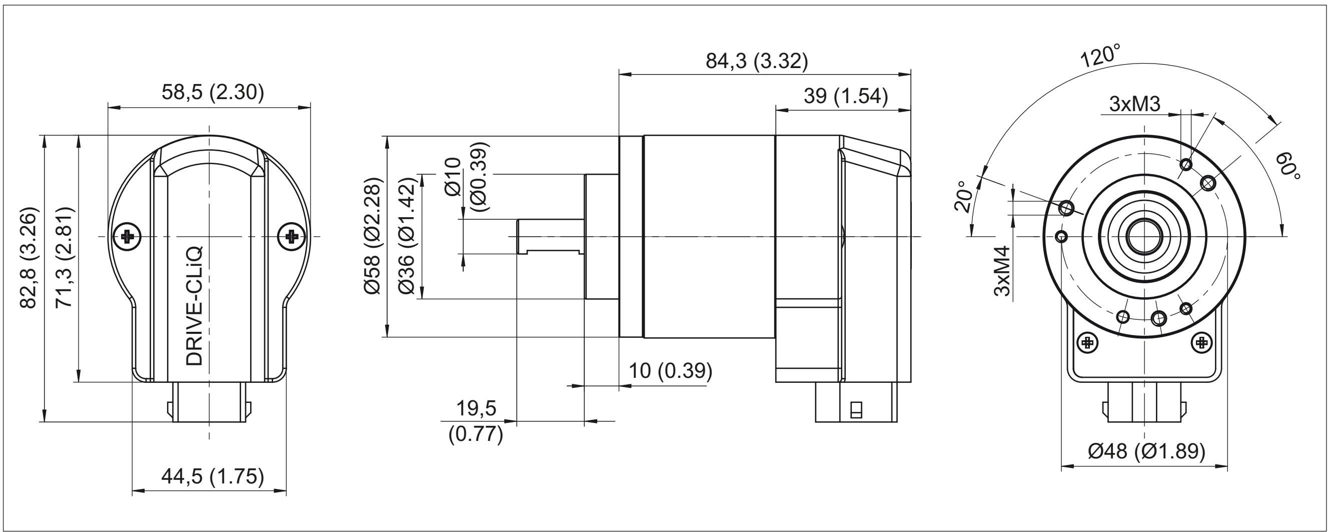


Figure 4-56 Dimension drawing of clamping flange, all data in mm and (inches)

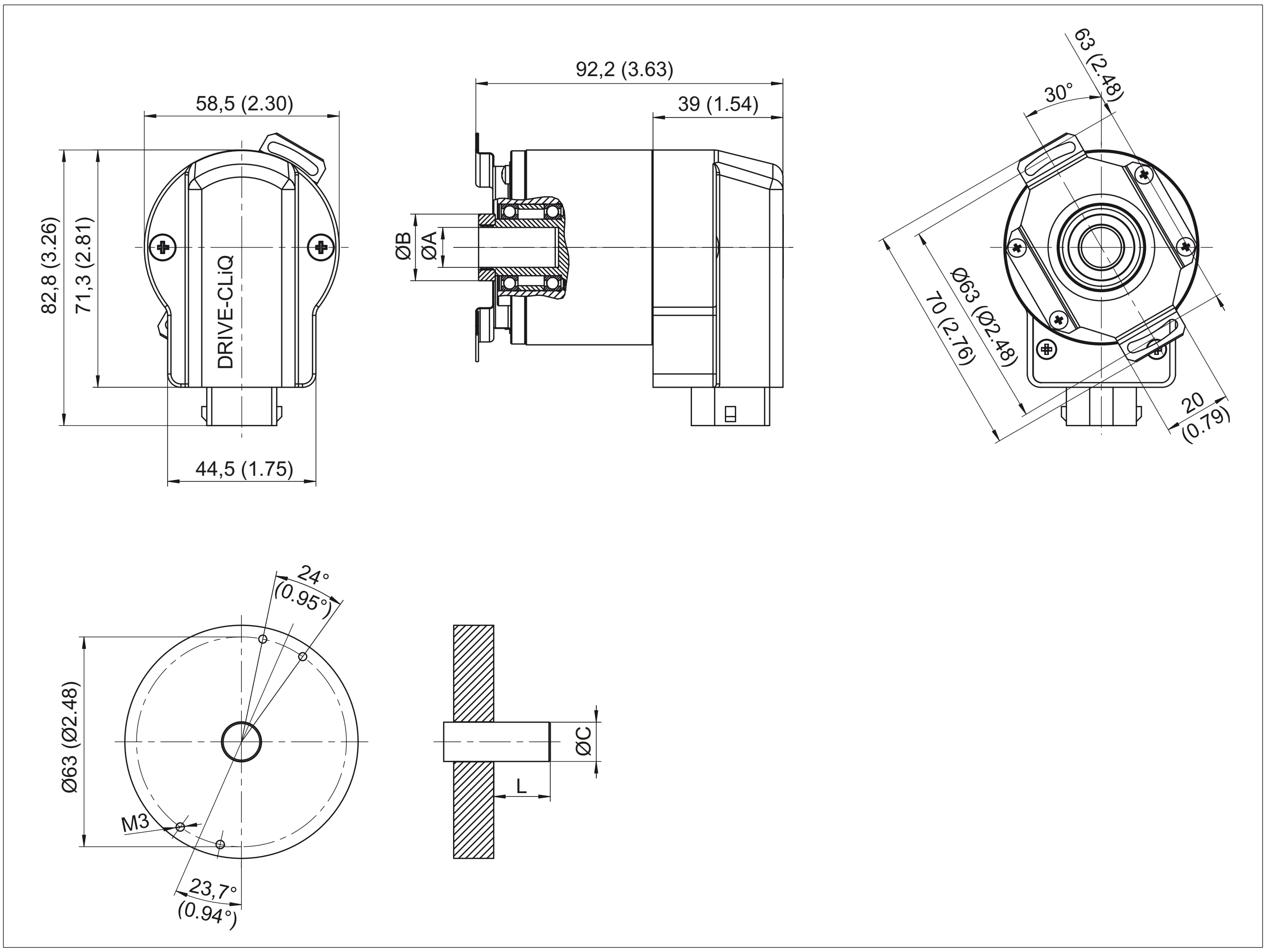


Figure 4-57 Dimension drawing of hollow shaft, all data in mm and (inches)

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

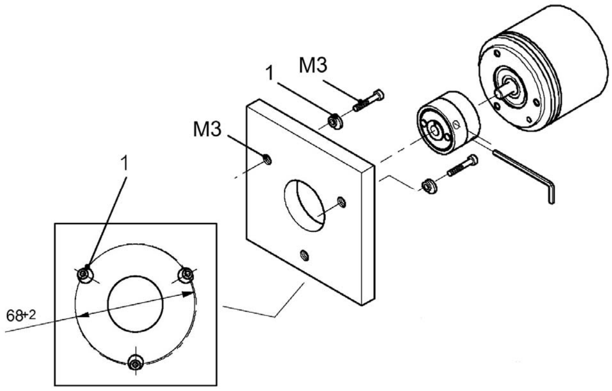


Figure 4-58 Installation: Synchronous flange, 1: Clamp straps

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 gcm²	20 gcm²
Max. speed	12000 rpm	12000 rpm
Operating temperature	-20 ... +150 °C	-20 ... +80 °C
Weight, approx.	16 g	20 g

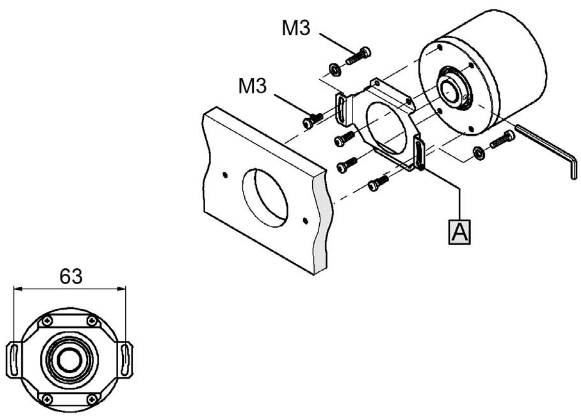


Figure 4-59 Installation: Hollow shaft, A: Spring plate (included in scope of supply)

4.10.6 Technical specifications

Table 4- 42 Technical data of 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
Max. cable length	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 control cabinet installation and electromagnetic compatibility (EMC), as well as on overcurrent and overvoltage protection, can be found in:

SINAMICS S120 Equipment Manual for Booksize Power Units (GH2)

Order No.: 6SL3097-4AC00-0BP3, Edition: 11/2010

Appendix A

A

A.1 Connectable conductor cross-sections for spring-loaded terminals

The type of spring-loaded terminal can be taken from the interface description of the particular component.

Table A- 1 Spring-loaded terminals

Spring-loaded terminal type			
1	Connectable conductor cross-sections	Rigid Flexible Flexible with end sleeve without plastic sleeve AWG/kcmil	0.14 mm^2 to 0.5 mm^2 0.14 mm^2 to 0.5 mm^2 0.25 mm^2 to 0.5 mm^2 26 to 20
	Stripped length	8 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
2	Connectable conductor cross-sections	Flexible	0.08 mm^2 to 2.5 mm^2
	Stripped length	8 to 9 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
3	Connectable conductor cross-sections	Rigid Flexible Flexible with end sleeve without plastic sleeve Flexible with end sleeve with plastic sleeve AWG/kcmil	0.2 mm^2 to 1 mm^2 0.2 mm^2 to 1.5 mm^2 0.25 mm^2 to 1.5 mm^2 0.25 mm^2 to 0.75 mm^2 24 to 16
	Stripped length	8 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
4	Connectable conductor cross-sections	25 mm^2 to 95 mm^2 AWG 4 to 4/0	
	Stripped length	35 mm	
5	Connectable conductor cross-sections	Rigid Flexible Flexible with end sleeve without plastic sleeve Flexible with end sleeve with plastic sleeve AWG/kcmil	0.2 mm^2 to 10 mm^2 0.2 mm^2 to 6 mm^2 0.25 mm^2 to 6 mm^2 0.25 mm^2 to 4 mm^2 24 to 8
	Stripped length	15 mm	

A.2 Connectable conductor cross-sections for screw terminals

The type of screw terminal can be taken from the interface description of the particular component.

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
	Stripped length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
	Tightening torque	0.22 to 0.25 Nm	
1_1	Connectable conductor cross-sections	Rigid, 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
	Stripped length	7 mm	
	Tool	Screwdriver 0.4 x 2.5 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
	Stripped 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
	Stripped length	9 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
4	Connectable conductor cross-sections	Flexible 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
	Stripped 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
	Stripped length	12 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.2 to 1.5 Nm	

Screw terminal type			
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
	Stripped 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	
	Stripped 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 includes all abbreviations and their meanings used in the entire SINAMICS user documentation.

Abbreviation	Source 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	-	Contactless proximity switch
BI	Binector Input	Binector input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	Germany's Institute for Occupational Safety and Health
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	Source of abbreviation	Meaning
C		
C	Capacitance	Capacitance
C...	-	Safety message
CAN	Controller Area Network	Serial bus system
CBC	Communication Board CAN	Communication board CAN
CD	Compact Disc	Compact Disc
CDC	Crosswise data comparison	Crosswise data comparison
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/binector output
COB ID	CAN Object Identification	CAN Object identification
COM	Common contact of a changeover relay	Center contact of a changeover contact
COMM	Commissioning	Commissioning
CP	Communication Processor	Communication 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
CUA	Control Unit Adapter	Control Unit Adapter
CUD	Control Unit DC MASTER	Control Unit DC MASTER
D		
DAC	Digital Analog Converter	Digital analog converter
DC	Direct Current	DC current
DC link	DC link	DC link
DCB	Drive Control Block	Drive Control Block
DCC	Drive Control Chart	Drive Control Chart
DCC	Data Cross Check	Crosswise data comparison
DCN	Direct Current Negative	DC current negative
DCP	Direct Current Positive	DC current positive
DDS	Drive Data Set	Drive data set
DI	Digital Input	Digital input
DI/DO	Digital Input/Digital Output	Digital input/output bidirectional
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

Abbreviation	Source of abbreviation	Meaning
DP	Decentralized Peripherals	Distributed IOs
DPRAM	Dual Ported Random Access Memory	Memory with dual access ports
DRAM	Dynamic Random Access Memory	Dynamic 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
ESD	Electrostatic Sensitive Devices	Electrostatic sensitive devices
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
EMC	Electromagnetic compatibility	Electromagnetic compatibility
EN	European standard	European standard
EnDat	Encoder Data Interface	Encoder interface
EP	Enable Pulses	Pulse enable
EPOS	Einfachpositionierer	Basic positioner
ES	Engineering System	Engineering System
ESB	Equivalent circuit diagram	Equivalent circuit diagram
ESD	Electrostatic Sensitive Devices	Electrostatic sensitive devices
ESR	Extended Stop and Retract	Extended stop and retract
F		
F...	Fault	Fault
FAQs	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	Fail-safe digital input
F-DO	Failsafe Digital Output	Fail-safe digital output
FEM	Fremderregter Synchronmotor	Separately excited synchronous motor
FEPROM	Flash EPROM	Non volatile read and write memory
FG	Function Generator	Function generator
FI	-	Fault current
FOC	Fiber-Optic Cable	Fiber-optic cable
FP	Function diagram	Function diagram
FPGA	Field Programmable Gate Array	Field Programmable Gate Array

Abbreviation	Source of abbreviation	Meaning
FW	Firmware	Firmware
G		
GB	Gigabyte	Gigabyte
GC	Global Control	Global Control Telegram (Broadcast Telegramm)
GND	Ground	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as G)
GSD	Generic Station Description	Generic station description: Describes the characteristics 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	Logic with a high fault threshold
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
IBN	Inbetriebnahme	Commissioning
ID	Identifier	Identification
IE	Industrial Ethernet	Industrial Ethernet
IEC	International Electrotechnical Commission	International Electrotechnical Commission
IF	Interface	Interface
IGBT	Insulated Gate Bipolar Transistor	Insulated gate bipolar transistor
IGCT	Integrated Gate-Controlled Thyristor	Semiconductor power switch with integrated control electrode
IL	Impulslöschung	Pulse cancelation
IP	Internet Protocol	Internet Protocol
IPO	Interpolator	Interpolator
IT	Isolé Terré	Non-grounded three-phase power supply
IVP	Internal Voltage Protection	Internal voltage protection
J		
JOG	Jogging	Jogging

Abbreviation	Source of abbreviation	Meaning
K		
KIP	Kinetische Pufferung	Kinetic buffering
Kp	-	Proportional gain
KTY	-	Special temperature sensor
L		
L	-	Formula symbol for inductance
LED	Light Emitting Diode	Light Emitting Diode
LIN	Linear motor	Linear motor
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 as 0 V (also referred to 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 Code
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
MSR	Motorstromrichter	Motor-side converter
MT	Machine Tool	Machine tool
N		
N. C.	Not Connected	Not connected
N...	No Report	No message or internal message
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie	Standardization association for measurement and control in the chemical industry
NC	Normally Closed (contact)	NC contact
NC	Numerical Control	Numerical control
NEMA	National Electrical Manufacturers Association	Standardization body in the US
NM	Nullmarke	Zero mark
NO	Normally Open (contact)	NO contact

Abbreviation	Source of abbreviation	Meaning
NSR	Netzstromrichter	Line-side converter
NVRAM	Non-Volatile Random Access Memory	Non-volatile read/write memory
O		
OA	Open Architecture	Open Architecture
OC	Operating Condition	Operating condition
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
OLP	Optical Link Plug	Fiber-optic bus connector
OMI	Option Module Interface	Option module interface
P		
p...	-	Adjustable parameters
PB	PROFIBUS	PROFIBUS
PC	Position Controller	Position Controller
PcCtrl	PC Control	Control for master
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-magnet 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
PPI	Point-to-Point Interface	Point-to-point interface
PRBS	Pseudo Random Binary Signal	White noise
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
R		
r...	-	Display parameters (read-only)
RAM	Random Access Memory	Read/write memory
RCCB	Residual Current Circuit Breaker	Residual current operated circuit breaker
RCD	Residual Current Device	Residual current operated circuit breaker
RCM	Residual Current Monitor	Residual current monitor

Abbreviation	Source of abbreviation	Meaning
RFG	Ramp-Function Generator	Ramp-function generator
RJ45	Registered Jack 45	Term for an 8-pin socket system for data transmission with shielded or non-shielded multi-wire 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 cable-connected serial data transmission between a sender and receiver (also known under EIA232)
RS485	Recommended Standard 485	Interface standard for a cable-connected differential, parallel, and/or serial bus system (data transmission between a number of senders and receivers, also known under EIA485)
RTC	Real Time Clock	Real time clock
RZA	Raumzeigerapproximation	Space vector approximation
S		
S1	-	Uninterrupted duty
S3	-	Intermittent duty
SBC	Safe Brake Control	Safe brake control
SBH	Sicherer Betriebshalt	Safe operating stop
SBR	-	Safe acceleration monitoring
SCA	Safe Cam	Safe cam
SD Card	SecureDigital Card	Secure digital memory 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
SI	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	Vector control without encoder
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

Abbreviation	Source of abbreviation	Meaning
SP	Service Pack	Service pack
SPC	Setpoint Channel	Setpoint channel
SPI	Serial Peripheral Interface	Serial interface for connecting peripherals
SS1	Safe Stop 1	Safe stop 1 (monitored for time and ramping up)
SS2	Safe Stop 2	Safe stop 2
SSI	Synchronous Serial Interface	Synchronous serial interface
SSM	Safe Speed Monitor	Safe feedback for speed monitoring (n < nx)
SSP	SINAMICS Support Package	SINAMICS support package
STO	Safe Torque Off	Safe torque off
STW	Steuerwort	Control word
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 network
Tn	-	Integral time
TPDO	Transmit Process Data Object	Transmit process data object
TT	Terre Terre	Grounded three-phase supply network
TTL	Transistor-Transistor Logic	Transistor-transistor logic
Tv	-	Rate time
U		
u.d.	under development	Under development: This feature is not currently available
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
UPS	Uninterruptible Power Supply	Uninterruptible power supply
UTC	Universal Time Coordinated	Universal time coordinated
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	Association 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

Abbreviation	Source of abbreviation	Meaning
X		
XML	Extensible Markup Language	Standard language for Web publishing and document management
Z		
ZM	Zero Mark	Zero mark
ZSW	Zustandswort	Status word

SINAMICS documentation overview

General documentation/catalogs

SINAMICS – G110
D11.1
Inverter Chassis Units
0.12 kW to 3 kW

SINAMICS – G130, G150
D11
Drive Converter Chassis Units
Drive Converter Cabinet Units

SIMOTION SINAMICS – S120
PM21
SIMOTION, SINAMICS S120 and
Motors for Production Machines

SINAMICS – S120, S150
D21.3
SINAMICS S120 Chassis Units
Chassis Format Units and Cabinet Modules
SINAMICS S150
Converter Cabinet Units

Manufacturer/service documentation

SINAMICS – G110
Getting Started
Operating Instructions
List Manual

SINAMICS – G120
Getting Started
Operating Instructions
Hardware Installation Manual
Function Manual Safety Integrated
List Manual

SINAMICS – G130
Operating Instructions
List Manual

SINAMICS – G150
Operating Instructions
List Manual

SINAMICS – GM150, SM150, GL150, SL150
Operating Instructions
List Manual

Manufacturer/service documentation

SINAMICS – S110
Equipment Manual
Getting Started
Function Manual
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SINAMICS – S120
Getting Started
Commissioning Manual
Commissioning Manual for CANopen
Function Manual Drive Functions
Function Manual Safety Integrated
Function Manual DCC
List Manual

SINAMICS – S120
Equipment Manual for Control Units and
Additional Components
Equipment Manual for Booksize Power Units
Equipment Manual for Chassis Power Units
Equipment Manual for Chassis Liquid
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Equipment Manual Cabinet Modules
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