

Edition

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EQUIPMENT MANUAL

SINAMICS

SINAMICS S220

Booksize power units

SIEMENS

SINAMICS

S220 Booksize power units


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

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


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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

Trademarks

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

Disclaimer of Liability

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

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Introduction

1.1 About SINAMICS

Overview

With the SINAMICS converter series you can solve drive tasks in low, medium and DC voltage range. All SIEMENS drive components, such as converters, motors and controls, are matched to each other and can be integrated into your existing automation system. With SINAMICS, you benefit from efficient engineering with a variety of tools for the entire product development and production process.

For more information, visit the SINAMICS (<https://new.siemens.com/global/en/products/drives/sinamics.html>) website.

1.2 About this documentation

Structure

The SINAMICS documentation is structured according to the following categories:

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

Target group

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

Content

This manual presents the SINAMICS S220 components and provides the information, procedures and/or operating actions required for the particular usage phase.

Standard scope

This documentation describes the functionality of the standard scope. This scope may differ from the scope of the functionality of the system that is actually supplied. Please refer to the ordering documentation only for the functionality of the supplied drive system.

Further functions may be executable in the system, which are not explained in this documentation. However, there is no entitlement to these functions in the case of a new delivery or service.

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

The machine manufacturer is obliged to document the additions or changes made to the product by the machine manufacturer.

Websites of third-party companies

This document may contain hyperlinks to third-party websites. Siemens is not responsible for and shall not be liable for these websites and their content. Siemens has no control over the information which appears on these websites and is not responsible for the content and information provided there. The user bears the risk for their use.

1.3 SINAMICS S documentation overview

Software		Manual
Alarms	Described in order of ascending numbers	SINAMICS S120/S150 List Manual
Parameters	Described in order of ascending numbers	SINAMICS S120/S150 List Manual
Function block diagrams	Sorted according to topic	SINAMICS S120/S150 List Manual
	Described in order of ascending numbers	
Drive functions		SINAMICS S120 Function Manual Drive Functions
Communication topics		SINAMICS S120 Function Manual Communication ²⁾
Safety Integrated	Basic and Extended Functions	SINAMICS S120 Safety Integrated Function Manual
	Basic Functions	SINAMICS S120 Function Manual Drive Functions
Commissioning	Of a simple SINAMICS S120 drive with STARTER	Getting Started ¹⁾
Commissioning	With STARTER	SINAMICS S120 Commissioning Manual ¹⁾
Commissioning	Of a simple SINAMICS S120 drive with Startdrive	Getting Started with Startdrive ²⁾
Commissioning	With Startdrive	SINAMICS S120 Commissioning Manual with Startdrive ²⁾
Web server		SINAMICS S120 Function Manual Drive Functions

Hardware			Manual
Control Units and expansion components	<ul style="list-style-type: none"> Control Units Option Boards Terminal Modules 	<ul style="list-style-type: none"> DRIVE-CLiQ HUB Modules VSM10 Encoder system connection 	SINAMICS S120 Equipment Manual for Control Units and Supplementary System Components
S220 booksize power units	<ul style="list-style-type: none"> Line connection S220 Smart Line Modules 	<ul style="list-style-type: none"> Control cabinet design 	SINAMICS S220 Equipment Manual Booksize Power Units
S120 booksize power units	<ul style="list-style-type: none"> Line connection Line Modules Motor Modules DC link components 	<ul style="list-style-type: none"> Braking resistors Motor-side power components Control cabinet design 	SINAMICS S120 Equipment Manual Booksize Power Units
Chassis power units			SINAMICS S120 Equipment Manual for chassis power units, air, liquid or water cooled
AC drive components			SINAMICS S120 Equipment Manual for AC Drives
S120 Combi components			SINAMICS S120 Equipment Manual Combi
Diagnostics via LEDs	STARTER		SINAMICS S120 Commissioning Manual ¹⁾
	Startdrive		SINAMICS S120 Commissioning Manual with Startdrive ²⁾
Meaning of the LEDs			Equipment Manuals: Booksize Power Units and Control Units and Expansion Components
High Frequency Drive components			SINAMICS S120 System Manual High Frequency Drives

¹⁾ Up to firmware version 5.1 SP1

²⁾ From firmware version 5.2

Additional information

You can find information on the topics below at the following address (<https://support.industry.siemens.com/my/ww/en/documentation/advanced/>):

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

Questions relating to the technical documentation

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

FAQs

You can find Frequently Asked Questions about SINAMICS under Product Support (<https://support.industry.siemens.com/cs/de/en/ps/faq>).

Siemens Support while on the move



With the "Siemens Industry Online Support" app, you can access more than 300,000 documents for Siemens Industry products – any time and from anywhere. The app supports you in the following areas, for example:

- Resolving problems when executing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Furthermore, you have access to the Technical Forum and other articles that our experts have drawn up:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

The "Siemens Industry Online Support" app is available for Apple iOS and Android.

Data matrix code on the rating plate

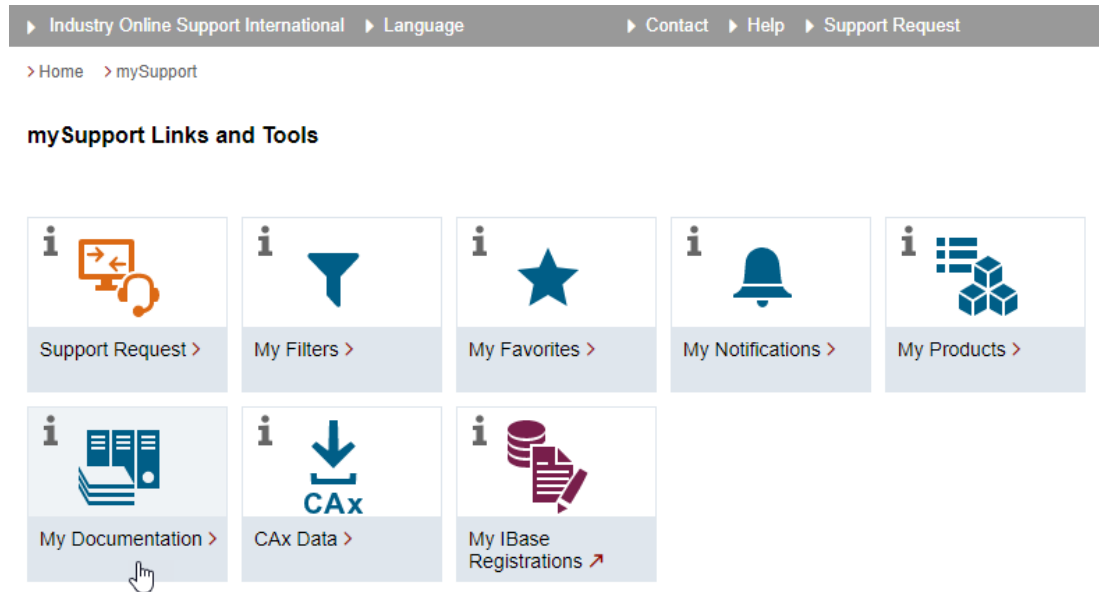
The data matrix code on the rating plate contains the specific device data. This code can be read in with any smartphone and technical information for the appropriate device can be displayed via the "Siemens Industry Online Support" mobile app.

1.4 mySupport documentation

Overview

With the "mySupport documentation" web-based system you can compile your own individual documentation based on Siemens content, and adapt it for your own machine documentation.

To start the application, click on the "My Documentation" tile on the mySupport homepage (<https://support.industry.siemens.com/cs/ww/en/my>):



The configured manual can be exported in RTF, PDF or XML format.

Note

Siemens content that supports the mySupport documentation application can be identified by the presence of the "Configure" link.

1.5 Additional information

Ensuring reliable operation

The manual describes a desired state which, if maintained, ensures the required level of operational reliability and compliance with EMC limit values.

Should there be any deviation from the requirements in the Equipment Manual, appropriate actions (e.g. measurements) must be taken to check/prove that the required level of operational reliability and compliance with EMC limit values are ensured.

Spare parts

Spare parts are available on the internet at the following address (<https://www.sow.siemens.com>).

Product maintenance

The components are subject to continuous further development within the scope of product maintenance (improvements to robustness, discontinuations of components, etc.).

These further developments are "spare parts-compatible" and do not change the article number.



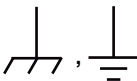
In the scope of such spare parts-compatible further developments, connector/connection positions are sometimes changed slightly. This does not cause any problems with proper use of the components. Please take this fact into consideration in special installation situations (e.g. allow sufficient clearance for the cable length).

Use of third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products. You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

Ground symbols

Icon	Meaning
	Connection for protective conductor
	Ground (e.g. M 24 V)
	Connection for functional equipotential bonding

1.6 General Data Protection Regulation

Compliance with the General Data Protection Regulation

Siemens respects the principles of data protection, in particular the data minimization rules (privacy by design).

For this product, this means:

The product does not process neither store any person-related data, only technical function data (e.g. time stamps). If the user links these data with other data (e.g. shift plans) or if he stores person-related data on the same data medium (e.g. hard disk), thus personalizing these data, he has to ensure compliance with the applicable data protection stipulations.

Fundamental safety instructions

2.1 General safety instructions



WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.



WARNING

Risk of electric shock and fire from supply networks with an excessively high impedance

Excessively low short-circuit currents can lead to the protective devices not tripping or tripping too late, and thus causing electric shock or a fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the converter is connected to the line supply at least meets the minimum requirements for the response of the protective device used.
- You must use an additional residual-current device (RCD) if a conductor-ground short circuit does not reach the short-circuit current required for the protective device to respond. The required short-circuit current can be too low, especially for TT supply systems.



⚠ WARNING

Risk of electric shock and fire from supply networks with an excessively low impedance

Excessively high short-circuit currents can lead to the protective devices not being able to interrupt these short-circuit currents and being destroyed, and thus causing electric shock or a fire.

- Ensure that the prospective short-circuit current at the line terminal of the converter does not exceed the breaking capacity (SCCR or I_{cc}) of the protective device used.



⚠ WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.



⚠ WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage. Contact with hazardous voltage can result in severe injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.



⚠ WARNING

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.



! WARNING

Electric shock due to unconnected cable shield

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.



! WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.



! WARNING

Electric shock due to residual charges in power components

Because of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

NOTICE

Damage to equipment due to unsuitable tightening tools.

Unsuitable tightening tools or fastening methods can damage the screws of the equipment.

- Be sure to only use screwdrivers which exactly match the heads of the screws.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

 **WARNING**

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

 **WARNING**

Active implant malfunctions due to electromagnetic fields

Converters generate electromagnetic fields (EMF) in operation. Electromagnetic fields may interfere with active implants, e.g. pacemakers. People with active implants in the immediate vicinity of a converter are at risk.

- As the operator of an EMF-emitting installation, assess the individual risks of persons with active implants.
- Observe the data on EMF emission provided in the product documentation.

 **WARNING**

Unexpected movement of machines caused by radio devices or mobile phones

Using radio devices or mobile telephones in the immediate vicinity of the components can result in equipment malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- Therefore, if you move closer than 20 cm to the components, be sure to switch off radio devices or mobile telephones.
- Use the "SIEMENS Industry Online Support app" only on equipment that has already been switched off.

NOTICE

Damage to motor insulation due to excessive voltages

When operated on systems with grounded line conductor or in the event of a ground fault in the IT system, the motor insulation can be damaged by the higher voltage to ground. If you use motors that have insulation that is not designed for operation with grounded line conductors, you must perform the following measures:

- IT system: Use a ground fault monitor and eliminate the fault as quickly as possible.
- TN or TT systems with grounded line conductor: Use an isolating transformer on the line side.

 **WARNING****Fire due to inadequate ventilation clearances**

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

NOTICE**Overheating due to inadmissible mounting position**

The device may overheat and therefore be damaged if mounted in an inadmissible position.

- Only operate the device in admissible mounting positions.

 **WARNING****Unrecognized dangers due to missing or illegible warning labels**

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

NOTICE**Device damage caused by incorrect voltage/insulation tests**

Incorrect voltage/insulation tests can damage the device.

- Before carrying out a voltage/insulation check of the system/machine, disconnect the devices as all converters and motors have been subject to a high voltage test by the manufacturer, and therefore it is not necessary to perform an additional test within the system/machine.

 **WARNING**

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.

2.2 Equipment damage due to electric fields or electrostatic discharge

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



NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber or aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
 - Wearing an ESD wrist strap
 - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

2.3 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

2.4 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit

<https://www.siemens.com/industrialsecurity> (<https://www.siemens.com/industrialsecurity>).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under

<https://www.siemens.com/industrialsecurity> (<https://new.siemens.com/global/en/products/services/cert.html#Subscriptions>).

Further information is provided on the Internet:

Industrial Security Configuration Manual (<https://support.industry.siemens.com/cs/ww/en/view/108862708>)

WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- On completion of commissioning, check all security-related settings.

2.5 Residual risks of power drive systems

When assessing the machine- or system-related risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer or system installer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
 - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
 - Response times of the control system and of the drive
 - Operation and/or environmental conditions outside the specification
 - Condensation/conductive contamination
 - Parameterization, programming, cabling, and installation errors
 - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
 - External influences/damage
 - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
 - Component failure
 - Software errors
 - Operation and/or environmental conditions outside the specification
 - External influences/damage
3. Hazardous shock voltages caused by, for example:
 - Component failure
 - Influence during electrostatic charging
 - Induction of voltages in moving motors
 - Operation and/or environmental conditions outside 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
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

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

System overview

3.1 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

Apart from SIMATIC, SIMOTION and SINUMERIK, SINAMICS is one of the core components of TIA. It is thus possible to assign parameters, program and commission all components in the automation solution with the Startdrive or STARTER commissioning tool using a standardized engineering platform and without any system transitions (seamless engineering). The system-wide data management functions ensure consistent data and simplify archiving of the entire plant project.

From V14, the Startdrive commissioning tool is an integral element of the TIA platform.

Communication via PROFINET

This Ethernet-based bus enables closed-loop control data to be exchanged at high speed via PROFINET IO with IRT or RT allowing SINAMICS to be used in multi-axis applications demanding the highest degree of performance. At the same time, PROFINET also uses standard IT mechanisms (TCP/IP) to transport information, e.g. operating and diagnostics data to higher-level systems. This makes it easy to integrate into an IT corporate network.

Communication via PROFIBUS DP

This bus provides a high-performance, system-wide and integrated communication network which links all automation components of the automation solution:

- HMI (operator control and monitoring)
- Control
- Drives and I/O

3.1 Platform Concept and Totally Integrated Automation



Figure 3-1 SINAMICS as part of the SIEMENS modular automation system

Modular system for sophisticated drive tasks

SINAMICS is deployed in complex drive tasks for a wide range of industrial applications, and is therefore designed and implemented as a modular drive system. Select from many different harmonized components and functions to create the combination that best meets your requirements. SIZER, a high-performance engineering tool, makes it easier to select and determine the optimum drive configuration.

SINAMICS optimally supports:

- Synchronous and induction motors
- Linear and torque motors

System architecture with a central Control Unit

With SINAMICS, the drive intelligence is combined with the closed-loop control functions in Control Units. These units can control drives in the vector, servo and U/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 by mouse click in the Startdrive or STARTER commissioning tool.

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

Most of the components, including the motors and encoders, are connected to each other via the common DRIVE-CLiQ serial interface. 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

The electronic rating plates integrated in every component are an important part of the digital link of the drive system. They allow all drive components to be detected automatically via a DRIVE-CLiQ link. This means that data does not have to be manually entered while commissioning the system or when replacing parts.

The electronic rating plate contains all the relevant technical data about that particular component. For motors, these are the parameters of the electrical equivalent circuit diagram and key values of the integrated motor encoder, for example.

In addition to technical data, the rating plate also includes logistical data, such as the manufacturer ID, article number and identification number. 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.

3.2 Intended use

Description

The products described in this manual, together with software, accessories, and options, form an electrical power drive system intended to feed low-voltage AC motors. The products are intended for use in industrial applications. The products must be installed and maintained by professionals with sufficient knowledge to implement the safety and EMC measures according to the specifications described in this manual and the recognized state of the art.

You may only use the products in compliance with the following requirements:

- All regulations and directives that are applicable at the site of the end use, especially with regard to electrical safety, functional safety and electromagnetic compatibility.
- All instructions, notes, technical data and safety information contained in this manual and other supporting documentation.

Before using the products, you must perform a risk assessment of the entire application and implement appropriate system design measures to ensure safety of persons, property and electromagnetic compatibility.

Open type products (IP00/IP20) are intended for incorporation within cubicles or enclosures which will provide necessary protection.

Any use other than the use explicitly permitted is prohibited and can result in unanticipated hazards.

3.3 Directives, standards, certificates

Relevant directives and standards

You can obtain an up-to-date list of currently certified components on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person.

Certificates for download

The certificates can be downloaded from the internet:

Certificates (<https://support.industry.siemens.com/cs/ww/en/ps/13229/cert>)



EC Declaration of Conformity

You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated") on the internet at the following address (<https://support.industry.siemens.com/cs/ww/en/ps/13231/cert>).

The following directives and standards are relevant for SINAMICS S devices:

- **European Low Voltage Directive**
SINAMICS S devices fulfil the requirements stipulated in the Low Voltage Directive 2014/35/EU, insofar as they are covered by the application area of this directive.
- **European Machinery Directive**
SINAMICS S devices fulfil the requirements stipulated in the Machinery Directive 2006/42/EC, insofar as they are covered by the application area of this directive.
However, the use of the SINAMICS S devices in a typical machine application has been fully assessed for compliance with the main regulations in this directive concerning health and safety.
- **Directive 2011/65/EU**
SINAMICS S devices comply with the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic devices (RoHS II).
- **European EMC Directive**
SINAMICS S devices comply with the EMC Directive 2014/30/EU.
- **UKCA certification**
The converter complies with the requirements for the British market (England, Wales and Scotland).
- **EMC requirements for South Korea**
SINAMICS S devices with the KC marking on the rating plate comply with EMC requirements for South Korea.
- **Eurasian conformity**
SINAMICS S devices comply with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).





- **North American market**
SINAMICS S devices provided with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications.
You can find the relevant certificates on the internet pages of the certifying body (<https://iq.ulprospector.com>).



- **Australia and New Zealand (RCM formerly C-Tick)**
SINAMICS S devices showing the test symbols fulfill the EMC requirements for Australia and New Zealand.
- **Quality systems**
Siemens AG employs a Quality Management System that meets the requirements of ISO 9001 and ISO 14001.

Not relevant standards



China Compulsory Certification

SINAMICS S devices do not fall in the area of validity of the China Compulsory Certification (CCC).

EMC limit values in South Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

The EMC limit values to be complied with for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives IEC 61800-3, category C2 or CISPR 11 / KN11. By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are observed. Further, additional measures may be required, such as using an additional radio interference suppression filter (EMC filter).

The measures for EMC-compliant design of the system are described in detail in this manual and in the EMC Installation Guideline Configuration Manual.

The final statement regarding compliance with the standard is given by the respective label attached to the individual unit.


3.4 S220 components and system data

3.4.1 Mixed operation of SINAMICS S120 and S220 modules

Overview

SINAMICS S120 and S220 components can be operated together in a drive lineup (mixed operation).

Requirement

 WARNING
<p>Danger to life due to unsuitable firmware version</p> <p>Operating SINAMICS S220 Booksize components with an unsuitable firmware version can lead to unsafe operating states. For example converter components can overheat, a motor can unexpectedly accelerate or safety functions malfunction.</p> <ul style="list-style-type: none"> • Use a Control Unit with firmware V5.2 SP3 HF10 or higher.

Description

The article numbers of SINAMICS S220 components start with 6SL5.

In mixed operation, the article numbers of SINAMICS S220 components are displayed with the compatible article numbers of SINAMICS S120 components in the engineering tools (e.g. Startdrive).

Table 3-1 Example in the engineering tools (e.g. Startdrive)

Article number on the nameplate	Displayed article number of the compatible component with respect to the Control Units/firmware version	Remarks
6SL5130-6UE21-6AC0	6SL3130-6TE21-6AA8	The compatible article number of the SINAMICS S120 component is displayed.
6SL5130-6UE21-6AD0	6SL5130-6UE21-6AD0	If the component has no predecessor, the article number of the S220 component is displayed.

For more information on compatible components, please refer to the SINAMICS S220/S120 compatibility list Compatibility list (<https://support.industry.siemens.com/cs/ww/en/view/109806050>).

3.4.2 Overview of Smart Line Modules

Line Modules generate a DC voltage from the connected line voltage that is used to power the Motor Modules.

All 16 kW and 24 kW Smart Line Modules have DRIVE-CLiQ interfaces for communication with the Control Unit.



Figure 3-2 Overview of 16 kW and 24 kW Smart Line Modules

General characteristics of the Line Modules

- Supply voltage 3 AC 380 V to 480 V, 50/60 Hz
- Suitable for TN, TT, and IT supply systems
- Internal air cooling
- Short-circuit/ground-fault-proof during the precharge phase
- Integrated DC link and electronics current busbar connection
- LEDs for indicating statuses and for diagnostics

Characteristics of the Smart Line Modules

- Unregulated DC link voltage
- Energy recovery capability
- Block-type line currents in the energy recovery direction

3.4.3 System data

Unless specified otherwise, the following technical data apply for all components of the SINAMICS S220 booksize drive system described in this manual.

Note

Mixed operation of SINAMICS S120 and S220 components

If the drive system includes at least one S120 component, then you must observe the system data provided in the Equipment Manual for S120 Booksize Power Units.

- Observe the system data for the particular S120 component in Chapter "System overview" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Table 3-2 Electrical data

Line connection voltage	3 AC 380 ... 480 V $\pm 10\%$ ($-15\% < 1$ min)
Line frequency	50/60 Hz (47 ... 63 Hz)
Electronics power supply	24 V DC $-15/+20\%$ ¹⁾ , protective/safety extra-low voltage PELV/SELV ²⁾ (see Chapter 24 V DC supply (Page 125))
Maximum rated short-circuit current (SCCR) according to UL 61800-5-1	100 kA at 480 V The SCCR value depends on the overcurrent protective device used, and can be taken from the Product Information "Protective Devices for SINAMICS S220 Line Modules Booksize (https://support.industry.siemens.com/cs/ww/en/view/109804134)".
Electromagnetic compatibility	According to IEC 61800-3: Used in the second environment (industrial line supplies). As standard, Category C3. With additional Category C2 components (see Chapter "Drive system applications (Page 112)").
Overvoltage category	III ³⁾ According to IEC 61800-5-1, EN 61800-5-1, UL 61800-5-1 and CSA C22.2 No 274
Degree of pollution	2 ⁴⁾ According to IEC 61800-5-1, EN 61800-5-1, UL 61800-5-1 and CSA C22.2 No 274

- When using a motor holding brake, take into consideration the restricted voltage tolerances ($24\text{ V} \pm 10\%$) that may apply.
- You can use power supplies with a safety/protective extra-low voltage (SELV/PELV). Implement the circuit as PELV circuit as the 24V electronics power supply is permanently grounded.
- The components are designed for connection to circuits of overvoltage Category III. If this has not already been ensured by the installation, an upstream overvoltage protection device may have to be installed. You must limit overvoltages to 6 kV with respect to ground and 4 kV between phases. Overvoltage protection devices must be suitable for the line voltage and the prospective short-circuit current of the line.
- You must protect the components against conductive pollution, e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529 or a Type 12 enclosure according to NEMA 250. A lower degree of cabinet protection is permissible if conductive pollution can be excluded at the installation site.

Table 3-3 Degree of protection / protection class

Degree of protection	IPXXB acc. to IEC 60529, open type acc. to UL/CSA
Protection class	I (with protective conductor connection)

3.4 S220 components and system data

Table 3-4 Environmental conditions

Chemically active substances	
Long-term storage	Class 1C2 according to IEC 60721-3-1:1997, in product packaging ¹⁾
Transport	Class 2C2 according to IEC 60721-3-2:1997, in transport packaging ²⁾
Operation	Class 3C2 according to IEC 60721-3-3:2002 Class 3C2 according to IEC 60068-2-42 G3 according to ANSI/ISA-S71.04.2013 Class 3C3 according to IEC 60721-3-3 for H2S and SO2
Biological environmental conditions	
Long-term storage	Class 1B1 according to IEC 60721-3-1:1997, in product packaging ¹⁾
Transport	Class 2B1 according to IEC 60721-3-2:1997, in transport packaging ²⁾
Operation	Class 3B1 according to IEC 60721-3-3:2002
Climatic conditions	
Long-term storage	Class 1K4 according to IEC 60721-3-1:1997, in product packaging ¹⁾ Temperature: -25 ... +55 °C
Transport	Class 2K4 according to IEC 60721-3-2:1997, in transport packaging ²⁾ Temperature: -40 ... +70 °C
Operation	Class 3K3 according to IEC 60721-3-3:2002 with increased ruggedness with respect to relative humidity Temperature: -10 ... +40 °C without derating > 40 ... +55 °C with a reduction of the output current by 2.5 % per °C Relative humidity: 5 ... 95 % no condensation (better than Class 3K3) Oil mist, salt mist, ice formation, condensation, dripping water, spraying water, splashing water and water jets are not permitted
Mechanical environmental conditions	
Long-term storage	Class 1M2 according to IEC 60721-3-1:1997, in product packaging ¹⁾
Transport	Class 2M3 according to IEC 60721-3-2:1997, in transport packaging ²⁾
Operation Vibration test in operation Shock test in operation	Class 3M1 according to IEC 60721-3-3:2002 According to IEC 60068-2-6 test Fc (sinusoidal) <ul style="list-style-type: none"> • 10 ... 57 Hz: 0.075 mm deflection amplitude • 57 ... 150 Hz: 1 g acceleration amplitude • 10 frequency cycles per axis According to IEC 60068-2-27 test Ea (half-sine) <ul style="list-style-type: none"> • 5 g peak acceleration • 30 ms duration • 3 shocks in all three axes in both directions

Installation altitude	
Operation	0 ... 1000 m above sea level without derating > 1000 ... 2000 m <ul style="list-style-type: none"> • Reduction of the output current by 10 % per 1000 meters, or • Reduction in the ambient temperature by 5 °C per 1000 meters > 2000 ... 4000 m <ul style="list-style-type: none"> • Reduction of the output current by 10 % per 1000 meters, or • Reduction in the ambient temperature by 5 °C per 1000 meters • Operation on line supply systems with grounded neutral point, or • Operation on an isolating transformer with secondary grounded neutral point

- 1) Product packaging (storage packaging) is individual packaging for storage and does not satisfy the requirements for transport. As a consequence, product packaging is therefore not suitable for shipping.
- 2) Transport packaging is either packaging that is directly suitable for transport, or secondary packaging which, together with the product packaging, satisfies the requirements for transport.

Table 3-5 Certificates

Declarations of conformity	EU Declaration of Conformity (Low Voltage Directive, EMC, Machinery Directive, RoHS), China RoHS, RCM, Morocco
Certifications	cULus, cURus, KC, EAC, UKCA

Line connection and line-side power components

The following devices are used to connect the components to the line supply:

- Disconnecter unit
- Overcurrent protective device
- Line contactor (optional)
- Line filter (optional)
- Line reactor (required)

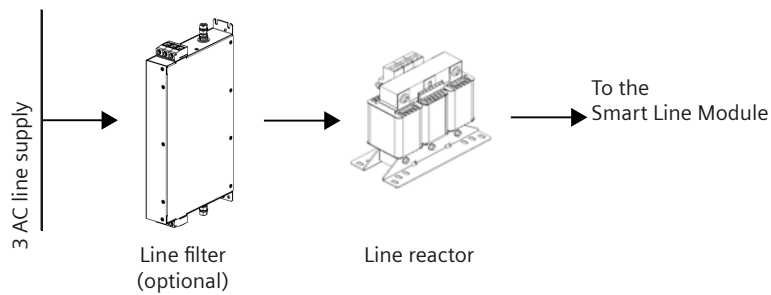


Figure 4-1 Line connection with line filters and line reactors (example for Smart Line Modules)

4.1 Information on the disconnecter unit

Disconnecter units for S220 Smart Line Modules

A disconnecter unit is required for disconnecting the drive lineup from the supply system. This must be selected in compliance with local regulations.

NOTICE
Damage to the drive electronics when switching the disconnecter unit under load
When switching the disconnecter unit under load, then the contacts will be subject to premature wear. This can cause the disconnecter unit to malfunction, with subsequent damage to the drive electronics.
<ul style="list-style-type: none">• Use a leading switch-off auxiliary contact or use a Voltage Sensing Module (VSM10).• If this is not possible, then avoid switching the disconnecter unit under load.

The accessories required for the disconnecter unit must be selected from the manufacturer catalogs.

4.2 Overcurrent protection using fuses and circuit breakers

You must use line fuses or circuit breakers for overcurrent protection. The following protective elements can result in reductions.

Detailed specifications regarding protective devices and their respective short-circuit current rating values can be found in the Product Information "Protective Devices for S220 Line Modules Booksize (<https://support.industry.siemens.com/cs/ww/en/view/109804134>)".



WARNING

Electric shock or fire due to overcurrent protective devices that trip too late or not at all

Overcurrent protective devices that trip too late or not all can cause electric shock or fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the converter is connected to the line supply corresponds as a minimum to the requirements of the protective device used.
- You must additionally use a residual current device (RCD) if, for a conductor-ground short circuit, the required short-circuit current is not reached. The required short-circuit current can be too low, especially for TT line supply systems.
- The short-circuit current must not exceed the SCCR of the converter and the breaking capacity of the protective device.

4.3 Connected to the line supply via residual current devices (RCD)

4.3.1 Line supply connection via residual current devices

Terminology

Code	Meaning
RCD	= higher-level term <ul style="list-style-type: none"> Residual current device Residual current device
RCCB	<ul style="list-style-type: none"> Residual current circuit breaker Residual current circuit breaker Ground-fault circuit interrupter
MRCB	<ul style="list-style-type: none"> Modular residual current device Modular residual current device

Description

Selectively tripping, AC/DC-sensitive residual current devices (type B) can be used in addition to the overcurrent protective devices.



<p>⚠ WARNING</p> <p>Electric shock or fire when using unsuitable residual current devices</p> <p>In the case of a fault, converters can generate smooth DC fault currents, rendering type A or type AC RCDs unusable.</p> <ul style="list-style-type: none"> Use the recommended type B RCDs to protect converters. If higher-level RCDs are used, then these must also be type B devices.
--

You must install residual current devices (RCDs) if the line supply conditions in terms of short-circuit power and loop impedance at the infeed point are such that if a fault occurs the installed overcurrent protective devices will not trip within the specified time. Residual current devices also offer preventative fire protection in the case of insulation faults, e.g. for use in high-fire-risk working environments.

Table 4-1 Suitable RCD

Residual current devices	RCCB
Rated current	≤80 A
S220 Smart Line Modules	16 ... 24 kW

Conditions for using residual current devices

- Super-resistant (short-time-delayed) universal current-sensitive RCDs, type B
- Rated residual current 300 mA
- Separate RCD for each Line Module

- Ensure that the loop impedance complies with local installation regulations.
- Check the total length of the shielded power cables (motor cables incl. line supply cables from line filters to the connection terminals of the Line Module) in the drive lineup. The total length must be less than 350 m.
- Only operate the system with the recommended line filters.
- Ensure that the switching elements (disconnecter unit, contactors) for connecting and disconnecting the drive system have a delay time of max. 35 ms between the closing/ opening of the individual main contacts.

Note**Nuisance tripping of RCDs**

In case of unfavorable line supply conditions, as a result of the system that they are being used in, converters can generate capacitive leakage currents that can cause RCDs to nuisance trip.

4.3.2 Residual current circuit breakers (RCCB)

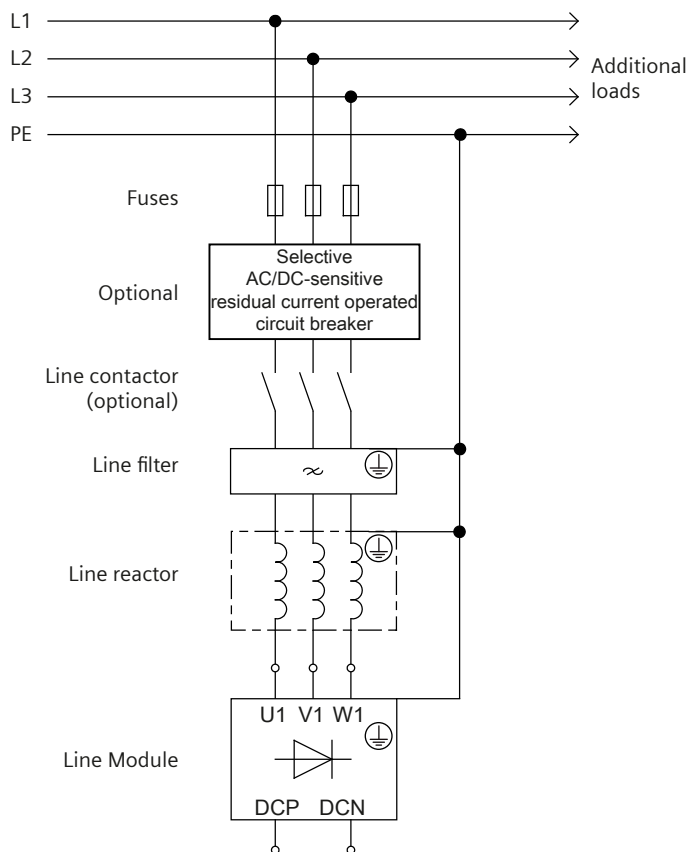


Figure 4-2 Connection of a residual-current protective device

4.3 Connected to the line supply via residual current devices (RCD)

Recommendation

- Siemens SIQUENCE RCCB (ground-fault circuit interrupter), type B, super-resistant [K], 300 mA rated fault current, series 5SV364.-4.

4.4 Line contactors

When selecting the line contactor, the values indicated in the technical data apply. Dimension the cables and conductors to be connected in strict compliance with local installation regulations.

NOTICE
Damage to the drive electronics when switching the line contactor under load
When switching the line contactor (type according to the recommended selection) under load, then the contacts will be subject to premature wear. This can cause the contactor to malfunction, with subsequent damage to the drive electronics.
<ul style="list-style-type: none">• Use a leading switch-off auxiliary contact or use a Voltage Sensing Module (VSM10).• If this is not possible, then avoid switching the line contactor under load.

Note

You must connect a surge suppression device (e.g. free-wheeling diode or varistor) to the contactor coil to limit switching overvoltages.

Take into account the switching capacity of the digital output used to control the line contactor.

4.5 Line filters

In conjunction with line reactors and a consequential EMC-compliant system design, line filters limit the conducted electromagnetic emissions generated by the Line Modules to the limit values according to IEC 61800-3.

4.5.1 Overview of line filters

The following line filter versions can be used for operating the Smart Line Module.

Table 4-2 Overview of line filters

Line filters	Article number
Basic Line Filter for S220 Smart Line Modules	
16 kW	6SL5100-0HE21-6DD0
24 kW	6SL5100-0HE22-4DD0

Basic Line Filters are used to attenuate conducted interference in accordance with the specifications contained in the EMC legislation. They are mainly effective in the frequency range from 9 kHz to 30 MHz; this is the range relevant to ensure compliance with the appropriate standard.

They can be used for Smart Line Modules in conjunction with the associated line reactors.

They are only suitable for direct connection to line supplies with grounded neutral point (TN or TT). An isolating transformer is required for other power systems.

Data regarding the radio interference voltage categories and maximum total cable lengths that can be achieved is provided in Chapter Combination options of Line Modules with line reactors and line filters (Page 114). The sum of the lengths of all motor cables, line supply cable from the line filter to the Line Module is called the total cable length.

4.5.2 Safety instructions for line filters



⚠ WARNING

Electric shock due to residual charges in power components

As a result of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off.

Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.



⚠ WARNING

High leakage currents when the protective conductor in the line supply cable is interrupted

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Carefully comply with the applicable regulations for dimensioning the protective conductor (see Chapter "Protective connection and equipotential bonding (Page 138)").



⚠ CAUTION

Burns due to high surface temperatures

The surface of the components can reach high temperatures during operation. You can get seriously burnt when touching the surface.

- Do not touch the component.

NOTICE

Line filter damage by connecting to impermissible line supply

The line filters are only suitable for direct connection to line supplies with grounded neutral point. Connecting the line filter to another network will damage the line filter.

- Only connect the line filter to a line supply with grounded neutral point.

NOTICE

Line filter damage due to interchanged connections

The line filter will be damaged if the input and output connections are interchanged.

- Connect the incoming line supply cable to LINE L1, L2, L3.
- Connect the outgoing line to line reactor at LOAD L1', L2', L3' (U, V, W).

NOTICE

Damage to the system caused by a line filter that is not permissible

A line filter that is not permissible can cause system damage.

- Only use the line filter with the components specified in Chapter "Combination options of Line Modules with line reactors and line filters (Page 114)".

NOTICE

Damage caused by using third party filters

According to product standard IEC 61800-3, radio interference suppression corresponding to the application conditions is required, and is legally stipulated in the EU (EMC Directive). Line filters and line reactors are required in order to comply with this standard. The use of filters of other makes can lead to limit value violations, resonances, overvoltage, and irreparable damage to motors or other equipment.

- The machine manufacturer must provide verification that the machine equipped with the drive products and the installed suppression elements, e.g. line filters, is EMC-compliant before the machines are placed in the market.

NOTICE

Destruction or damage of components by incorrectly connecting the line filter

When incorrectly connecting the line filter, components can be destroyed or damaged.

- Connect the line filter in accordance with the instructions in the technical documentation.
- Do not connect any additional loads downstream of the line filter.

NOTICE

Damage caused by connecting several loads to the same line infeed point

Damage can be caused if several loads are connected to the same line infeed point.

- Provide interference suppression for the other loads using appropriate line filters. To prevent mutual interference, it is not permissible that this line filter is equipped with capacitors on the line side with respect to ground. A filter from the B84144A*R120 (EPCOS) series is recommended.

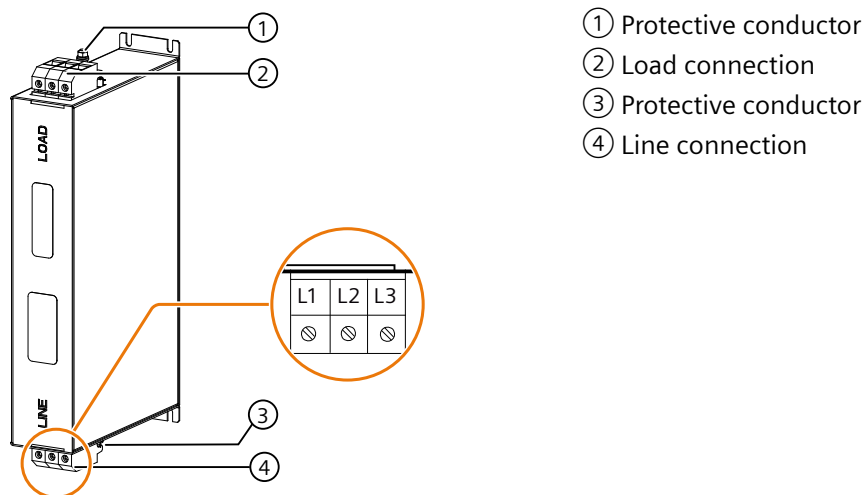
Note

Disconnect the line filter for a high-voltage test

If a high-voltage test is conducted in the system with an alternating voltage, you must disconnect the line filters in order to obtain a correct measurement result.

4.5.3 Interface description

Overview



You can use either the upper or lower screw to connect the protective conductor. One of the screws remains unused. "Looping-through" the protective connection to the line reactor is not permissible.

Line and load connections

Table 4-3 Line and load connections, Basic Line Filter for Smart Line Modules

Article number	6SL5100-	
	0HE21-6DD0	0HE22-4DD0
Rated power [kW]	16	24
Line connection L1, L2, L3	Screw terminals 6 ... 16 mm ² (AWG 6 ... AWG 10), 3-pin	Screw terminals 6 ... 16 mm ² (AWG 6 ... AWG 10), 3-pin
Load connection L1', L2', L3'	2.0 ... 2.2 Nm (17.7 ... 19.5 lbf in)	2.0 ... 2.2 Nm (17.7 ... 19.5 lbf in)
Protective conductor connection ¹⁾	M8 5.7 ... 6.3 Nm (55.7 lbf in)	M8 5.7 ... 6.3 Nm (55.7 lbf in)
¹⁾ For ring cable lugs without insulation		

The maximum cable length between line filter and line reactor and between line reactor and Smart Line Module is 10 m.

4.5 Line filters

4.5.4 Dimension drawing

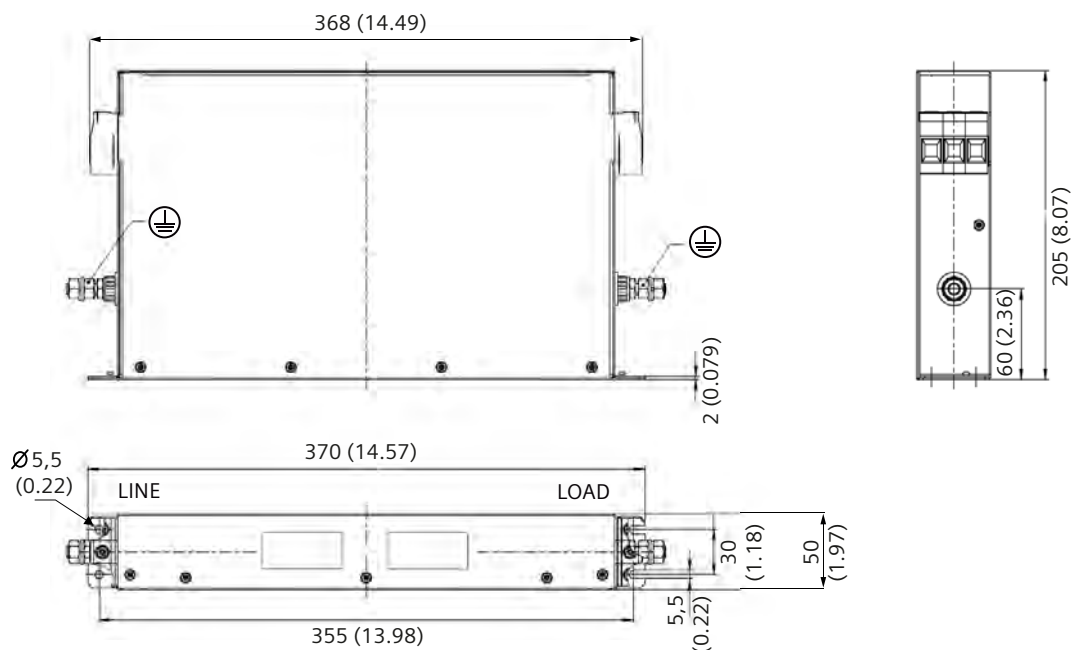


Figure 4-3 Dimension drawing of Basic Line Filter for the 16 kW and 24 kW Smart Line Modules, all data in mm and (inches)

4.5.5 Technical data

Table 4-4 Technical data, Basic Line Filter for S220 Smart Line Modules

Article number	6SL5100-		
		OHE21-6DD0	OHE22-4DD0
Rated power	kW	16	24
Supply voltage: Line voltage Line frequency	V _{AC} Hz	3 AC 380 ... 480 50/60 (47 ... 63)	
Rated current	A _{AC}	30	44
Power loss (see power loss tables (Page 143))	W	12.0	22.0
Total cable length (according to IEC 61800-3)		See "Combination options of Smart Line Modules with line filters and line reactors (Page 114)"	
Degree of protection according to IEC 60529		IPXXB	IPXXB
Weight	kg	5.0	5.0
Mounting position		Vertical or horizontal	

4.6 Line reactors

Line reactors are interfaces on the line side for the Smart Line Modules. These limit line harmonics to permissible values. This is the reason that you must always use line reactors when operating Smart Line Modules.

4.6.1 Overview of line reactors

The line reactors listed below must be used for operating the Line Module.

Table 4-5 Overview of line reactors

Line reactors	Article number
Line reactors for S220 Smart Line Modules	
16 kW C type	6SL3100-0EE21-6AA0
16 kW D type	6SL5100-0EE21-6AD0
24 kW C type	6SL5100-0EE22-4AC0
24 kW D type	6SL5100-0EE22-4AD0

4.6.2 Safety instructions for line reactors



CAUTION

Burns resulting from high surface temperature of the line reactor

The line reactors can become very hot. You can get seriously burnt when touching the surface.

- Mount the line reactors so that contact is not possible. If this is not possible, attach clearly visible and understandable warning notices at hazardous positions.
- To prevent adjacent components from suffering damage due to these high temperatures, maintain a ventilation clearance of 100 mm on all sides of the line reactors.

NOTICE

Damage to the system caused by line reactors that are not permissible

Line reactors that are not permissible can damage the Line Modules.

Line harmonics that damage/disturb other loads connected to the same line supply can also occur.

- Only use line reactors that are listed in this Equipment Manual.

4.6 Line reactors

Note

Malfunctions through magnetic fields

Line reactors produce magnetic fields that can disturb or damage components and cables.

- Arrange the components and cables at a suitable distance (at least 200 mm) or shield the magnetic fields appropriately.

Note

Length of connecting cables

The connecting cables between line reactor and Line Module, as well as between line reactor and line filter, must be kept as short as possible (max. 10 m).

Use shielded connecting cables and connect the cable shields at both ends.

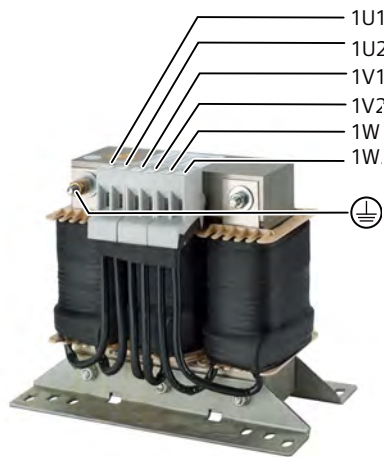
Shielding is not required if the following preconditions are satisfied:

- The cables do not exceed 1 m in length.
- The cables are laid flush with the rear metal panel of the control cabinet.
- The cables are laid in a way that keeps them physically separate from signal cables.

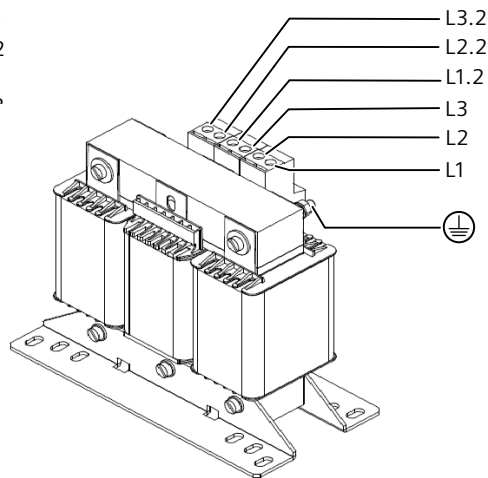
All signal cables must be laid separately from the line reactor and from unshielded connecting cables of the reactor with a minimum clearance of 200 mm.

4.6.3 Interface description

Overview



6SL3100-0EE21-6AA0



6SL5100-0EE21-6AD0, 6SL5100-0EE22-4AC0,
6SL5100-0EE22-4AD0

Line and load connections

Table 4-6 Line and load connections, line reactors for Smart Line Modules

Article number	6SL3100-	6SL5100-		
	0EE21-6AA0	0EE21-6AD0	0EE22-4AC0	0EE22-4AD0
Line connection	1U1, 1V1, 1W1	L1, L2, L3	L1, L2, L3	L1, L2, L3
Load connection	1U2, 1V2, 1W2	L1.2, L2.2, L3.2	L1.2, L2.2, L3.2	L1.2, L2.2, L3.2
Terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals
Line connection and load connection	10 mm ² (AWG 8) 1.5 ... 1.8 Nm (15.9 lbf in)	16 mm ² (AWG 10) 2.5 Nm (22.1 lbf in)	16 mm ² (AWG 10) 2.5 Nm (22.1 lbf in)	16 mm ² (AWG 10) 2.5 Nm (22.1 lbf in)
Protective conductor connection	Terminal studs M6 ¹⁾	Screw M6 6 Nm (53.1 lbf in)	Screw M6 6 Nm (53.1 lbf in)	Screw M6 6 Nm (53.1 lbf in)

¹⁾ For ring cable lugs without insulation

4.6.4 Dimension drawings

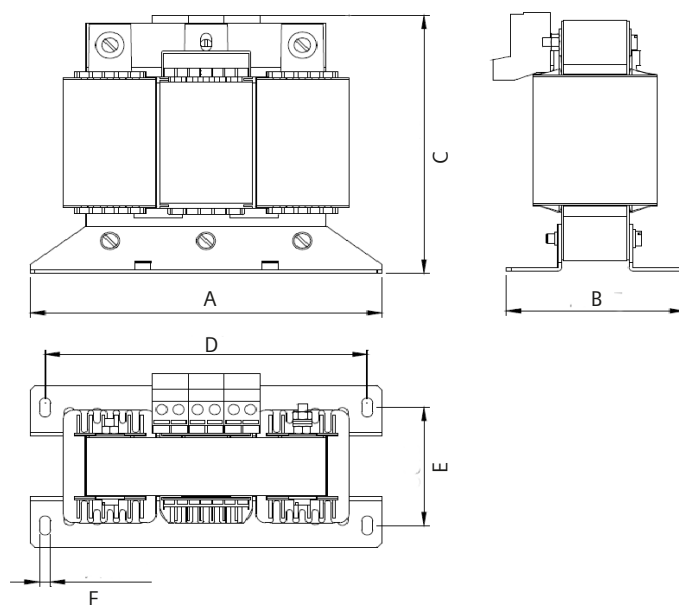


Figure 4-4 Dimension drawing of line reactors for 16 kW and 24 kW Smart Line Modules, all dimensions in mm and (inches)

Article number	Dimensions, all dimensions in mm and (inches)											
	A		B		C		D		E		F	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
6SL3100-0EE21-6AA0	219	8.62	110.5	4.35	176	6.93	201	7.91	80.5	3.17	7.0 x	0.28
6SL5100-0EE21-6AD0											13	x 0.51
6SL5100-0EE22-4AC0	219	8.62	126	4.96	195	7.68	201	7.91	96	3.78	7.0 x	0.28
6SL5100-0EE22-4AD0											13	x 0.51

4.6 Line reactors

4.6.5 Technical data

Table 4-7 Technical data, line reactors for S220 Smart Line Modules

Article number		6SL3100-	6SL5100-		
		0EE21-6AA0	0EE21-6AD0	0EE22-4AC0	0EE22-4AD0
Rated current	A_{rms}	29	29	43.5	43.5
Power loss ¹⁾ (see power loss tables (Page 143))	W	90	90	92	92
Total cable length (according to IEC 61800-3)		See "Combination options of Smart Line Modules with line filters and line reactors (Page 114)"			
Degree of protection according to IEC 60529		IPXXB	IPXXB	IPXXB	IPXXB
Weight	kg	9.0	9.0	15.5	15.5
Mounting position		Vertically upright or hanging horizontally			

¹⁾ Applies to a line voltage of 400 V.

Smart Line Modules

5.1 Description

The Smart Line Module is a non-regulated infeed/energy recovery unit. The Smart Line Module supplies the Motor Modules with a non-regulated DC voltage at the DC link busbars. In infeed mode, the Smart Line Module exhibits the typical current and voltage waveforms of a 6-pulse diode rectifier bridge.

Smart Line Modules are suitable for direct operation on TN, TT and IT systems.

In the energy recovery mode, the current waveform is square waved.

16 kW and 24 kW Smart Line Modules are equipped with a DRIVE-CLiQ connection, which means that when required, you can deactivate energy recovery using parameter p3533.

The DC link starts precharging as soon as the line voltage is applied and is independent of its phase sequence direction. Load can be applied to the DC link after the Smart Line Module has been enabled.

A main contactor can be installed on the line side if the system has to be electrically isolated from the line supply.

Note

Operation on line supplies where energy recovery is not possible

For line supply systems without energy recovery capability (e.g. a diesel generator), device faults can occur as the braking energy cannot be dissipated.

- Deactivate the energy recovery function of the Smart Line Modules using parameter p3533.
 - The braking energy must then be dissipated via an additional Braking Module with braking resistor in the drive lineup.
-

5.2 Overview

Table 5-1 Overview of Smart Line Modules

Rated power [kW]	Width [mm]	C type	D type
		Article number 6SL5130-	
16	100	6UE21-6AC0	6UE21-6AD0
24	100	6UE22-4AC0	6UE22-4AD0

5.3 Safety instructions for Smart Line Modules Booksize



WARNING

Electric shock when the protective flap of the DC link is open

Contact with live parts can result in death or serious injury.

- Only operate the components with closed protective flap.



WARNING

High leakage currents when the protective conductor in the line supply cable is interrupted

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Carefully comply with the applicable regulations for dimensioning the protective conductor (see Chapter "Protective connection and equipotential bonding").



WARNING

Electric shock due to improper DC link connection

Incorrect connections can cause overheating and so fire and smoke development. There is also a risk of an electric shock. This can result in serious injury or death.

- When connecting to the DC link, only use the DC link adapter that has been approved by Siemens.



WARNING

Electric shock due to missing DC link side covers

Live parts are exposed if the DC link side covers are not fitted. Contact with these live parts could cause an electric shock.


- Mount the side covers on the first and last component in the drive lineup.
- Order any missing side covers (Article number: 6SL3162-5AA00-0AA0).

WARNING

Fire due to overheating resulting from power cables with inadequate cable cross-sections

Power cables with excessively low cross-sections can cause them to overheat. This can result in severe injury or death due to fire and smoke.

- Only use power cables with sufficiently large cross-sections. Take into account the routing type, ambient temperature and cable length.

 WARNING
Fire due to overheating when the total length of the power cables is exceeded
Overheating can result when the total length of the power cables is exceeded. This can result in severe injury or death due to fire and smoke.
<ul style="list-style-type: none">• Ensure that the total length of all power cables (motor supply cables and DC link cables) does not exceed the values specified in Chapter "Combination options of Line Modules with line reactors and line filters".

NOTICE
Damage through use of incorrect DRIVE-CLiQ cables
Damage or malfunctions can occur on the devices or system when DRIVE-CLiQ cables are used that are either incorrect or have not been approved for this purpose.
<ul style="list-style-type: none">• Only use suitable DRIVE-CLiQ cables that have been approved by Siemens for the particular application.

Note

Malfunctions due to polluted DRIVE-CLiQ interfaces

Malfunctions can occur in the system through the use of polluted DRIVE-CLiQ interfaces.

- Cover unused DRIVE-CLiQ interfaces with the supplied blanking covers.
-

Note for UL applications

Note

Overload protection for Smart Line Modules

The Smart Line Module has integrated overload protection according to UL 61800-5-1.

Ensure that overload protection is active by following the instructions below:

- The protection threshold is 115 % of the rated output current of the Smart Line Module.
 - Using the appropriate configuration, ensure that when the Smart Line Module develops a fault condition, a pulse inhibit is set for the Motor Modules connected to the DC link.
-

5.4 Frequency with which the DC link is precharged

The frequency with which the DC link capacitance is precharged via the Line Module is determined using the following formula:

$$\text{Number of pre-charging operations within 8 minutes} = \frac{\text{Max. permissible DC link capacitance Line Module in } \mu\text{F}}{\Sigma\text{DC link capacitance of the configured drive line-up in } \mu\text{F}}$$

The DC link capacitances of the individual components can be taken from the relevant technical data.

5.5 Line failure buffer concept

You must dimension the system comprising Line Modules and Motor Modules so that at the rated power there is no functional restriction (3 ms of the line supply dip or interruption according to IEC 61800-3 (2017)).

General statements cannot be made regarding the specified times. The times can be extended a multiple number of times depending on the particular drive system and the operating conditions. Significantly longer times can be obtained when components operate in either the motoring or generating mode. You must assess each specific installation.

5.6 Interface description

5.6.1 Interface overview

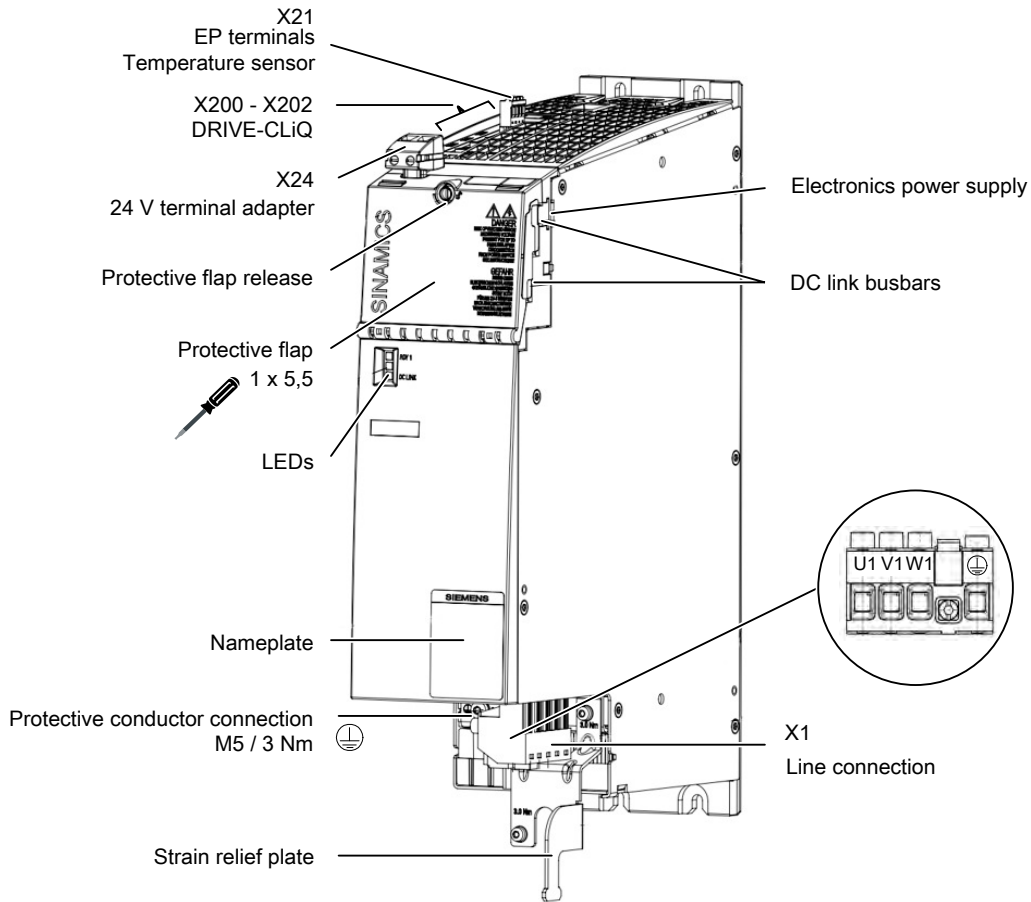
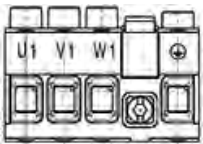



Figure 5-1 Interface overview, 16 kW and 24 kW Smart Line Modules

5.6.2 X1 line connection

Table 5-2 X1: Line connection for Smart Line Modules 16 kW and 24 kW

X1: Line connection	Terminal	Function	Technical specifications
	U1	Line connection	Supply voltage: 380 ... 480 V 3 AC, 50/60 (47 ... 63) Hz
	V1		
	W1		
		Protective conductor connection at the power plug	1.2 ... 1.5 Nm (10.6 lbf in)

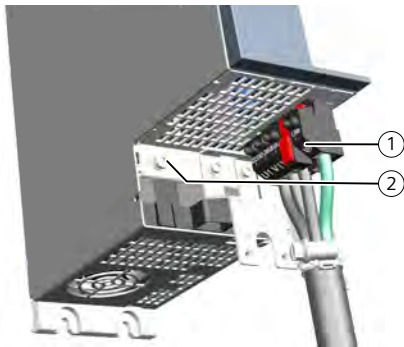
5.6 Interface description

X1: Line connection	Terminal	Function	Technical specifications
Connectable cable cross-sections	Flexible		6 ... 16 mm ²
	With end sleeve, without plastic sleeve		6 ... 16 mm ²
	With end sleeve, with plastic sleeve		6 ... 16 mm ²
Stripped length	12 mm (0.47 inch)		10 ... 6
Tool	Slotted screwdriver, 1.0 x 5.5 mm		
Tightening torque	1.2 ... 1.5 Nm (10.6 lbf in)		

1) For ring cable lugs without insulation

The power plug is included in the scope of supply.

5.6.3 Protective conductor connection



- ① Protective conductor connection at the power plug
- ② Protective conductor connection at the housing

You can connect the protective conductor either at the power plug or at the housing.

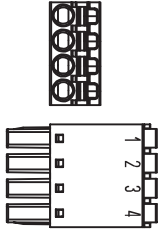
The protective conductor connection at the housing is located next to the strain relief plate.

Protective conductor connection at the housing	Technical specifications
Screw	M5
Ring/pipe-type cable lug	M5
Tool	Torx screwdriver T20
Tightening torque	3 Nm (26.6 lbf in)

For further information about protective connections, please refer to Chapter "Protective connection and equipotential bonding (Page 138)".

5.6.4 X21 EP terminal / temperature sensor

Table 5-3 X21: EP terminal/temperature sensor for 16 kW and 24 kW Smart Line Modules

X21: EP terminal/ temperature sensor	Terminal	Function	Technical specifications
	1	+ Temp	Temperature sensors ¹⁾²⁾ : Pt1000 ³⁾ / PTC ³⁾ / KTY84-130 ³⁾ / bimetallic switch with NC contact
	2	- Temp	
	3	EP +24 V (pulse enable)	Voltage: 24 V DC (20.4 ... 28.8 V) Current consumption, typical: 4 mA at 24 V Isolated input
	4	EP M (Enable Pulses)	
Connectable cable cross-sections	Rigid, flexible Flexible with end sleeve, without plastic sleeve With end sleeve, with plastic sleeve AWG / kcmil	0.25 ... 1.5 mm ² 0.25 ... 1.5 mm ^{2 1)} 0.25 ... 0.75 mm ² 24 ... 16	
Stripped length	8 mm (0.31 inch)		

¹⁾ The temperature sensor type and the temperature output can be selected by parameter (see the SINAMICS S120/S150 List Manual).

²⁾ Accuracy of the temperature measurement (temperature sensor, including evaluation):
 - Pt1000: ± 5 °C (Pt1000 tolerance Class B acc. to DIN EN 60751)
 - PTC: ± 5 °C
 - KTY: ± 7 °C

³⁾ Temperatures are detected but not evaluated in the Smart Line Module.

Terminals X21.1 and X21.2 - temperature sensor connection

You can use terminals X21.1 and X21.2 to perform an external temperature measurement.

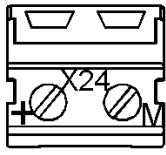
Terminals X21.3 and X21.4

For operation, the 24 V DC voltage must be connected to terminal X21.3 and ground to terminal X21.4.

A pulse inhibit is activated when disconnecting the power supply. As a consequence, energy recovery is deactivated and the bypass relay drops out. If the Smart Line Module is not disconnected from the line supply when the EP terminal is de-energized, for example, because a main contactor is not installed, then the DC link remains charged.

5.6.5 X24 24 V terminal adapter

Table 5-4 X24: 24 V terminal adapter

X24: 24 V terminal adapter	Terminal	Function	Technical specifications
	+	24 V power supply	24 V DC supply voltage
	M	Ground	Electronics ground
Connectable cable cross-sections		Flexible with end sleeve, without plastic sleeve Flexible with end sleeve, with plastic sleeve AWG / kcmil	0.5 ... 6 mm ² 0.5 ... 6 mm ² 0.5 ... 6 mm ² 20 ... 8
Stripped length		12 mm (0.47 inch)	
Tool		Screwdriver 1.0 x 4.0 mm	
Tightening torque		1.2 ... 1.5 Nm (10.6 ... 13.3 lbf in)	

The 24 V terminal adapter is included in the scope of supply.

5.6.6 Meaning of the LEDs

The Smart Line Module has 3 LEDs on the front cover. The upper LED (RDY 1) and the lower LED (DC LINK) are active.

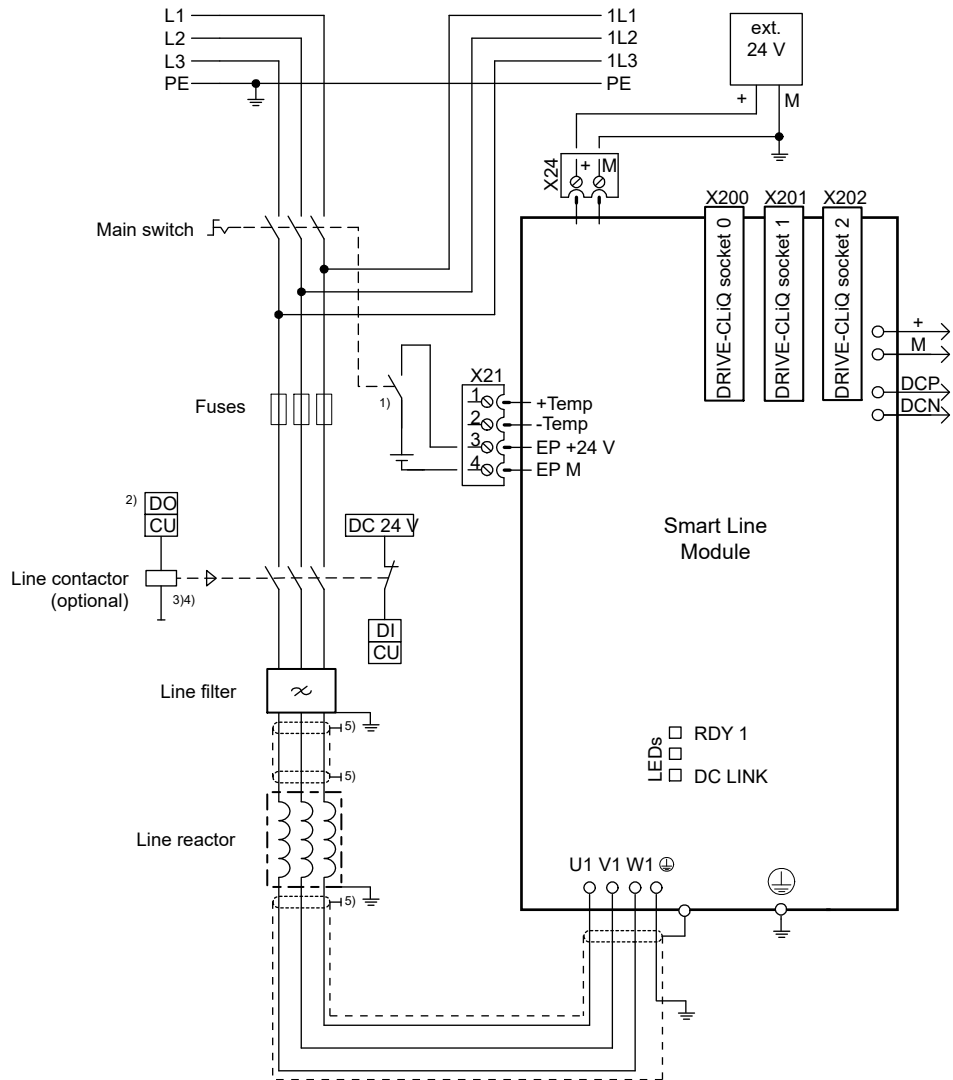
Table 5-5 Meaning of the LEDs on the Smart Line Module

Status		Description, cause	Remedy
LED RDY 1	DC LINK		
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
Green	-- ¹⁾	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is outside the permissible tolerance range.	Check the line voltage.
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	-- ¹⁾	This component has at least one fault.	Resolve and acknowledge the fault.
Green/red (0.5 Hz)	-- ¹⁾	Firmware is being downloaded.	–

Status		Description, cause	Remedy
LED RDY 1	DC LINK		
Green/red (2 Hz)	-- ¹⁾	Firmware download has been completed. The system waits for POWER ON.	Carry out a POWER ON.
Green/orange or red/orange (2 Hz)	-- ¹⁾	Component recognition via LED is activated (p0124=1). Note: Whether the LED flashes green/orange or red/orange depends on the status the LED had during activation (setting of parameter p0124 to "1").	–

¹⁾ Irrespective of the status of the LED "DC LINK"

5.7 Connection example



- 1) Leading opening contact $t > 10$ ms
When using a VSM10, the leading opening contact is not required.
- 2) DI/DO, controlled by the Control Unit
- 3) No additional load permitted downstream of the line contactor
- 4) Observe the current-carrying capacity of the digital output. It may be necessary to use an output coupling link.
- 5) Contact is established through the rear panel or shield rails in accordance with the EMC installation guideline

Figure 5-2 Connection example for 16 kW and 24 kW Smart Line Modules

5.8 Dimension drawing

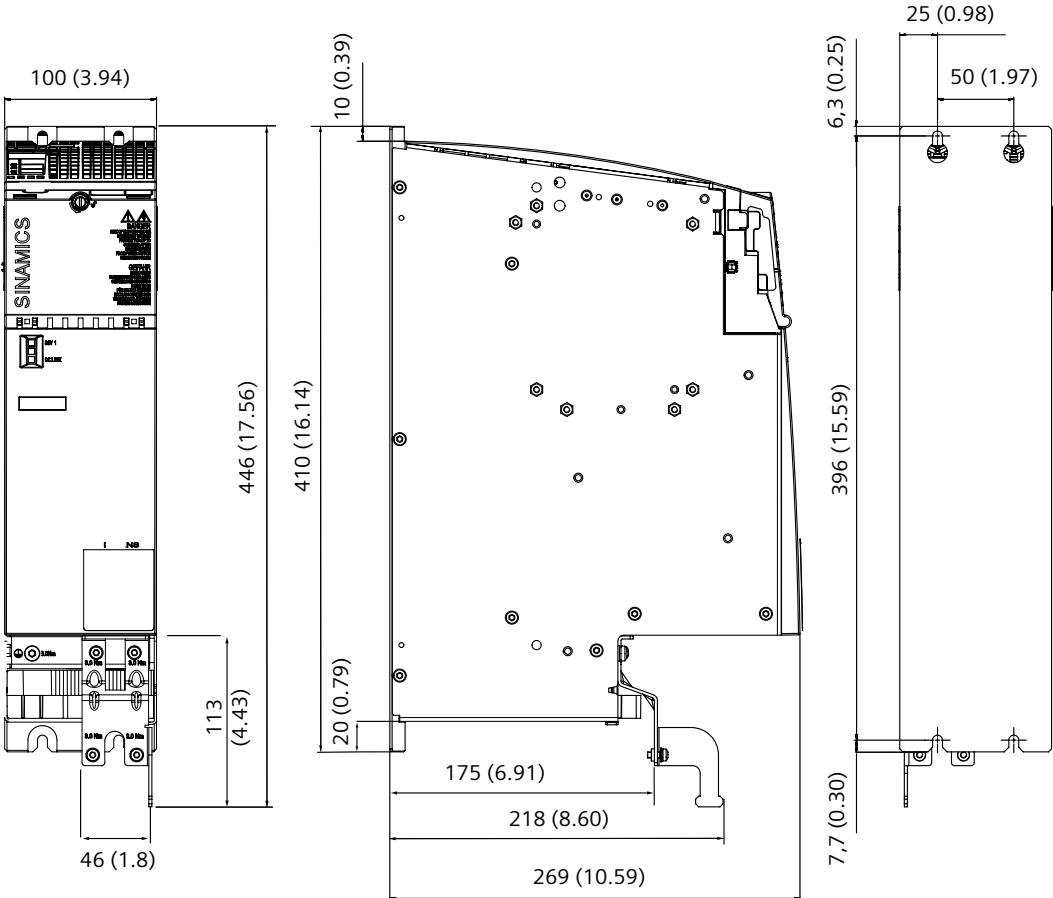


Figure 5-3 Dimension drawing of 16 kW and 24 kW Smart Line Modules, all dimensions in mm and (inch)

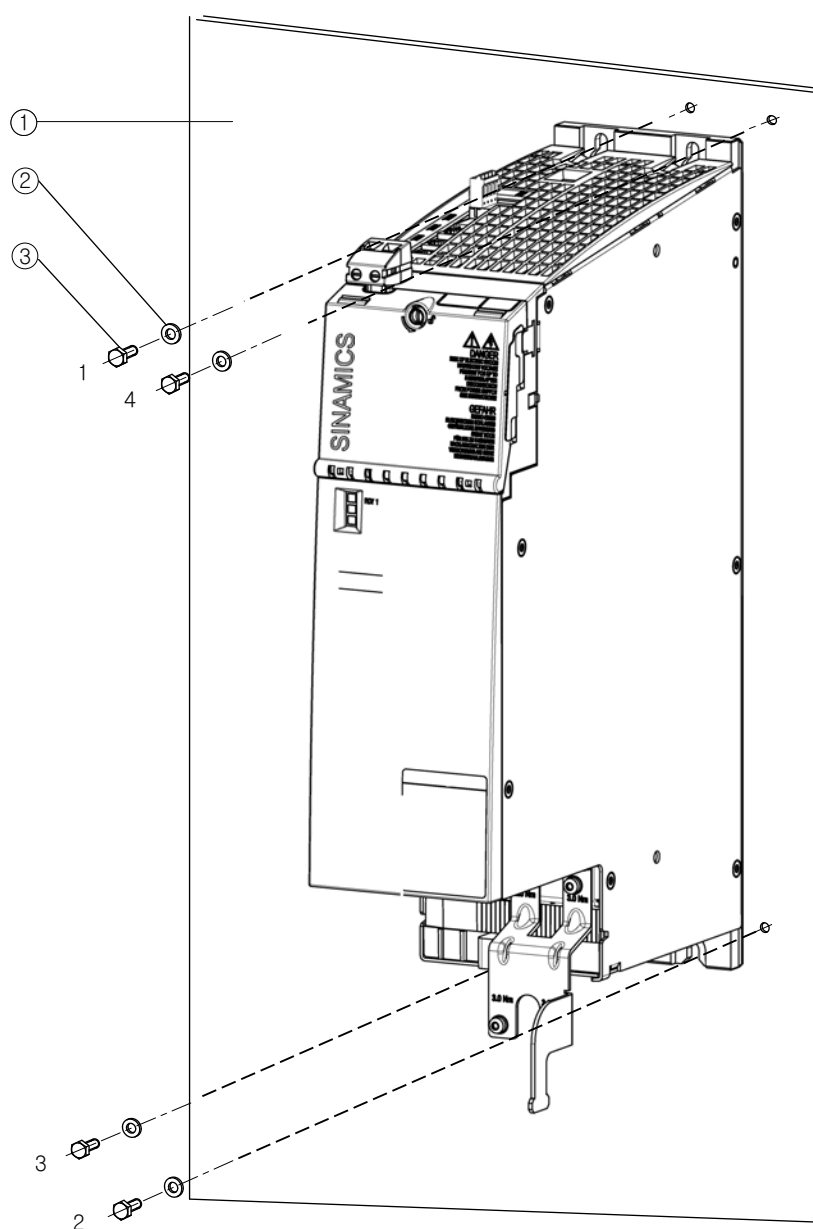
5.9 Installation

Smart Line Modules are designed to be vertically installed in the control cabinet. They are fixed to the control cabinet panel or a mounting panel using M6 screws.

NOTICE
Overheating of components due to incorrect mounting position
Incorrectly installed components can overheat during operation. Overheating can lead to malfunctions and component damage.
<ul style="list-style-type: none">• Only install the components in a permissible mounting position in the control cabinet.

Requirements placed on the control cabinet

- Housing: Sheet steel
- Panel thickness: 3 mm (0.12 in)
- Tensile strength: ≥ 270 N/mm² acc. to DX51 EN 10346



- ① Control cabinet panel/mounting panel
- ② Washer
- ③ M6 screw

Figure 5-4 Installation of a Smart Line Module

Tightening torques:

1. Initially, only tighten the nuts by hand.
Tightening torque: 0.5 Nm (4.4 lbf in)
2. Then tighten the nuts in the specified sequence 1 to 4.
Tightening torque: 6 Nm (53.1 lbf in)

5.10 Technical data

Table 5-6 Technical data, S220 Smart Line Modules Booksize 16 kW and 24 kW

Article number: 6SL5130-		6UE21-6AC0	6UE21-6AD0	6UE22-4AC0	6UE22-4AD0
		C type	D type	C type	D type
Performance data					
Rated power at 380 V / 400 V / 480 V	kW	16 / 16.8 / 20.2	16 / 16.8 / 20.2	24 / 25.3 / 30	24 / 25.3 / 30
Maximum power at 380 V / 400 V / 480 V	kW	35 / 37 / 51	48 / 51 / 61	48 / 51 / 61	72 / 76 / 91
Input data		380 ... 480 V 3 AC $\pm 10\%$ (-15 % < 1 min)			
Line voltage	V _{AC}	50/60 Hz (47 ... 63 Hz)			
Line frequency	Hz	24 -15 % $\pm 20\%$			
Electronics power supply	V _{DC}				
Rated current	A _{AC}	29	29	43	43
Maximum current	A _{AC}	62	86	86	129
Output data		495 ... 720 (typically 1.35 x line voltage)			
DC link voltage	V _{DC}	820 $\pm 2\%$			
Overvoltage trip	V _{DC}	360 ... 446 $\pm 2\%$ ¹⁾			
Undervoltage trip	V _{DC}				
Rated current	A _{DC}	33	33	49	49
Peak current	A _{DC}	71	97	97	146
Current-carrying capacity					
DC link busbars	A _{DC}	200	200	200	200
24 V DC busbars	A _{DC}	20	20	20	20
Electronics current drawn					
At 24 V DC	A _{DC}	0.70	0.70	0.70	0.70
Total power loss²⁾	W	150	150	200	200
DC link capacitance					
Smart Line Module	μF	820	820	940	940
Drive lineup, max.	μF	20000	20000	20000	20000
Power factor	cos ϕ	0.98			
Circuit breaker (IEC 60947 and UL)		See Chapter Overcurrent protection using line fuses and circuit breakers (Page 39)			
Total cable length³⁾		See Chapter Combination options of Line Modules with line reactors and line filters (Page 114)			
Sound pressure level	dB(A)	< 70	< 70	< 70	< 70
Cooling method		Internal fan			
Cooling air requirement	m ³ /h	77	77	77	77
Ventilation clearances above/below	mm	≥ 80			
Weight	kg	8.2	8.2	8.2	8.2

¹⁾ Depends on the parameterized line voltage.

²⁾ Total power loss, including electronics losses, see power loss tables.

³⁾ Maximum total cable length = Σ motor cables, line supply cable from the line filter to the Line Module

5.11 Characteristics

Rated duty cycles S220 Smart Line Modules

Note

Maximum power, P_{max}

If the maximum power of the Smart Line Module is less than 300% of the rated power, then the specified maximum power P_{max} is restricted to the maximum power.

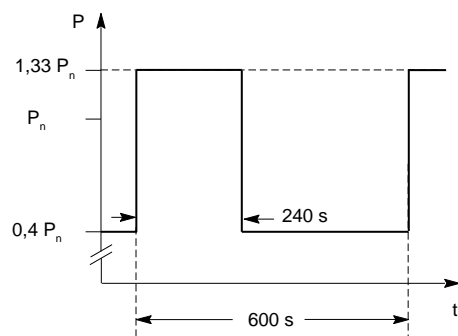


Figure 5-5 S6 duty cycle with initial load for a duty cycle duration of 600 s

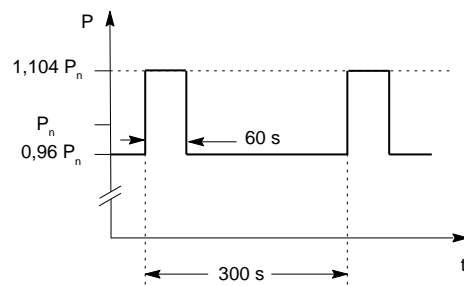


Figure 5-6 Duty cycle with low overload for a duty cycle duration of 300 s

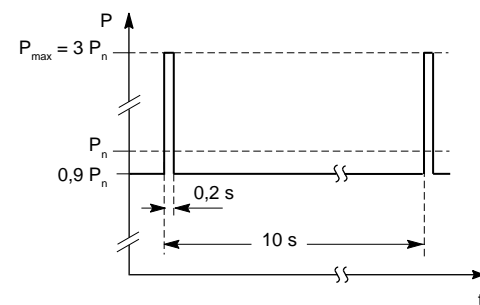


Figure 5-7 Peak power duty cycle with 0.2 s overload for a duty cycle duration of 10 s

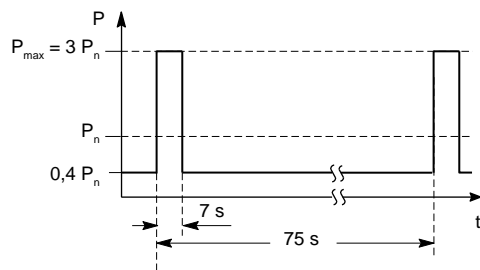


Figure 5-8 Peak power duty cycle with 7 s overload for a duty cycle duration of 75 s

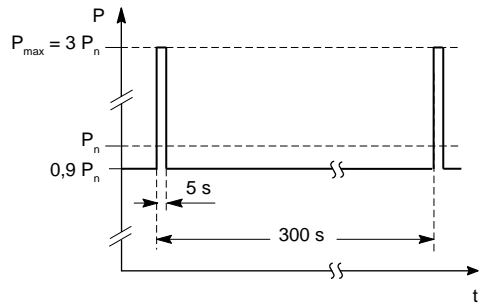


Figure 5-9 Peak power duty cycle with 5 s overload for a duty cycle duration of 300 s

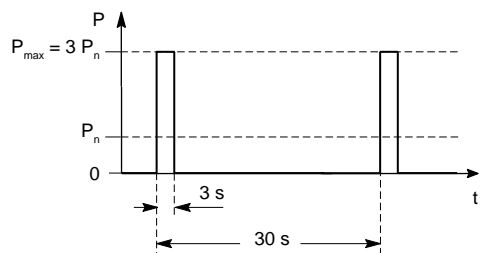


Figure 5-10 Spindle duty cycle with 3 s overload for a duty cycle duration of 30 s

Accessories

6.1 DC link adapter

6.1.1 Description

The following DC link adapters are used to individually supply a component. This means that the component is connected separately to the DC link. The internal DC link busbar is not used in this case. This DC link adapter is supplied in unit quantities of 1.

6SL3162-2BD00-0AA0

Rated current: 43 A



6SL3162-2BE00-0AA0

Rated current: 72 A



Requirements for supplying several components

If you use the DC link adapter to supply several components that are mounted directly adjacent to one another, then the installation must meet the following requirements:

- Mount the DC link adapter on the component to the far right.
- Configure the cross-section of the connecting cables according to the power demand of all connected components. You must protect the connecting cables accordingly.

Note

When using DC link adapters and DC link busbars, the limit values (radio interference suppression) to comply with Category C2 according to IEC 61800-3 can no longer be guaranteed.

6.1 DC link adapter

The following DC link adapter is required if the drive lineup must be distributed across two or more tiers. It can be mounted on all Line Modules and Motor Modules.

6SL3162-2BM01-0AA0



6.1.2 Safety instructions for DC link adapters



! WARNING

Electric shock due to the residual charge of the DC link capacitors

Because of the DC link capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off.

Contact with live parts can result in death or serious injury.

- Do not open the protective flap of the DC link until 5 minutes have elapsed.
- Verify that the DCP and DCN DC link terminals are de-energized before starting any work.



! WARNING

Electric shock when the protective flap of the DC link is open

Contact with live parts can result in death or serious injury.

- Only operate the components with closed protective flap.



! WARNING

Electric shock due to improper DC link connection

Incorrect connections can cause overheating and so fire and smoke development. There is also a risk of an electric shock. This can result in serious injury or death.

- When connecting to the DC link, only use the adapter that has been approved by Siemens (DC link adapter).



! WARNING

Electric shock if the cutout in the protective flap has been broken out

Live components are exposed and accessible if the DC link adapters (6SL3162-2BD00-0AA0 and 6SL3162-2BE00-0AA0) are removed. Touching live components can result in death or serious injury.

- Replace the protective flap with the broken out cutouts with a new protective flap.



! WARNING

Electric shock or fire if the necessary clearances and creepage distances are not complied with

When using non-insulated end sleeves, the required clearances and creepage distances for the DC link adapter (6SL3162-2BD00-0AA0) are not complied with. This can result in flashover between the cables and the undesirable formation of arcs. As a consequence, there is a risk of electric shock and fire.

- Only use DC link connecting cables with insulated end sleeves.

! WARNING

Fire and device damage as a result of ground fault/short-circuit

The DC link connecting cables must be laid so that a ground fault or short-circuit is impossible. A ground fault can cause a fire with smoke development.

- Comply with local installation regulations, which allow this fault to be ruled out.
- Protect the cables against mechanical damage.

Also implement one of the following measures:

- Use cables with double insulation.
- Maintain adequate clearance, e.g. by using spacers.
- Lay the cables in separate cable ducts or conduits.

! WARNING

Fire due to overheating when permissible power cable lengths are exceeded

Excessively long power cable lengths can cause components to overheat with the associated risk of fire and smoke.

- Ensure that the total length of the DC link including the connecting cables does not exceed 10 m.



! WARNING

Electric shock due to incorrectly laid 24 V supply cables

If supply cables are laid without safe electrical separation, the insulation can fail with an electric shock.

- Maintain a clearance of at least 100 mm between the 24 V supply cables and the DC link connecting cables.
- Or use cables with double insulation (e.g. sheathed cables) for the 24 V supply cables.

6.1 DC link adapter

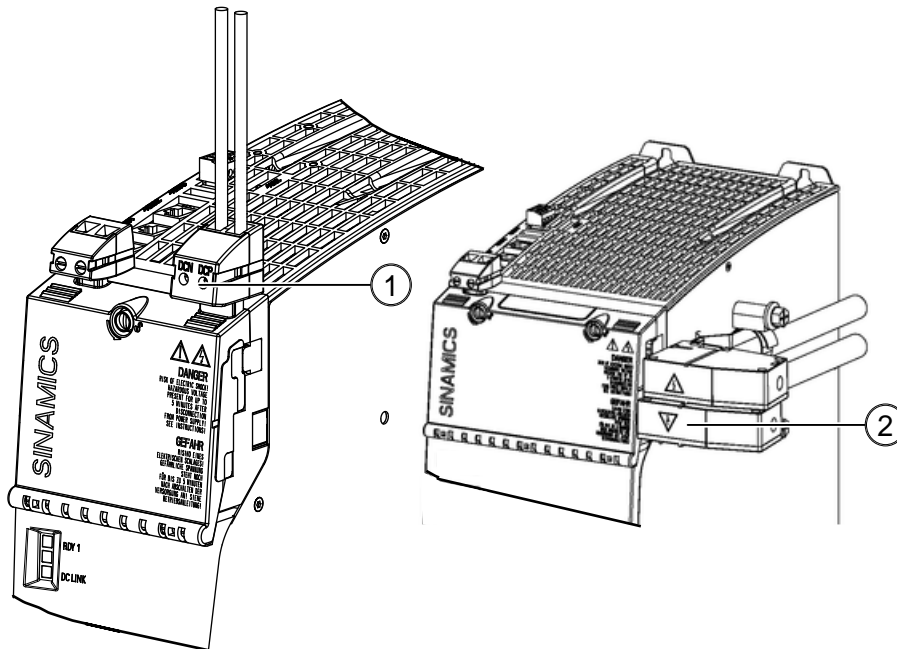
⚠ WARNING

Fire as a result of incorrectly dimensioned overcurrent protective devices in the DC link connecting cable

Incorrectly dimensioned overcurrent protective devices can result in a fire and associated smoke.

- Protect personnel and prevent fires by dimensioning the overcurrent protective devices in the DC link connecting cable corresponding to the particular application.
- Comply with local installation regulations.
- Carefully check the overcurrent protective device to ensure that it functions perfectly, and maintain it regularly in accordance with local installation regulations.

6.1.3 Interface description



- ① Mounted DC link adapter 6SL3162-2BD00-0AA0, rated current: 43 A for a 100 mm wide component
- ② Mounted DC link adapter 6SL3162-2BM01-0AA0 for a 150 mm wide component (for multi-tier configurations)

Table 6-1 DC link connection (6SL3162-2BD00-0AA0 and 6SL3162-2BE00-0AA0)

Terminal	Function	Technical specifications
DCP	DC link positive	Supply voltage: 495 ... 720 V _{DC}
DCN	DC link negative	

6.1.4 Dimension drawings

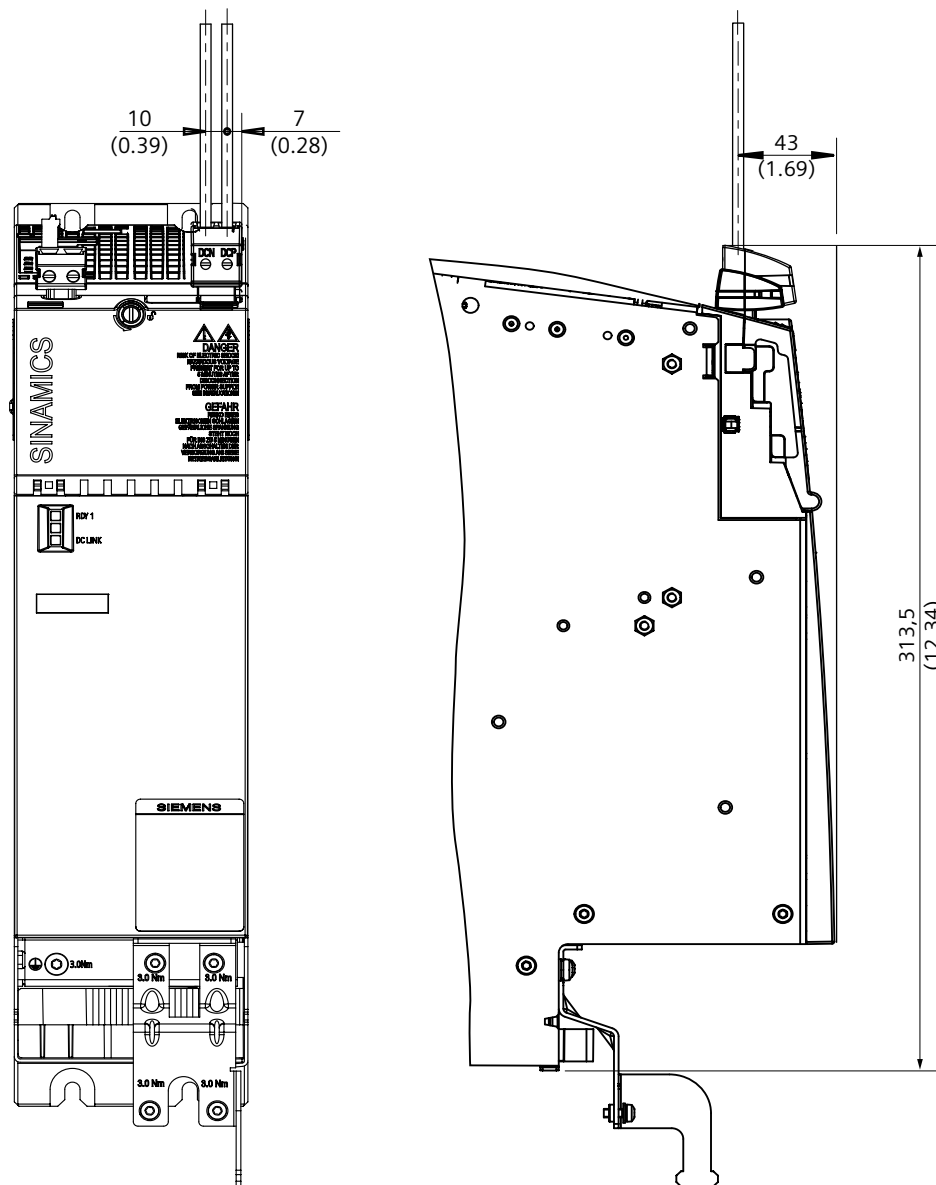


Figure 6-1 Dimension drawing for a 100 mm wide S220 component (Smart Line Module) with 43 A DC link adapter (6SL3162-2BD00-0AA0), all dimensions in mm and (inches)

6.1 DC link adapter

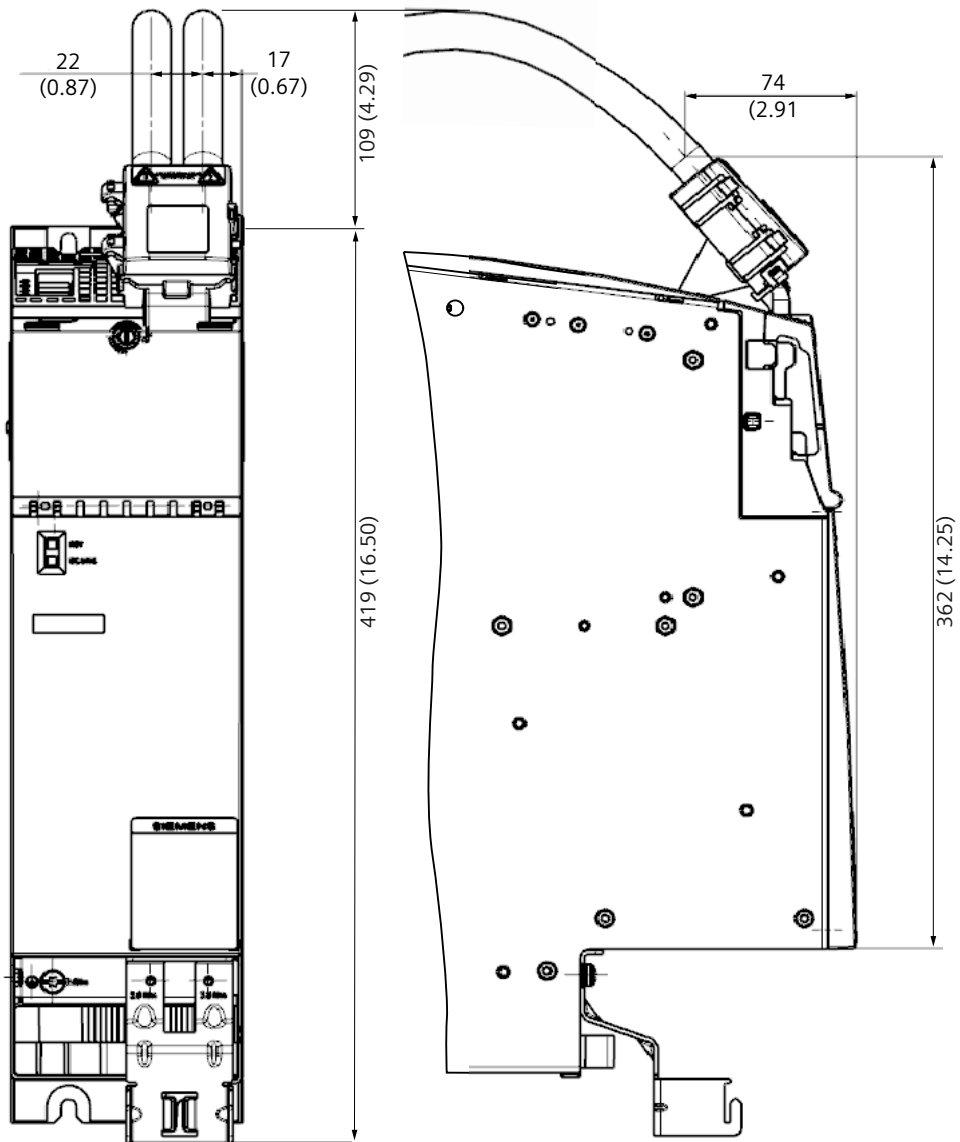


Figure 6-2 Dimension drawing of a 100 mm wide S120 component with 72 A DC link adapter (6SL3162-2BE00-0AA0), dimensions in mm and (inch)

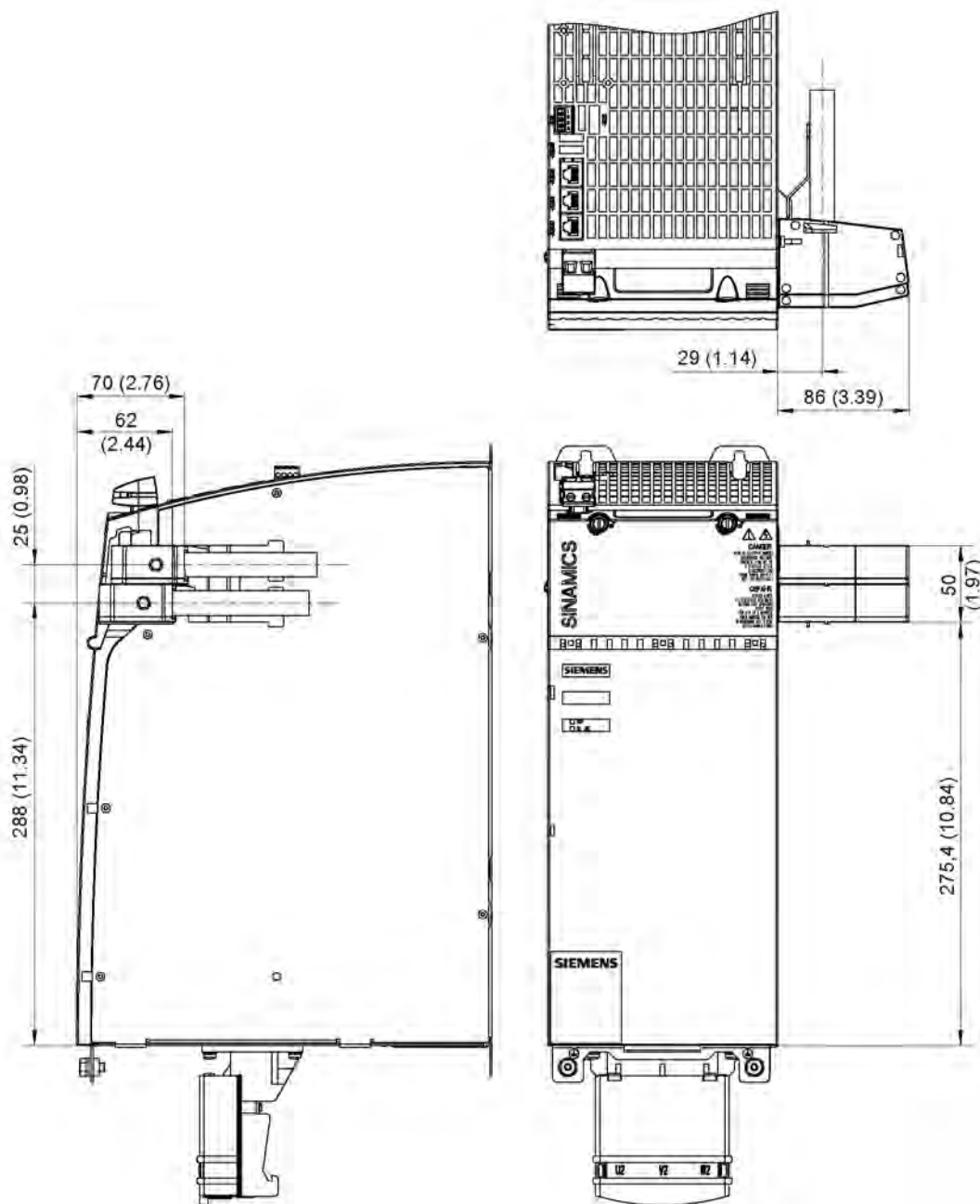


Figure 6-3 Dimension drawing of a 150 mm wide S120 component with DC link adapter (6SL3162-2BM01-0AA0), all dimensions in mm and (inch)

6.1.5 Mounting

Opening the protective flap, removing the DC link screws and mounting the DC link adapter are identical for S220 and S120 components. The procedure for S120 components is described in the next section.





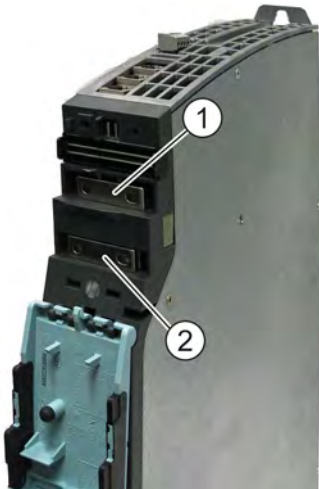
6.1 DC link adapter

6.1.5.1 Opening the protective flap and removing the DC link screws

Required tools:

- Flat bladed screwdriver (1 x 5.5) for releasing the protective flap

Table 6-2 Opening the protective flap and removing the DC link screws

 <p>1 x 5,5</p>	 <p>T20</p>	
<p>1. Release and open the protective flap.</p>	<p>2. Remove the upper left-hand screw and the DC link bridge</p>	<p>3. Remove the lower left-hand screw and the DC link bridge</p>
	 <p>1</p> <p>2</p>	<p>To install the DC link adapter, it is essential to leave the DC link busbars ① and ② in the component (hold firmly to prevent them falling out).</p>
<p>4. Remove the upper and lower right-hand DC link screw.</p>		

6.1.5.2 43 A DC link adapter (6SL3162-2BD00-0AA0)

If you are using the DC link adapter to supply several components, then you must install it on the component to the far right.

Required tools:

- Torx T10 screwdriver to fasten the 24 V terminal adapter
- Torx screwdriver T20 for DC link screws (Torx slot)
- Pliers for breaking out the cutouts

Table 6-3 Installing the DC link adapter and 24 V terminal adapter

<p>1. Screw the DC link adapter on the right-hand side of the component using the original M4x20 screws.</p>	<p>Do NOT use the screw holes on the left-hand side of the component.</p>	<p>3. Attach and screw on the 24 V terminal adapter using the associated screw (provided in the accessories pack).</p>
<p>4. Breakout the cutouts in the protective flap.</p>	<p>5. Close the protective flap until you hear it snap into place.</p>	<p>Component with mounted DC link adapter and 24 V terminal adapter</p>

6.1.5.3 72 A DC link adapter (6SL3162-2BE00-0AA0)

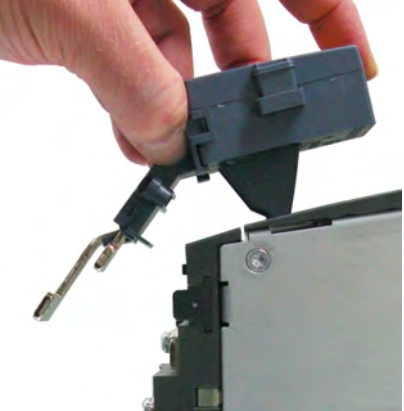





If you are using the DC link adapter to supply several components, then you must install it on the component to the far right.

6.1 DC link adapter

Required tools:

- Torx T10 screwdriver to attach the adapter
- Torx screwdriver T20 for DC link screws (Torx slot)
- Pliers for knocking out the cutouts

Table 6-4 Mounting the 72 A DC link adapter

		
<p>1. Engage the DC link adapter in the grille.</p>	<p>2. Press it down.</p>	<p>3. Fasten the adapter busbars using the M4x20 screws (Torx 20; 1.8 Nm / 16 lbf-in) that were previously removed.</p>
		
<p>4. Fasten the DC link adapter using the associated screw provided in the accessories pack (Torx 10; 0.8 Nm / 7 lbf-in).</p>	<p>5. Break out the cutout in the protective flap.</p>	<p>Mounted DC link adapter with closed protective flap.</p>

6.1.5.4 DC link adapter (6SL3162-2BM01-0AA0)

By moving the adapter housing, the DC link adapter can be attached to either the left-hand or right-hand side of the component.



WARNING

Electric shock when touching the DC link busbars

Contact with live parts can result in death or serious injury.

- The DC link adapters must be installed so that, after closing the DC link cover, the DC link busbars cannot be touched!



WARNING

Electric shock due to incorrectly mounted DC link bridges

Incorrectly installed DC link bridges at the left-hand end of the drive lineup can cause an electric shock.

- For all components that are 75 mm wide or wider, you must neither swing the DC link bridges out of the component to the left nor remove them.

Note

- When mounting with only 2 screws, use the inner hole of the adapter busbar.

Washers

DC link adapters are supplied with washers, which are attached using a securing strap at the inner hole of the DC link busbar. You must use these washers if you mount a DC link adapter onto the left-hand side of a 150 to 300 mm wide component (one for each screw). In all other cases, it is not permissible that you use these.

Additional information on using the washers is provided in Chapter "DC link adapters" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Required tools:

- Flat bladed screwdriver (1 x 5.5) for releasing the protective flap
- Torx screwdriver T20 for DC link screws (Torx slot)

6.1 DC link adapter

Table 6-5 Mounting the DC link adapter (example for a 150 mm wide component)

<p>1. Fasten the DC link adapter (1.8 Nm / 15.9 lbf in) using the previously removed screws. Use the right-hand holes ①.</p>	<p>2. Remove the DC link side cover, install the 24 V terminal adapter (if required) and close the protective flap until it audibly clicks into place.</p>
	<p>Mounted DC link adapter and 24 V terminal adapter</p>

6.1.6 Electrical connection

The electrical connection of the DC link adapter is identical for S220 and S120 components. The procedure for S120 components is described in the next section.

6.1.6.1 Connectable conductor cross-sections for UL applications

The selection of the cross-section for the DC link connecting cables depends on the power demand of all connected components. You can find the values of the DC link current for the respective component in the technical data.

Select the higher of the following two values:

- Cross-section based on the DC link output current of the Line Module.
- Cross-section based on the DC link current of the Motor Module.

The following cross-sections refer to cables for 75 °C:

Table 6-6 Approved AWG conductor cross-sections for the S220 Smart Line Modules

S220 Smart Line Modules		
Rated power	16 kW	24 kW
AWG conductor cross-sections	AWG 8	AWG 6

Table 6-7 Approved AWG conductor cross-sections for the S120 Motor Modules

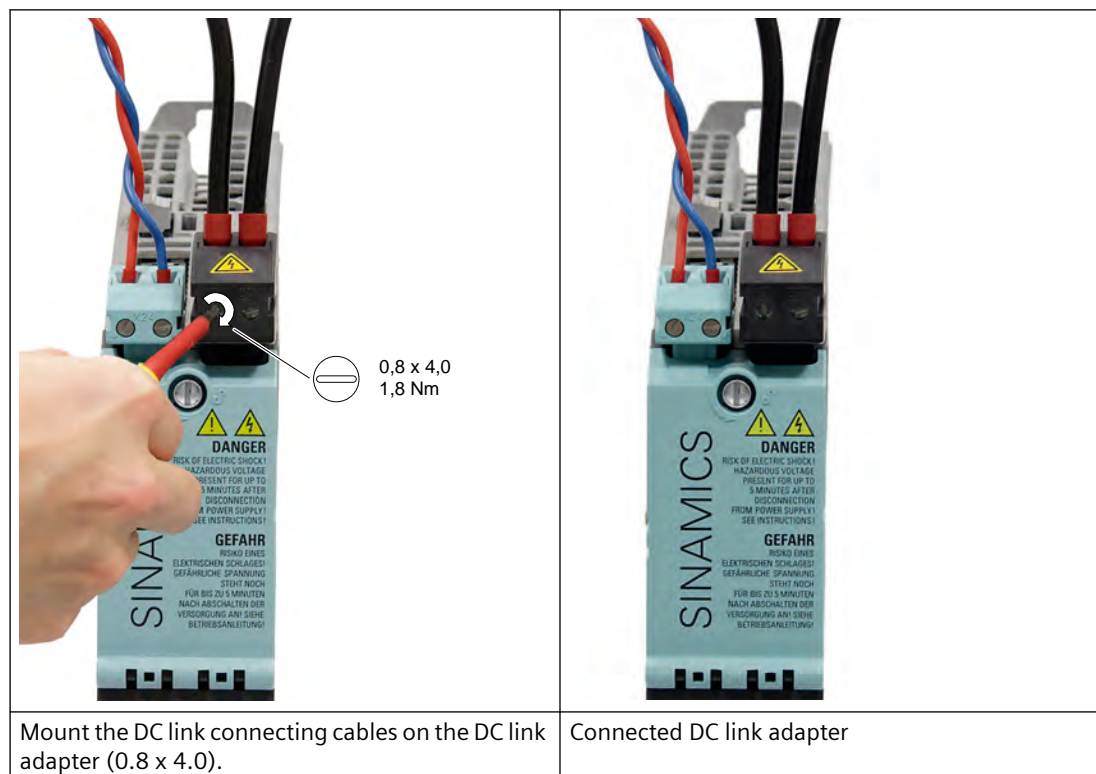
S120 Motor Modules								
Rated current	3 A, 5 A, 9 A, 2x1.7 A, 2x3 A, 2x5 A	18 A, 2x9 A	24 A, 30 A	2x18 A	45 A	60 A	85 A	132 A, 200 A
AWG conductor cross-sections	AWG 14	AWG 10	AWG 8	AWG 6	AWG 5	AWG 3	AWG 1	AWG 4/0

6.1.6.2 43 A DC link adapter (6SL3162-2BD00-0AA0)

Required tool:

- Flat bladed screwdriver (0.8 x 4.0)

Table 6-8 Electrical connection of the 43 A DC link adapter (6SL3162-2BD00-0AA0)



6.1 DC link adapter

6.1.6.3 72 A DC link adapter (6SL3162-2BE00-0AA0)

Required tools:



- Flat bladed screwdriver (1 x 5.5) for releasing the protective flap
- Socket wrench, 10 mm socket
- Pliers for knocking out the cutouts

Note

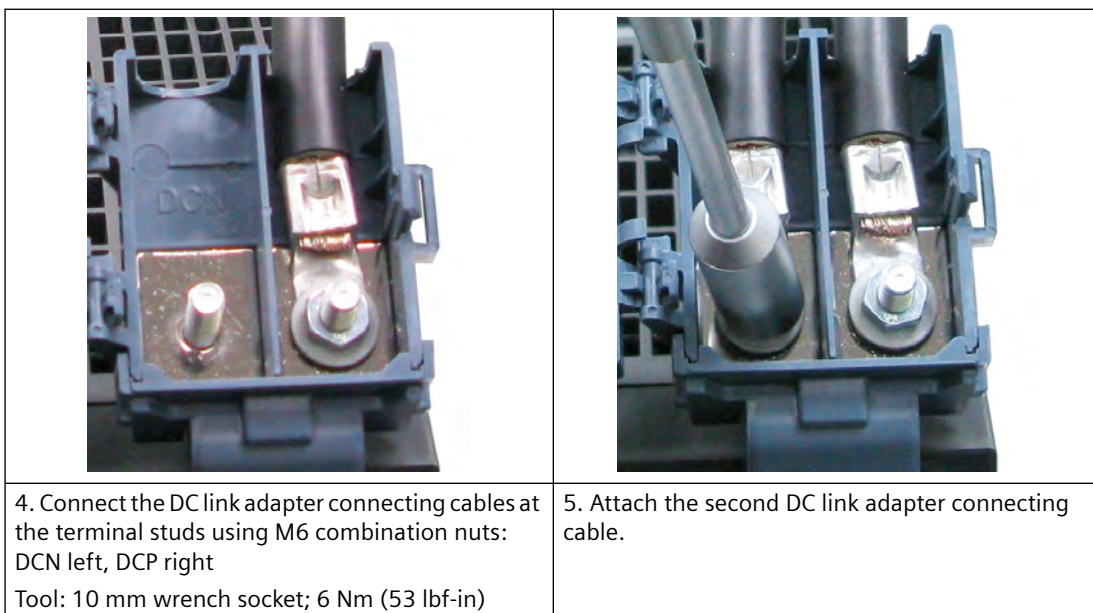
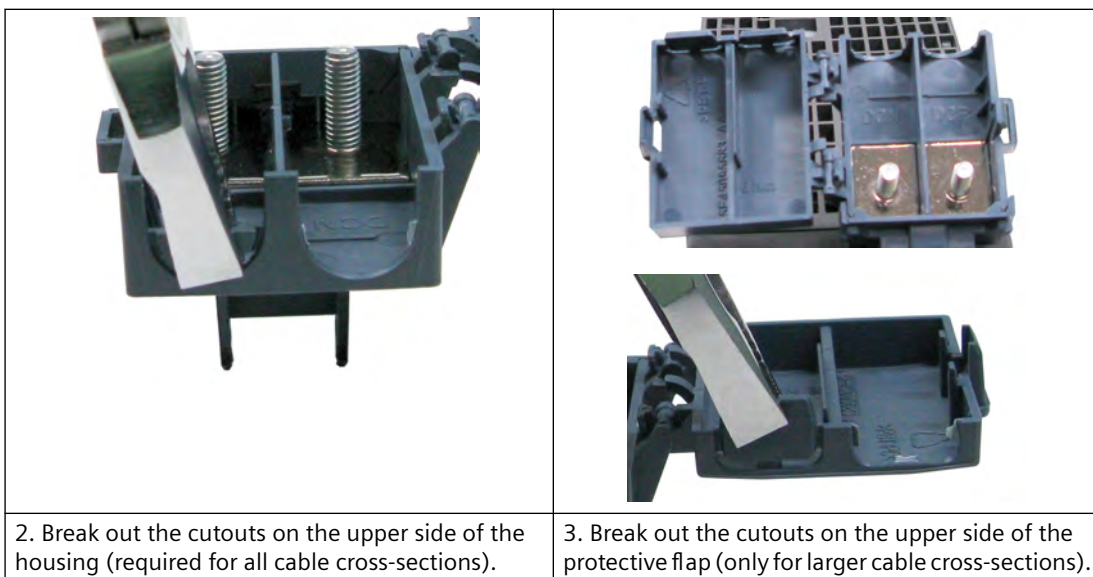
Using shrink sleeving

You must use shrink-on sleeves for all non-insulated current-carrying parts of cable lugs and cables with a clearance from bolts exceeding 32 mm (1.26 inches).

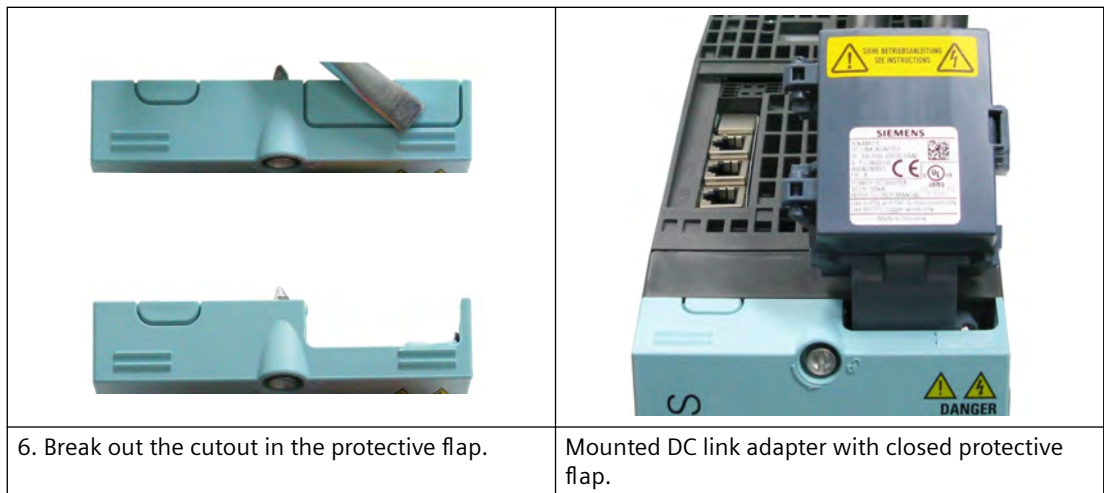
Table 6-9 Electrical connection of the 72 A DC link adapter (6SL3162-2BE00-0AA0)

	
<p>1. Release the protective flap of the DC link adapter using a flat bladed screwdriver 1 x 5.5.</p>	<p>Open adapter housing with terminal studs</p>

6.1 DC link adapter



6.1 DC link adapter



6. Break out the cutout in the protective flap.

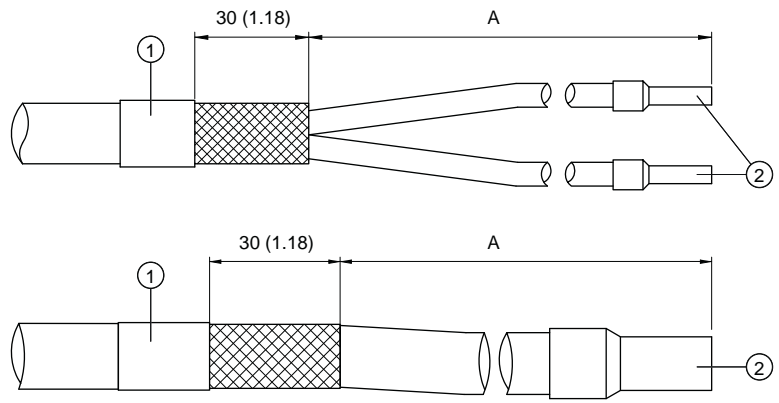
Mounted DC link adapter with closed protective flap.

6.1.6.4 DC link adapter (6SL3162-2BM01-0AA0)

Preparing the DC link connecting cables

To connect the various sub lineups, use shielded single wires that are mechanically secured.

1. Prepare the DC link connecting cables as shown below.



- ① Braided shield folded back and fixed using shrink sleeving
- ② Insulated end sleeve

Figure 6-4 Single-core and two-core DC link connecting cable with insulated end sleeves, all dimensions in mm and (inch)

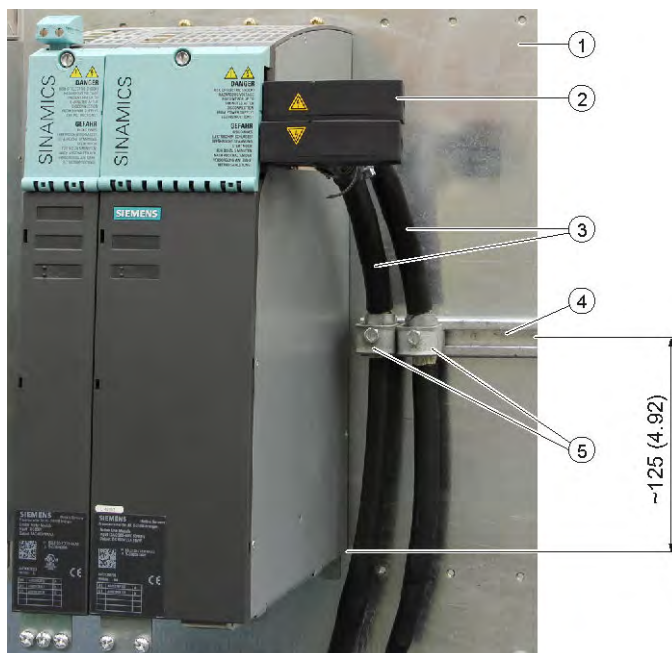
2. Only use shielded cables with insulated end sleeves.

Refer to the table below for dimension A:

Conductor cross-section [mm ²]	Mounting location of the DC link adapter at the drive lineup	Connection	A [mm]
35 / 50 / 70 / 95 / 120	Left / right	DCP	60
		DCN	70

Fixing the cables to the rear cabinet panel

1. Fix the DC link connecting cables directly next to the last component at the rear control cabinet panel. Use the C rails and the matching cable clamps from the Rittal company. The distance between the C rail and the lower side of the component is approximately 125 mm.
2. Appropriately insulate the cable cores at the connection location before mounting.



- ① Control cabinet panel
- ② DC link adapter
- ③ Cores of the DC link connecting cable
- ④ C rail from the Rittal company (article number 7831.570 / 7831.571)
- ⑤ Cable clamps for C rails from the Rittal company

Figure 6-5 Mounting the DC link adapter (6SL3162-2BM01-0AA0), dimensions in mm and (inch)

Cable connection and shield support

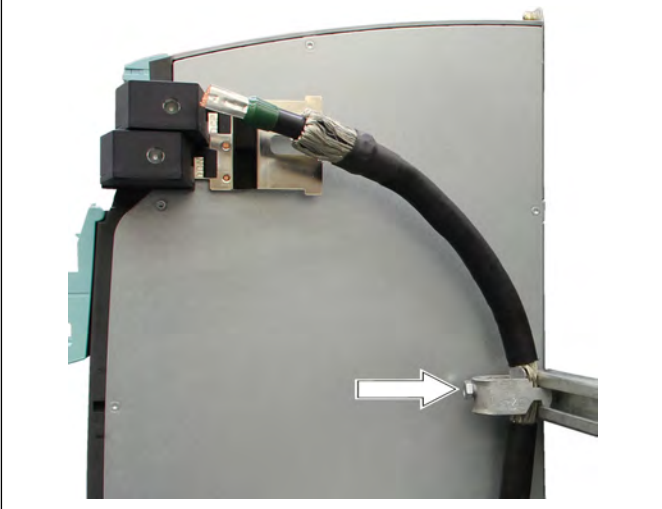

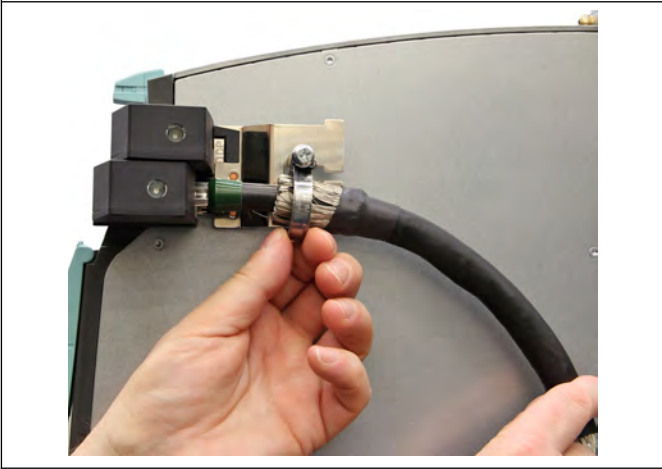
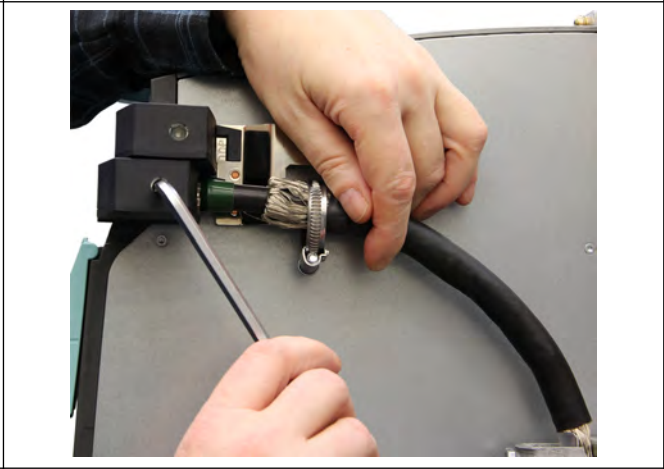
In order to simplify installing the DC link connecting cables at the DC link adapter, first fix the cables to the control cabinet panel (see diagram above).

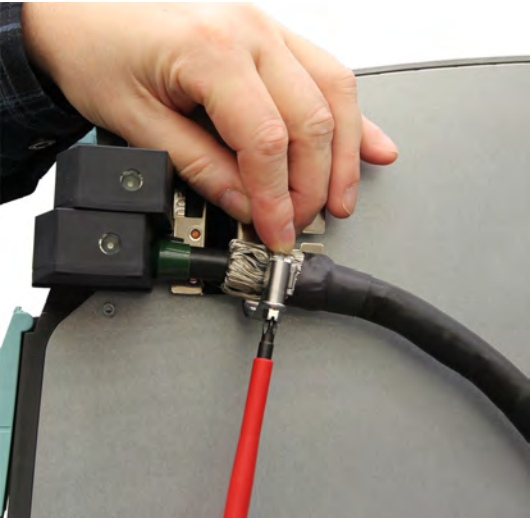
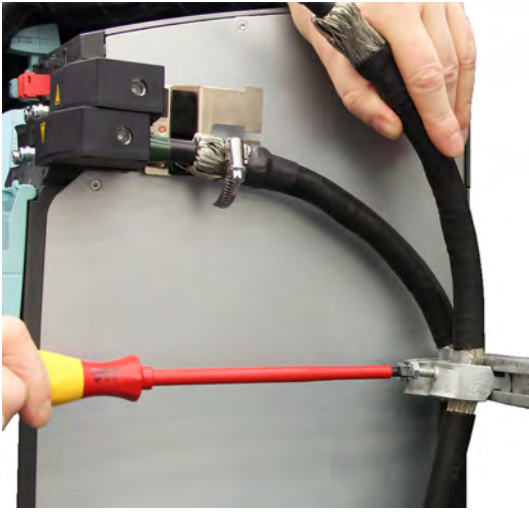

Required tools:

- Size 6 Allen key to attach the cables
- Suitable tool for hose clamps, e.g. flat-bladed screwdriver

6.1 DC link adapter

Table 6-10 Connecting the DC link connecting cables to the DC link adapter

	
<p>1. Fix the first conductor of the DC link connecting cable to the mounting rail using a cable clamp.</p>	<p>2. Route the cable end through an appropriate hose clamp.</p>
	
<p>3. Slide the hose clamp onto the contact plate, and then insert the end of the cable into the DCN connection of the DC link adapter.</p>	<p>4. Tighten the cable using an Allen key.</p>

	
<p>5. Tighten the screw of the hose clamp using a suitable screwdriver.</p>	<p>6. Fix the second conductor of the DC link connecting cable to the mounting rail using a cable clamp.</p> <p>Connect the cable for the DCP connection as described under Points 2 to 5.</p> <p>After installing the cables, ensure that the EMC contact plates of the DC link adapter are in contact with the side panel of the component.</p>
	<p>The installed DC link connecting cable is shown in the adjacent diagram.</p>

6.1.7 Technical data

Table 6-11 Technical data 43 A and 72 A DC link adapter

Article number	6SL3162-	2BD00-0AA0	2BE00-0AA0
Supply voltage	V_{DC}	495 ... 720	495 ... 720
Current-carrying capacity at 55 °C	A_{DC}	43	72
Conductor cross-section (flexible)	mm ² (AWG)	0.5 ... 10 (20 ... 6)	10 ... 35 (8 ... 2)

Accessories

6.1 DC link adapter

Article number	6SL3162-	2BD00-0AA0	2BE00-0AA0
Stripped length	mm	11	acc. to cable lug
Terminal Fixing screw Tightening torque	Nm (lbf in)	Slotted (0.8x4.0) 1.8 (15.9)	Torx T10 0.8 (7.1)
DC link busbars Fixing screw Tightening torque	Nm (lbf in)	Torx T20 1.8 (15.9)	Threaded bolts M6 6 (53)
Weight	kg	0.05	0.10

Table 6-12 Technical data DC link adapter (6SL3162-2BM01-0AA0)


Article number	Unit	6SL3162-2BM01-0AA0
Supply voltage	V _{DC}	495 ... 720
Current-carrying capacity attached using 2 screws attached using 4 screws	A _{DC} A _{DC}	150 200
Maximum ambient temperature	°C	55
Rated short-circuit current (SCCR)	kA	100
Conductor cross-section flexible	mm ² (AWG)	35 ... 120 (4 ... 4/0)
Stripped length	mm	27
Terminal Mounting Tightening torque	Nm (lbf in)	Hexagon socket-head screw size 6 13 (115)
DC link busbars Mounting Tightening torque	Nm (lbf in)	Torx-slotted screw T20 1.8 (15.9)
Weight	kg	0.34

6.2 Accessories for Smart Line Modules

6.2.1 Connection plug

The line supply cable is connected to the Smart Line Module using a connection plug (power connector).



	WARNING
Electric shock or fire caused by using non-certified plug connectors	
Using non-certified plug connectors to connect the power can result in overheating with associated fire or electric shock.	
<ul style="list-style-type: none"> • Only use approved plug connectors to connect the power. 	



6SL5166-2NA00-0AA0


Connection type: Screw connection

The connection plug is included in the scope of supply of the component and does not have to be ordered separately.

6.2.1.1 Pin assignment



- ① U1, V1, W1
- ② Catch
- ③ Protective conductor connection

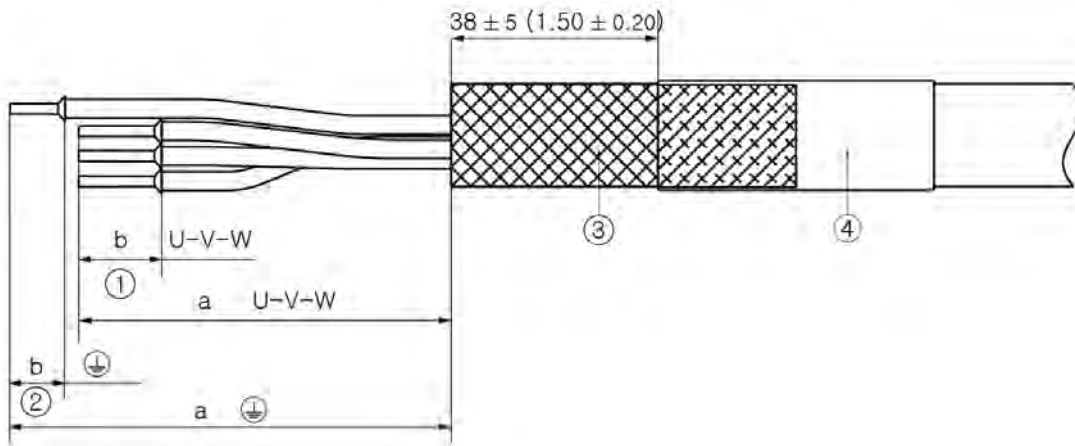
Terminal	Function	Technical specifications
U1	Line connection	Screw terminal
V1		
W1		
	Protective conductor connection at the power plug	
Conductor cross-section for cables with conductor end sleeves		6 ... 16 mm ² AWG 6 ... AWG 10

6.2 Accessories for Smart Line Modules

Terminal	Function	Technical specifications
Stripped length		12 mm (0.47 inch)
Tool		Slotted screwdriver, 1.0 x 5.5 mm
Tightening torque		1.2 ... 1.5 Nm (10.6 lbf in)

6.2.1.2 Preparing the power cables

Observe the following stripped lengths when connecting the connection plug and the cable shield.



- ① Insulated conductors U-V-W
- ② Protective insulated conductor
- ③ Braided shield
- ④ Shrink sleeving

Table 6-13 Insulated conductor and stripped lengths as a function of the cable cross-section, data in mm and (inch)

Connection	6 mm ² AWG 10		10 mm ² / 16 mm ² AWG 8 / AWG 6	
	a	b	a	b
U1	90 +2/-3	12 ±0.5	90 +2/-3	15 ±0.5
V1	(3.54+0.08/-0.12)	(0.47 ±0.02)	(3.54+0.08/-0.12)	(0.59 ±0.02)
W1				
Protective conductor	95 +2/-3	12 ±0.5	95 +2/-3	15 ±0.5
	(3.74 +0.08/-0.12)	(0.47 ±0.02)	(3.74 +0.08/-0.12)	(0.59 ±0.02)

Prepare the power cables as follows:

1. Remove the cable sheath to a length of 90 mm (3.54 in) with a tolerance of ±5 mm (±0.20 in).
2. Fold back the braided shield.
3. Fix the braided shield. Preferably use shrink sleeving with hot melt adhesive.
4. Shorten the single wires as specified in the table.
5. Strip the insulation from the single wires as specified in the table.
6. Use end sleeves according to DIN 46228 with the appropriate cross-section.

Note

Damage to the line supply cable due to excessively short stripped length

If the specified insulated conductor and stripped lengths are not complied with, single wires can be damaged or shield contact prevented.



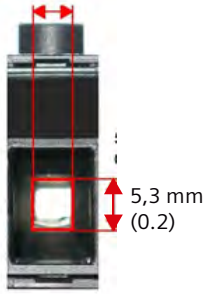
- Comply with the specified insulated conductor and stripped lengths.

Note

Cables for UL applications

Use only 75 °C copper cables for UL applications.

Table 6-14 End sleeves and recommended cable cross-sections

End sleeves and recommended cable cross-sections	Dimensions of the terminal openings
	6 mm ² AWG 10
	10 mm ² AWG 8
	16 mm ² AWG 6 ¹⁾
5,3 mm (0.2) 	

¹⁾ When crimped, end sleeves must not exceed the maximum dimensions of 5.3 x 5.3 mm (0.21 x 0.21 in), as otherwise single wires will not be able to be inserted or removed.

6.2.1.3 Crimping conductor end sleeves

The following crimping tool is available from Weidmüller to crimp conductor end sleeves (www.weidmueller.com).

- Type PZ 6/5, article number 9011460000

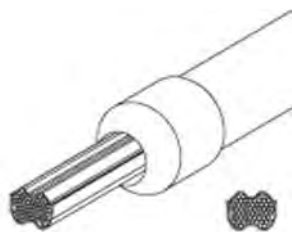


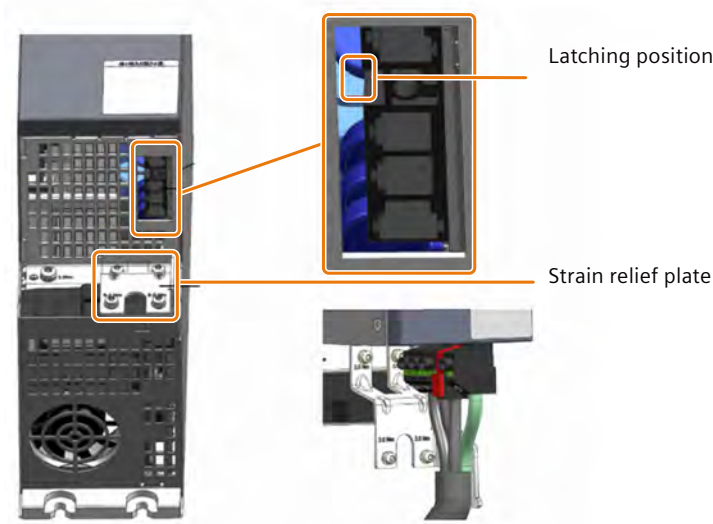
Figure 6-6 Crimp shape PZ 6/5

6.2.1.4 Connecting the cable



1. Starting with W1, V1, U1, insert the insulated conductors into the open terminals.
 - Ensure that the insulated conductors are inserted as far as they will go.
 - For larger cross-sections, it is helpful if U1, V1, W1 are simultaneously inserted and secured by screws.
2. Insert the protective conductor into the open terminals. Alternatively, you can connect the protective conductor at the housing.
3. Tighten the screws with a tightening torque of 1.2 ... 1.5 Nm (18 lbf in). Screwdriver: Slotted 1.0 x 5.5 mm

6.2.1.5 Installation



Insert the plug

1. Insert the plug into connection socket X1 at the Smart Line Module until it snaps into place. The plug has been completely inserted once you hear it snap into place.
2. Secure the cable using a cable tie to provide strain relief. For more information about shielding, see Chapter "Shield connection plate and terminal (Page 96)".

Withdraw the plug



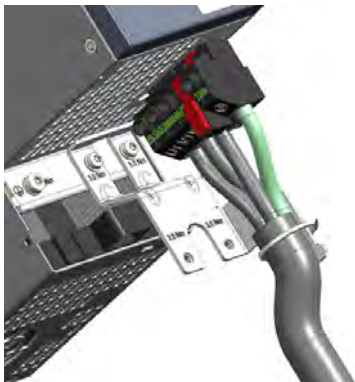
Variant 1 (left): Using one hand, hold the plug at the front and back. Release the plug using your other hand.

Variant 2 (right): Grasp the cable and release it with your thumb.

6.2.1.6 Secure with a cable tie

The latching does not provide reliable strain relief for the cable.

Use a cable tie to fasten the cable to the strain relief plate.

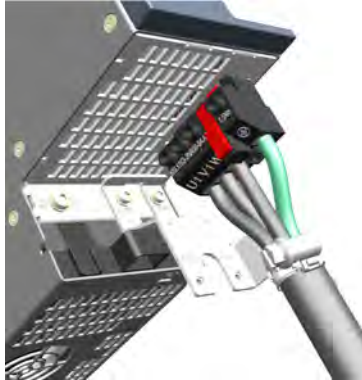


6.2.2 Shield connection plate and terminal

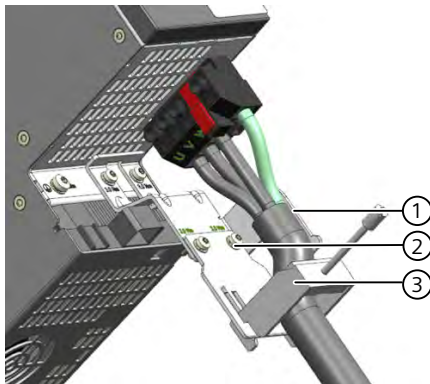
6.2.2.1 Option for the shielding

You can use one of the following two methods for connecting the shield:

- Connect the cable to the strain relief plate using a hose clamp.



- Use the optional shield connection plate in combination with a shield connection clamp. This provides for improved contacting and makes it easier to connect the shield.



- ① Strain relief plate (included in the scope of supply)
- ② Optional shield connection plate (6SL5166-1BD00-0AA0)
- ③ Shield connection clamp (8WH9130-0NA00 (Phoenix SK28) or 8WH9130-0PA00 (Phoenix SK35))

The optional shield connection plate, the shield connection clamps and the hose clamp are not included in the scope of supply of the Smart Line Module.

Note

Only use shielded connecting cables with the optional shield connection plate and the shield connection clamp.

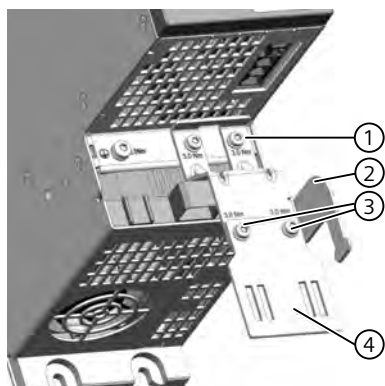
Note

Shielding is not required if at least one of the following conditions is satisfied:

- The cables must not be longer than 1 m.
- The cables are routed flush with the rear metal panel of the control cabinet.
- In the control cabinet, the cables are routed separately from the signal cables.

6.2.2.2 Shield support with optional shield connection plate

Only use shielded connecting cables with the optional shield connection plate. It is recommended that the cable is additionally fastened to the strain relief plate.



- ① Screws for fastening the strain relief plate
- ② Strain relief plate
- ③ Screws for fastening the optional shield connection plate
- ④ Optional shield connection plate with fastening for the shield connection clamp

Figure 6-7 Shield support for Smart Line Modules



Table 6-15 Optional shield connection plate

Designation	Article number	Tightening torque for ③
Optional shield connection plate	6SL5166-1BD00-0AA0	3 Nm (26.6 lbf in)

6.2 Accessories for Smart Line Modules

The optional shield connection plate has several slots, which provide various options for the shield support:

Table 6-16 Accessories for the shield support - shield connection clamp

Article number and designation	Recommended cable diameter	Torque
 8WH9130-0NA00 Phoenix SK28	up to 20 mm	0.8 Nm (7.08 lbf in)
 8WH9130-0PA00 Phoenix SK35	from more than 20 mm to a maximum of 35 mm	1.8 Nm (15.93 lbf in)

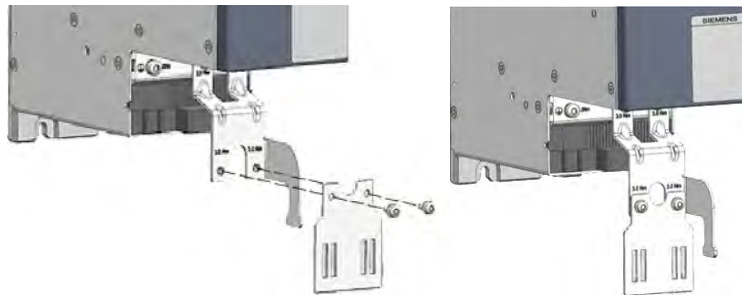
Mounting the optional shield connection plate

The connecting cable shield is attached to the shield connection plate of the Smart Line Module using the supplied shield connection clamp.

Required tool:

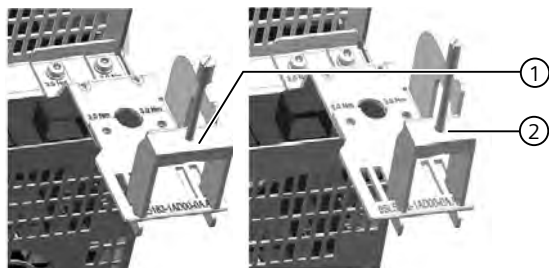
- T20 Torx screwdriver for the shield connection plate

1. Fasten the shield connection plate to the lower mounting points of the strain relief plate.



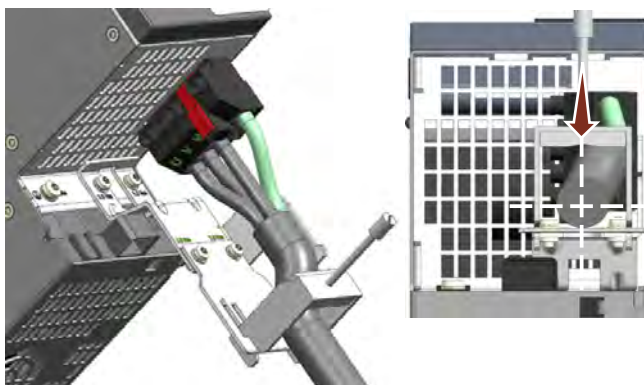
2. Tighten the two screws with a torque of 3 Nm (26.6 lbf in).
3. Insert the connection plug into connection socket X1 at the Smart Line Module until it snaps into place. The plug has been completely inserted once you hear it snap into place.

4. Insert the connecting cables into the center of the shield connection clamp. Hook the shield connection clamp into the slits of the shield connection plate.
Position of the shield connection clamp:



- ① Phoenix SK35 (8WH9130-0PA00)
- ② Phoenix SK28 (8WH9130-0NA00)

5. To fix the connecting cables, tighten the pressure plates of the shield connection clamps using the knurled screws.
 - The tightening torques are listed in the table above.
 - When doing this, carefully ensure that the connecting cable is positioned at the center of the clamp.



6.3 DRIVE-CLiQ cabinet bushings and coupling

DRIVE-CLiQ cabinet bushing

A DRIVE-CLiQ cabinet bushing is used to connect the DRIVE-CLiQ cables between the inside and outside of the control cabinet. It is used in a control cabinet panel. The data cables and the power supply contacts of the DRIVE-CLiQ are also routed through the bushing. The DRIVE-CLiQ cabinet bushing is available for DRIVE-CLiQ cables with RJ45 plug and M12 plug/socket.

Additional information is provided in Chapter "Accessories" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

DRIVE-CLiQ coupling

The DRIVE-CLiQ coupling is used to connect 2 DRIVE-CLiQ cables in accordance with degree of protection IP67 acc. to IEC 60529.

Additional information is provided in Chapter "Accessories" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

DC link components

7.1 Description

DC link components are installed in addition to the Line Modules and Motor Modules. They are connected to other components via the DC link.

Additional information on the DC link components is provided in Chapter "DC link components" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Component	Function
Braking Modules or Braking Modules Compact	Stopping the drives in the event of a power failure and limiting the DC link voltage
Capacitor Module	Increases the DC link capacitance to buffer brief line supply failures.
Control Supply Module	Generates a 24 V DC output voltage for the other components in the drive lineup. The Control Supply Module requires its own dedicated AC supply when starting.
SITOP PSU400M	Generates a 24 V DC output voltage for the other components in the drive lineup from the DC link.

7.2 SITOP PSU400M

Description

The SITOP PSU400M is a power supply for connection to DC link voltages. It provides an output voltage of 24 V to 28.8 V DC. The output voltage can be adjusted using an integrated potentiometer.

The SITOP PSU400M is used to maintain the 24 V supply for S220 Smart Line Modules. When the power fails, it automatically changes over to supply from the DC link. This makes it possible to execute retraction movements in the event of a power failure.

Table 7-1 Technical data, SITOP PSU400M (6EP1536-3AA00)



Input data	
Input voltage when starting the power supply	200 ... 900 V DC > 400 V DC
Input current	0.85 A
Inrush current (at 25 °C)	approx. 8 A
Output data	
Output voltage	24 V DC
Adjustment range	24 ... 28.8 V DC
Output current	20 A
Startup delay	10 s can be selected
Overload behavior (at $U_E = 300 \dots 820$ V DC)	Extra power: 30 A for 5 s/min

7.2.1 Electrical connection

Connection to the DC link busbars

The SITOP PSU400M is connected to the DC link via the "+" and "-" terminals using a DC link adapter.

Table 7-2 INPUT DC: Input-side connection of the SITOP PSU400M at the DC link

INOUT DC	Terminal	Technical specifications
	+ positive	Screw terminals: DC inputs "+" and "-", PE:
	- negative	
		
Connectable cable cross-sections		0.05 - 4 (2.5) mm ² solid (finely stranded) (AWG 24 ... 12)
Tool		Cross-tip screwdriver (0.6 x 3.5)
Tightening torque		0.5 - 0.6 Nm (lbf in)

Note

Connecting the protective conductor

The SITOP PSU400M power supply has two protective conductor connections. Do not connect the protective conductor to the input (not even capacitively). The cross-sections of the protective conductor connections and the DC link connecting cable must be identical.

Table 7-3 Compatible DC link adapter

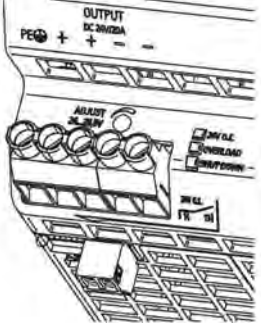

DC link adapter	6SL3162-2BD00-0AA0	
Rated current	43 A	
Terminal	DCP	Supply voltage: 495 ... 720 VDC
	DCN	

Information about connecting the DC link adapter to Smart Line Modules is provided in Chapter "DC link adapters (Page 82)".

Connection to the 24 V busbars

The SITOP PSU400M provides an output voltage for the 24 V supply of the Smart Line Module via the "+" and "-" terminals.

Table 7-4 OUTPUT DC: Output-side connection (24 V) of the SITOP PSU400M

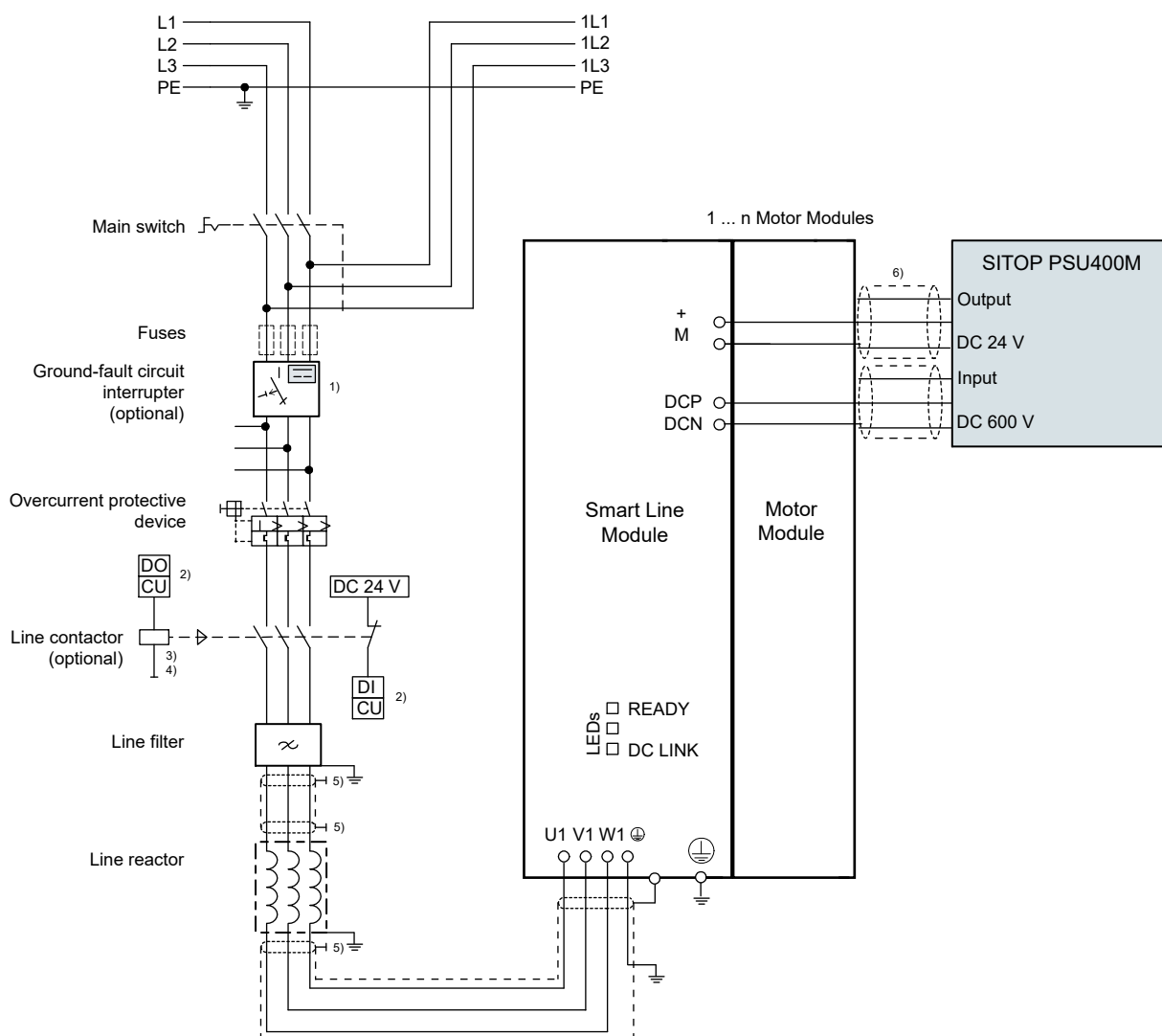
OUTPUT DC	Terminal	Technical specifications
	+ positive	Screw terminals: Outputs "+", "-", PE
	- negative	
		
Connectable cable cross-sections		0.05 - 4 (2.5) mm ² solid (finely stranded) (AWG 24 ... 12)
Tool		Cross-tip screwdriver (0.6 x 3.5)
Tightening torque		0.5 - 0.6 Nm (lbf in)

Note

At the power supply output, you must connect the ground potential to the protective conductor system (PELV). The cross-section of this connection must be at least as large as the cross-section of the 24 V conductors.

More information on connecting the unit is provided in the "Installation" chapter of the Equipment Manual "SITOP PSU400M Power Supply (<https://support.industry.siemens.com/cs/de/en/view/59038719>)".

The SITOP PSU400M is connected to the drive lineup via the DC link adapter and via the 24 V terminal adapter.



- ① The cable connection must always be available.
- ② DI/DO, controlled by the Control Unit
- ③ No additional load permitted downstream of the line contactor.
- ④ Observe the current-carrying capacity of the DO. It may be necessary to use an output coupling link.
- ⑤ Contact is established through the rear panel or shield rails in accordance with the EMC installation guideline.
- ⑥ A DC link adapter is required for connection to the DC link. The 24 V connection is made via a 24 V terminal adapter.

Figure 7-1 Connection example, SITOP PSU400M

7.2.2 Supported operation conditions

The following two operation conditions are supported when using the SITOP PSU400M. The precharging relay must be closed directly after the drive lineup has run up as the SITOP PSU400M represents a load for the DC link precharging resistors (equipped with PTCs). The DC link voltage collapses as a consequence.

First operation condition

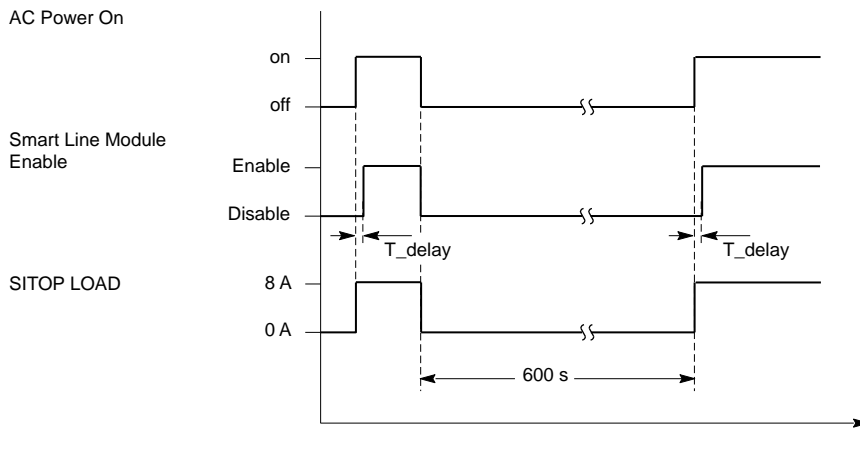


Figure 7-2 Time diagram

Condition:

- Environment: 40 °C line voltage: 400 V
- Drive system capacitance: 10 mF
- Module status: cold

Note

T_{delay} is the permitted system startup time, less than 45 s.

Operation condition

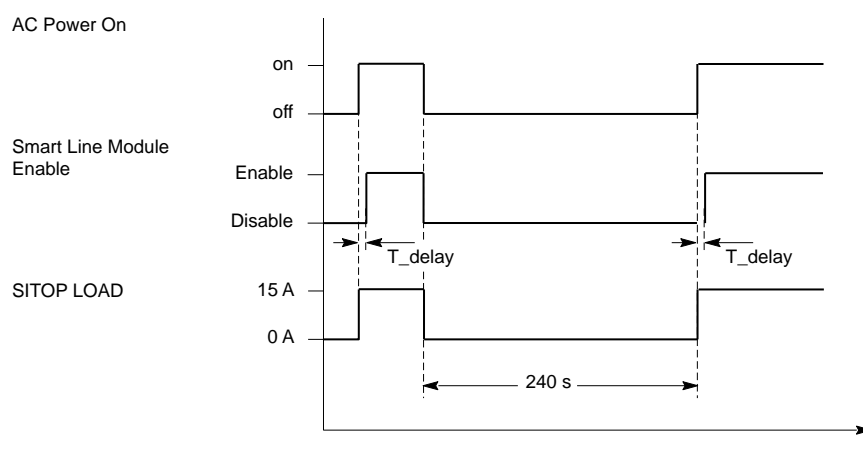


Figure 7-3 Time diagram

Condition:

- Environment: 55 °C line voltage: 480 V
- Drive system capacitance: 10 mF
- Module status: warm

Note

T_{delay} is the permitted system startup time, less than 45 s.

Control cabinet design and EMC booksize

8.1 General information

SINAMICS S components are available as chassis units with degree of protection IP20 or IPXXB according to IEC 60529 and as open type devices to UL 50. This therefore ensures that fingers cannot come into contact with any active components.

To also ensure protection against mechanical stress and climatic conditions, the components must always be operated in housings, cabinets or enclosed electrical areas/rooms that as a minimum fulfill degree of protection IP54 according to European enclosure specifications, or in compliance with US, Canadian and Mexican regulations, as enclosure type 12 according to NEMA 250.

Note

Protection against the spread of fire

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

The installation of the converter with open type / IPXXB degree of protection in a metal control cabinet or protection implemented with another equivalent measure must prevent the propagation of fire and emissions outside the control cabinet.

Note

Protection against condensation and electrically conductive pollution

To ensure the functional safety and safety functions of Safety Integrated, protect the converter, e.g. by installing it in a control cabinet with degree of protection IP54 according to IEC 60529 or Type 12 according to NEMA 250. Further measures may be necessary for particularly critical operating conditions.

A lower degree of cabinet protection is permissible if condensation and conductive pollution can be excluded at the installation site.

Low-voltage switchgear and controlgear assemblies

If the SINAMICS S drive lineup is used for the electrical equipment of machines, the applicable requirements of EN 60204-1 must also be adhered to.

Safety of machinery - electrical equipment of machines

All information relating to device selection in this section applies to

- Operation on TN and TT line supply systems with grounded neutral point and grounded line conductor as well as to IT line supply systems
- Operating voltage range from 3-phase 380 ... 480 V AC $\pm 10\%$

8.2 Safety instructions when mounting and installing the control cabinet

 **WARNING**

Risk of injury as a result of foreign bodies in the device

Parts (e.g.: drilling chips, end sleeves) falling into the device can cause short-circuits and damage the insulation. This can result in severe injury (arcing, loud bang, parts that are flung out).

- Only perform installation and other work when the devices are current-free.
- Cover the ventilation slots when mounting and installing the control cabinet and remove the cover before switching on.

8.3 Electromagnetic compatibility

8.3.1 General information

Electromagnetic compatibility (EMC) describes – according to the definition of the EMC Directive – the "ability of equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to other equipment in that environment". The devices must demonstrate a sufficiently high immunity, and also the interference must be limited to acceptable values.

Product standard IEC 61800-3 describes the EMC requirements for "Adjustable-speed electrical power drive systems". A variable-speed drive system (or Power Drive System - PDS) consists of a Control Unit, Line Module and Motor Module - as well as the associated electric motors, encoders and connecting cables. The driven machine is not part of the drive system.

To ensure conformance with the EMC Directive of the EC, fully comply with the measures described in the "EMC Installation Guideline" Configuration Manual (article number 6FC5297-0AD30-0.P.). When installing the components in control cabinets, the following conditions must also be fulfilled:

- Operation on TN and TT line supply systems with grounded neutral point
- Observance of information about cable shielding and equipotential bonding
- Use of the recommended power cables and signal cables from Siemens.
- Only use Siemens cables for the DRIVE-CLiQ connections.

8.3.2 Line supply connection conditions

Table 8-1 Line connection conditions for Smart Line Modules

Component	Description ¹⁾
S220 Smart Line Module	Operation on line supplies from $S_{K\text{line}}/P_n \geq 30$

¹⁾ $S_{K\text{line}}$ = short-circuit power of the line supply; P_n = rated power of the Line Module

8.3.3 Classification of EMC

The EMC environments and EMC categories are defined in the EMC product standard IEC 61800-3 as follows:

Environments

First environment (public systems)

An environment that includes domestic premises and establishments that are connected directly to a public low-voltage line supply without the use of an intermediate transformer.

Examples: houses, apartments, commercial premises or offices in residential buildings.

Second environment (industrial systems)

An environment that includes all other establishments that are not connected directly to a public low-voltage line supply.

Examples: industrial and technical areas of buildings fed from a dedicated transformer.

Categories

Category C1

Drive systems with a rated voltage < 1000 V that are intended for unrestricted use in the first environment.

Category C2

Drive systems with a rated voltage < 1000 V for operation in the second environment.

 **WARNING**

Use in a residential environment

In a residential environment, the drive may cause radio interference. In such cases, supplementary interference suppression measures may be required.

- Have the installation and commissioning performed with appropriate radio interference suppression measures by experts.

Category C3

Drive systems with a rated voltage < 1000 V that are solely intended for use in the second environment.

 **WARNING**

Use in a residential environment

The device is not intended for use in a residential environment, and cannot ensure appropriate protection of radio reception in environments such as these.

- Do not use this device in the first environment (residential area).

Category C4

Drive systems for IT line supplies with a rated voltage >1000 V for operation in complex systems in the second environment. An EMC plan must be drawn up.

8.3.4 Drive system applications

SINAMICS S220 components may only be used in the second environment. They are to be used on a professional basis in trade, business and industry and are not sold to the general public.

In order to satisfy the EMC requirements, the drive system must be installed by appropriately qualified personnel in compliance with EMC regulations and the installation notes provided in the manual.

Note

Appropriately trained and qualified personnel

An appropriately trained and qualified person has the necessary experience for installing and/or commissioning drive systems (Power Drive Systems - PDS), including the associated EMC aspects.

Carefully observe the information in the "EMC installation guideline" Configuration Manual for EMC-compliant installation.

To ensure that the drive system satisfies the requirements of the EMC category, you must comply with the requirements listed in the subsequent table:

Table 8-2 Application conditions for S220 Smart Line Modules according to IEC 61800-3

Category	Requirements
C2	<ul style="list-style-type: none"> • Use radio interference suppression filters • Operate the drive system in a network with a grounded neutral point • Use motor cables with shielding and observe the maximum total cable lengths: <ul style="list-style-type: none"> – SLM with line reactor and Basic Line Filter up to 750 m • Ensure that the connecting cables between line filters and the Smart Line Module via the line reactor do not exceed a total length of 10 m.
C3	<ul style="list-style-type: none"> • Use radio interference suppression filters • Operate the drive system in a network with a grounded neutral point • Use motor cables with shielding and observe the maximum total cable lengths: <ul style="list-style-type: none"> – SLM with line reactor and Basic Line Filter up to 1000 m • Ensure that the connecting cables between line filters and the Smart Line Module via the line reactor do not exceed a total length of 10 m.
C4	<p>The following combinations are permitted for operation in IT line systems:</p> <ul style="list-style-type: none"> • SLM with line reactor without Basic Line Filter up to 1200 m

Note

Note: Conducted interferences above 1 MHz

In individual cases, additional measures may be necessary to reduce conducted interferences above 1 MHz. This applies particularly to the operation of Motor Modules if the settings of the pulse frequency or the DC link voltage deviate from the default settings.

For the line supply cable, route the cores of the three individual line conductors and the cores of the protective conductors together through the toroidal ferrite cores. Series T60006 toroidal cores from VAC Vacuumschmelze with VITROPERM core material - for example T60006-L2080-W531 - are recommended.

Note

Operation on line supplies that are not grounded at the neutral point

For operation on line supplies that are not grounded at the neutral point (e.g. IT line systems or line supplies with grounded line conductor), it cannot be guaranteed that the requirements of the EMC categories are complied with. The following conditions apply:

- Basic Line Filters must not be used.
- In conjunction with Smart Line Modules, special external filters can be used (without capacitors to ground) to reduce symmetrical interference.

8.3.5 Combination options of Line Modules with line reactors and line filters

Table 8-3 Combination options of Smart Line Modules with line filters and line reactors

SLM rated power		Combined with: filter / reactor		Max. permissible total cable length ¹⁾ to maintain limit values according to IEC 61800-3		Limit values not complied with		Can be operated on IT line systems
16 kW	24 kW	Basic Line Filter	Line reactor	Category C2 shielded in m	Category C3 shielded in m	Shielded in m	Unshielded in m	
●	●	-	x	-	-	1000	1200	Yes
●	●	x	x	750	1000	-	-	No

¹⁾ Maximum total cable length = Σ motor cables, line supply cable from the line filter to the Line Module.

8.3.6 Interference/immunity

Limiting interference

Radio interference suppression filters are required in order to limit interference. These filters can either be integrated in the device or externally mounted.

Additional information on limiting the interference for the drive system is provided in Chapter "Electromagnetic compatibility" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Immunity for a drive system equipped with SINAMICS S220 components

Note**Integrating SINAMICS S220 components in other plants/machines**

When variable-speed drive systems are integrated in other plants/machines, additional measures may be required in order to comply with their product standards.

With respect to the compliance with limits for harmonic currents, EMC product standard IEC 61800-3 for drive systems (PDS) refers to compliance with standards IEC 61000-3-2 and IEC 61000-3-12. Converters are classified as equipment used on a professional basis, deployed in certain areas of business and industry - and are not operated in the general public domain.

Observe the following conditions when using the system in the first environment:

- The drive system must be installed in compliance with EMC regulations by appropriately trained professionals.
 - The converters must be equipped with a Category C2 line filter.
 - The device-specific information and instructions for maintaining harmonic current limits must be complied with.
-

Note**Malfunctions when not using original Siemens accessories**

Malfunctions can occur if accessories are used that are not original.

- For DRIVE-CLiQ connections, only use the genuine Siemens DRIVE-CLiQ wiring and DRIVE-CLiQ cabinet bushings.
-

Note**Faulty operation of the machine due to incorrect shielding or cables that are too long**

The machine can malfunction if the shielding is incorrect or the cables are too long.

- Always follow the correct procedures for shielding and permissible cable lengths.
-

8.4 Electromagnetic fields at the workplace

8.4.1 Preliminary remarks

Protection of workers from electromagnetic fields is specified in the European EMF Directive 2013/35/EU. This directive is implemented in national law in the European Economic Area (EEA). Employers are obligated to design workplaces in such a way that workers are protected from impermissibly strong electromagnetic fields. To this end, assessments and/or measurements must be performed for workplaces.

General conditions for correct assessment or measurement

1. The laws for protection from electromagnetic fields in force in individual EU member states can go beyond the minimum requirements of the EMF Directive 2013/35/EU and always take precedence.
2. The ICNIRP 2010 limits for the workplace are the basis for the assessment.
3. The 100 μT (RMS) mentioned below for assessment of active implants comes from the 26th BImSchV (German Federal Emission Protection Regulations). According to Directive 2013/35/EU, 500 μT (RMS) at 50 Hz is applicable here.
4. Compliance with the limit values was checked for the following frequencies:
 - Line frequency 47 ... 63 Hz (see system data)
 - Pulse frequency, for example 4/8/16 kHz and multiples thereof, assessed up to a maximum of 100 kHz (see system data or relevant technical data)
5. The routing of power cables has a significant impact on the electromagnetic fields that occur. You can find more detailed information in the "EMC installation guideline (<https://support.industry.siemens.com/cs/ww/en/view/60612658>)".

8.4.2 Measurements/assessments for SINAMICS S220 booksize power units

Note

Validity

The following information regarding electromagnetic fields relates solely to products and components supplied by Siemens. A precondition is the installation and operation of components inside metallic cabinets in compliance with the documentation and the "EMC installation guideline" and the use of shielded motor cables. You can find more detailed information in the "EMC installation guideline (<https://support.industry.siemens.com/cs/ww/en/view/60612658>)".

The components are normally used in machines. The assessment and testing is based on DIN EN 12198.

Table 8-4 Information for frequency range 0 Hz to 300 GHz

Frequency range	0 Hz ... 100 kHz	100 kHz ... 300 GHz
Electric field strength	Limits not exceeded	Limits not exceeded
Magnetic flux density	For assessment, see the following table	Limits not exceeded

Table 8-5 Minimum clearances to SINAMICS S220 power units at 0 Hz ... 100 kHz in cm (inch)

Power of the Line Module	Generally		Individuals with active implants	
	Control cabinet closed	Control cabinet open	Control cabinet closed	Control cabinet open
$P \leq 36$ kW	0 (0)	10 (4)	The limit of 100 μ T (RMS) at 50 Hz is not exceeded. Must be separately assessed depending on the active implant.	Must be separately assessed depending on the active implant.

Note

The minimum distances indicated above apply to the head and complete torso of the human body. Shorter distances are possible for extremities.

8.5 Layout of the components

8.5.1 General information

The arrangement of the components and equipment depends on the following conditions:

- Space requirements
- Cable routing
- Bending radii of the connecting cables (MOTION-CONNECT cables, refer to Catalog D21.4 or NC62)
- EMC

The components of the drive lineup should preferably be installed on a conductive mounting surface to ensure low impedance between the component and the mounting surface. Mounting plates with a galvanized surface are suitable.

Components are usually located centrally in a cabinet. The ventilation clearances required above and below the components can possibly exceed the minimum clearances specified in the manual.

The components can be arranged in one or more tiers. In a multiple-tier arrangement, vertical mounting or, in a cabinet row, side-by-side mounting in different cabinet sections is possible.

The DC link busbar current-carrying capacity, which is specified in the relevant technical data, is used to determine the cross-section. You must maintain a ventilation clearance of 100 mm around the line reactor (not including the mounting surface).

Support relating to the mechanical control cabinet design is available from:

Siemens AG
Digital Industries, DI MC MF - WKC
TCCCC (Technical Competence Center Cabinets Chemnitz)
E-mail: cc.cabinetcooling.aud@siemens.com

8.5.2 DC link busbar current-carrying capacity

Carefully observe the current-carrying capacity of the DC link busbar when engineering and installing the drive lineup. The maximum current-carrying capacity of the DC link busbar differs for the components.

Table 8-6 Current-carrying capacity of the DC link busbars

DC link busbar or bridge	Maximum current-carrying capacity [A]
S220 Smart Line Modules 16 kW and 24 kW (100 mm)	200

8.6 Single and multi-tier drive lineup

Single-tier drive lineup

Due to the current-carrying capacity of the DC link busbars and their function in particular, the components should be arranged according to the following rule.

From left to right:

- Line Modules
- Motor Modules in order of power from the highest power to the lowest power
- DC link components, e.g. Braking Module, Control Supply Module, Capacitor Module

More information is provided in Chapter "Arrangement of the components and units" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Multi-tier drive lineup

Additional information on the design of a multi-tier drive lineup is provided in Chapter "Arrangement of the components and units" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

8.7 Electrical connection

Before commissioning, you must have completed the connection of the DC link busbars and 24 V busbars between all of the components.

Releasing the DC link protective flap and connecting the DC link busbars is identical for S220 and S120 components. The procedure for S120 components is described in the next sections.

8.7.1 Connecting the DC link busbars and the 24 V busbars

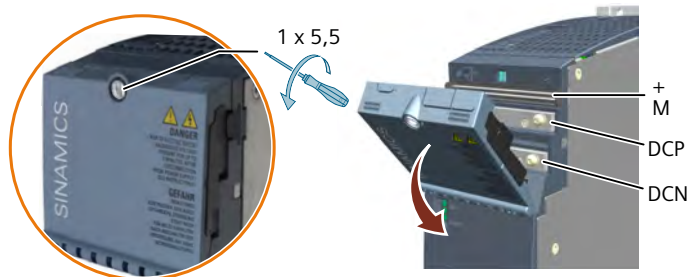
Releasing the DC link protective flap

The protective flaps for the component DC links have an interlock mechanism.

Required tool:

- Flat bladed screwdriver (1 x 5.5)

To open the protective flap, use a screwdriver (1 x 5.5) to slightly turn the interlock screw in the counter-clockwise direction.



Connecting DC link busbars

The connection of a Line Module to a Motor Module is shown in the following.

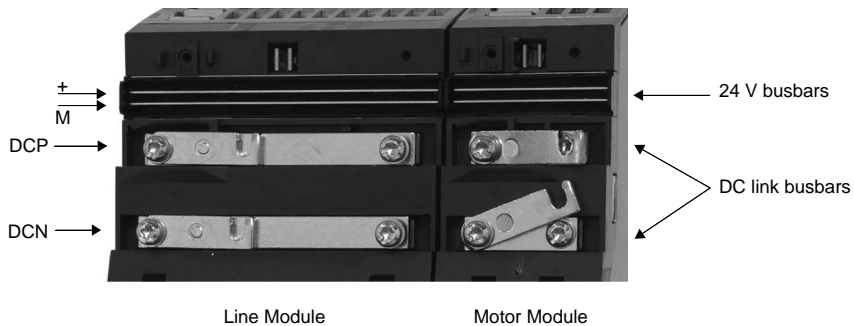


Figure 8-1 Line Module and Motor Module as delivered

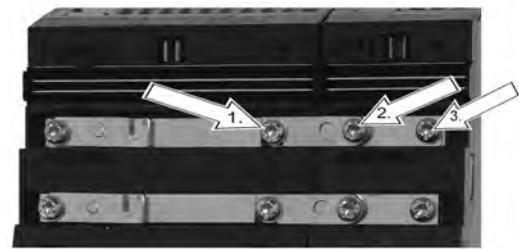
Always connect the lower DC link busbars first and then the upper DC link busbars.

Required tool:

- Torx screwdriver T20
1. Loosen the DC link screws.
 2. Turn over the DC link bridge.
 3. Tighten the DC link screws with a tightening torque of 1.8 Nm (15.9 lbf in). It is essential that you follow the sequence shown below (1) and (2).
 4. On the right-hand side of the component (3) located to the far right, tighten the DC link screw with a tightening torque of 1.8 Nm (15.9 lbf in). The electrical connection from the DC link busbar to the component is now established.



1. Connection of the lower DC link busbars



2. Connection of the upper DC link busbars

Connection of the 24 V busbars

The 24 V busbars of the components are connected using the 24 V connectors. The 24 V connectors are provided in the accessories pack.

- Plug a 24 V connector onto each of the 24 V busbars between the Line Module, Motor Module and DC link component.
- All of the 24 V connectors must be inserted before commissioning.

 WARNING
--

Fire hazard for 24 V connectors and unconnected DC link busbars

For drive lineups in series, whose DC link busbars are not connected with one another, it is not permissible to insert 24 V connectors between these drive lineups. Otherwise the 24 V connectors can burn and cause severe injury or death as result of fire or smoke.

- If the DC link busbars of the components are not connected with one another, then you must use a 24 V terminal adapter for each component to establish the 24 V supply.

NOTICE**Damage to the 24 V connector as a result of incorrect insertion/withdrawal**

Incorrect insertion/withdrawal of a 24 V connector can damage it.

- It is only permissible to withdraw or insert 24 V connectors a maximum of 5 times.

8.7 Electrical connection

Required tool:

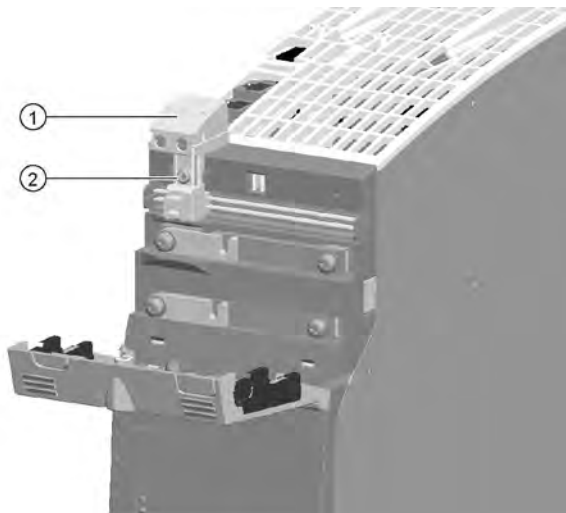
- Torx screwdriver T10
1. Place the 24 V connectors on to the 24 V busbars.
 2. Press the 24 V connectors down until they click into place.
 3. If required, mount the 24 V terminal adapter to supply the 24 V DC. Tightening torque, 0.5 Nm (4.4 lbf in).



- ① Mounted 24 V terminal adapter
- ② Mounted 24 V connector

8.7.2 Mounting the 24 V terminal adapter

The 24 V terminal adapter is included in the scope of supply of the Smart Line Modules and can be ordered as a spare part (article number: 6SL3162-2AA00-OAA0).



- ① 24 V terminal adapter
- ② Screw: SHR, PT-TORX K30-3, 0X16-ST-A2F WN1452 / from EJ
Tightening torque: 0.5 Nm (4.4 lbf in)

Releasing the DC link protective flap and connecting the DC link busbars are identical for S220 and S120 components. The procedure for S120 components is described in the next section (using an S120 Active Line Module as an example).

**⚠ WARNING****Electric shock if the cutout in the protective flap has been broken out**

Live components are exposed and accessible if the 24 V terminal adapter or the DC link adapter is removed. Touching live components can result in death or serious injury.

- Replace the protective flap with the broken out cutouts with a new protective flap.

Mount the 24 V terminal adapter on the left side of the component that is located to the far left in order to avoid space problems at other locations with the 24 V jumpers. When required, for 50 mm and 100 mm wide components, you can also mount the 24 V terminal adapter on the right.

NOTICE**Damage to the 24 V connector as a result of incorrect insertion/withdrawal**

Incorrect insertion/withdrawal of a 24 V connector can damage it.

- Only withdraw the 24 V terminal adapter vertically in relation to the front plate.
- It is only permissible to withdraw or insert 24 V connectors a maximum of 5 times.

Required tools:

- Slot-head screwdriver 1 x 5.5 for releasing the protective flap
- Torx T10 screwdriver to fasten the 24 V terminal adapter
- Suitable pliers to break out the cutout in the protective flap

8.7 Electrical connection

Table 8-7 Mounting the 24 V terminal adapter using an Active Line Module (36 kW) as an example

<p>1. Release and open the protective flap.</p>	<p>2. Clip the 24 V terminal adapter onto the 24 V busbars. 3. Screw the 24 V terminal adapter tight with the supplied screw. Tightening torque: 0.5 Nm (4.4 lbf in)</p>
<p>4. Break out the cutout in the protective flap.</p>	<p>5. Close the protective flap. The protective flap must latch into place audibly.</p>

8.8 24 V DC supply voltage

8.8.1 General information

The 24 V DC voltage is required for:

- Supplying the electronics of the components via the integrated 24 V busbar
- Supplying the electronics of the Control Units, Option Boards, Sensor Modules, and Terminal Modules, as well as the process voltage of their digital inputs
- Supplying the load voltage of the digital outputs
- Supplying the motor holding brakes

Note

Connecting the electronics power supply

Implement the 24 V electronics power supply as described in Chapter "System data".

When connecting a DC power supply as specified in EN 60204-1:1997, Sect. 4.3.3, malfunctions may occur due to the voltage interruptions permitted for them.

Note

Grounding the 24 V electronics power supply

In the components, electronics ground M is permanently connected to the protective conductor potential. The connection cannot be disconnected.

Note

Malfunction because 24 V supply voltage is too low

If the 24 V supply voltage falls below the specified minimum value on a device in the assembly, a malfunction can occur.

- Select an input voltage that is high enough for there to be sufficient voltage at the last device. Do not exceed the maximum value for the supply voltage. If required, supply the voltage to the assembly at various locations in the lineup.
-

Other loads can be connected to these power supply units if they are separately protected against overcurrent.

NOTICE
Damage to other loads as a result of overvoltage
Overvoltage of switched inductances (contactors, relays) can damage connected loads.
<ul style="list-style-type: none">• Install suitable overvoltage protection circuits.

8.8.2 Options for the 24 V supply of the components

Line Modules, Motor Modules and DC link components are connected via the integrated 24 V busbars. The current-carrying capacity of these busbars is 20 A.

You can use the following components for the 24 V supply:

- Control Supply Module
- External 24 V power supply (e.g. SITOP)
- SITOP-PSU400M

Note

Using the SITOP PSU400M

More information on the SITOP PSU400M is provided in Chapter SITOP PSU400M (Page 102).

Using a Control Supply Module

When a Control Supply Module is used, the 24 V supply is directly established via the busbars. The electronic current limiting function integrated in the Control Supply Module protects the busbar system when a fault occurs. Additional loads can be connected via the 24 V terminal adapter.

Note

If you use cables with a cross-section of 2.5 mm², no additional protection is required on the 24 V side for the following cable types:

- Cables of the XLPE type
 - Cables of the EPR type
 - Cable with a similar properties and which is thermally stable up to 90 °C
-

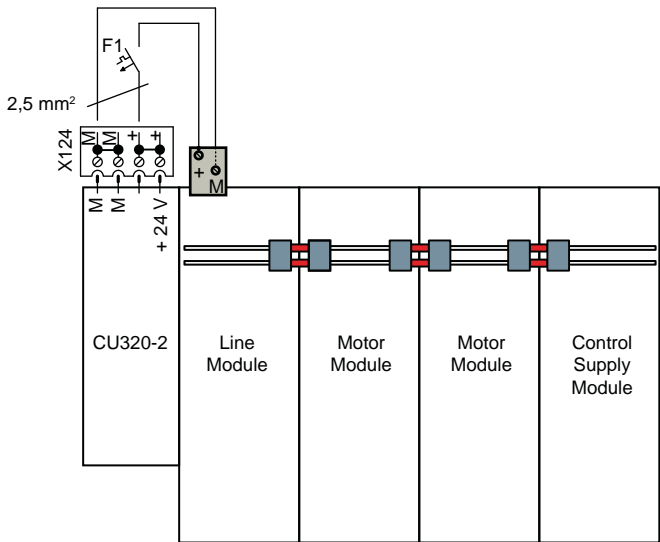


Figure 8-2 Example of a 24 V supply via a Control Supply Module

Using an external 24 V power supply

SELV or PELV power supplies can be used for the external 24 V volt supply, e.g. SITOP. The ground potential must be connected to the protective conductor system at the power supply output (PELV). The cross-section of this connection must be at least as large as the cross-section of the 24 V conductors.

A 24 V terminal adapter must be connected to the component for the infeed. The external power supply should be located very close to the load.

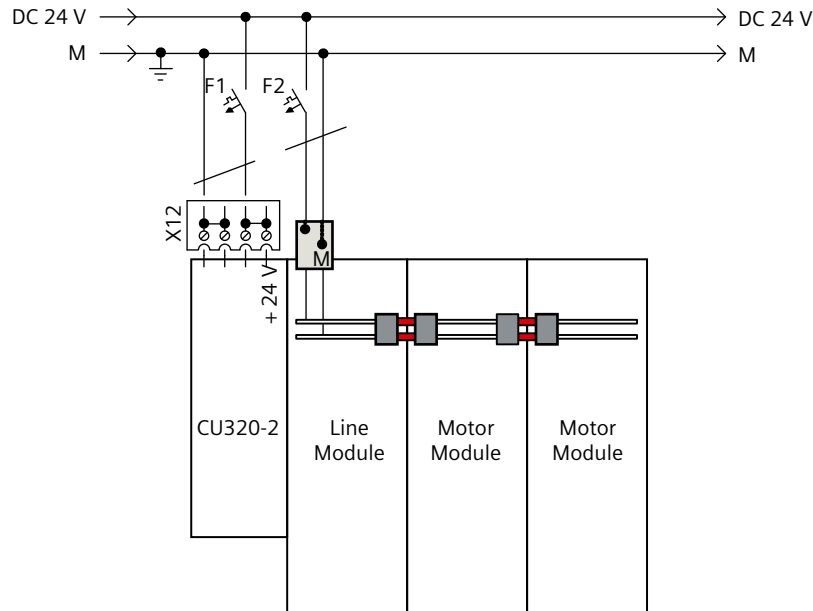


Figure 8-3 Example of a 24 V supply via an external power supply

8.8.3 Overcurrent protection

The cables on the primary and secondary sides of the 24 V power supply must be protected against overcurrent.

Primary side protection must be implemented according to the manufacturer's instructions.

Secondary side protection depends on the prevailing situation. Note the following points:

- Load levels as a result of connected loads, including the rated diversity factor depending on the operation of the machine
- Current-carrying capacity of the conductors used and cables in normal and short-circuit conditions
- Ambient temperature
- Cable bundling (laying cables in a common duct)
- Type of cable routing

EN 60204-1, Section 14, can be used to determine the overcurrent protective devices.

8.8 24 V DC supply voltage

The following are recommended as overcurrent protective devices:

- On the primary side: Circuit breakers
- On the secondary side: Miniature circuit breakers or SITOP select (article number 6EP1961-2BA00)

Additional data can be obtained in the "Siemens Industry Mall (<https://mall.industry.siemens.com/goos/WelcomePage.aspx?regionUrl=/de&language=en>)".

When selecting the miniature circuit breaker, take into consideration local installation guidelines.

Table 8-8 MCBs by conductor cross-section and temperature

Conductor cross-section	Max. current up to 40 °C	Max. current up to 55 °C
1.5 mm ²	10 A	6 A
2.5 mm ²	16 A	10 A
4 mm ²	25 A	16 A
6 mm ²	32 A	20 A
24 V busbar	20 A	20 A

Select the tripping characteristic of the miniature circuit breakers to match the loads to be protected and the max. current provided by the power supply unit in the event of a short-circuit.

8.8.4 Overvoltage protection

Overvoltage protection devices are required for cable lengths > 30 m.

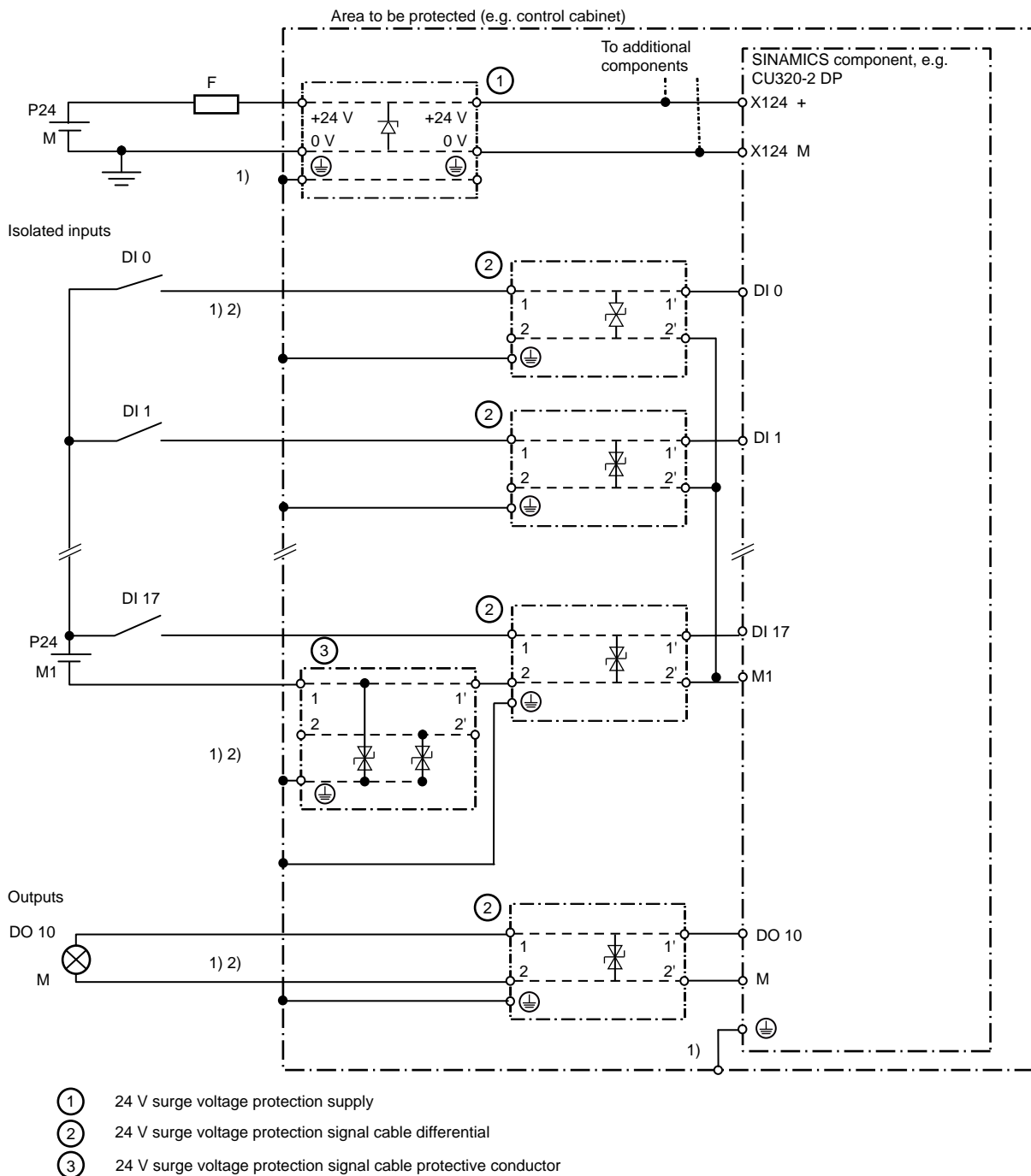
The following Dehn overvoltage protection elements (surge arresters) are recommended for protecting the 24 V power supply of the components and the 24 V signal cables against overvoltage:

Table 8-9 Recommendations for overvoltage protection

24 V power supply	24 V signal cables
Manufacturer: Dehn Article: BVT AVD 24 Article number: 918422	For digital inputs and outputs up to 0.1 A Manufacturer: Dehn Article: BXT ML4 BE C 24 and BSP BAS 4 Article numbers: 920364 and 926304 For digital inputs and outputs up to 0.5 A Manufacturer: Dehn Article: DCO SD2 ME 24 and DCO SD2 MD 24 Article numbers: 917921 and 917941

Always place the overvoltage protection elements at the boundary of the area to be protected, e.g. at the entry point to the control cabinet. All 24 V conductors which exit the protected area must be routed through an overvoltage protection element.

The diagram below uses a CU320-2 DP as an example to show how the overvoltage protection elements are connected.



- 1) The metallic enclosure of the component and the protective conductor connection of the overvoltage protection element must be connected with one another, ensuring good conductivity (equipotential bonding). You can achieve this, for example, by mounting the component on a metallic mounting plate, ensuring good conductivity and connecting the protective conductor connections of the overvoltage protection elements to the mounting plate through the shortest distance.
- 2) By snapping the overvoltage protection element for the signal cables onto a metal DIN rail, the protective conductor connection is connected to the rail. In this case, it is sufficient to establish a good conductive connection between the DIN rail and the metallic enclosure of the component (equipotential bonding). To establish this connection, you must mount the DIN rail and the component on a common metallic mounting plate.

Figure 8-4 Connection example: Overvoltage protection elements connected to components

8.8.5 Typical 24 V current consumption

The following table lists a typical current consumption to calculate the 24 V DC supply required for the S220 components. The values serve as basis for the configuration.

Table 8-10 Current consumption 24 V DC

Component	Typical current consumption [A _{DC}]
S220 Smart Line Modules	
16 kW	0.70
24 kW	0.70

The typical current consumption values of S120 components are listed in Chapter "24 V DC supply" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

8.8.6 Selecting power supply units

The following devices meet the applicable requirements of EN 60204-1 and their use is recommended.

Table 8-11 Recommended power supplies: SITOP Power modular

Rated output current [A]	Phases	Rated input voltage [V] Operating voltage range [V]	Short-circuit current [A]	Article number
5	1 / 2	AC 120 ... 230/230 ... 500 85 ... 264/176 ... 550	Approx. 5.5 (powering up) Typ. 15 for 25 ms (in operation)	6EP1333-3BA00-8AC0
10	1 / 2	AC 120 ... 230/230 ... 500 85 ... 264/176 ... 550	Approx. 12 (powering up) Typ. 30 for 25 ms (in operation)	6EP1334-3BA00-8AB0
20	1 / 2	AC 120 / 230 85 ... 132/176 ... 264	Approx. 23 (powering up) Typ. 60 for 25 ms (in operation)	6EP1336-3BA00-8AA0
	3	3 AC 230/400 ... 288/500 320 ... 550		6EP1436-3BA00-8AA0
40	1 / 2	AC 120/230 85 ... 132/176 ... 264	Approx. 46 (powering up) Typ. 120 for 25 ms (in operation)	6EP1337-3BA00-8AA0
	3	3 AC 230/400 ... 288/500 320 ... 550		6EP1437-3BA00-8AA0

Table 8-12 Recommended Control Supply Module

Rated output current [A]	Phases	Input voltage range [V]	Short-circuit current [A]	Article number
20	3	3 AC 380 -10 % (-15 % < 1 min) to 3 AC 480 +10 % DC 300 ... 800	< 24	6SL3100-1DE22-0AA.



⚠ WARNING

Hazardous voltage when connecting an unsuitable power supply

If a power supply is connected that is not suitable, parts and components of the device could be live (under voltage). Touching live components can result in death or severe injury.

- Connect the ground potential to the protective conductor connection.
- Mount the power supply close to the drive lineup.
Ideally, they should be mounted on a common mounting plate. If different mounting plates are used, they must be electrically connected in compliance with the Configuration Manual, "EMC installation guideline".

8.9 Connection system

8.9.1 Conditions for UL applications

Note

Conditions for UL applications

- Only use copper cables rated for 75 °C.
 - For line and motor connections, only use UL-approved ring cable lugs (ZMVV) that are certified for the particular voltage. The permissible current-carrying capacity of the cable (routing type B2) must be at least 125 % of the input or output current.
-

8.9.2 DRIVE-CLiQ signal cables and MOTION-CONNECT power cables

DRIVE-CLiQ signal cable

The various options for connecting a direct measuring system with DRIVE-CLiQ and M12 plug via MOTION-CONNECT cables to a DRIVE-CLiQ component are described in Chapter "Connection system" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

8.9.3 Current-carrying capacity and derating factors for power cables and signal cables

The current-carrying capacity of PVC/PUR-insulated copper cables is specified for routing types B1, B2 and C under continuous operating conditions in the table below with reference to an ambient air temperature of 40°C. You must calculate the current-carrying capacity for deviating ambient temperatures. To do this, use the derating factor listed in the table below.

Table 8-13 Routing types

B1	Cables in conduits or cable ducts
B2	Multi-conductor cables in conduits or cable ducts
C	Cables along walls, without conduits or cable ducts

Table 8-14 Current-carrying capacity according to EN 60204-1 for 40°C ambient temperature

Cross-section mm ²	Current-carrying capacity, effective; AC 50/60 Hz or DC For routing type		
	B1 A	B2 A	C A
Signal cables			
0.20	–	4.3	4.4
0.50	–	7.5	7.5
0.75	–	9.0	9.5
Power cables			
0.75	8.6	8.5	9.8
1.00	10.3	10.1	11.7
1.50	13.5	13.1	15.2
2.50	18.3	17.4	21
4	24.0	23.0	28
6	31	30	36
10	44	40	50
16	59	54	66
25	77	70	84
35	96	86	104
50	117	103	125
70	149	130	160
95	180	165	194
120	208	179	225

Table 8-15 Current-carrying capacity according to IEC 60364-5-52 for 40°C ambient temperature

Cross-section mm ²	Current-carrying capacity, effective; AC 50/60 Hz or DC For routing type		
	B1 A	B2 A	C A
Power cables			
150	–	–	260
185	–	–	297
> 185	Values must be taken from the standard		

Table 8-16 Derating factors for the current load-carrying capacity for deviating ambient temperatures

Ambient air temperature [°C]	Derating factor according to EN 60204-1, Table D1
30	1.15
35	1.08

8.9 Connection system

Ambient air temperature [°C]	Derating factor according to EN 60204-1, Table D1
40	1.00
45	0.91
50	0.82
55	0.71
60	0.58

8.9.4 Connectable cable cross-sections


<p> WARNING</p> <p>Overheating of power cables when permissible cross-sections are fallen below</p> <p>Excessively thin power cables can result in overheating. This can result in severe injury or death due to fire and smoke.</p> <ul style="list-style-type: none"> • Only use power cables with sufficiently large cross-sections. Take into account the routing type, ambient temperature and cable length. • If smaller cross-sections are selected, you must ensure the appropriate level of conductor protection in another way, e.g. by suitably setting the control parameters.

Table 8-17 Connectable cable cross-sections for Smart Line Modules

Rated power	Terminal type and tightening torque	Conductor cross-section [mm ² /AWG]		
		6 10	10 8	16 6
16 kW	Screw connector (Page 91) 1.2 ... 1.5 Nm (10.6 ... 13.3 lbf in)	X	X	-
24 kW	Screw connector (Page 91) 1.2 ... 1.5 Nm (10.6 ... 13.3 lbf in)	-	X	X

The connectable cable cross-sections for S120 components are specified in Chapter "Connection system" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Note

Selection of the line supply cable

When selecting the line supply cable, observe the loop resistance to ensure that the relevant protective elements (line fuse, residual current device, ...) function reliably, and that in the event of a fault, no hazardous shock currents or touch voltages occur.

If the loop resistance of the line supply at the infeed point is not suitable, so that fuses do not rupture in the specified time in the case of insulation failure (ground fault, fault to frame), then you must use additional residual current devices RCD (RCCB or MRCD), Type B to protect personnel and protect against fire.

8.9.5 Maximum cable lengths

An overview of the maximum permissible lengths of all signal, supply and power cables is provided in the following table.

Table 8-18 Maximum permissible cable lengths

Type	Maximum length [m]
24 V DC power supply cables	30 ¹⁾
24 V signal cables	30 ¹⁾
DRIVE-CLiQ signal cables MC500	100
DRIVE-CLiQ signal cables MC800PLUS	75
DC link, including extensions	10
Connecting cable between line filter and line reactor	10 (shielded/unshielded) ²⁾
Connecting cable between line reactor and Line Module	10 (shielded/unshielded) ²⁾

¹⁾ For longer lengths, you must connect a suitable circuit to provide overvoltage protection. More information is provided in Chapter "24 V DC supply" of the SINAMICS S120 Equipment Manual Booksize Power Units.

²⁾ To comply with EMC limit values, you must use shielded cables (preferably MOTION-CONNECT cables).

The maximum permissible cable lengths for S120 components are specified in Chapter "Connection system" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Note

Total cable lengths to comply with the EMC category

The maximum total cable lengths of Smart Line Modules are specified in Chapter "Combination options of Line Modules with line reactors and line filters" (Page 114).

8.10 Cable shielding and routing

To comply with EMC requirements, it is especially important to ensure that cables are routed so that they are adequately separated from other cables and that components are mounted an adequate distance away. Always use shielded cables for the following:

- Line supply cables from line filter via line reactor to Line Module
- All motor cables (if necessary, including cables for motor holding brake)
- Cables for "fast inputs" of the Control Unit
- Cables for analog direct voltage/current signals
- Signal cables for encoders
- Cables for temperature sensors

Supplementary conditions

- You can apply measures that provide comparable results. This includes e.g. routing cables behind the mounting plates or with appropriate clearances. This excludes measures that relate to the design, installation, and routing of motor power cables and signal cables.
- If unshielded cables are used between the line supply connection point and line filter, carefully ensure that no cables with interference are routed in parallel.
- Always route power cables and signal cables separately. For this purpose, it is practical if you arrange the various cables according to cable groups. You can combine cables belonging to a group to form a bundle. You must route the various cable groups with the necessary distance between them. A minimum clearance of 20 cm has proven itself in practice. As an alternative, shield connection plates equipped with multiple contact points can be used between the cable bundles.
- All cables inside the cabinet must be routed as closely as possible to parts connected with cabinet ground, such as a mounting plate or cabinet wall. Adequate shielding is provided using sheet steel ducts or when cables are routed between sheet steel partitions, e.g. between the mounting plate and rear panel.
- Keep all cables as short as possible to minimize the antenna effect.
- Signal and power cables may cross each other (if absolutely necessary), but must never be routed closely to one and other in parallel over longer distances.
- Route all signal cables away from strong magnetic fields (motors, transformers) with a minimum clearance of 20 cm. As an alternative to maintaining a clearance, you can use shield connection plates equipped with multiple contact points.
- Wherever possible, avoid routing unshielded cables in the immediate vicinity of sources of interference, e.g. transformers. Route all shielded and unshielded signal cables connected to the drive lineup well away from strong external magnetic sources (e.g. transformers, line reactors). In both cases, a clearance of ≥ 300 mm is usually sufficient.

Shield support

You must connect cable shields as close as possible to conductor connection points to ensure a low-impedance connection with the cabinet ground.

For power cables from Siemens in which the shield is connected to the connector housing (see relevant catalog), this is a sufficiently good shield support.

- For components that do not have any special shield connection or where the shield connection is not adequate, you can connect the cable shields to the metal mounting plate using hose clamps and toothed rails. Keep the cable length between the shield connection point and the terminals for cable conductors as short as possible.
- For the 16 kW and 24 kW connecting cables of the S220 Smart Line Modules, it is permissible to connect the shield to the strain relief plate using a hose clamp. Alternatively, you can order an optional shield connection plate. More information is provided in Chapter "Shield connection plate and terminal (Page 96)".
- For S120 Line Modules and Active Interface Modules up to and including 16 kW - as well as for Motor Modules up to and including 30 A or 2x18 A - shield connection plates are either included in the scope of supply of the components or integrated in the connection plug. You must order shield connection plates for all other components. More information is provided in Chapters "Shield connection plates" and "Accessories" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Routing 24 V conductors

When routing 24 V conductors, carefully observe the following additional requirements:

- A maximum of one conductor pair may be bundled together.
- You must route 24 V conductors separately away from other cables and conductors that may carry operational current.
- Never route 24 V conductors in parallel to power cables.
- You must route 24 V conductors and power cables to components so that they never cover the ventilation slots.

Conditions of use for 24 V conductors

- Ambient temperature: 55 °C
- Conductor limit temperature: ≤ 70 °C for operation with the rated load current
- Max. cable length: 30 m for 24 V conductors and for signal cables without additional circuitry
Overvoltage protection devices must be used for longer cable lengths.

8.11 Protective connection and equipotential bonding

The components are designed for use in control cabinets with a protective conductor connection.

Conductor cross-section for protective connections

The protective conductor connection of the components must be connected to the protective conductor connection of the control cabinet as follows:

Table 8-19 Conductor cross-section for copper protective connections

Line supply cable in mm ²	Copper protective connection in mm ²
Up to 16 mm ²	The same as the line supply cable
From 16 mm ² to 35 mm ²	16 mm ²
From 35 mm ²	0.5 x line supply cable

The values listed in the table are applicable for protective conductors manufactured out of the same metal as the line conductors. If this is not the case, then you must calculate the protective conductor cross-section in such a way that a conductivity is obtained that is at least equivalent to the specifications listed in this table.

More information is provided in Chapter "Protective connection and equipotential bonding" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

You must dimension cable cross-sections in compliance with local installation regulations.

More information is provided in the Product Information "Dimensioning the protective conductors for SINAMICS S220 Booksize (<https://support.industry.siemens.com/cs/ww/en/view/109804135>)".

Protective connection concept SINAMICS S booksize power units

Power units must always be connected with a protective conductor connected to the central PE busbar or the conductive mounting plate in the control cabinet.

More information is provided in Chapter "Protective connection and equipotential bonding" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

Functional equipotential bonding

You must arrange the drive lineup on a common, bare metal mounting plate in order to comply with EMC limit values. You must connect the mounting plate to the protective conductor connection of the control cabinet through a low impedance connection.

More information on the functional equipotential bonding surface, functional equipotential bonding conductor and mounting components on DIN rails is provided in Chapter "Protective connection and equipotential bonding" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

8.12 Control cabinet cooling

The following options are available for cooling the control cabinet:

- Filter fans
- Heat exchangers
- Cooling unit

The environmental conditions and the cooling power required define the method used to cool the control cabinet.

Observe the air routing within the control cabinet and the specified ventilation clearances. No components may be mounted and no cables routed in the ventilation clearance spaces.

NOTICE

Reduction of the component service lives through incorrect mounting

If you do not observe the guidelines when mounting components in the control cabinet, this can reduce the service life of components and result in premature component failure.

- Observe the guidelines for installing components.

8.12.1 General information on ventilation

The components are force-ventilated using integrated fans and cooled by natural convection.

Variable speed fans are used whose speed depends on the heat sink temperature. When the pulse enable is issued, the fans operate for approx. 10 s at their maximum speed. The speed is reduced as a function of the heat sink temperature.

NOTICE

Damage caused by overheating resulting from covered ventilation slots

Covered ventilation slots can cause the system to overheat.

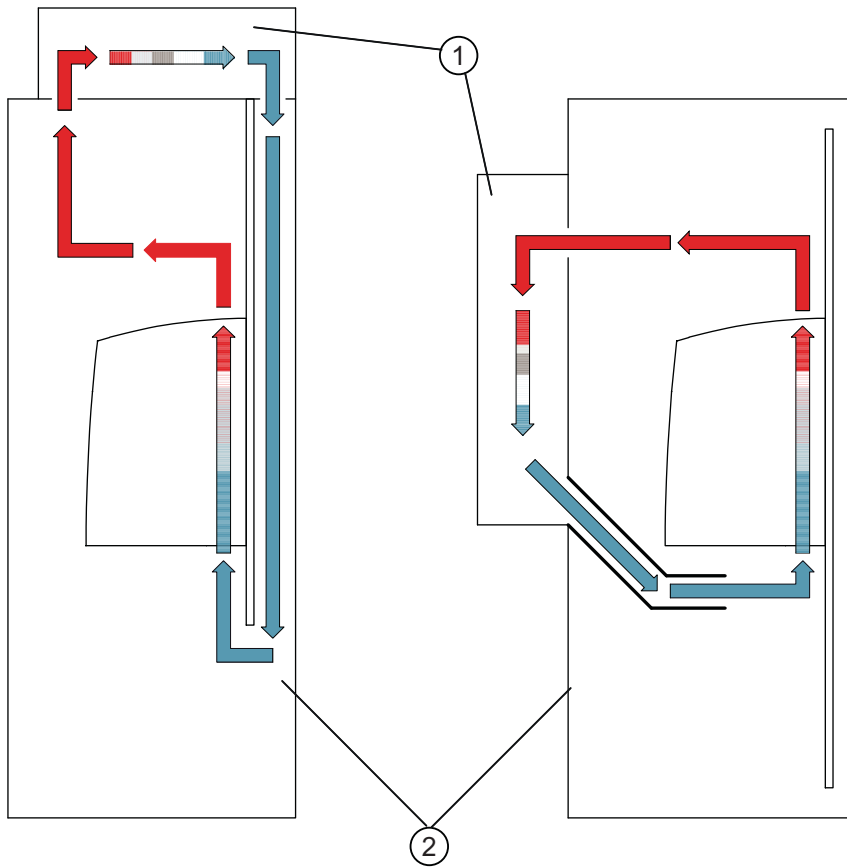
- Route the connected signal and power cables to the components in such a way that they do not cover the ventilation slots.

Air guidance

The cooling air must flow through the components vertically from the bottom (cold region) to the top (warm region heated up when the system is operational).

- Ensure that the air flows in the right direction if you are using filter fans, heat exchangers or air-conditioning units.
- Ensure that warm air can escape at the top.
- Maintain a ventilation clearance of at least 80 mm above and below.

8.12 Control cabinet cooling



- ① Cooling unit
- ② Control cabinet

Figure 8-5 Examples of cabinet ventilation

Note

The distance between the discharge opening of the air conditioning unit and the electronic equipment must be at least 200 mm.

Note

If the components are installed in a sealed control cabinet, you must use internal air cooling that ensures an unobstructed airflow to prevent local hotspots. It is best to mount the fan above the components to optimize the air flow (air is drawn in).

Humidity**NOTICE****Component damage caused by condensation**

Condensation on the components can cause them to fail.

- Select the air circuit and arrangement of the cooling equipment in such a way that no condensation can form on the components.
- If required, an anti-condensation heater must be installed in the cabinet.

When using air-conditioning units, the relative humidity of the air that is discharged can increase as a result of the air being cooled in the air-conditioning unit. Under certain circumstances, the humidity can exceed the dew point.

- To avoid condensation, arrange the air-conditioning units so that cold discharged air is not directly blown onto the components.
- If required, use air guidance baffles to ensure that the air is adequately mixed with the air inside the control cabinet. Mixing with warm air reduces the relative humidity down to uncritical values.

8.12.2 Ventilation clearances

Table 8-20 Ventilation clearances above and below components

Component	Minimum clearance [mm]
Line filters for Smart Line Modules	100
Line reactors for Smart Line Modules	100
Smart Line Modules	80

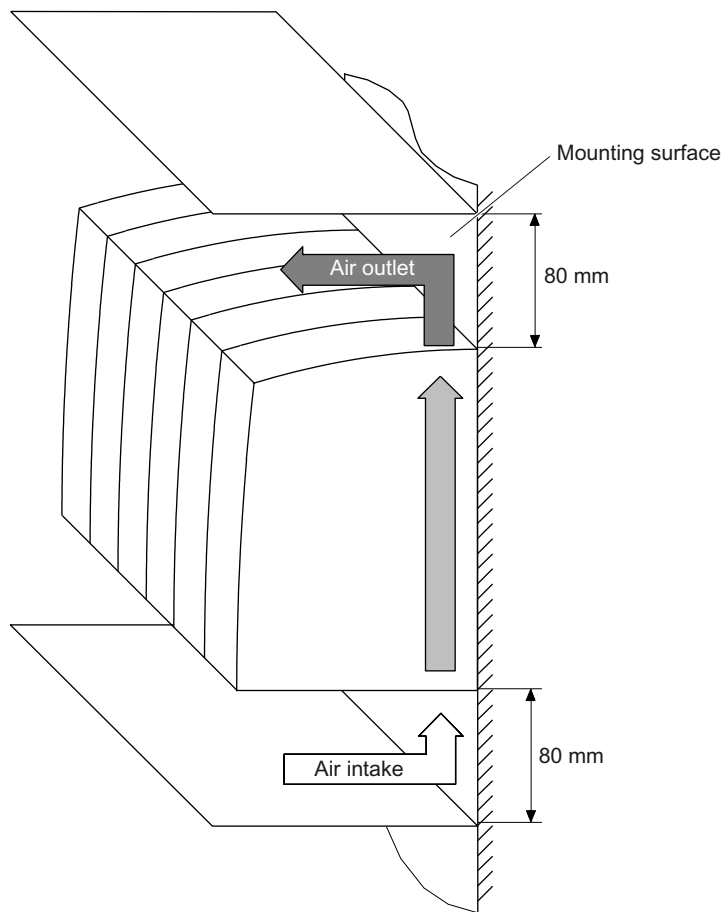


Figure 8-6 Ventilation clearances for a drive lineup

Carefully observe the ventilation clearances required for the particular S120 component in Chapter "Ventilation clearances" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

8.12.3 Notes on dimensioning climate control equipment

Power loss calculation

Manufacturers provide calculation programs for selecting climate control equipment. It is always necessary to know the power loss of the components and equipment installed in the control cabinet.

Additional information on calculating the power loss of your drive system is provided in Chapter "Dimensioning climate control equipment" of the SINAMICS S120 Equipment Manual Booksize Power Units (<https://support.industry.siemens.com/cs/ww/en/view/109781351>).

8.13 Power losses of the components

The tables below provide an overview of the power loss of S220 Smart Line Modules operated at their rated power.

The total losses of the relevant power unit (Line Module, Motor Module) are calculated from the power loss and the corresponding electronics loss of the power unit.

The following values apply under the subsequent conditions:

- Line voltage for Line Modules 400 V
- Operating components at their rated power

Table 8-21 Power losses for power units operated at their rated power (including losses of the electronics)

S220 Smart Line Modules	Unit	Power loss
16 kW	W	150
24 kW	W	250

Table 8-22 Losses of the electronics for power units

S220 Smart Line Modules	Unit	Power loss
16 kW	W	14.9
24 kW	W	15.6

Table 8-23 Power losses at rated operation for line filters

S220 Smart Line Modules	Unit	Power loss
Basic Line Filter for Smart Line Modules		
16 kW	W	12.0
24 kW	W	22.0

Table 8-24 Power losses at rated operation for line reactors

S220 Smart Line Modules	Unit	Power loss
Line reactors for Smart Line Modules		
16 kW	W	90
24 kW	W	92

8.13 Power losses of the components


Service and maintenance

9.1 Spare parts

You can find spare parts in the internet here (<https://www.sow.siemens.com>).

9.2 Replacing the fan



 WARNING
Electric shock when live parts are touched
Before replacing the fan, you must switch off the power supplies (400 V AC and 24 V DC). A hazardous voltage is still present for up to five minutes after the power supply has been switched off.
Contact with live parts can result in death or serious injury.
<ul style="list-style-type: none"> • Remove the device cover or the fan cover only after a certain time. • Check for zero voltage before removing the component.

Note

When replacing the fan, you must observe the ESD regulations.

Only qualified personnel are permitted to install spare parts.

The fan modules of Smart Line Modules can be ordered as replacement parts.

Smart Line Modules have an operating hours counter (p0251) and issue a message (A30042) once the maximum operating time has been reached.

Note

No ventilation if wrong fan module is used

S220 Smart Line Modules are only equipped with 12 V fans. It is not permissible that you use fan modules with a rated fan voltage of 24 V.

- When replacing the fan always use the associated fan module.

Table 9-1 Fan modules for replacing a fan

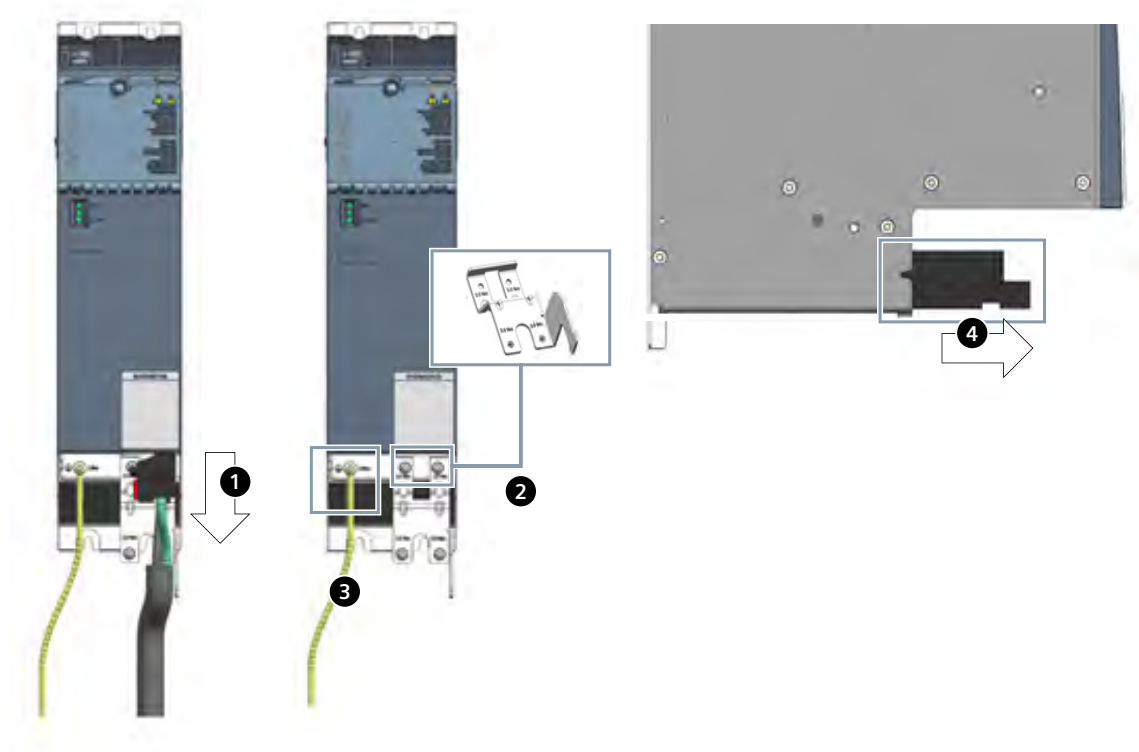
Smart Line Modules		Fan modules	
Width	Rated power	Article number	Rated fan voltage
100 mm	16 kW / 24 kW	6SL5166-0AD00-0AA0	12 V

Required tools:

- Torx screwdriver T20
- Slotted screwdriver 0.8 x 5.5 mm

Replacing the fan

Removing the existing fan module



1. Release the connection plug catch, and withdraw the plug from the Smart Line Module. If you are using an optional shield connection plate, first remove the shield connection clamp.
2. Remove the strain relief plate from the Smart Line Module (Torx screwdriver T20).
3. Release the protective conductor (Torx screwdriver T20).
4. Withdraw the fan module from the Smart Line Module toward the front.

Installing a new fan module

Installation is in the reverse sequence.

1. Insert a new fan module into the Smart Line Module. The power supply for the fan is automatically established.
2. Connect the protective conductor to the Line Module.
Tightening torque: 3 Nm (26.6 lbf in).
3. Reattach the strain relief plate and tighten the fastening screws.
Tightening torque: 3 Nm (26.6 lbf in).

9.2 Replacing the fan

4. Insert the connection plug until it snaps into place. The plug has been completely inserted once you hear it snap into place. More information on the shield support is provided in Chapter "Mounting (Page 94)".
5. Reattach the line supply cable to the strain relief plate with a cable tie and reattach the shield.
 - A correct shield support is required to ensure EMC-compliant installation.
 - An optional shield connection plate can be used for this purpose. More information on the shield support is provided in Chapter "Shield connection plate and terminal (Page 96)".

9.3 Forming the DC link capacitors

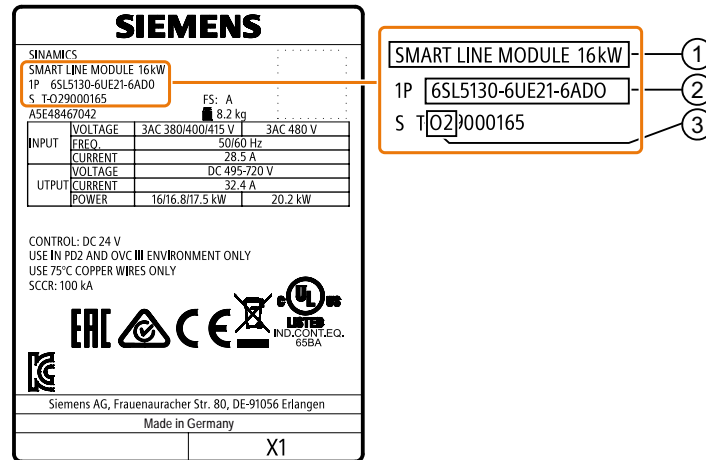
Overview

DC link capacitors must be reformed for Line Modules that have been in storage for more than 2 years. If this is not performed, the components could be damaged when they are switched on.

Requirement

DC link capacitors of components for which the storage period of 2 years has been exceeded must be reformed.

- The storage period is calculated from the date of manufacture and not from the date that the equipment was shipped.
- Refer to the serial number on the rating plate for the date of manufacture.



- ① Designation
- ② Article number
- ③ Year of manufacture (here O = 2022) and month of manufacture (here 2 = February)

Figure 9-1 Rating plate (example: Smart Line Module 16 kW)

Table 9-2 Year and month of manufacture on the rating plate

Year of manufacture		Month of manufacture	
Character	Year	Character	Month
O	2022	1 ... 9	January to September
P	2023	O	October
Q	2024	N	November
R	2025	D	December
S	2026		



! WARNING

Electric shock due to the residual charge of the DC link capacitors

Due to the DC link capacitors, a hazardous voltage is present in the DC link for up to five minutes after the power supply has been switched off.

Contact with live parts can result in death or serious injury.

- Do not open the protective flap of the DC link until 5 minutes have elapsed.
- Check that the cabinet is de-energized.


Components required:

- 1 fuse switch 3-phase 400 V / 10 A
- Cable 1.5 mm²
- 3 PTC resistors 350 Ω / 35 W
(recommendation: PTC-35W PTC800620-350 Ohm, Michael Koch GmbH)

Procedure

Proceed as follows to reform DC link capacitors:

1. Remove the DC link bridge.
2. Make sure that the device **does not** receive a switch-on command (e.g. via PROFINET/ PROFIBUS, BOP20 or terminal block).
3. Connect the forming circuit. When forming with PTC resistors, the component must remain in the circuit for approx. 1 h.

 CAUTION
<p>Burns resulting from high surface temperature of the PTC resistors</p> <p>The resistors can reach a high temperature if there is a fault in the component (surface temperature > 80 °C). You can get seriously burnt when touching the surface.</p> <ul style="list-style-type: none"> • Mount the PTC resistors so that contact is not possible. If this is not possible, attach clearly visible and understandable warning notices at hazardous positions.

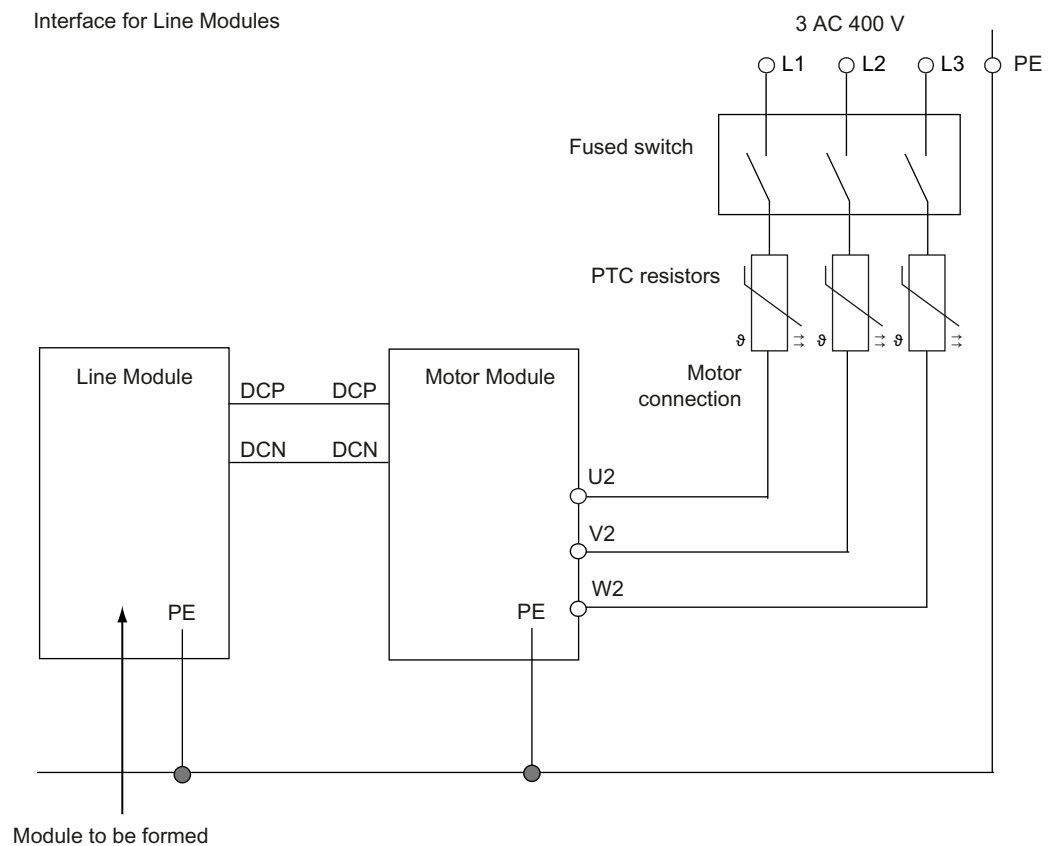


Figure 9-2 Forming circuit for Line Modules with PTC resistors

9.4 Recycling and disposal



For environmentally-friendly recycling and disposal of your old device, contact a company certified for the disposal of old electrical and electronic equipment, and dispose of the device as specified in the regulations for your particular country.

More information

Siemens:
www.siemens.com

Industry Online Support (service and support):
www.siemens.com/online-support

IndustryMall:
www.siemens.com/industrymall

Siemens AG
Digital Industries
Motion Control
Postfach 3180
91050 Erlangen
Germany

Scan the QR-Code
for product
information

