SIEMENS

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Safety

FUNCTION MANUAL

SINAMICS

G130/G150/S120 Chassis/S120 Cabinet Modules/S150

Safety Integrated

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SINAMICS

G130, G150, S120 Chassis, S120 Cabinet Modules, S150 Safety Integrated

Function Manual

Firmware version V5.2

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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

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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.

Siemens AG
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Preface

Target group

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

Standard version

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

- Other functions not described in this documentation might be able to be executed in the drive system. This does not, however, represent an obligation to supply such functions with a new controller or when servicing.
- The documentation can also contain descriptions of functions that are not available in a particular product version of the drive system. The functionalities of the supplied drive system should only be taken from the ordering documentation.
- Extensions or changes made by the machine manufacturer must be documented by the machine manufacturer.

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

Technical Support

Your routes to Technical Support (https://support.industry.siemens.com/cs/ww/en/sc/4868):

- Support Request (https://www.siemens.com/SupportRequest)
- Contact person database (https://www.automation.siemens.com/aspa_app)
- "Industry Online Support" mobile app

The Support Request is the most important input channel for questions relating to products from Siemens Industry. This assigns a unique ticket number to your request for tracking purposes. The Support Request offers you:

- Direct access to technical experts
- Recommended solutions for various questions (e.g. FAQs)
- Status tracking of your requests

Technical Support also assists you in some cases via remote support (https://support.industry.siemens.com/cs/ww/en/view/106665159) to respond to your requests. A Support representative will assist you in diagnosing or resolving the problem through screen transfer.

More information on the support service packages is available on the Internet via the following address (https://support.industry.siemens.com/cs/ww/en/sc/4869).

Spare parts

Spare parts are available on the Internet at:
Spare parts (https://support.industry.siemens.com/sc/de/en/sc/2110)

Internet address for SINAMICS

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

Internet address for Safety Integrated

http://www.siemens.com/safety

This address contains detailed application examples for Safety Integrated.

Table of contents

Safety information

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Safety notices

⚠WARNING

Failure to observe the safety instructions and residual risks

If the safety instructions and residual risks are not observed in the associated documentation, accidents involving severe injuries or death can occur.

- Observe the safety instructions given in the associated documentation.
- When assessing the risk, take into account residual risks.

⚠WARNING

Malfunctions of the machine as a result of incorrect or changed parameter settings

Machines can malfunction as a result of incorrect or changed parameter assignment, which in turn can lead to injuries or death.

- Protect the parameterization (parameter assignments) against unauthorized access.
- Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

1.1 Industrial security

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 form part of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. These 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 can be implemented, please visit:
https://www.siemens.com/industrialsecurity (http://www.siemens.com/industrialsecurity)

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

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:
https://www.siemens.com/cert (https://www.siemens.com/cert)

Additional 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.

- Update your software regularly.
- Integrate the automation and drive components into a holistic, state-of-the-art industrial security concept for the plant 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.

⚠DANGER

Risk minimization through Safety Integrated

Safety Integrated can be used to minimize the level of risk associated with machines and plants.

Machines and plants can only be operated safely in conjunction with Safety Integrated when the machine manufacturer carefully takes into consideration the following preconditions:

- This technical user documentation – including the documented limitations, safety information and residual risks – is known and complied with.
- The plant or machine is carefully designed and engineered. A careful and thorough acceptance test is then performed by qualified personnel and the results documented.
- All the measures required in accordance with the plant or machine risk analysis by means of the programmed and configured Safety Integrated Functions or by other means are implemented and validated.

The use of Safety Integrated does not replace the plant or machine risk assessment carried out by the machine manufacturer as required by the EC machinery directive!

In addition to using Safety Integrated Functions, further risk reduction measures must be implemented.

NOTICE

Danger to life as a result of inactive Safety Integrated Functions after powering up

The Safety Integrated Functions are only activated after the system has completely powered up. System startup is a critical operating state with increased risk. When accidents occur, this can result in death or severe injury.

- Carefully ensure that the machine is safe when the system runs up.

⚠WARNING

Danger to life as a result of undesirable motor motion when the system runs up and the drives are activated after changing or replacing hardware and/or software

After hardware and/or software components have been modified or replaced, it is only permissible for the system to run up and the drives to be activated with the protective devices closed. Personnel shall not be present within the danger zone.

- It may be necessary to carry out a partial or complete acceptance test or a simplified functional test after having made certain changes or replacements.
- Before personnel may re-enter the hazardous area, all of the drives should be tested to ensure that they exhibit stable control behavior by briefly moving them in both the plus and minus directions (+/-).
- **When switching on carefully observed the following:**

  The Safety Integrated Functions are only available and can only be selected after the system has completely powered up.

Note

Malfunctions as a result of withdrawing and inserting components

Malfunctions can occur by withdrawing and inserting components that are used for Safety Integrated without having to exit the fail-safe state. For example, PROFIsafe communication is not reestablished after this event.

- Withdrawing and inserting components used for Safety Integrated (power units, Sensor Modules, TM54F) in operation **and** in the deactivated state is **not** permissible. Activating the components always requires a POWER ON.

Note

Approval of option K82

Only circuits that have been manufactured by the OEM or by certified factories or that have been installed by the authorized service for option K82, possess an approval. Possible plant-side reproductions by non-certified manufacturers do not possess this approval!

An up-to-date list of authorized factories is available on request from your local Siemens office or from your sales support office.

Introduction

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This document is a supplement to the "SINAMICS S120 Safety Integrated Function Manual" which serves as the basis for the functional scope of the Safety Integrated Functions.

The "SINAMICS S120 Safety Integrated Function Manual" is available on the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/man).

This document contains additional information on the use of the Safety Integrated Functions with the following SINAMICS converters:

- SINAMICS G130
- SINAMICS G150
- SINAMICS S120 Chassis and Chassis-2
- SINAMICS S120 Cabinet Modules
- SINAMICS S150

General information about SINAMICS Safety Integrated

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3.1 Supported functions

All of the Safety Integrated Functions available under SINAMICS are listed in this section. SINAMICS makes a distinction between Safety Integrated Basic Functions, Extended Functions and Advanced Functions.

The safety functions listed here conform to:

- Safety Integrity Level (SIL) 2 according to IEC 61508
- Category 3 to ISO 13849-1
- Performance Level (PL) d according to ISO 13849-1.

The safety functions correspond to the functions according to IEC 61800-5-2 (under the assumption that they are defined there).

The following Safety Integrated Functions (SI Functions) are available:

- **Safety Integrated Basic Functions**

  These functions are part of the standard scope of the drive and can be used without requiring an additional license. These functions are always available, and do not require an encoder and/or do not place any special requirements on the encoder used.

  – Safe Torque Off (STO)

    Safe Torque Off is a safety function to avoid unexpected starting in accordance with IEC 60204-1. STO prevents the supply of energy to the motor which can generate a torque and corresponds to Stop Category 0.

  – Safe Stop 1 (SS1, time-controlled)

    Safe Stop 1 is based on the "Safe Torque Off" function. This allows a Category 1 stop in accordance with IEC 60204-1 to be implemented.

  – Safe Brake Control (SBC)

    Safe Brake Control safely controls a holding brake.[1)]

- **Safety Integrated Extended Functions**

  These functions require an additional safety license. Extended Functions with encoder require an encoder with safety capability (safety-relevant).

  – Safe Torque Off (STO)

    Safe Torque Off is a safety function to avoid unexpected starting in accordance with IEC 60204-1.

  – Safe Stop 1 (SS1, time- and acceleration-controlled)

    Safe Stop 1 is based on the "Safe Torque Off" function. This allows a Category 1 stop in accordance with IEC 60204-1 to be implemented.

  – Safe Brake Control (SBC)

    Safe Brake Control safely controls a holding brake.[1)]

  – Safe Operating Stop (SOS)

    Safe Operating Stop protects against unintentional movement. The drive is in closed-loop control mode and is not disconnected from the power supply.

  – Safe Stop 2 (SS2)

    Safe Stop 2 safely brakes the motor with a subsequent transition into the "Safe Operating Stop" state (SOS). This allows a Category 2 stop in accordance with IEC 60204-1 to be implemented.

  – Safely-Limited Speed (SLS)

    Safely-Limited Speed monitors that the drive does not exceed a preset speed/velocity limit.

  – Safe Speed Monitor (SSM)

    Safe Speed Monitor safely identifies when a speed limit is undershot in both directions of motion, e.g. to identify zero speed. A fail-safe output signal is available for further processing.

  – Safe Direction (SDI)

    Safe Direction is used to safely monitor the direction of motion.

  – Safe gearbox stage switchover

    The "Safe gearbox stage switchover" function facilitates reliable switching between different gearbox stages. The switchover is only possible via PROFIsafe.

  – Safely-Limited Acceleration (SLA)

    Safely-Limited Acceleration monitors (the same as SLS) the acceleration, and intervenes when a limit value is violated. SLA cannot prevent that the acceleration threshold is briefly exceeded.

  – Safe Brake Test (SBT)

    The diagnostic function "Safe Brake Test" (SBT) checks the required holding torque of a brake (operating or holding brake).

- **Safety Integrated Advanced Functions**

  These functions require an additional safety license. Advanced Functions with encoder require an encoder with safety capability (safety relevant).

  – Safely-Limited Position (SLP)

    Safely-Limited Position ensures that a freely definable traversing range is not left.

  – Transferring safe position values (SP)

    The "Transfer safe position values (SP)" function enables you to transfer a safe position to a higher-level controller via PROFIsafe.

  – Safe Cam (SCA)

    The "Safe Cam" function outputs a safe signal if the drive is within a specified position range. Safe axis-specific range detection can be implemented using this function.

[1)] Note on Power/Motor Modules in the chassis format:
For the chassis format, SBC is only supported by Power/Motor Modules with article number ...3 or higher. In addition, for this format a Safe Brake Adapter is required.
For the Chassis-2 format, a Safe Brake Adapter is also required.

Note

Parallel use of Safety Integrated Functions

All Safety Integrated Functions can be used simultaneously.

Exception:

If SOS and SLS are activated simultaneously, SOS has higher priority and overrides the SLS reaction.

Invalid operating modes for Safety Integrated Extended Functions "without encoder"

- For the independent setting of current controller clock cycle and pulse frequency in conjunction with Safety Integrated "without encoder", the following system clock cycles are not permissible:
  - Power Modules / Motor Modules: <62.5 µs
  - p9589 = 3300 must be set to allow the current controller clock cycle and pulse frequency to be independently set.
- For Chassis and Chassis-2 format devices, the following also applies:
  - For Chassis and Chassis-2 format devices, operation without encoder is only permissible for induction motors, however **not** for synchronous motors.
  - No operation involving parallel connections
  - Optimized pulse patterns cannot be selected
  - Only using parameter p1810 = factory setting, this includes:

    - No wobbling

    - No fine setting of the pulse frequency
- Induction motors up to a maximum of 1000 kW; for extremely large machines, it is necessary to adapt parameter p9585

3.1.1 SINAMICS G130

3.1.1.1 Basic functions

Requirements

The Safety Integrated Basic Functions are part of the standard scope of the drive and can be used without an additional license.

Supported Safety Integrated Basic Functions

Safety function	Abbreviation	
Safe Torque Off	**STO**	Yes
Safe Stop 1	**SS1**	Yes
Safe Brake Control	**SBC**	Via Safe Brake Adapter Article No. 6SL3355-2DX00-1AA0

Control options

- Control Unit and terminal (on the power unit)
- PROFIsafe and terminal (on the power unit)

3.1.1.2 Extended Functions

Requirements

- Option **F01**: Safety license for one axis

  Note

  The term "axes" should also be interpreted as "drives".

- For Extended Functions with encoder:
  Two SMC30 Sensor Modules (HTL/TTL encoders)

Supported Safety Integrated Extended Functions

Safety function	Abbreviation	With encoder [1]	Without encoder
Safe Torque Off	**STO**	Yes	Yes[2]
Safe Stop 1 with **- Safe Brake Ramp** **- Safe Acceleration Monitor**	**SS1** **SBR** **SAM**	Yes	Yes[2]
Safe Brake Control	**SBC**	Yes[3]	Yes[2][3]
Safe Operating Stop	**SOS**	Yes	No
Safe Stop 2	**SS2**	Yes	No
Safely-Limited Speed	**SLS**	Yes	Yes[2]
Safe Speed Monitor	**SSM**	Yes	Yes[2]
Safe Direction	**SDI**	Yes	Yes[2]
Safe gearbox stage switchover	--	Yes	No
Safely-Limited Acceleration	**SLA**	No	No
Safe Brake Test	**SBT**	Yes	No

[1] Two SMC30 Sensor Modules (HTL/TTL encoders)

[2] The use of this safety function without an encoder is permitted only for induction motors.

[3] Using Safe Brake Adapter.

Control options

- TM54F Terminal Module
- PROFIsafe

3.1.2 SINAMICS G150

3.1.2.1 Basic functions

Requirements

The Safety Integrated Basic Functions are part of the standard scope of the drive and can be used without an additional license.

Supported Safety Integrated Basic Functions

Safety function	Abbreviation	
Safe Torque Off	**STO**	Yes
Safe Stop 1	**SS1**	Yes
Safe Brake Control	**SBC**	Via option K88

Control options

- With option **K82**: Terminal Module for controlling safety functions "STO" and "SS1"
- Control Unit and terminal (on the power unit)
- PROFIsafe and terminal (on the power unit)

3.1.2.2 Extended Functions

Requirements

- Option **K01**: Safety license for one axis

  Note

  The term "axes" should also be interpreted as "drives".

- For Extended Functions with encoder:
  Options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

Supported Safety Integrated Extended Functions

Safety function	Abbreviation	With encoder [1]	Without encoder
Safe Torque Off	**STO**	Yes	Yes[2]
Safe Stop 1 with **- Safe Brake Ramp** **- Safe Acceleration Monitor**	**SS1** **SBR** **SAM**	Yes	Yes[2]
Safe Brake Control	**SBC**	Yes[3]	Yes[2][3]
Safe Operating Stop	**SOS**	Yes	No
Safe Stop 2	**SS2**	Yes	No
Safely-Limited Speed	**SLS**	Yes	Yes[2]
Safe Speed Monitor	**SSM**	Yes	Yes[2]
Safe Direction	**SDI**	Yes	Yes[2]
Safe gearbox stage switchover	--	Yes	No
Safely-Limited Acceleration	**SLA**	No	No
Safe Brake Test	**SBT**	Yes	No

1) Options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

2) The use of this safety function without an encoder is permitted only for induction motors.

3) Using Safe Brake Adapter (option **K88**).

Control options

- Option **K87**: TM54F Terminal Module
- PROFIsafe

3.1.3 SINAMICS S120 Chassis and Chassis-2

3.1.3.1 Basic functions

Requirements

The Safety Integrated Basic Functions are part of the standard scope of the drive and can be used without an additional license.

Supported Safety Integrated Basic Functions

Safety function	Abbreviation	
Safe Torque Off	**STO**	Yes
Safe Stop 1	**SS1**	Yes
Safe Brake Control	**SBC**	Via Safe Brake Adapter Article No. 6SL3355-2DX00-1AA0

Control options

- Control Unit and terminal (on the power unit)
- PROFIsafe and terminal (on the power unit)

3.1.3.2 Extended Functions

Requirements

- Option **F01 to F05**: Safety license for one to five axes

  Note

  The term "axes" should also be interpreted as "drives".

- For Extended Functions with encoder:
  - Sin/cos sensor evaluation (SMC20, SME20/25/120/125, SMI20 Sensor Modules) or
  - Two SMC30 Sensor Modules (HTL/TTL encoders)

Supported Safety Integrated Extended Functions

Safety function	Abbreviation	With encoder [1]	Without encoder
Safe Torque Off	**STO**	Yes	Yes[2]
Safe Stop 1 with **- Safe Brake Ramp** **- Safe Acceleration Monitor**	**SS1** **SBR** **SAM**	Yes	Yes[2]
Safe Brake Control	**SBC**	Yes[3]	Yes[2][3]
Safe Operating Stop	**SOS**	Yes	No
Safe Stop 2	**SS2**	Yes	No
Safely-Limited Speed	**SLS**	Yes	Yes[2]
Safe Speed Monitor	**SSM**	Yes	Yes[2]
Safe Direction	**SDI**	Yes	Yes[2]
Safe gearbox stage switchover	**--**	Yes	No
Safely-Limited Acceleration	**SLA**	Yes	No
Safe Brake Test	**SBT**	Yes	No

1) Sin/cos sensor evaluation or 2 SMC30 Sensor Modules (HTL/TTL encoders)

2) The use of this safety function without an encoder is permitted only for induction motors.

3) Using Safe Brake Adapter.

Control options

- TM54F Terminal Module
- PROFIsafe

3.1.3.3 Advanced Functions

Requirements

- Option **A01 to A06**: Safety license for one to six axes

  Note

  The term "axes" should also be interpreted as "drives".

- For Advanced Functions with encoder:
  - Sin/cos sensor evaluation (SMC20, SME20/25/120/125, SMI20 Sensor Modules) or
  - Two SMC30 Sensor Modules (HTL/TTL encoders)

Supported Safety Integrated Advanced Functions

Safety function	Abbreviation	With encoder [1]	Without encoder
Safely-Limited Position	**SLP**	Yes	No
Transferring safe position values	**SP**	Yes	Yes[2]
Safe Cam	**SCA**	Yes	No

[1] Sin/cos sensor evaluation or 2 SMC30 Sensor Modules (HTL/TTL encoders)

[2] Only for the transfer of relative position values. An encoder is required to transfer absolute position values.

Control options

- Terminal (TM54F)
- PROFIsafe

3.1.4 SINAMICS S120 Cabinet Modules, Booksize format

3.1.4.1 Basic functions

Requirements

The Safety Integrated Basic Functions are part of the standard scope of the drive and can be used without an additional license.

Supported Safety Integrated Basic Functions

Safety function	Abbreviation	
Safe Torque Off	**STO**	Yes
Safe Stop 1	**SS1**	Yes
Safe Brake Control	**SBC**	Using Safe Brake Adapter

Control options

- With option **K82**: Terminal Module for controlling safety functions "STO" and "SS1"
- Control Unit and terminal (on the power unit)
- PROFIsafe and terminal (on the power unit)

3.1.4.2 Extended Functions

Requirements

- Option **K01 to K05**: Safety license for one to five axes

  Note

  The term "axes" should also be interpreted as "drives".

- For Extended Functions with encoder
  - Option **K48**: SMC20 Sensor Module (sin/cos encoder) or
  - Options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

Supported Safety Integrated Extended Functions

Safety function	Abbreviation	With encoder [1]	Without encoder
Safe Torque Off	**STO**	Yes	Yes[2]
Safe Stop 1 with **- Safe Brake Ramp** **- Safe Acceleration Monitor**	**SS1** **SBR** **SAM**	Yes	Yes[2]
Safe Brake Control	**SBC**	Yes	Yes[2]
Safe Operating Stop	**SOS**	Yes	No
Safe Stop 2	**SS2**	Yes	No
Safely-Limited Speed	**SLS**	Yes	Yes[2]
Safe Speed Monitor	**SSM**	Yes	Yes[2]
Safe Direction	**SDI**	Yes	Yes[2]
Safe gearbox stage switchover	--	Yes	No
Safely-Limited Acceleration	**SLA**	Yes	No
Safe Brake Test	**SBT**	Yes	No

[1] Option **K48**: SMC20 Sensor Module (sin/cos encoder) or
options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

[2] The use of this safety function without encoder is permitted only for induction motors or synchronous motors belonging to the SIMOTICS A-1FU series (previously: SIEMOSYN).

Control options

- Option **K87**: TM54F Terminal Module
- PROFIsafe

3.1.5 SINAMICS S120 Cabinet Modules, Chassis and Chassis-2 formats

3.1.5.1 Basic functions

Requirements

The Safety Integrated Basic Functions are part of the standard scope of the drive and can be used without an additional license.

Supported Safety Integrated Basic Functions

Safety function	Abbreviation	
Safe Torque Off	**STO**	Yes
Safe Stop 1	**SS1**	Yes
Safe Brake Control	**SBC**	Via option K88

Control options

- With option **K82**: Terminal Module for controlling safety functions "STO" and "SS1"
- Control Unit and terminal (on the power unit)
- PROFIsafe and terminal (on the power unit)

3.1.5.2 Extended Functions

Requirements

- Option **K01 to K05**: Safety license for one to five axes

  Note

  The term "axes" should also be interpreted as "drives".

- For Extended Functions with encoder:
  - Option **K48**: SMC20 Sensor Module (sin/cos encoder) or
  - Options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

Supported Safety Integrated Extended Functions

Safety function	Abbreviation	With encoder [1]	Without encoder
Safe Torque Off	**STO**	Yes	Yes[2]
Safe Stop 1 with **- Safe Brake Ramp** **- Safe Acceleration Monitor**	**SS1** **SBR** **SAM**	Yes	Yes[2]
Safe Brake Control	**SBC**	Yes[3]	Yes[2][3]
Safe Operating Stop	**SOS**	Yes	No
Safe Stop 2	**SS2**	Yes	No
Safely-Limited Speed	**SLS**	Yes	Yes[2]
Safe Speed Monitor	**SSM**	Yes	Yes[2]
Safe Direction	**SDI**	Yes	Yes[2]
Safe gearbox stage switchover	--	Yes	No
Safely-Limited Acceleration	**SLA**	Yes	No
Safe Brake Test	**SBT**	Yes	No

[1] Option **K48**: SMC20 Sensor Module (sin/cos encoder) or
options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

[2] The use of this safety function without an encoder is permitted only for induction motors.

[3] Using Safe Brake Adapter (option **K88**).

Control options

- Option **K87**: TM54F Terminal Module
- PROFIsafe

3.1.6 SINAMICS S150

3.1.6.1 Basic functions

Requirements

The Safety Integrated Basic Functions are part of the standard scope of the drive and can be used without an additional license.

Supported Safety Integrated Basic Functions

Safety function	Abbreviation	
Safe Torque Off	**STO**	Yes
Safe Stop 1	**SS1**	Yes
Safe Brake Control	**SBC**	Via option K88

Control options

- With option **K82**: Terminal Module for controlling safety functions "STO" and "SS1"
- Control Unit and terminal (on the power unit)
- PROFIsafe and terminal (on the power unit)

3.1.6.2 Extended Functions

Requirements

- Option **K01**: Safety license for one axis

  Note

  The term "axes" should also be interpreted as "drives".

- For Extended Functions with encoder:
  - Option **K48**: SMC20 Sensor Module (sin/cos encoder) or
  - Options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

Supported Safety Integrated Extended Functions

Safety function	Abbreviation	With encoder [1]	Without encoder
Safe Torque Off	**STO**	Yes	Yes[2]
Safe Stop 1 with **- Safe Brake Ramp** **- Safe Acceleration Monitor**	**SS1** **SBR** **SAM**	Yes	Yes[2]
Safe Brake Control	**SBC**	Yes[3]	Yes[2][3]
Safe Operating Stop	**SOS**	Yes	No
Safe Stop 2	**SS2**	Yes	No
Safely-Limited Speed	**SLS**	Yes	Yes[2]
Safe Speed Monitor	**SSM**	Yes	Yes[2]
Safe Direction	**SDI**	Yes	Yes[2]
Safe gearbox stage switchover	--	Yes	No
Safely-Limited Acceleration	**SLA**	Yes	No
Safe Brake Test	**SBT**	Yes	No

[1] Option **K48**: SMC20 Sensor Module (sin/cos encoder) or
options **K50 and K52**: Two SMC30 Sensor Modules (HTL/TTL encoders)

[2] The use of this safety function without an encoder is permitted only for induction motors.

[3] Using Safe Brake Adapter (option **K88**).

Control options

- Option **K87**: TM54F Terminal Module
- PROFIsafe

3.2 Drive monitoring with or without encoder

If motors without a (safety-capable) encoder are being used, not all Safety Integrated Functions are available.

Note

Definition: "Without encoder"

When "without encoder" is used in this manual, then this always means that either no encoder or no safety-capable encoder is being used.

In operation without encoder, the actual speed values are calculated from the measured electrical actual values. Therefore, speed monitoring is also possible during operation without encoder.

Table 3- 1 Overview of Safety Integrated Functions

	Functions	Abbr.	With encoder	Without encoder	Brief description
Basic Functions	Safe Torque Off	STO	Yes	Yes	Safe Torque Off
	Safe Stop 1	SS1	Yes	Yes	Safe stop according to stop category 1
	Safe Brake Control	SBC	Yes	Yes	Safe Brake Control
Extended Functions	Safe Torque Off	STO	Yes	Yes[1)]	Safe Torque Off
	Safe Stop 1	SS1	Yes	Yes[1)]	Safe stop according to stop category 1
	Safe Brake Control	SBC	Yes	Yes[1)]	Safe Brake Control
	Safe Operating Stop	SOS	Yes	No	Safe monitoring of the standstill position
	Safe Stop 2	SS2	Yes	No	Safe stop according to stop category 2
	Safely-Limited Speed	SLS	Yes	Yes[1)]	Safe monitoring of the maximum speed
	Safe Speed Monitor	SSM	Yes	Yes[1)]	Safe monitoring of the minimum speed
	Safe Direction	SDI	Yes	Yes[1)]	Safe monitoring of the direction of motion
	Safe referencing/homing	SR	Yes	No	Safe referencing/homing
	Safely-Limited Acceleration	SLA	Yes	No	Safely limited acceleration
	Safe Brake Test	SBT	Yes	No	Safe test of the required holding torque of a brake
	Safe Acceleration Monitor	SAM	Yes	Yes[1)]	Safe monitoring of drive acceleration
	Safe Brake Ramp	SBR	Yes	Yes[1)]	Safe braking ramp
	Safe gearbox stage switch-over	–	Yes	No	–
Advanced Functions	Safely-Limited Position	SLP	Yes	No	Safely limited position
	Transferring safe position values	SP	Yes	Yes[1)]	Transferring safe position values
	Safe Cam	SCA	Yes	No	Safe cam

[1)] The use of this safety function without encoder is permitted only for induction motors or synchronous motors of the SIMOTICS A-1FU (previously: SIEMOSYN).

The configuration of the Safety Integrated Functions and the selection of monitoring with or without encoder is realized in the Safety screens of the STARTER or Startdrive tools.

Description of Safety Integrated functions

4

Safety Integrated Basic Functions and Safety Integrated Extended Functions are described in detail in the "SINAMICS S120 Safety Integrated Function Manual".

The "SINAMICS S120 Safety Integrated Function Manual" is available on the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/man).

4.1 Preconditions for Safety Integrated Basic Functions

The following prerequisites apply for operation of the Safety Integrated Basic Functions:

- For G150, S120 Cabinet Modules and S150 with control cables >30 m:
  Option K82 (terminal module for controlling safety functions "Safe Torque Off" and "Safe Stop 1")
- An activated current controller in the drive (comprising converter and motor)
- For the safe brake control:
  - For G150, S120 Cabinet Modules and S150:
    Option K88 (Safe Brake Adapter 230 VAC)
  - For the G130 and S120 Chassis units:
    Option SBA (Safe Brake Adapter)

4.2 Preconditions for Safety Integrated Extended Functions

- For operation of the Safety Integrated Extended Functions, **one** license is required for **each** axis.
- Control possible via
  - PROFIsafe
  - TM54F
  - Active functions without control (SLS, SDI)
- An activated current controller in the drive
- Overview of hardware components that support the Extended Functions:
  - Motor Modules Booksize with an article number ending: -xxx3 or higher
  - Motor Modules Booksize C/D type with article No.: -..C. or -..D.
  - Motor Modules Chassis with an article number ending: -xxx3 or higher
  - Motor Modules Chassis-2
  - Motor Modules Cabinet with an article number ending: -xxx2 or higher
  - Motor Modules Chassis-2
  - Control Unit Adapter CUA31 as of article number: 6SL3040-0PA00-0AA1
  - Control Unit Adapter CUA32 as of article number: 6SL3040-0PA01-0AA0
  - For the Extended Functions with encoder:

    Motors with sin/cos encoder and encoder evaluation with DRIVE-CLiQ interface or via Sensor Module SMC20, SME20/25/120/125

    Motors with two independent HTL/TTL encoders or a special double HTL/TTL encoder

    The list of approved encoders can be found on the Internet at link (https://support.industry.siemens.com/cs/ww/en/view/33512621).

4.3 Preconditions for Safety Integrated Advanced Functions

- A **license** is required for **every** axis that is to be operated with Safety Integrated Advanced Functions.
  The license for Safety Integrated Advanced Functions includes the license for Safety Integrated Extended Functions.
- Control possible via
  - PROFIsafe
  - TM54F
  - Active functions without control (SLS, SDI)
- An activated current controller in the drive
- Overview of hardware components that support Advanced Functions:
  - Motor Modules Booksize with an article number ending: -xxx3 or higher
  - Motor Modules Booksize C/D type with article No.: -..C. or -..D.
  - Motor Modules Chassis with an article number ending: -xxx3 or higher
  - Motor Modules Chassis-2
  - Motor Modules Cabinet with an article number ending: -xxx2 or higher
  - Motor Modules Chassis-2
  - Control Unit Adapter CUA31 as of article number: 6SL3040-0PA00-0AA1
  - Control Unit Adapter CUA32 as of article number: 6SL3040-0PA01-0AA0
  - For the Extended Functions with encoder:

    Motors with sin/cos encoder and encoder evaluation with DRIVE-CLiQ interface or via Sensor Module SMC20, SME20/25/120/125

    Motors with two independent HTL/TTL encoders or a special double HTL/TTL encoder

    The list of approved encoders can be found on the Internet at link (https://support.industry.siemens.com/cs/ww/en/view/33512621).

Controlling the safety functions

5

5.1 Control possibilities

The following options for controlling Safety Integrated Functions are available:

Table 5- 1 Controlling the Safety Integrated Functions

	Terminals (on the Control Unit and Motor/Power Module)	**PROFIsafe based on PROFIBUS or PROFINET**	**TM545F**	**Control without selection**
Basic Functions	Yes	Yes	No	No
Extended Functions	No	Yes	Yes	SLS, SDI
Advanced Functions	No	Yes	Yes	No

Note

PROFIsafe or TM54F

Using a Control Unit, control is possible either via PROFIsafe or TM54F. Mixed operation is not permissible.

The safety-related input and output terminals (F-DI and F-DO) act as an interface between the SINAMICS Safety Integrated functionality and the process.

A dual-channel signal applied to an F-DI (Fail-safe Digital Input, safety-oriented digital input = safe input terminal pair) controls the active monitoring of the activation/deactivation of safety functions.

An F-DO (Fail-safe Digital Output, safety-oriented digital output = safe output terminal pair) delivers a dual channel signal representing feedback from the safety functions.

Dual-channel processing of I/O signals

A dual-channel structure is realized for data input/output and for processing fail-safe I/O signals. All requests and feedback signals for fail-safe functions should be entered or picked off using both channels.

5.2 Control of "STO" and "SS1" via terminal module for option K82

5.2.1 Terminal module for control of "STO" and "SS1" for SINAMICS G150

Description

Option K82 (terminal module for controlling "Safe Torque Off" and "Safe Stop 1") is used to control Safety Integrated Basic Functions in an electrically isolated fashion.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

Option K82 is used to control the following Safety Integrated Basic Functions (terms and definitions in accordance with IEC 61800-5-2):

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Power Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In combination with option K82, the requirements specified in IEC 61800-5-2, IEC 60204-1 as well as ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This option is used when the following requirements apply:

- Control is realized with electrical isolation in a voltage range 24 V DC/AC.
- Using non-shielded control lines which are longer than 30 m.
- The devices are deployed in plants dispersed over a wide area (no ideal equipotential bonding).

Principle of operation

Two independent channels of the integrated safety function are controlled via relays (-K41, -K42).

Relay -K41 controls the signal at the Control Unit that is necessary for the safety function and relay -K42, the corresponding signal at the Power Module.

The selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The circuit is structured so that it is protected against wire break, i.e. if the relay's control voltage fails then the safety function is active.

A feedback signal is not part of the safety concept.

Note

The feedback signal is not necessary to comply with standard ISO 13849-1 Cat. 3 PL d and IEC 61508 SIL 2.

The selection of the safety function must be performed in two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or 61508 SIL 2) for the complete system.

Forced checking procedure

The maximum value for the forced checking procedure interval when using option K82 is 12 months (8760 h).

Customer interface -X41

Table 5- 2 Terminal strip -X41

Terminal	Meaning	Technical data
-X41:1	Control of -K41:A1	Connection for actuating element at channel 1 "+"
-X41:2	Connected to -X41:1	
-X41:3	Control of -K41:A2, -K42:A2, N conductor or ground	Connection of reference potential for actuating elements at channel 1 and channel 2
-X41:4	Connected to -X41:3	
-X41:7	Control of -K42:A1	Connection for actuating element at channel 2 "+"
-X41:8	Connected to -X41:7	
-X41:10	Output -K41: Permanently wired with CU320-2: -X132:4 (DI 7)	

Control circuit:

Rated voltage: 24 V DC/AC (0.85 ... 1.25 x U_{Rated})

Max. cable length (applies to the sum of the outgoing and return lines):

- 24 V DC (min. cross-section, 0.75 mm²): 1000 m
- 24 V AC (cable capacitance: 300 pF/m): 500 m

  The value applies for 50 Hz; at 60 Hz, the cable lengths must be reduced by 20 %.

⚠WARNING

Danger to life as a result of exceeding the permissible cable lengths and/or the permissible cable capacitances

When the permissible cable lengths and/or the permissible cable capacitances are exceeded, the relay can remain energized as a result of the coupling capacitances of the cable and the associated residual current, in spite of the fact that the actuating elements are open. Death and serious injury can result in the event of an error.

- Do not exceed the maximum permissible cable lengths and cable capacitances.

Max. connectable cross-section: 2.5 mm²

Fuse: Max. 4 A

Installation altitude: up to 4000 m for overvoltage category II according to IEC 61800-5-1

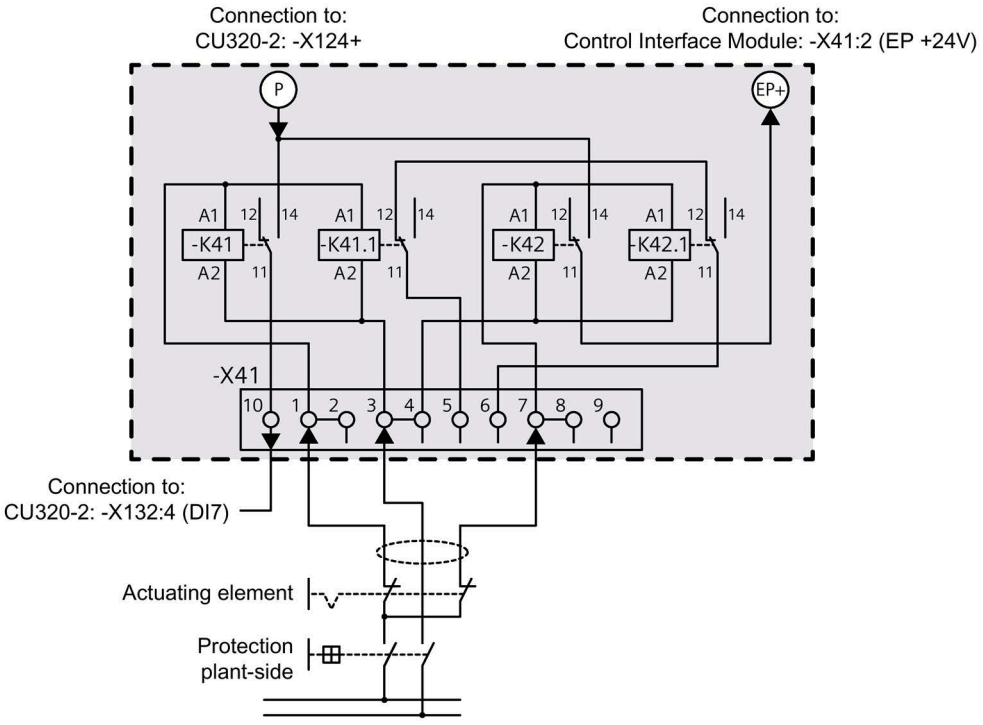


Figure 5-1 Terminal module circuit for option K82 for a single circuit

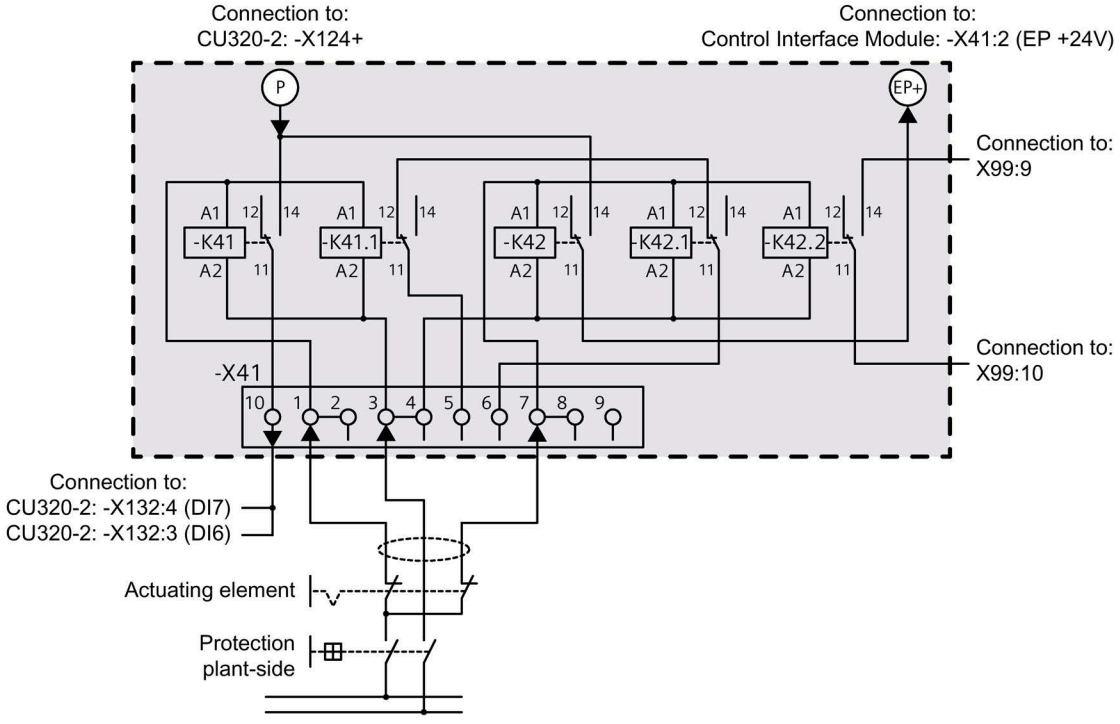


Figure 5-2 Terminal module circuit for option K82 for a parallel circuit

A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

Note

Terminal -X41:10 is permanently connected to digital input DI 7 of the Control Unit.

Note

For the subsequently listed cabinet units (synchronizers), digital input DI 6 of the Control Unit is also assigned:

- for 380 to 480 V 3 AC:
  6SL3710-2GE41-1AA3, 6SL3710-2GE41-4AA3, 6SL3710-2GE41-6AA3
- for 500 to 600 V 3 AC:
  6SL3710-2GF38-6AA3, 6SL3710-2GF41-1AA3, 6SL3710-2GF41-4AA3
- for 660 to 690 V 3 AC:
  6SL3710-2GH41-1AA3, 6SL3710-2GH41-4AA3, 6SL3710-2GH41-5AA3

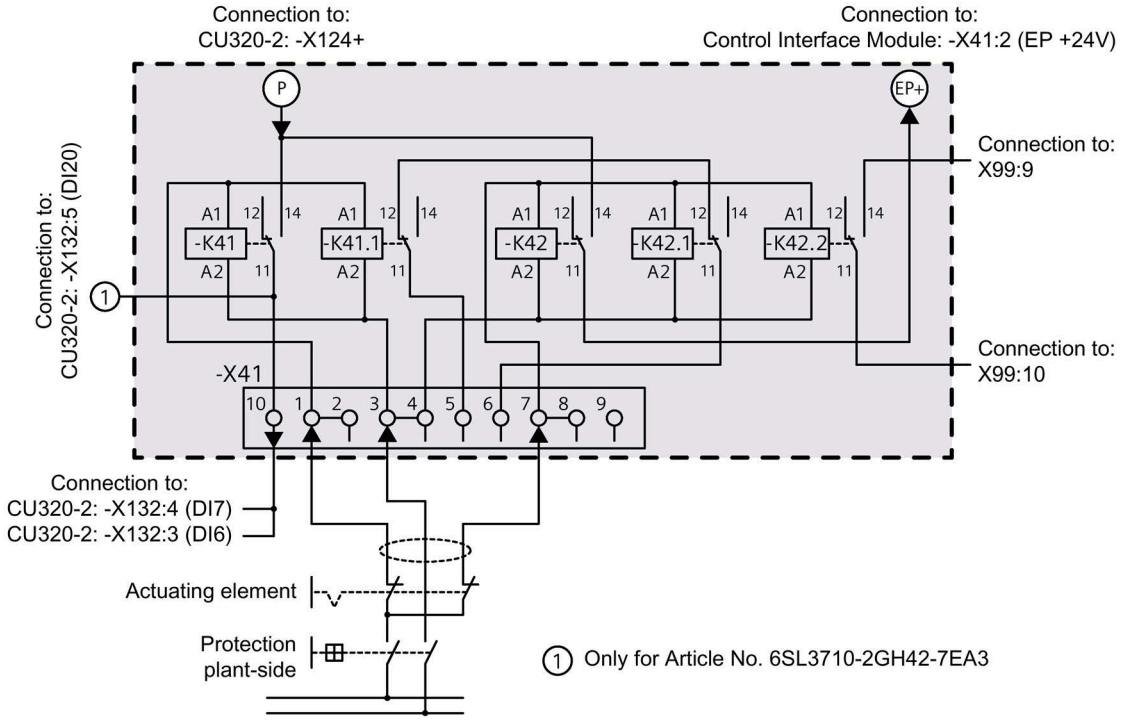


Figure 5-3 Terminal module circuit for option K82 for G150 HighPower

Interconnection in groups

When using a single actuating element for multiple cabinet units, the following terminals have to be used on terminal strip -X41:

- -X41:2: Interconnection to the next cabinet unit, terminal -X41:1
- -X41:4: Interconnection to the next cabinet unit, terminal -X41:3
- -X41:8: Interconnection to the next cabinet unit, terminal -X41:7

Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.2.2 Terminal module for control of "STO" and "SS1" for SINAMICS S120 Cabinet Modules

5.2.2.1 General information

Availability of the option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kit
- Motor Module in chassis format
- Motor Module Chassis-2 format

Description

Option K82 (terminal module for controlling "Safe Torque Off" and "Safe Stop 1") is used to control Safety Integrated Basic Functions in an electrically isolated fashion.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

Option K82 is used to control the following Safety Integrated Basic Functions (terms and definitions in accordance with IEC 61800-5-2):

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In combination with option K82, the requirements specified in IEC 61800-5-2, IEC 60204-1 as well as ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This option is used when the following requirements apply:

- Control is realized with electrical isolation in a voltage range 24 V DC/AC.
- Using non-shielded control lines which are longer than 30 m.
- The devices are deployed in plants dispersed over a wide area (no ideal equipotential bonding).

Principle of operation

Two independent channels of the integrated safety function are controlled via relays (-K41, -K42).

Relay -K41 controls the signal at the Control Unit that is necessary for the safety function and relay -K42, the corresponding signal at the Motor Module.

The selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The circuit is structured so that it is protected against wire break, i.e. if the relay's control voltage fails then the safety function is active.

A feedback signal is not part of the safety concept.

Note

The feedback signal is not necessary to comply with standard ISO 13849-1 Cat. 3 PL d and IEC 61508 SIL 2.

The selection of the safety function must be performed in two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or IEC 61508 SIL 2) for the complete system.

Forced checking procedure

The maximum value for the forced checking procedure interval when using option K82 is 12 months (8760 h).

Customer interface -X41

Table 5- 3 Terminal strip -X41

Terminal	Meaning	Technical data
-X41:1	Control of -K41:A1	Connection for actuating element at channel 1 "+"
-X41:2	Connected to -X41:1	Connection for actuating element at channel 1 "+", for interconnecting Motor Modules in groups
-X41:3	Control of -K41:A2, -K42:A2, N conductor or ground	Connection of reference potential for actuating elements at channel 1 and channel 2
-X41:4	Connected to -X41:3	Connection of reference potential for actuating elements at channel 1 and channel 2, for interconnecting Motor Modules in groups
-X41:7	Control of -K42:A1	Connection for actuating element at channel 2 "+"
-X41:8	Connected to -X41:7	Connection for actuating element at channel 2 "+", for interconnecting Motor Modules in groups
-X41:10	Output -K41: Permanently wired with CU320-2: -X132:4 (DI 7)	Output -K41: For connecting to a digital input according to the Safety settings on the CU320-2 (already wired in option K90)

Control circuit:

Rated voltage: 24 V DC/AC (0.85 ... 1.25 x U_{Rated})

Max. cable length (applies to the sum of the outgoing and return lines):

- 24 V DC (min. cross-section, 0.75 mm^2): 1000 m
- 24 V AC (cable capacitance: 300 pF/m): 500 m

  The value applies for 50 Hz; at 60 Hz, the cable lengths must be reduced by 20 %.

⚠WARNING

Danger to life as a result of exceeding the permissible cable lengths and/or the permissible cable capacitances

When the permissible cable lengths and/or the permissible cable capacitances are exceeded, the relay can remain energized as a result of the coupling capacitances of the cable and the associated residual current, in spite of the fact that the actuating elements are open. Death and serious injury can result in the event of an error.

- Do not exceed the maximum permissible cable lengths and cable capacitances.

Max. connectable cross-section: 2.5 mm^2

Fuse: Max. 4 A

Installation altitude: up to 4000 m for overvoltage category II according to IEC 61800-5-1

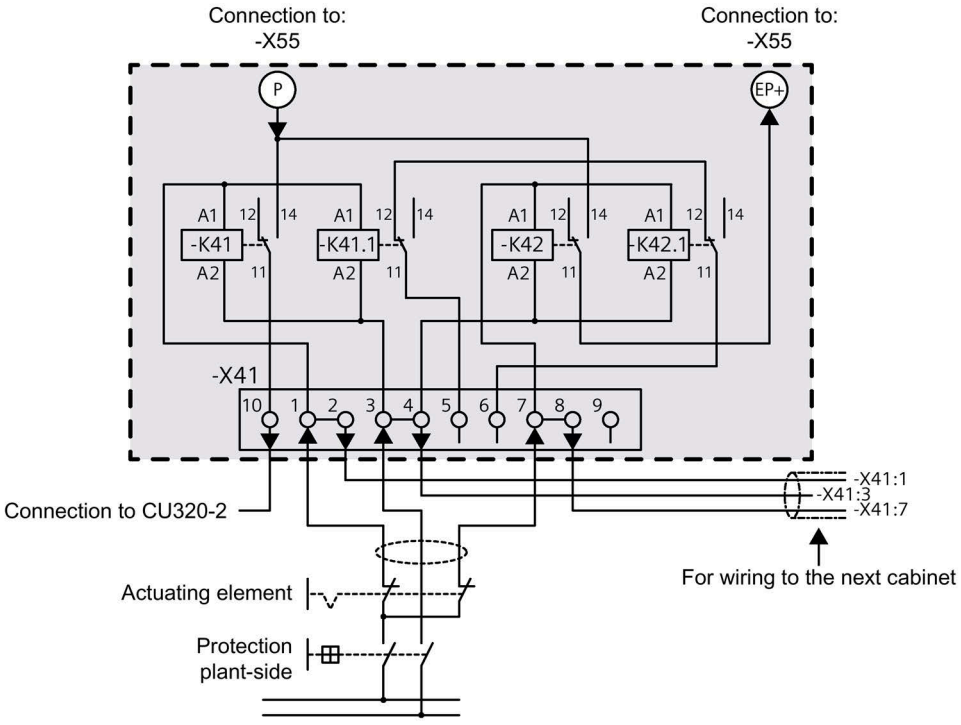


Figure 5-4 Circuit Terminal Module for option K82

A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

5.2.2.2 Use of the K82 option with Control Unit CU320-2

In conjunction with option K90 or K95 (CU320-2 DP or CU320-2 PN), terminal -X41:10 is already connected inside the cabinet with digital input DI 7 of the CU320-2.

These interconnections have to be taken into account when Safety function parameters are assigned.

5.2.2.3 Use of the K82 option with Control Unit CU320-2

If option K90 or K95 is not available, -X41:10 should be connected to the particular Control Unit associated with the Motor Module. Digital inputs DI 0 to DI 7, DI 16, DI 17, DI 20, DI 21 are available for this purpose.

These interconnections have to be taken into account when Safety function parameters are assigned.

If the cable is routed to the Control Unit outside the cabinet, then the cable may not be longer than 30 m. For longer cable lengths, suitable protective circuitry must be provided on the plant side to provide overvoltage protection.

Table 5- 4 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

Note

Terminal -X41:10 can only be connected with digital inputs DI 0 to DI 7, DI 16, DI 17, DI 20, DI 21 of the Control Unit, other digital inputs cannot be interconnected.

5.2.2.4 Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.2.3 Terminal module for control of "STO" and "SS1" for SINAMICS S150

Description

Option K82 (terminal module for controlling "Safe Torque Off" and "Safe Stop 1") is used to control Safety Integrated Basic Functions in an electrically isolated fashion.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

Option K82 is used to control the following Safety Integrated Basic Functions (terms and definitions in accordance with IEC 61800-5-2):

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In combination with option K82, the requirements specified in IEC 61800-5-2, IEC 60204-1 as well as ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This option is used when the following requirements apply:

- Control is realized with electrical isolation in a voltage range 24 V DC/AC.
- Using non-shielded control lines which are longer than 30 m.
- The devices are deployed in plants dispersed over a wide area (no ideal equipotential bonding).

Principle of operation

Two independent channels of the integrated safety function are controlled via relays (-K41, -K42).

Relay -K41 controls the signal at the Control Unit that is necessary for the safety function and relay -K42, the corresponding signal at the Motor Module.

The selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The circuit is structured so that it is protected against wire break, i.e. if the relay's control voltage fails then the safety function is active.

A feedback signal is not part of the safety concept.

Note

The feedback signal is not necessary to comply with standard ISO 13849-1 Cat. 3 PL d and IEC 61508 SIL 2.

The selection of the safety function must be performed in two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or IEC 61508 SIL 2) for the complete system.

Forced checking procedure

The maximum value for the forced checking procedure interval when using option K82 is 12 months (8760 h).

Customer interface -X41

Table 5- 5 Terminal strip -X41

Terminal	Meaning	Technical data
-X41:1	Control of -K41:A1	Connection for actuating element at channel 1 "+"
-X41:2	Connected to -X41:1	
-X41:3	Control of -K41:A2, -K42:A2, N conductor or ground	Connection of reference potential for actuating elements at channel 1 and channel 2
-X41:4	Connected to -X41:3	
-X41:7	Control of -K42:A1	Connection for actuating element at channel 2 "+"
-X41:8	Connected to -X41:7	
-X41:10	Output -K41: Permanently wired with CU320-2: -X132:4 (DI 7)	

Control circuit:

Rated voltage: 24 V DC/AC (0.85 ... 1.25 x U_{Rated})

Max. cable length (applies to the sum of the outgoing and return cables):

- 24 V DC (min. cross-section, 0.75 mm²): 1000 m
- 24 V AC (cable capacitance: 300 pF/m): 500 m

  The value applies for 50 Hz; at 60 Hz, the cable lengths must be reduced by 20 %.

⚠WARNING

Danger to life as a result of exceeding the permissible cable lengths and/or the permissible cable capacitances

When the permissible cable lengths and/or the permissible cable capacitances are exceeded, the relay can remain energized as a result of the coupling capacitances of the cable and the associated residual current, in spite of the fact that the actuating elements are open. Death and serious injury can result in the event of an error.

- Do not exceed the maximum permissible cable lengths and cable capacitances.

Max. connectable cross-section: 2.5 mm²

Fuse: Max. 4 A

Installation altitude: up to 4000 m for overvoltage category II according to IEC 61800-5-1

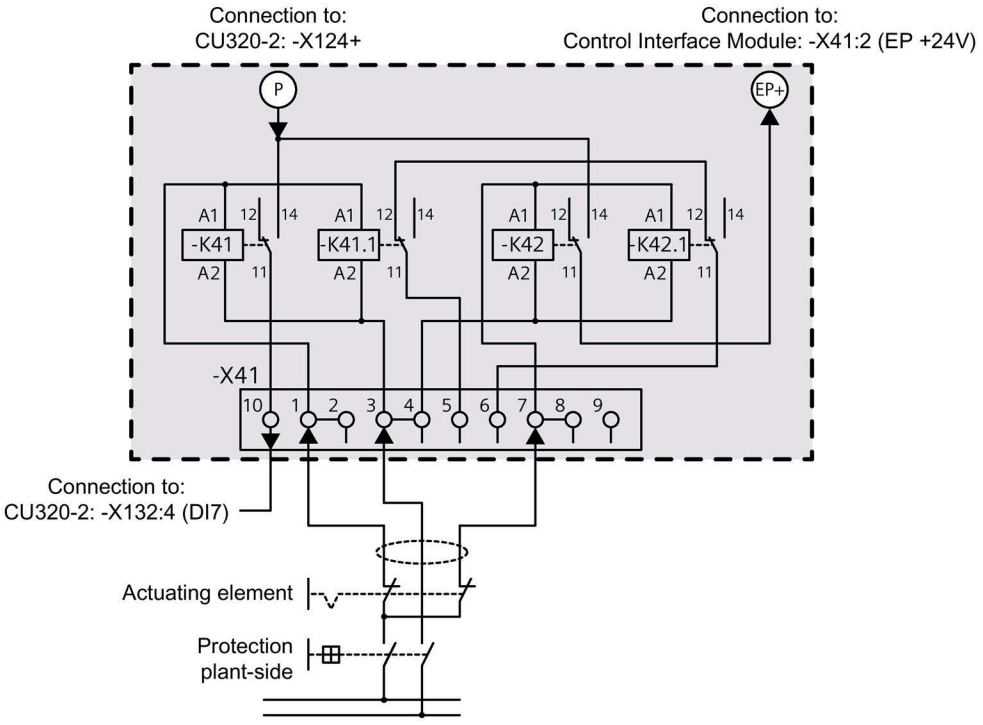


Figure 5-5 Circuit Terminal Module for option K82

A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

Note

Terminal -X41:10 is permanently connected to digital input DI 7 of the Control Unit.

Interconnection in groups

When using a single actuating element for multiple cabinet units, the following terminals have to be used on terminal strip -X41:

- -X41:2: Interconnection to the next cabinet unit, terminal -X41:1
- -X41:4: Interconnection to the next cabinet unit, terminal -X41:3
- -X41:8: Interconnection to the next cabinet unit, terminal -X41:7

Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.2.4 Technical data

Refer to the documentation of the corresponding built-in device or cabinet unit for technical data relating to temperature, vibration, shock and environmental classes.

Table 5- 6 Technical data of the terminal module for option K82

Functional safety	
SIL claim limit	SIL 2 according to IEC 61800-5-2 Depending on the application and the diagnostic test interval
Achievable category and Performance Level	PL d / Cat. 3 according to ISO 13849-1 Depending on the application and the diagnostic test interval
PFH, PFH_D [1]	0.5×10^{-9} 1/h according to IEC 61800-5-2 / IEC 62061
PFD [2]	0.5×10^{-4} 1/h acc. to IEC 61511
TM: Usage time (mission time) [3]	20 years
Test stop	≤ 1 year
HFT	HFT = 1
Response time when activating STO	100 ms additional response time to the STO response time without K82
Switch-on threshold Switch-off threshold	≤ 15 V ≥ 5 V

1) PFH, PFH_D: Probability of dangerous failures per hour.

2) PFD: Probability of dangerous failure on demand

3) IEC 61800-5-2 mission time TM: Usage time, defined accumulated operating duration of the PDS(SR) over its complete service life.

5.3 Control of "STO" and "SS1" via terminals on the Control Unit and the Motor/Power Module

Features

- Only for the Basic Functions.
- Dual-channel structure via two digital inputs (Control Unit / power unit).
- A debounce function can be applied to the terminals of the Control Unit and the Motor Module to prevent incorrect trips due to signal disturbances or test signals. The filter times are set via parameters p9651 and p9851.
- Different terminal blocks depending on the format.
- Automatic AND operation of up to eight digital inputs (p9620[0..7]) on the Control Unit for chassis format power units connected parallel switching.

Overview of the terminals for safety functions

The different power unit formats have different terminal designations for the inputs of the safety functions. These are shown in the following table.

Table 5- 7 Inputs for safety functions

Module	1st switch-off signal path (p9620[0])	2nd switch-off signal path (EP terminals)
Control Unit CU320-2	-X122.1...6 / -X132.1...6 DI 0...7/16/17/20/21	
Single Motor Module Booksize	(see CU320-2)	-X21.3 and -X21.4 (on the Motor Module)
Motor Module/ Power Module Chassis	(see CU320-2)	-X41.1 and -X41.2
Motor Module Chassis-2	(see CU320-2)	-X41.1 and -X41.2
For further information about the terminals, see the Equipment Manuals.		

Terminals for STO, SS1 (time-controlled), SBC

The functions are separately selected/deselected for each drive using two terminals.

1. **Switch-off signal path, Control Unit**

   The desired input terminal is selected via BICO interconnection (BI: p9620[0]).

2. **Switch-off signal path Motor Module / Power Module**

   The input terminal is the "EP" terminal ("Enable Pulses")

   The EP terminal is periodically interrogated with a sampling time which is rounded off to an integer multiple of the current controller cycle; however, it is a minimum of 1 ms. (example: t_i = 400 µs, t_{EP} => 3 x t_i = 1.2 ms)

Both terminals must be energized within the tolerance time p9650, otherwise a fault will be output.

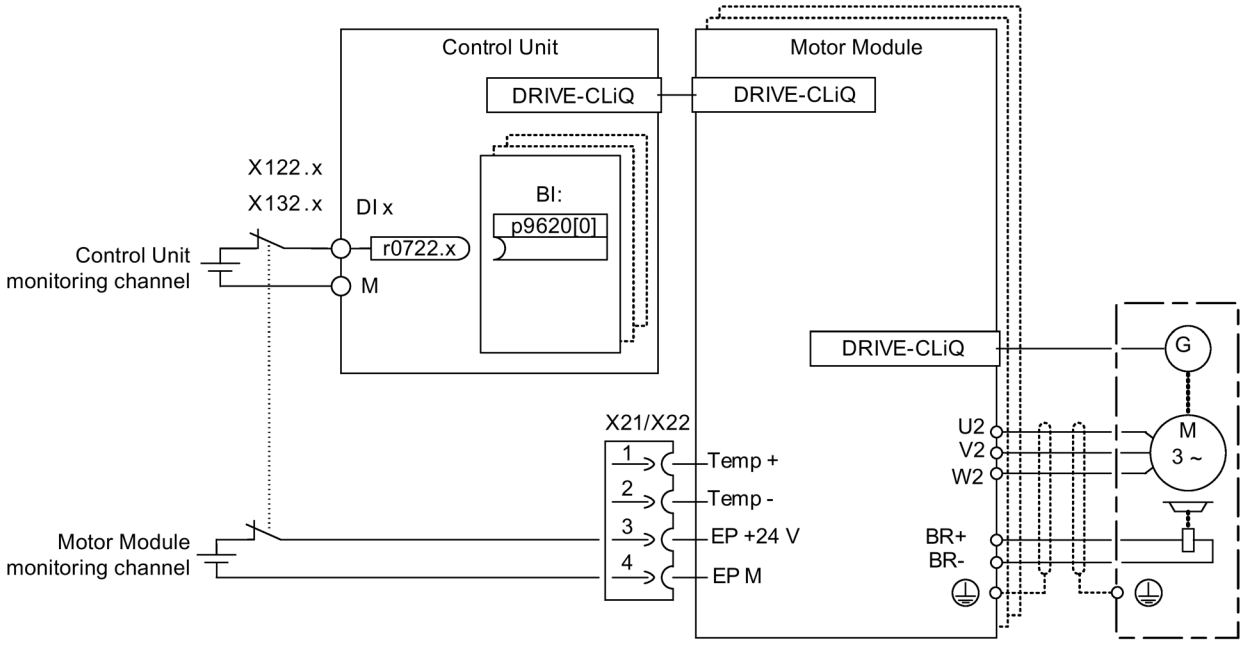


Figure 5-6 Example: Terminals for "Safe Torque Off": Example of Motor Modules Booksize and CU320-2

Grouping drives

To ensure that the function works for more than one drive at the same time, the terminals for the corresponding drives must be grouped together as follows:

1. Switch-off signal path

   By appropriately interconnecting the binector input to a joint input terminal for the drives to be combined to form a group.

2. Switch-off signal path (Motor Module / Power Module)

   By appropriately wiring the terminals for the individual Motor Modules / Power Modules belonging to the group.

Note

Parameterization of the grouping

The grouping must be configured (DI on Control Unit) and wired (EP terminals) identically in both monitoring channels.

Note

Response of STO for grouping

If a fault in a drive results in a "Safe Torque Off" (STO), this does not automatically mean that the other drives in the same group also switch to "Safe Torque Off" (STO).

The assignment is checked during the test for the switch-off signal paths. The operator selects "Safe Torque Off" for each group. The check is drive-specific.

Example: Terminal groups

It must be possible to select/deselect "Safe Torque Off" separately for group 1 (drives 1 and 2) and group 2 (drives 3 and 4).

For this purpose, the same grouping for "Safe Torque Off" must be realized both for the Control Unit and the Motor Modules.

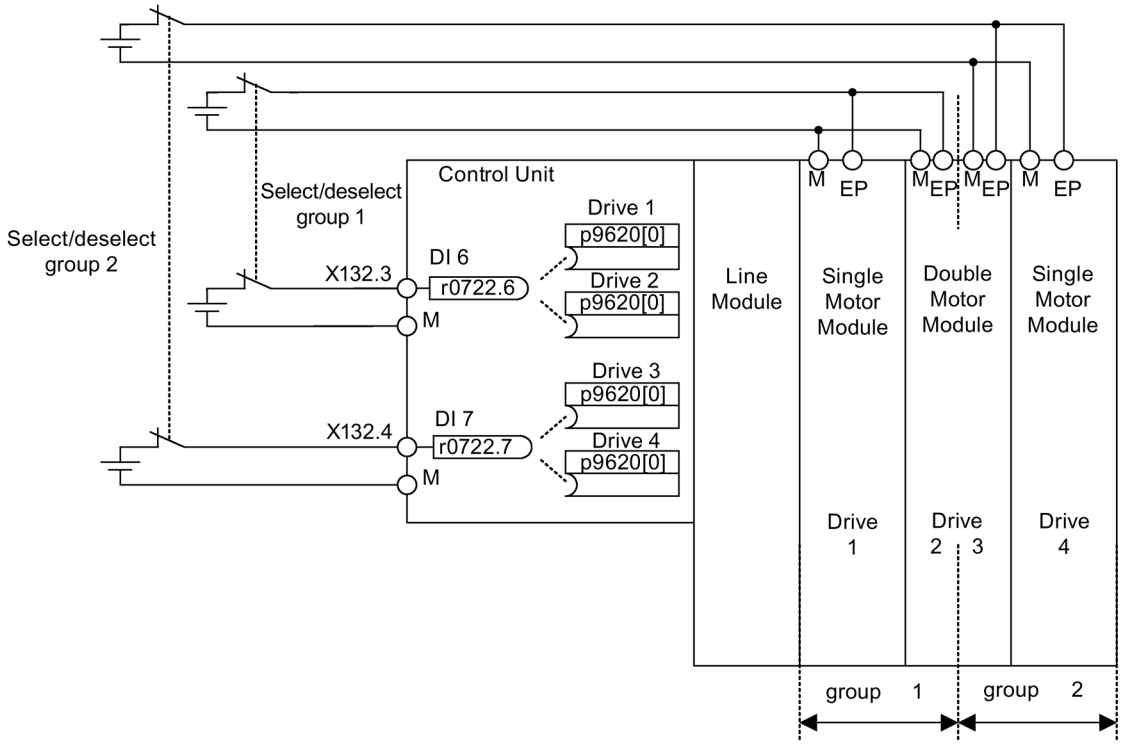


Figure 5-7 Example: Grouping terminals with Motor Modules Booksize and CU320-2

Notes on connecting Motor Modules format Chassis or Chassis-2 in parallel

When Motor Modules in the Chassis or Chassis-2 format are connected in parallel, a safety-relevant AND element is created on the parallel drive object. The number of indexes in p9620 corresponds to the number of parallel chassis components in p0120.

5.3.1 Simultaneity and tolerance time of the two monitoring channels

The "Safe Torque Off" function must be selected/deselected simultaneously in both monitoring channels using the input terminals and is only effective for the associated drive.

- 1 signal: Deselecting the function
- 0 signal: Selecting the function

The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. The tolerance time, within which the selection and/or deselection must be realized in both monitoring channels in order to be considered as "simultaneous" is specified using the following parameters:

- p9650 (Basic Functions)
- p10002 (Extended/Advanced Functions)

Note

Parameterization of the tolerance time

In order to avoid that faults are incorrectly initiated, at these inputs the tolerance time must always be set shorter than the shortest time between two switching events (ON/OFF, OFF/ON).

- If the monitoring functions are not selected/deselected within the tolerance time, this is detected by the cross-check, and the following fault (STOP F) is output.
  - F01611 (Basic Functions)
  - C01770 (Extended/Advanced Functions)

  For STO the following applies: In this case, the pulses have already been canceled as a result of the selection of "Safe Torque Off" on one channel.

  Note

  Timing between the switching operations for Basic Functions

  Message F01611 with fault value 1000 is output if switching operations occur too frequently. The cause depends on the type of control:
  - The signals are continually changing at the F-DI.
  - STO is being permanently initiated via PROFIsafe (also as subsequent response).

  Within the time 5 × p9650, there must be at least two switching operations at the terminals or via PROFIsafe with a minimum time between them of p9650.

- If the "Safe Stop 1" of the Basic Functions is not selected within the tolerance time in two channels, this is detected by the cross-check, and fault F01611 (STOP F) is output. After the set "SI Safe Stop 1 delay time" (p9652), the pulses are suppressed.

Note

To enable the drive to brake to standstill even when selected through one channel, the time in p9652 must be shorter than the sum of the parameters for the data cross-check (p9650 and p9658). Otherwise, the drive will coast down after the time p9650 + p9658 has elapsed.

Further notes for setting the discrepancy time are contained in the List Manual for the following messages

- F01611 (Basic Functions)
- C01770 (Extended/Advanced Functions)

Overview of important parameters

- p9650 SI SGE switchover discrepancy time (Control Unit)
- p9652 SI Safe Stop 1 delay time (Control Unit)
- p9658 SI transition time STOP F to STOP A (Control Unit)
- p10002 SI Motion F-DI switchover discrepancy time (processor 1)

5.3.2 Bit pattern test

Bit pattern test of fail-safe outputs

The converter normally responds immediately to signal changes in its fail-safe inputs. This is not desired in the following case: Several control modules test their fail-safe outputs using bit pattern tests (light/darkness tests) to identify faults due to either short-circuiting or cross circuiting. When you interconnect a fail-safe input of the converter with a fail-safe output of a control module, the converter responds to these test signals.

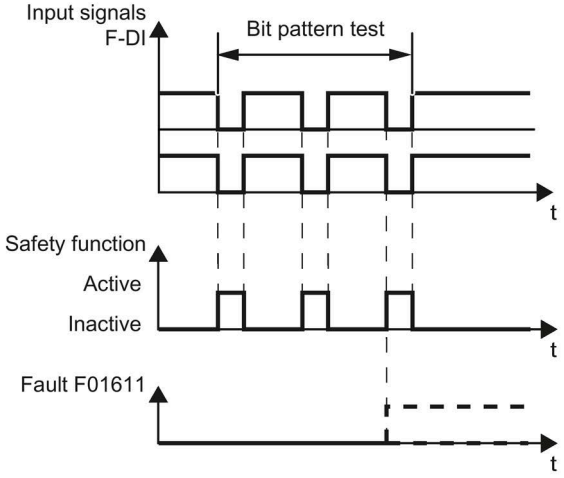


Figure 5-8 Converter response to a bit pattern test

Note

Debounce time for unwanted triggering of Safety Integrated functions

If the test pulses cause an unwanted triggering of the Safety Integrated Functions, these test pulses can be suppressed using the F-DI input filter (p9651 for Basic Functions or p10017 for Extended/Advanced Functions). To do this, a value that is greater than the duration of a test pulse must be entered in p9651 or p10017.

Overview of important parameters

- p9651 SI STO/SBC/SS1 debounce time (Control Unit)
- p10017 SI Motion digital inputs debounce time (processor 1)

5.3.3 Control of "STO" and "SS1" for SINAMICS G130

Description

The safety functions contained in the standard ("Safe Torque Off" and "Safe Stop 1") can be used with the Power Module.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

The following Safety Integrated Basic Functions (terms and definitions according to IEC 61800-5-2) can be controlled:

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Power Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This variant is used when:

- Activation will be executed optically isolated with a voltage of 24 VDC.
- Working with control lines that are shorter than 30 m.
- Devices are deployed in plants with low spatial elongation (observe the drop in voltage at 24 VDC!).

Principle of operation

The first switch-off signal path for the integrated safety functions is controlled via a digital input on the Control Unit. Digital inputs DI 0 to DI 7, DI 16, DI 17, DI 20 and DI 21 are available for this purpose.

The second switch-off signal path for the integrated safety functions is controlled via the terminals (-X41:1, -X42:2) on the Control Interface Module of the Power Module.

Selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The selection of the safety function on the Control Unit and on the Control Interface Module of the Power Module must be performed in two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or IEC 61508 SIL 2) for the complete system.

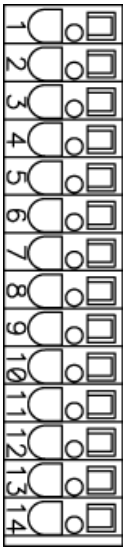
Terminal strip –X41 on the Control Interface Module of the Power Module

Table 5- 8 Terminal strip –X41 on the Control Interface Module of the Power Module

Terminal	Function	Technical data
-X41:2	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X41:1	EP M1 (enable pulses)	

Terminal strip -X122 on the CU320-2 Control Unit

Table 5- 9 Terminal strip -X122 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M1 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 8, DI 9, DI 10 and DI 11 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M1: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

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

This is achieved by using one of the following measures:

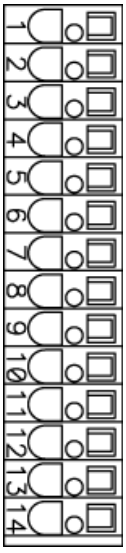
1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Terminal strip -X132 on the CU320-2 Control Unit

Table 5- 10 Terminal strip -X132 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M2 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 12, DI 13, DI 14 and DI 15 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm²			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved by using one of the following measures:

1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.3.4 Control of "STO" and "SS1" for SINAMICS G150

Description

The safety functions contained in the standard ("Safe Torque Off" and "Safe Stop 1") can also be used without option K82.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

The following Safety Integrated Basic Functions (terms and definitions according to IEC 61800-5-2) can be controlled:

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Power Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This variant is used when:

- Activation will be executed optically isolated with a voltage of 24 VDC.
- Working with control lines that are shorter than 30 m.
- Devices are deployed in plants with low spatial elongation (observe the drop in voltage at 24 VDC!).

Principle of operation

The first switch-off signal path for the integrated safety functions is controlled via a digital input on the Control Unit. Digital inputs DI 0 to DI 7, DI 16, DI 17, DI 20 and DI 21 are available for this purpose.

The second switch-off signal path for the integrated safety functions is controlled via the terminals (-X41:1, -X42:2) on the Control Interface Module of the Power Module.

Note

Additional inputs must be controlled for the following cabinet units (synchronizers):

- An additional digital input on the CU320-2 and
- The terminals (-X41:1, -X42:2) on the Control Interface Module of the second Power Module connected in parallel.

Synchronizers:

- for 380 to 480 V 3 AC:
  6SL3710-2GE41-1AA3, 6SL3710-2GE41-4AA3, 6SL3710-2GE41-6AA3
- for 500 to 600 V 3 AC:
  6SL3710-2GF38-6AA3, 6SL3710-2GF41-1AA3, 6SL3710-2GF41-4AA3
- for 660 to 690 V 3 AC:
  6SL3710-2GH41-1AA3, 6SL3710-2GH41-4AA3, 6SL3710-2GH41-5AA3

Selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The selection of the safety function on the Control Unit and on the Control Interface Module of the Power Module must be performed in two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠ WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or IEC 61508 SIL 2) for the complete system.

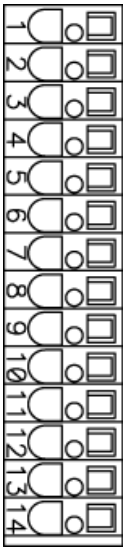
Terminal strip –X41 on the Control Interface Module of the Power Module

Table 5- 11 Terminal strip –X41 on the Control Interface Module of the Power Module

Terminal	Function	Technical data
-X41:2	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X41:1	EP M1 (enable pulses)	

Terminal strip -X122 on the CU320-2 Control Unit

Table 5- 12 Terminal strip -X122 on the CU320-2 Control Unit

	Terminal	Designation [1)]	Technical data
	1	DI 0	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M1 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple)
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	

	Terminal	Designation [1]	Technical data
	14	M	"1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 8, DI 9, DI 10 and DI 11 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
Max. connectable cross-section: 1.5 mm^2			

1) DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M1: Reference ground

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

3) Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

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

This is achieved by using one of the following measures:

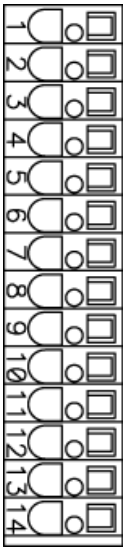
1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Terminal strip -X132 on the CU320-2 Control Unit

Table 5- 13 Terminal strip -X132 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M2 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 12, DI 13, DI 14 and DI 15 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm²			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved by using one of the following measures:

1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.3.5 Control of "STO" and "SS1" for SINAMICS S120 Chassis and Chassis-2

Description

The safety functions contained in the standard ("Safe Torque Off" and "Safe Stop 1") can be used with the Motor Module.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

The following Safety Integrated Basic Functions (terms and definitions according to IEC 61800-5-2) can be controlled:

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This variant is used when:

- Activation will be executed optically isolated with a voltage of 24 VDC.
- Working with control lines that are shorter than 30 m.
- Devices are deployed in plants with low spatial elongation (observe the drop in voltage at 24 VDC!).

Principle of operation

The first switch-off signal path for the integrated safety functions is controlled via a digital input on the Control Unit. Digital inputs DI 0 to DI 7, DI 16, DI 17, DI 20 and DI 21 are available for this purpose.

The second switch-off signal path for the integrated safety functions is controlled via the terminals (-X41:1, -X42:2) on the Control Interface Module of the Motor Module or the Motor Module, format Chassis-2.

Selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The selection of the safety function on the Control Unit and on the Motor Module must be executed over two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or IEC 61508 SIL 2) for the complete system.

Terminal strip -X41 on the Control Interface Module of the Motor Module, Chassis format

Table 5- 14 Terminal strip -X41 on the Control Interface Module of the Motor Module, Chassis format

Terminal	Function	Technical data
-X41:2	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X41:1	EP M1 (enable pulses)	

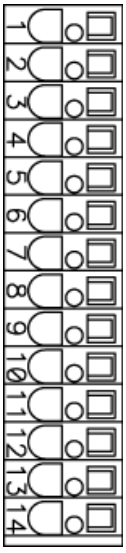
Terminal strip -X41 of the Motor Modules Chassis-2

Table 5- 15 Terminal strip -X41 of the Motor Modules Chassis-2

Terminal	Function	Technical data
-X41:1	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X41:2	EP M1 (enable pulses)	

Terminal strip -X122 on the CU320-2 Control Unit

Table 5- 16 Terminal strip -X122 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M1 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 8, DI 9, DI 10 and DI 11 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm²			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M1: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

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

This is achieved by using one of the following measures:

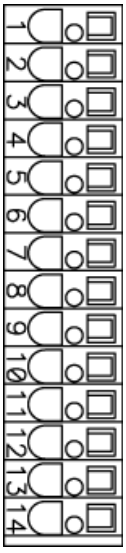
1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Terminal strip -X132 on the CU320-2 Control Unit

Table 5- 17 Terminal strip -X132 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M2 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 12, DI 13, DI 14 and DI 15 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm²			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved by using one of the following measures:

1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.3.6 Control of "STO" and "SS1" for SINAMICS S120 Cabinet Modules

Description

The safety functions contained in the standard ("Safe Torque Off" and "Safe Stop 1") can also be used without option K82.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

The following Safety Integrated Basic Functions (terms and definitions according to IEC 61800-5-2) can be controlled:

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This variant is used when:

- Activation will be executed optically isolated with a voltage of 24 VDC.
- Working with control lines that are shorter than 30 m.
- Devices are deployed in plants with low spatial elongation (observe the drop in voltage at 24 VDC!).

Principle of operation

The first switch-off signal path for the integrated safety functions is controlled via a digital input on the Control Unit. Digital inputs DI 0 to DI 7, DI 16, DI 17, DI 20 and DI 21 are available for this purpose.

Motor Module Chassis and Chassis-2

- The second switch-off signal path for the integrated safety functions is controlled via the terminals (-X41:1, -X42:2) on the Control Interface Module of the Motor Module.

Booksize Cabinet Kit

- The second switch-off signal path for the integrated safety functions is controlled using the terminals (-X21:3, -X21:4) on the Motor Module Booksize.

Selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The selection of the safety function on the Control Unit and on the Motor Module must be executed over two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠ WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or IEC 61508 SIL 2) for the complete system.

Terminal strip -X41 on the Control Interface Module of the Motor Module, Chassis format

Table 5- 18 Terminal strip -X41 on the Control Interface Module of the Motor Module, Chassis format

Terminal	Function	Technical data
-X41:2	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X41:1	EP M1 (enable pulses)	

Terminal strip -X41 of the Motor Modules Chassis-2

Table 5- 19 Terminal strip -X41 of the Motor Modules Chassis and Chassis-2

Terminal	Function	Technical data
-X41:1	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X41:2	EP M1 (enable pulses)	

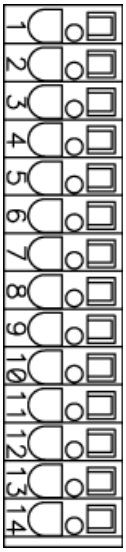
Terminal strip -X21 on the Motor Modules Booksize

Table 5- 20 Terminal strip -X21 on the Motor Modules Booksize

Terminal	Function	Technical data
-X21:3	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA Signal propagation times: L → H: 100 µs H → L: 1000 µs The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X21:4	EP M1 (enable pulses)	

Terminal strip -X122 on the CU320-2 Control Unit

Table 5- 21 Terminal strip -X122 on the CU320-2 Control Unit

	Terminal	Designation [1)]	Technical data
	1	DI 0	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M1 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple)
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	

	Terminal	Designation [1]	Technical data
	14	M	"1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 8, DI 9, DI 10 and DI 11 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
Max. connectable cross-section: 1.5 mm^2			

1) DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M1: Reference ground

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

3) Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

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

This is achieved by using one of the following measures:

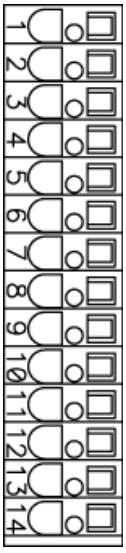
1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Terminal strip -X132 on the CU320-2 Control Unit

Table 5- 22 Terminal strip -X132 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M2 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 12, DI 13, DI 14 and DI 15 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm²			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved by using one of the following measures:

1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.3.7 Control of "STO" and "SS1" for SINAMICS S150

Description

The safety functions contained in the standard ("Safe Torque Off" and "Safe Stop 1") can also be used without option K82.

Note

Refer to the circuit diagrams enclosed for the interconnections of your device.

Note

The Safety functions must be activated prior to use via parameter assignment. An acceptance test must be performed and an acceptance log must be created.

The following Safety Integrated Basic Functions (terms and definitions according to IEC 61800-5-2) can be controlled:

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In addition, most of the SINAMICS safety functions have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office or local sales office.

Recommended application

This variant is used when:

- Activation will be executed optically isolated with a voltage of 24 VDC.
- Working with control lines that are shorter than 30 m.
- Devices are deployed in plants with low spatial elongation (observe the drop in voltage at 24 VDC!).

Principle of operation

The first switch-off signal path for the integrated safety functions is controlled via a digital input on the Control Unit. Digital inputs DI 0 to DI 7, DI 16, DI 17, DI 20 and DI 21 are available for this purpose.

The second switch-off signal path for the integrated safety functions is controlled via the terminals (-X41:1, -X42:2) on the Control Interface Module of the Motor Module.

Selection and deselection must be simultaneous. The time delay that is unavoidable due to mechanical switching operations, for example, can be adapted via parameters. p9650 specifies the tolerance time within which selection/deselection of the two monitoring channels must take place to be considered as "simultaneous".

The selection of the safety function on the Control Unit and on the Control Interface Module of the Motor Module must be executed over two channels. A switch according to ISO 13850, positive opening according to IEC 60947-5-1 or a certified safety control must be used as actuating element.

⚠WARNING

Failure of the safety functions as a result of an unsuitable actuating element

An unsuitable actuating element may cause the safety function to fail which can result in death or serious injury.

- Select the correct actuating element to comply with the standard to be complied with (ISO 13849-1 Cat. 3 PL d or IEC 61508 SIL 2) for the complete system.

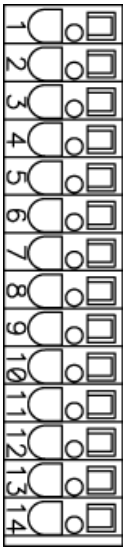
Terminal strip -X41 on the Control Interface Module of the Motor Module

Table 5- 23 Terminal strip -X41 on the Control Interface Module of the Motor Module

Terminal	Function	Technical data
-X41:2	EP +24 V (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
-X41:1	EP M1 (enable pulses)	

Terminal strip -X122 on the CU320-2 Control Unit

Table 5- 24 Terminal strip -X122 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M1 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 8, DI 9, DI 10 and DI 11 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M1: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

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

This is achieved by using one of the following measures:

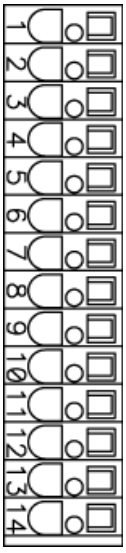
1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Terminal strip -X132 on the CU320-2 Control Unit

Table 5- 25 Terminal strip -X132 on the CU320-2 Control Unit

	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage: -3 ... +30 V DC Electrical isolation: Yes Reference potential: M2 Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 50 µs for "1" → "0": typ. 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: Signal "0" reliably detected Input delay for "0" → "1": typ. 5 µs for "1" → "0": typ. 50 µs DI 12, DI 13, DI 14 and DI 15 are "fast inputs"[2] **As output**: Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X124.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 400 µs (ohmic load) for "1" → "0": typ. 75 µs / max. 100 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	

	Terminal	Designation [1]	Technical data
Max. connectable cross-section: 1.5 mm²			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Reference ground

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

[3] Data for: V_{cc} = 24 V; Load 48 Ω; High ("1") = 90% V_{out}; Low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved by using one of the following measures:

1. Route the ground reference for the digital inputs
2. A jumper to terminal M
   Note: This removes isolation for these digital inputs.

Note

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

Wiring

The control cables should be permanently routed (e.g. cable duct, retained using cable ties).

Signal cables and encoder cables should be installed separated from one another.

The shields of the control cables should be grounded through the largest possible surface area immediately after they enter the control cabinet.

Outside the control cabinet, the cables must be routed in such a way that they are safe to walk on (e.g. as specified in IEC 60204-1).

5.4 Activating "SBC" via the Safe Brake Adapter

5.4.1 Activating "SBC" via the Safe Brake Adapter for option K88 (230 V AC)

Description

The Safe Brake Control (SBC) is a safety function which is used in safety-related applications, e.g. in presses or in rolling mills. In the no-current state, the brake acts on the motor of the drive using spring force. The brake is released when current flows (=low active).

The Safe Brake Adapter 230 VAC is installed in the factory in the cabinet unit. Power is connected to terminal -X12 on the Safe Brake Adapter. A connection between the Safe Brake Adapter and the Control Interface Module is established in the factory so that the Safe Brake Adapter can be controlled.

For controlling the brake, a connection must be established on the plant side between terminal -X14 on the Safe Brake Adapter and the rectifier of the brake. Direct connection of AC brakes is not permissible.

Fast de-energization

Some brake rectifier types feature two additional connections for switching the brake load on the DC side. This allows the brake coil to be quickly de-energized, i.e. the braking effect starts earlier.

The Safe Brake Adapter supports such fast de-energizing using the two additional connections -X15:1 and -X15:2. This function does not belong to safe brake control.

Note

Determination of the time until the brake engages without fast de-energization

As the fast de-energization is not part of the safety function, this functionality is not monitored. The fast de-energization can therefore fail during operation without being noticed.

Therefore, to determine the time until the brake closes for a machine acceptance, the fast de-energization must be bypassed by short-circuiting the terminals at -X15:1, 2.

Safety instructions

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

With the Safe Brake Adapter (option K89), the requirements specified in IEC 61800-5-2, IEC 60204-1 as well as ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are complied with.

NOTICE

Device defective because a 24 V DC brake has been connected

If a 24 V DC brake is connected to option K88, Safe Brake Adapter 230 V AC on the plant side, then this can damage the Safe Brake Adapter.
This can result in the following undesirable effects:

1. Closing the brake is not displayed on the LEDS.
2. The fuse is ruptured.
3. The contact service life of the relay is reduced.

- Do not connect a 24 VDC brake to the 230 V AC Safe Brake Adapter.

Interfaces

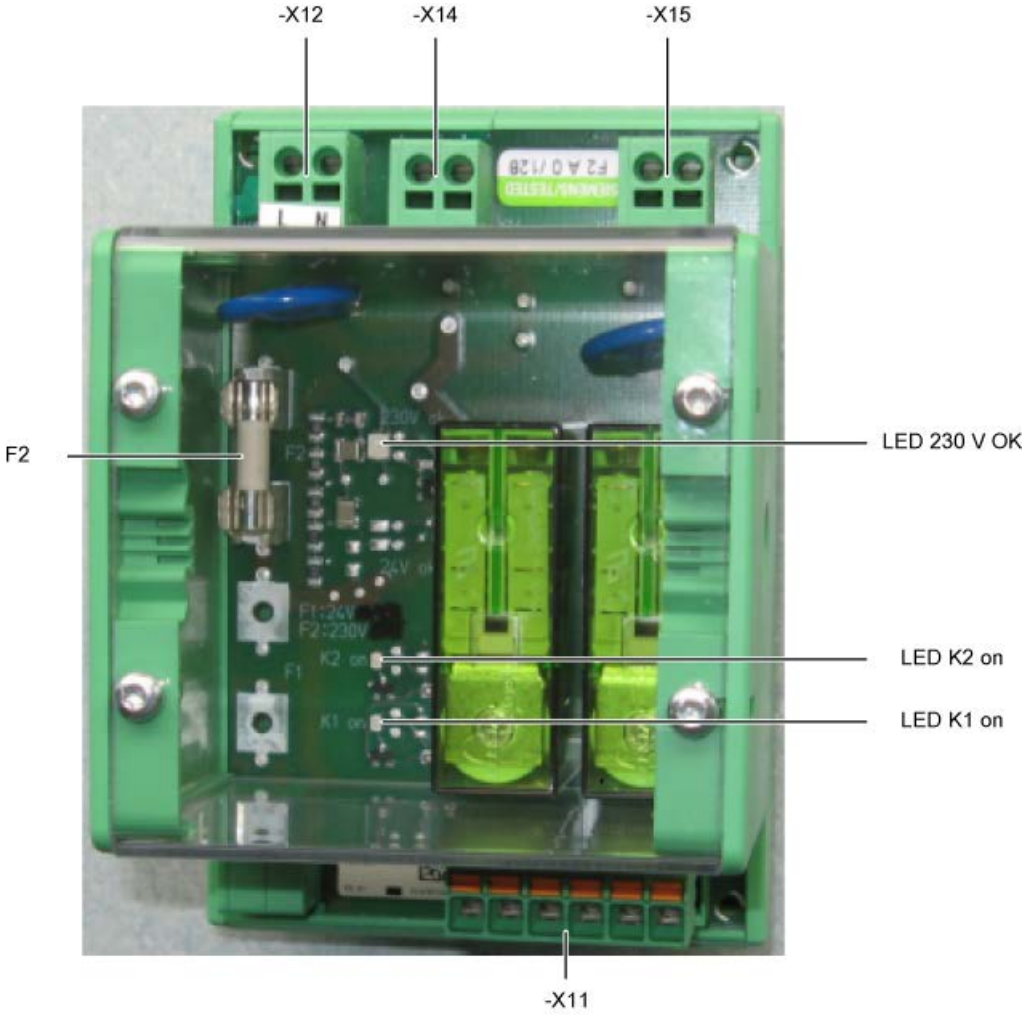


Figure 5-9 Safe Brake Adapter interface overview 230 VAC

Table 5- 26 Terminal strip -X12, 230 V AC power supply

Connection	Signal	Description
-X12.1	L	Supply voltage: 230 V AC Current consumption: 2 A Protection according to IEC 60269-1, operating class gG
-X12.2	N	
Max. connectable cross-section 2.5 mm²		

Table 5- 27 Terminal strip -X14, interface to the load

Connection	Signal	Description
-X14.1	BR L	Supply voltage: 230 V AC Current consumption: 2 A, only for brakes with brake rectifier
-X14.2	BR N	
Max. connectable cross-section 2.5 mm²		

⚠WARNING

Exceeding the permissible cable length of the brake control

If the permissible cable length of the brake control is exceeded this can result in death or serious injury in the event of an error.

- The maximum permissible cable length of 300 m between the 230 V AC Safe Brake Adapter and the brake must be carefully maintained.
- To accurately calculate the maximum cable length, see the SINAMICS Low Voltage Configuration Manual on the customer DVD supplied with the device.

Table 5- 28 Terminal strip -X15, fast de-energization

Connection	Signal	Description
-X15.1	AUX1	Supply voltage: 230 V AC
-X15.2	AUX2	Current consumption: 2 A
Max. connectable cross-section 2.5 mm^2		

Spare fuse

The type of spare fuse is as follows: 2 A, time-lag.

Note

Correctly mounting the housing cover after replacing a fuse

An adhesive label is provided on the housing cover indicating the position of the connector. Mount the cover in the correct position so that the inscription of the label matches the actual connectors.

5.4.2 Safe Brake Adapter SBA 230 V AC for SINAMICS G130/SINAMICS S120 Chassis

Description

The Safe Brake Control (SBC) is a safety function which is used in safety-related applications, e.g. in presses or in rolling mills. In the no-current state, the brake acts on the motor of the drive using spring force. The brake is released when current flows (=low active).

Power must be connected to terminal -X12 on the Safe Brake Adapter.

For controlling the brake, a connection must be established between terminal -X14 on the Safe Brake Adapter and the rectifier of the brake.

For the control, a connection must be established between the Safe Brake Adapter and the Control Interface Module.
The cable harness with article number 6SL3060-4DX04-0AA0 can be used.

Fast de-energization

Some brake rectifier types feature two additional connections for switching the brake load on the DC side. This allows the brake coil to be quickly de-energized, i.e. the braking effect starts earlier.

The Safe Brake Adapter supports such fast de-energizing using the two additional connections -X15:1 and -X15:2. This function does not belong to safe brake control.

Note

Determination of the time until the brake engages without fast de-energization

As the fast de-energization is not part of the safety function, this functionality is not monitored. The fast de-energization can therefore fail during operation without being noticed.

Therefore, to determine the time until the brake closes for a machine acceptance, the fast de-energization must be bypassed by short-circuiting the terminals at -X15:1, 2.

Safety instructions

Note

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

With the Safe Brake Adapter, the requirements specified in IEC 61800-5-2, IEC 60204-1 as well as ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are complied with.

NOTICE

Device defective because a 24 V DC brake has been connected

If a 24 V DC brake is connected to the 230 V AC Safe Brake Adapter on the plant side, this may cause damage to the Safe Brake Adapter.
This can result in the following undesirable effects:

1. Closing the brake is not displayed on the LEDS.
2. The fuse is ruptured.
3. The contact service life of the relay is reduced.

- Do not connect a 24 VDC brake to the 230 V AC Safe Brake Adapter.

Interfaces

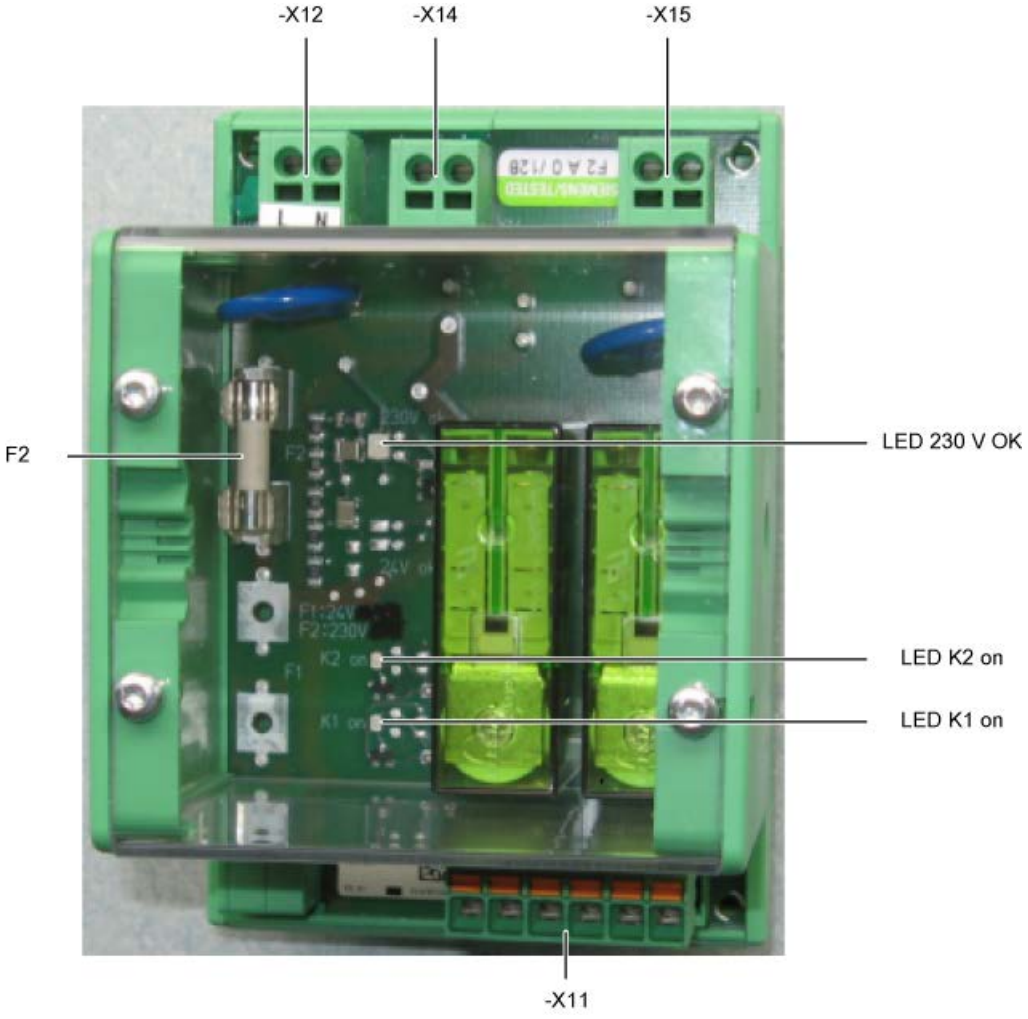


Figure 5-10 Safe Brake Adapter interface overview 230 VAC

Table 5- 29 Terminal strip -X11, interface to the Control Interface Module

Connection	Signal	Description	Technical data
-X11.1	BR+	Control channel 1	Connection to the Control Interface Module, -X46:1
-X11.2	BR-	Control channel 2	Connection to the Control Interface Module, -X46:2
-X11.3	FB+	Relay feedback signal	Connection to the Control Interface Module, -X46:3
-X11.4	FB-	Ground of the relay feedback signal	Connection to the Control Interface Module, -X46:4
-X11.5	P24	P24 of the auxiliary voltage to supply the feedback signal	Connection to the Control Interface Module, -X42:2
-X11.6	M	Ground of the auxiliary voltage	Connection to the Control Interface Module, -X42:3
Max. connectable cross-section 2.5 mm^2			

⚠WARNING

Exceeding the maximum permissible cable length between the Safe Brake Adapter and the Control Interface Module

If the permissible cable length between the Safe Brake Adapter and the Control Interface Module is exceeded this can result in death or serious injury in the event of an error.

- Comply with the maximum permissible cable length of 10 m between the 230 V AC Safe Brake Adapter and the Control Interface Module.
- Route the cable according to ISO 13849-2, Table D.4.
- It is recommended that the cable harness (length 4 m) with article number 6SL3060-4DX04-0AA0 is used.

Table 5- 30 Terminal strip -X12, 230 V AC power supply

Connection	Signal	Description
-X12.1	L	Supply voltage: 230 V AC Current consumption: 2 A Protection according to IEC 60269-1, operating class gG
-X12.2	N	
Max. connectable cross-section 2.5 mm^2		

Table 5- 31 Terminal strip -X14, interface to the load

Connection	Signal	Description
-X14.1	BR L	Supply voltage: 230 V AC Current consumption: 2 A, only for brakes with brake rectifier
-X14.2	BR N	
Max. connectable cross-section 2.5 mm^2		

⚠WARNING

Exceeding the permissible cable length of the brake control

If the permissible cable length of the brake control is exceeded this can result in death or serious injury in the event of an error.

- The maximum permissible cable length of 300 m between the 230 V AC Safe Brake Adapter and the brake must be carefully maintained.
- To accurately calculate the maximum cable length, see the SINAMICS Low Voltage Configuration Manual on the customer DVD supplied with the device.

Table 5- 32 Terminal strip -X15, fast de-energization

Connection	Signal	Description
-X15.1	AUX1	Supply voltage: 230 V AC
-X15.2	AUX2	Current consumption: 2 A
Max. connectable cross-section 2.5 mm²		

Spare fuse

The type of spare fuse is as follows: 2 A, time-lag.

Note

Correctly mounting the housing cover after replacing a fuse

An adhesive label is provided on the housing cover indicating the position of the connector. Mount the cover in the correct position so that the inscription of the label matches the actual connectors.

Mounting

The Safe Brake Adapter is designed for mounting on a rail according to IEC 60715.

The dimensions are shown in the following dimension drawing.

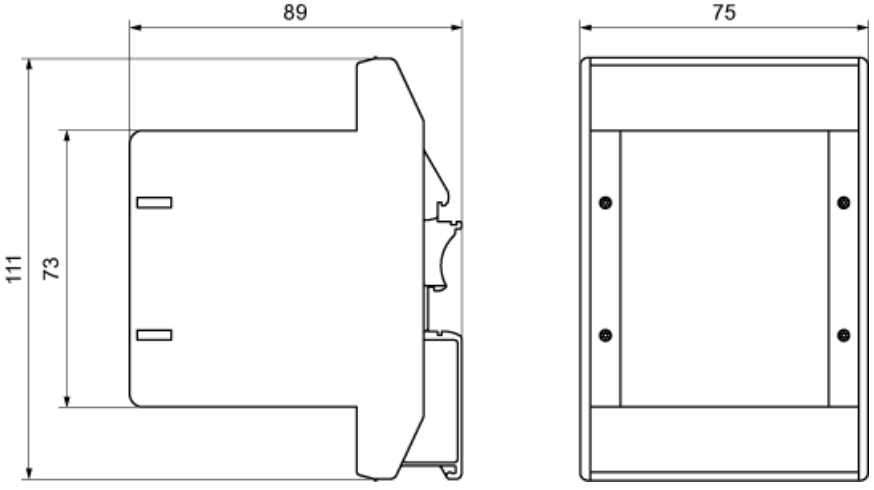


Figure 5-11 Dimension drawing of the Safe Brake Adapter (data in mm)

Technical data

Table 5- 33 Technical data

6SL3355-2DX00-1AA0	
Electronic power supply Power supply voltage (via the Control Interface Module)	24 VDC (20.4 ... 28.8)
Power supply of the motor holding brake	230 V AC
Max. permissible current drain of the motor holding brake	2 A
Max. permissible current drain of the fast de-energization	2 A
Weight	0.250 kg

5.5 Control by way of PROFIsafe

The activation via PROFIsafe is described in detail in the SINAMICS S120 Safety Integrated Function Manual.

The "SINAMICS S120 Safety Integrated Function Manual" is available on the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/man).

5.6 Control via TM54F

The activation via TM54F is described in detail in the SINAMICS S120 Safety Integrated Function Manual.

The "SINAMICS S120 Safety Integrated Function Manual" is available on the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/man).

5.6.1 Control via TM54F for SINAMICS G130, S120 Chassis

The TM54F Terminal Module must be supplied with 24 VDC and connected to the Control Unit via DRIVE-CLiQ.

⚠WARNING

Overheating if ventilation clearances are too small

Insufficient ventilation clearances result in overheating with danger to persons as a result of smoke and fire. This can also result in more downtimes and reduced service lives of the Terminal Module.

- For this reason, it is imperative that you maintain the 50 mm clearances above and below the Terminal Module.

5.6.2 Control using Option K87 for SINAMICS G150

With option K87 the Terminal Module TM54F is integrated in the cabinet unit (-A70) and connected with the Control Unit via DRIVE-CLiQ.

5.6.3 Control via option K87 for SINAMICS S120 Cabinet Modules

With option K87 the Terminal Module TM54F is integrated in the cabinet unit (-A70) and connected with the Control Unit via DRIVE-CLiQ.

5.6.4 Control via K87 for SINAMICS S150

With option K87 the Terminal Module TM54F is integrated in the cabinet unit (-A70) and connected with the Control Unit via DRIVE-CLiQ.

5.7 Motion monitoring without selection

As an alternative to controlling via terminals and/or PROFIsafe, there is also the option to parameterize several safety functions without selection. For this mode, after parameterization and a POWER ON, these functions are permanently selected.

Example

"SLS without selection" can be used, for example, to monitor the maximum velocity to prevent that the drive exceeds a mechanical speed limit. For this purpose, using the "without selection" function, an F-DI does not have to be used; an F-CPU is also not required.

Features

- The function "Motion monitoring without selection" is available in the following versions:

p9601	Meaning	Functionality	Comment
0024 hex	Drive-integrated motion monitoring functions without selection are enabled	• SLS • SDI	• p9501.0 = 1 • p9501.17 = 1
0025 hex	Drive-integrated motion monitoring functions without selection with STO via terminals are enabled	• SLS • SDI • STO • SS1 • SBC	• p9501.0 = 1 • p9501.17 = 1 • Basic Functions • Basic Functions • Basic Functions

- The functions "SLS without selection" and "SDI without selection positive/negative" are selected with p9512.
- The functions without selection are available in the versions "with encoder" and "without encoder" (selection via p9506).
- The functions without selection are parameterized and enabled in the same way as the versions with control via PROFIsafe/terminals.

Acknowledging safety faults

For acknowledging safety faults, a distinction should be made between the following cases:

- Drive-integrated motion monitoring functions without selection

  Acknowledging safety faults is only possible with POWER ON.

- Drive-integrated motion monitoring functions without selection and Basic Functions via onboard terminals

  Acknowledging Safety faults is possible with POWER ON or selecting/deselecting STO or SS1.

Differences

Differences in the behavior of the functions to the versions with control via PROFIsafe/terminals are described in the sections for commissioning the individual functions.

Overview of important parameters

- p9501.0 SI Motion enable safety functions (Control Unit)
- p9512 SI Motion enable safety functions without selection (Control Unit)
- p9601 SI enable functions integrated in the drive (Control Unit)

Commissioning, maintenance and acceptance test 6

The commissioning of the Safety Integrated Functions, maintenance and the acceptance test are described in detail in the SINAMICS S120 Safety Integrated Function Manual.

The "SINAMICS S120 Safety Integrated Function Manual" is available on the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/man).

Deactivating safety functions

7

Only qualified personnel may deactivate or decommission a safety function.

After deactivating or decommissioning a safety function, a modified acceptance test or an acceptance test of another safety function involved must be performed.

When deactivating individual safety functions or safety subfunctions, carefully ensure that the safety of the overall system is not inadmissibly diminished or at risk; when necessary, carefully apply suitable countermeasures.

The requirements relating to deactivating or decommissioning a safety function are specified in IEC 61508-1, Chapter 7.17: "Decommissioning or withdrawing from service safety-related E/E/PE systems " (electrical/electronic/programmable electronic systems):

- Before any deactivation or decommissioning, the consequences must be carefully assessed. This involves assessing the effects of the recommended deactivation or decommissioning on the functional safety of a safety-relevant E/E/PE system associated with an End Use Certificate (EUC).

  This applies to the hardware and the software (parameterization).

Decommissioning a safety function and modifying safety functions or safety subfunctions is described in the SINAMICS S120 Function Manual Safety Integrated. It is available in the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/man).

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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