

## Industrial Controls

### Safety engineering SIRIUS 3SK1 safety relays




#### Manual

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## Legal information

### Warning notice system

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

|  |
|--|
|  <b>DANGER</b>        |
| indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken. |
|  <b>WARNING</b>       |
| indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.  |
|  <b>CAUTION</b>       |
| indicates that minor personal injury can result if proper precautions are not taken.                   |
| <b>NOTICE</b>  |
| 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

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

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# Introduction

## 1.1 User responsibility for system design and function

The products described here were developed to perform safety-related functions as part of an overall installation or machine.

A complete, safety-related system is generally equipped with sensors, evaluation units, and signaling units, and uses reliable shutdown concepts.

It is the responsibility of the manufacturer of a system or machine to ensure that the product functions properly.

Siemens AG, its regional offices, and associated companies (hereinafter referred to as "Siemens") cannot guarantee all the properties of an entire plant, system or machine that has not been designed by Siemens.

Nor can Siemens assume liability for recommendations that appear or are implied in the following description. No new guarantee, warranty, or liability claims beyond the scope of the Siemens general terms of supply are to be derived or inferred from the following description.

## 1.2 Required basic knowledge

A general knowledge of the following areas is needed in order to understand this manual:

- Low-voltage switchgear
- Digital circuit logic
- Automation systems
- Safety systems

## 1.3 Validity range

The manual is valid for these safety relays SIRIUS 3SK1. It describes the components that are valid at the time of publication.

SIEMENS reserves the right of including a Product Information for each new component, and for each component of a later version.

## 1.4 Definitions

"3SK1" always applies to all variants of the SIRIUS 3SK1 safety relays.

## 1.5 Service&Support

### Online Support

The Online Support in the Service&Support portal is an extensive information system for all questions relating to Siemens products and solutions. This service enables direct and central access to in-depth information concerning the products, systems and applications for industry and to a large number of programming, configuration and application examples. Its content is available via a mobile app.

The Technical Forum of the Online Support provides the opportunity for users to swap information. Support Request allows contact to be established with Siemens experts in Technical Support.

Siemens Industry Online Support ensures that users in industry are always kept up-to-date with news, software updates and announcements by means of newsletters and Twitter.

**Links:** Service&Support Portal (<http://support.automation.siemens.com>), Online Support (<http://support.automation.siemens.com/WW/view/en/16605022>)

### Product Support

Are you looking for product information such as technical data, updates or FAQs? Here, the "Product Support" section of the Service & Support Portal offers an extensive collection of all information about the Siemens Industry Automation and Drive Technologies products and solutions:

- Answers to frequently asked questions (FAQs)
- Updates/upgrades, service packs and support tools for downloading
- Manuals and operating instructions
- Technical data/CAx data
- Approvals and certificates
- Test certificates and characteristic curves

All Product Support information is at your disposal free of charge and around the clock, and you always get the current version.

**Link:** Product Support (<http://support.automation.siemens.com/WW/view/en/4000024>)

## CAx data

The CAx Download Manager provides you with a simple means of gaining access to up-to-date product data for your CAx or CAe system.

You configure your own download package with just a few clicks. You can choose from the following information for products

- Product images
- 2D dimensional drawings
- 3D models
- Internal circuit diagrams
- EPLAN macro files
- Manuals
- Characteristics
- Operating instructions
- Certificates
- Product master data

**Link:** CAx Download Manager

(<http://support.automation.siemens.com/WW/view/en/42455541>)

## Applications & Tools

Applications & Tools supports you with various tools and examples when it comes to solving your automation tasks. Solutions are presented in interaction with several components in the system, without focusing on individual products.

- Application examples
- Function blocks & tools
- Background and system descriptions
- Performance statements
- Demonstration systems/videos

**Link:** Applications & Tools (<http://support.automation.siemens.com/WW/view/en/20208582>)

## My Documentation Manager

My Documentation Manager enables you to compile your own documentation from our standard documents (manuals), which are located in the Product Support section. Under mySupport, you have the opportunity to create and manage you own compilations in a structure of their own.

**Link:**

MyDocumentationManager (<http://support.automation.siemens.com/WW/view/en/38715968>)

## Reference

You can find further information on structure and navigation in Online Support here (<http://support.automation.siemens.com/WW/view/en/4000024>).

## 1.6 Configurator for 3SK1 safety relays

### Configurator

Various configurators are available on the Internet to assist you with configuration.

The configurator for 3SK1 safety relays and matching accessories is an easy-to-use selection and configuration tool. You can select the individual components and plan your system in accordance with your specific requirements. You can save your selection, export it as a text file or you can order it directly.

The configurator automatically compiles a document list of the information available in Service&Support for every component. You can use it as the basis for putting together your system documentation.

**Link:**

- Configurator (<http://www.siemens.com/industrial-controls/configurators>)

## 1.7 DataMatrix code

A DataMatrix code is lasered onto the lower terminal cover of all 3SK1-series safety relays.

DataMatrix codes are standardized in ISO/IEC 16022. The DataMatrix codes on Siemens devices use ECC200 coding for powerful error correction.

The following device information is encoded in the DataMatrix codes as a bit stream:

- Article number (MLFB)
- Serial number
- MAC address, if applicable

This information is stored in the following format in the DataMatrix code:

|                 |                          |           |  |
|-----------------|--------------------------|-----------|--|
| 1P              | Article number<br>(MLFB) | +         | S serial number<br>(+ 23S MAC address) |
| Data identifier | Net content              | Separator |  |

---

**Note**

The information content is displayed without spaces.

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This machine-readable information simplifies and accelerates handling of the respective devices.

As well as fast access to the serial numbers of the respective devices for unique identification, the DataMatrix codes simplify communication with Siemens Technical Support.



## SIEMENS Industry Support App

The Data Matrix codes enable in particular extremely fast and convenient access to all the device-specific information available on an article number (MLFB) in the SIEMENS Service&Support Portal, such as operating instructions, manuals, data sheets, FAQs, etc. We offer the SIEMENS Industry Support App free for this purpose. This can be used on commercially available smartphones and tablet PCs.

The SIEMENS Industry Support App is available for iOS and Android-based terminal devices and can be accessed via the following links:



Link for Android



Link for iOS

## 1.8 Correction sheet

The appendix to this manual contains a correction sheet for evaluation and feedback. Please use it to record your suggestions for improvements, additions and corrections, and return the sheet to us. This will help us to improve the next edition of the manual.

Thank you.

## 1.9 History

| Product version | New features                                |
|-----------------|---|
| 02/2013         | Initial release                             |
| 02/2014         | Integration of 3RM1 Failsafe motor starters |
| 09/2015         | Revision of the manual                      |



## Product-specific safety information

### 2.1 General safety notes

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**Note****Recycling and disposal**

Dispose of existing packing material in accordance with applicable regulations or recycle it.

3SK1 safety relays are able to be recycled thanks to a low-pollutant manufacturing process. For environmentally compatible recycling and disposal of your old device, contact a company certified for the disposal of electronic waste.

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**Note****SILCL 3 in accordance with IEC 62061:2005PL e / Cat. 4 in accordance with EN ISO 13849-1: 2008**

3SK1 safety relays are designed in such a way as to allow implementation of applications up to SILCL 3 in accordance with IEC 62061 and PL e/Kat. 4 in accordance with EN ISO 13849-1.

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**Note****Safe state**

The basis of the safety function is the definition of the safe state. In the case of safety relays, this is the "OFF state", i.e. an open contact for sensors or shutdown of the actuators.

---

** WARNING****Protection against electrically conductive contamination!**

The devices must be protected against conductive contamination while taking account of the ambient conditions. You can achieve this by installing the devices in a control cabinet with the appropriate degree of protection.

You will find more detailed information in IEC 60529, for example.

 **WARNING**

**Safe functional extra-low voltage**

The 3SK1 safety relays with a supply voltage of 24 V DC must be operated with safe functional extra-low voltage (SELV, PELV). This means these modules must only be subjected to a voltage of  $U_m$  even in the event of a fault. The following applies for these 3SK1 safety relays:  **$U_m < 60.0 \text{ V}$** .

You can find more detailed information about safe functional extra-low voltage in the data sheets of the power supplies to be used.

 **CAUTION**

**Protection against electrostatic charge**

When handling and installing 3SK1 safety relays, ensure that the components are protected from being electrostatically charged. Changes to the system configuration and wiring are only permissible while the supply voltage is switched off.

Connection of 3SK1 safety relays is only permissible when the power supply units (PELV and SELV) are switched off.

 **CAUTION**

**Noise immunity / grounding**

The following must be grounded in accordance with the regulations to ensure noise immunity of the 3SK1 safety relays:

- PELV / SELV power supply units (please also note the documentation for the respective power supply unit in this regard).

**Note**

Cover the 3ZY12 device connector on the left-hand side using the cover supplied with the device termination connector.

**! WARNING**

3SK1..1 and 3SK1..3 safety relays (devices with outputs using contacts):  
In continuous operation, the key safety values apply where the function test interval (state change of the outputs) for SIL2  $\leq$  1 year and for SIL3  $\leq$  1 month.

Exception: A function test interval  $\leq$  1 year is also permissible for SIL3 applications in the process industry (in accordance with IEC 61511), exclusively for low-demand use, due to a significantly lower failure rate/probability of the electromechanical components. This does **not** apply to safety-related applications in accordance with the Machinery Directive 2006/42/EC.

3SK1..2 and 3SK1120 safety relays (devices with semiconductor outputs up to product version E01/V1.0.0):  
In continuous operation, the key safety values apply where the function test interval (state change of the outputs)  $\leq$  1 year.

3SK1..2 and 3SK1120 safety relays (devices with semiconductor outputs from product version E02/V1.1.0):  
In continuous operation, the key safety values apply where the function test interval (state change of the outputs)  $\leq$  20 years.

**Function test procedure:**

- Actuate the connected sensors.
- Check their effect on the safety relay and the downstream actuators.
- Activate the safety relay via the connected sensors.
- Check their effect on the safety relay and the downstream actuators.
- Replace the defective devices.

**Note**

3SK1..2 and 3SK1120 safety relays (devices with semiconductor outputs) as from E02/V1.1.0 run power-on tests, so-called light tests, at regular intervals in the "OFF state".


**! WARNING**

As a result of light tests at the semiconductor outputs, the level changes to the ON state for up to 2.5 ms. Users are responsible for ensuring that this does not result in any actuator changing to the active state.

**Note****3ZY12 device connectors**


Only safety relays with a supply voltage of **24 V DC** may be used on the 3ZY12 device connector.

## 2.2 Intended use

|  |
|--|
|  <b>WARNING</b>   |
| <p><b>Hazardous Voltage.</b><br/><b>Can Cause Death, Serious Injury, or Property Damage.</b></p> <p><b>Proper use of hardware products</b></p> <p>This equipment is only allowed to be used for the applications described in the catalog and in the technical description, and only in conjunction with non-Siemens equipment and components recommended by Siemens.</p> <p>Correct transport, storage, installation and assembly, as well as careful operation and maintenance, are required to ensure that the product operates safely and without faults.</p> <p>EU note: Commissioning is absolutely prohibited until it has been ensured that the machine in which the component described here is to be installed complies with the stipulations of the Directive 2006/42/EC.</p> |

## 2.3 Current information about operational safety

### Important note for maintaining operational safety of your system

|  |
|--|
|  <b>WARNING</b>   |
| <p><b>Hazardous Voltage</b><br/><b>Can Cause Death, Serious Injury, or Property Damage.</b><br/><b>Please take note of our latest information.</b></p> <p>Systems with safety-related characteristics are subject to special operational safety requirements on the part of the operator. The supplier is also obliged to comply with special product monitoring measures. For this reason, we publish a special newsletter containing information on product developments and features that are (or could be) relevant to operation of safety-related systems. By subscribing to the appropriate newsletter, you will ensure that you are always up-to-date and able to make changes to your system, when necessary:</p> <p>SIEMENS newsletter (<a href="http://www.industry.siemens.com/newsletter">http://www.industry.siemens.com/newsletter</a>)</p> <p>Register under "Products and Solutions" for the following newsletter:</p> <ul style="list-style-type: none"><li>• Industrial Controls - SIRIUS News (en)</li><li>• Safety Integrated Newsletter</li></ul> |

## **2.4 Declaration of conformity**

The manufacturer declares that the safety components of the SIRIUS 3SK1 series in the designs marketed by us comply with the applicable basic safety and health requirements of the EC Directives\* stated (including amendments) and that the stated standards\* were applied in their design and construction.

\* You can download the complete EC Declaration of Conformity as a PDF.





# Product overview for 3SK1

## 3.1 Overview

### Overview of 3SK1 safety relays

The following tables provide an overview of the 3SK1 safety relays.

#### 3SK1 basic units Standard

| Designation   | Voltages            | Article number (MLFB) |
|---|---------------------|-----------------------|
| 3SK1 basic unit Standard instantaneous (with relay outputs)         | 24 V AC/DC          | 3SK1111-xAB30         |
|   | 110 ... 240 V AC/DC | 3SK1111-xAW20         |
| 3SK1 basic unit Standard instantaneous (with semiconductor outputs) | 24 V DC             | 3SK1112-xBB40         |

x = 1: screw terminals; x = 2: push-in terminals

#### 3SK1 Advanced basic units

| Designation  | Voltages | Article number (MLFB) |
|--|----------|-----------------------|
| 3SK1 Advanced basic unit instantaneous (with relay outputs)                | 24 V DC  | 3SK1121-xAB40         |
| 3SK1 Advanced basic unit time-delayed (with relay outputs)                 | 24 V DC  | 3SK1121-xCB4y         |
| 3SK1 Advanced basic unit instantaneous (with semiconductor outputs)        | 24 V DC  | 3SK1122-xAB40         |
| 3SK1 Advanced basic unit time-delayed (with semiconductor outputs)         | 24 V DC  | 3SK1122-xCB4y         |
| 3SK1 Advanced basic unit 17.5 mm instantaneous (with semiconductor output) | 24 V DC  | 3SK1120-xAB40         |

x = 1: screw terminals; x = 2: push-in terminals

y = 1: 0.05 ... 3 s; y = 2: 0.5 ... 30 s; y = 4: 5 ... 300 s

3.1 Overview

Expansion units

| Designation                           | Voltages            | Article number (MLFB) |
|---------------------------------------|---------------------|-----------------------|
| 3SK1211 output expansion              | 24 V AC             | 3SK1211-xBB00         |
|                                       | 24 V DC             | 3SK1211-xBB40         |
|                                       | 110 ... 240 V AC/DC | 3SK1211-xBW20         |
| 3SK1213 output expansion              | 24 V DC             | 3SK1213-xAB40         |
|                                       | 115 V AC            | 3SK1213-xAJ20         |
|                                       | 240 V AC            | 3SK1213-xAL20         |
| 3SK1220 input expansion               | 24 V DC             | 3SK1220-xAB40         |
| 3SK1230 power supply                  | 110 ... 240 V AC/DC | 3SK1230-xAW20         |
| 3RM1 Failsafe direct-on-line starters | 24 V DC             | 3RM11..-xAA4          |
| 3RM1 Failsafe reversing starters      | 24 V DC             | 3RM13..-xAA4          |

x = 1: screw terminals; x = 2: push-in terminals

x = 3 (3RM1 only) hybrid connection method: Control circuit realized as push-in spring-loaded terminal and main circuit as screw terminal

Overview of the safety-related outputs

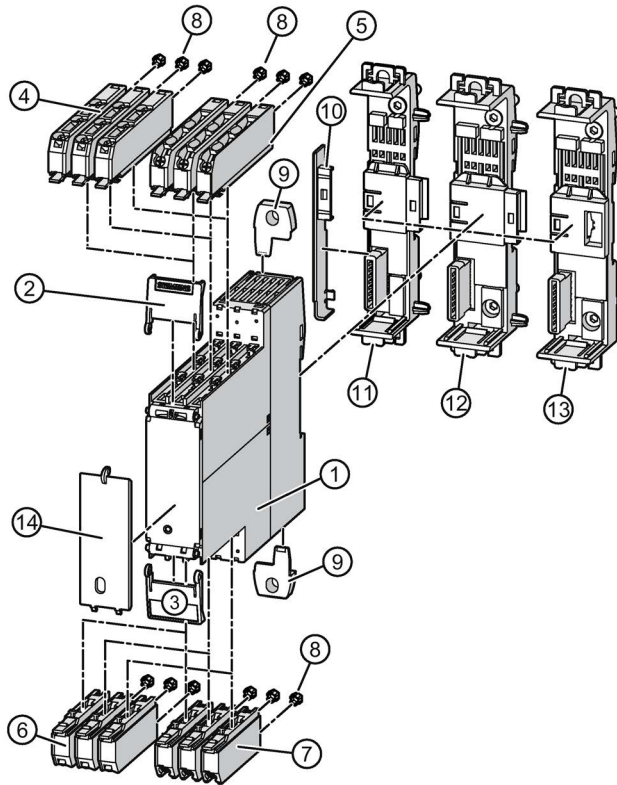
| Type and number of safety-related outputs |               |         |                |         |                                  |                   |
|---|---------------|---------|----------------|---------|----------------------------------|-------------------|
| Advanced                                  | Relay         |         | Semiconductors |         | Semiconductor signaling circuits | Device connectors |
|   | Instantaneous | Delayed | Instantaneous  | Delayed |                                  |                   |
| 3SK1121-xAB40                             | 3             | -       | -              | -       | 1                                | ✓                 |
| 3SK1121-xCB4x                             | 2             | 2       | -              | -       | -                                | ✓                 |
| 3SK1122-xAB40                             | -             | -       | 3              | -       | 1                                | ✓                 |
| 3SK1122-xCB4x                             | -             | -       | 2              | 2       | -                                | ✓                 |
| 3SK1120-xAB40                             | -             | -       | 1              | -       | -                                | ✓                 |
| <b>Standard</b>                           |               |         |                |         |                                  |                   |
| 3SK1111-xAxx0                             | 3             | -       | -              | -       | 1                                | -                 |
| 3SK1112-xBB40                             | -             | -       | 2              | -       | 1                                | -                 |
| <b>Output expansions</b>                  |               |         |                |         |                                  |                   |
| 4RO                                       |               |         |                |         |                                  |                   |
| 3SK1211                                   | 4             |         | -              | -       | 1                                | ✓ (for 24 V DC)   |
| 3RO                                       |               |         |                |         |                                  |                   |
| 3SK1213                                   | 3             | -       | -              | -       | 1                                | ✓ (for 24 V DC)   |

## Online configurator

To assist you with configuration, the "SIRIUS 3SK1 safety relay configurator" is at your disposal on the Internet (<http://www.siemens.com/industrial-controls/configurators>). You can select and order the correct safety relays here and generate the complete product documentation:

- Product data sheet
- Dimension drawings
- CAD data in 2-D and 3-D model images
- Ordering data
- Product photo

### 3.2 Overview of components and accessory parts



- ① 3SK1 safety relay (basic unit/expansion unit)
- ② Top cover flap
- ③ Bottom cover flap
- ④ Terminals, 3-pole, push-in, 1 x 2.5 mm<sup>2</sup>
- ⑤ Terminals, 3-pole, screw-type, 1 x 2.5 mm<sup>2</sup>
- ⑥ Terminals, 2-pole, push-in, 1 x 2.5 mm<sup>2</sup>
- ⑦ Terminals, 2-pole, screw-type, 1 x 2.5 mm<sup>2</sup>
- ⑧ Coding pins
- ⑨ Push-in lugs for wall mounting
- ⑩ Cover
- ⑪ Device connector for 3SK1 safety relay, 17.5 mm wide
- ⑫ Device connector for 3SK1 safety relay, 22.5 mm wide
- ⑬ Device termination connector for 3SK1 safety relay, 22.5 mm wide
- ⑭ Sealable cover

### 3.3 Functional scope of the 3SK1 basic units

| Function   | 3SK1 Standard                  |                | 3SK1 Advanced   |                 |
|--|--------------------------------|----------------|-----------------|-----------------|
|  | Type of safety-related outputs |                |                 |                 |
|  | Relays                         | Semiconductors | Relays          | Semiconductors  |
| <b>Sensors</b>                                       |                                |                |                 |                 |
| Mechanical sensors                                   | ✓                              | ✓              | ✓               | ✓               |
| Non-floating sensors                                 | ✓                              | ✓              | ✓               | ✓               |
| Antivalent sensors                                   | Not possible                   | Not possible   | ✓               | ✓               |
| Sensor number can be increased                       | Not possible                   | Cascading only | ✓               | ✓               |
| <b>Parameter</b>                                     |                                |                |                 |                 |
| Type of start (autostart/monitored start)            | ✓                              | ✓              | ✓               | ✓               |
| Sensor connection 2x single-channel / 1x two-channel | Using wiring                   | ✓              | ✓               | ✓               |
| Cross-circuit detection OFF / ON                     | Using wiring                   | ✓              | ✓               | ✓               |
| Start-up test OFF / ON                               | No start-up test               | ✓              | ✓               | ✓               |
| Monitoring of two-hand control units                 | Not possible                   | Not possible   | ✓               | ✓               |
| <b>Safety-related outputs</b>                        |                                |                |                 |                 |
| Instantaneous  | ✓                              | ✓              | ✓               | ✓               |
| Delayed  | None                           | None           | ✓               | ✓               |
| Expandable with relay outputs                        | Using wiring                   | Using wiring   | ✓               | ✓               |
| Device connector                                     | Cannot be used                 | Cannot be used | ✓               | ✓               |
| <b>Rated control supply voltage</b>                  |                                |                |                 |                 |
| 24 V DC  | ✓                              | ✓              | ✓               | ✓               |
| 110 ... 240 V AC/DC                                  | ✓                              | Not possible   | ✓ <sup>1)</sup> | ✓ <sup>1)</sup> |

<sup>1)</sup> Possible using 3SK1230 power supply and device connector

## 3.4 Introduction

SIRIUS 3SK1 safety relays are used mainly in autonomous safety applications that are not connected to a safety-related bus system. Here they are used to evaluate sensors and ensure safety-related shutdown when required. They also check and monitor the sensors, actuators, and the safety-related functions of the safety relay.

### Applications

Depending on the version of the device and the external connection of sensors and actuators, applications up to SILCL 3 in accordance with IEC 62061, SIL 3 in accordance with IEC 61508 and PL e (Cat. 4) in accordance with ISO 13849-1 can be implemented.

- Monitoring the switch position of the sensors
- Monitoring of the sensor lines
- Monitoring of correct functioning of the safety relay
- Monitoring of the actuators
- Safety-related shutdown in case of hazards

## 3.5 3SK1 system

### 3.5.1 Standard

#### 3.5.1.1 Typical system configuration

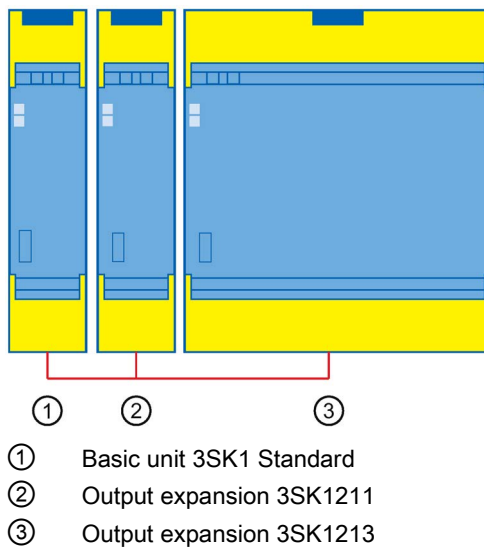
##### System configuration for 3SK1 Standard

A 3SK1 Standard system can comprise the following devices:

- Basic units (one basic unit per system)
  - 3SK1111 Standard basic unit instantaneous (with relay outputs) (Page 48)
  - 3SK1112 Standard basic unit instantaneous (with semiconductor outputs) (Page 55)
- Output expansions
  - Output expansion 3SK1211 (Page 86)
  - Output expansion 3SK1213 (Page 89)

The devices are connected using wiring.

Typical 3SK1 Standard system configuration



## 3.5.2 Advanced

### 3.5.2.1 Typical system configuration

#### System configuration for 3SK1 Advanced

A 3SK1 Advanced system can comprise the following devices:

- Basic units (one basic unit per system)
  - 3SK1121 Advanced basic unit instantaneous (with relay outputs) (Page 65)
  - 3SK1121 Advanced basic unit time-delayed (with relay outputs) (Page 68)
  - 3SK1122 Advanced basic unit instantaneous (with semiconductor outputs) (Page 72)
  - 3SK1122 Advanced basic unit time-delayed (with semiconductor outputs) (Page 76)
  - 3SK1120 Advanced basic unit instantaneous (with semiconductor outputs) (Page 80)
- Input expansions
  - Power supply 3SK1230 (Page 97)
  - Input expansion 3SK1220 (Page 93)
- Output expansions
  - Output expansion 3SK1211 (Page 86)
  - Output expansion 3SK1213 (Page 89)
  - 3RM1 Failsafe motor starter output expansion (you will find additional information in the manual SIRIUS 3RM1 motor starters (<http://support.automation.siemens.com/WW/view/en/66295730>))
- (Optional) 3ZY12 device connector (Page 106)

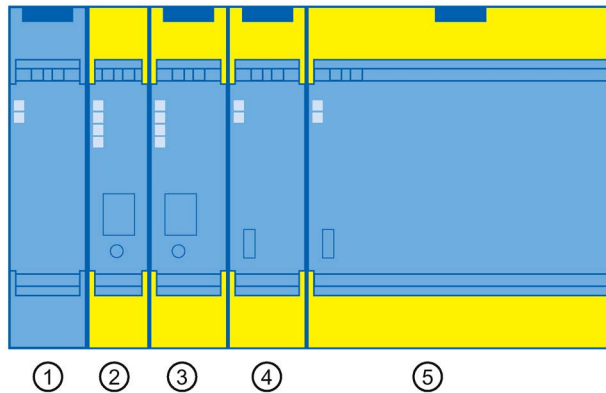
The devices are connected by means of 3ZY12 device connectors or wiring.

When a 3ZY12 device connector is used, there is no wiring whatsoever between the basic unit and the expansion unit(s). In this case, all necessary signals are exchanged via the device connector.

You will find the rules for configurations with device connectors in the section "System configuration rules (Page 109)".

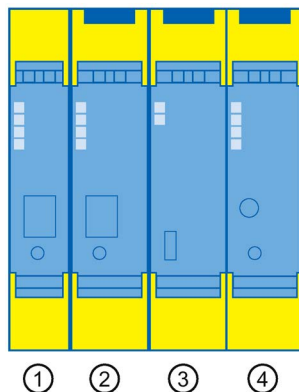


Typical 3SK1 Advanced system configuration

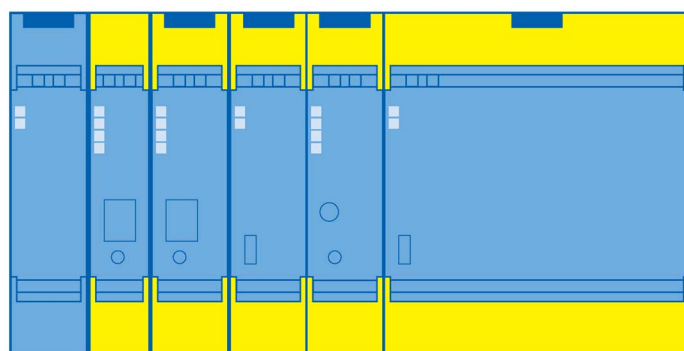


- ① 3SK1230 power supply
- ② 3SK1220 input expansion
- ③ 3SK1 basic unit Advanced
- ④ 3SK1211 output expansion
- ⑤ 3SK1213 output expansion

Typical 3SK1 Advanced system configuration with 3RM1 Failsafe motor starter



- ① 3SK1220 input expansion
- ② 3SK1 basic unit Advanced
- ③ 3SK1211 output expansion
- ④ 3RM1 Failsafe motor starter output expansion



- ① 3SK1230 power supply
- ② 3SK1220 input expansion
- ③ 3SK1 basic unit Advanced
- ④ 3SK1211 output expansion
- ⑤ 3RM1 Failsafe motor starter output expansion
- ⑥ 3SK1213 output expansion

## Safety systems - General information

### 4.1 What is safety?

Safety defines a state in which the risk of damage is reduced to a tolerable level, or which can be regarded as risk-free. Following on from this definition, functional safety concerns persons, machines and the environment.

The objective of safety systems is to reduce the risk for humans and machines that is posed by a use case to an acceptable level. The first step is, therefore, to identify the risk of a use case. In order to make a reliable assessment regarding the application, each individual function of a machine or plant must be analyzed for potential hazards.

For further information, refer to the brochure "Safety of machines and plants" which is available here as a download: Functional safety (<http://www.siemens.com/safety>).

### 4.2 Safety function

A safety function describes the reaction of a machine/plant to the occurrence of a specific event (e.g. opening of a protective door). Execution of the safety function(s) is carried out by a safety-related control system. This usually comprises three subsystems, **detecting**, **evaluating** and reacting.

**Detecting** (sensors):

- Detecting a safety requirement, e. g.: EMERGENCY STOP or a sensor for monitoring a hazardous area (light array, laser scanner, etc.) is operated.

**Evaluating** (safety relay):

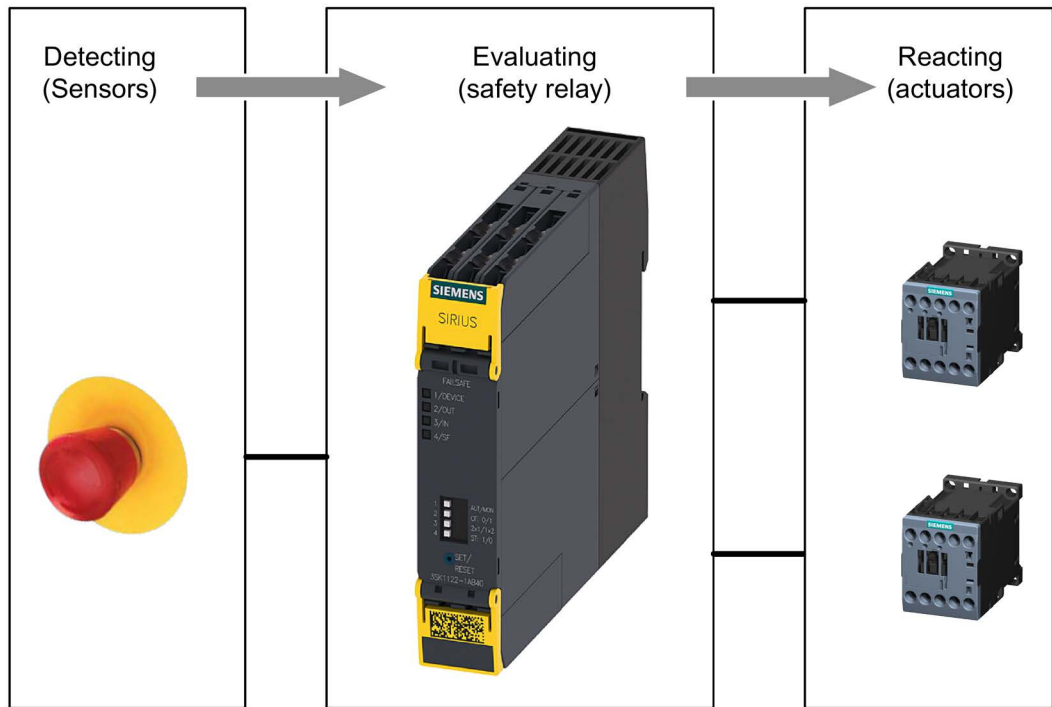
- Detecting a safety requirement and safely initiating the reaction (e.g. switching off the safety-related outputs).
- Monitoring the correct operation of sensors and actuators
- Initiating a reaction upon detection of faults

For the 3SK1 products described in this manual, this concerns evaluation units for safety functions.

**Reacting** (actuators):

- Switching off the hazard by means of downstream actuators.

4.2 Safety function



## 4.3 Basic terminology

### 4.3.1 Redundancy/single-channel and two-channel

#### Redundancy

With redundancy, more than one component is implemented for the same function, so a faulty function of a component is performed instead by the other component(s).

A redundant configuration reduces the probability of a function failing due to a single defective component. This requirement is essential for achieving SILCL 3 in accordance with IEC 62061, SIL 3 in accordance with IEC 61508 and PL e (Cat. 4) in accordance with ISO 13849-1 (also necessary for SIL 2 / PL d under certain circumstances).

The simplest form of redundancy is **two-channel redundancy**.

If a circuit fails, two-channel redundancy or appropriate wiring ensures that the safety function is maintained.

In a redundant system configuration, the subsystems for detecting and reacting must also be implemented with two-channel redundancy.

#### Note

All SIRIUS Safety devices that comply with SILCL 3 in accordance with IEC 62061, SIL 3 in accordance with IEC 61508 and PL e (Cat. 4) in accordance with DIN EN ISO 13849-1 are redundantly configured with regard to the internal logic as well as with regard to the output circuits.

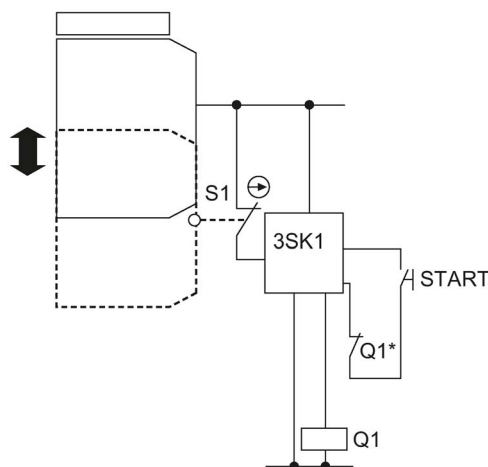


Figure 4-1 Single-channel sensor connection

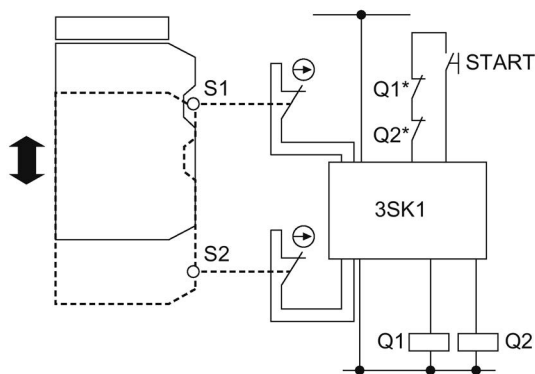


Figure 4-2 Two-channel sensor connection

\* = positively-driven auxiliary contacts/mirror contacts

### 4.3.2 Cross-circuit detection

Cross-circuit detection is a diagnostic function of a safety relay that detects short-circuits and cross-circuits between the input channels (sensor circuits) during two-channel sensing or reading. A cross-circuit can be caused, for example, by a cable casing being squashed. In devices without cross-circuit detection, this can mean that a two-channel EMERGENCY STOP circuit does not trip even though only one NC contact is faulty (secondary error).

With 3SK1 devices, a cross-circuit is detected in the sensor circuits by means of signals with different clock pulses. If the clocked signals overlap, the device detects a cross-circuit. With 3SK1 basic units, cross-circuit detection can be deactivated to allow electronic sensors to be evaluated (that monitor themselves as well as the cable to the evaluation unit).

### 4.3.3 Enabling circuit (safety-related output)

An enabling circuit provides a safety-related output signal. From an external viewpoint, enabling circuits usually act as NO contacts (however, in terms of functionality, safety-oriented opening is always the most important aspect).

An individual enabling circuit that is redundantly configured internally in the safety relay can be used for SIL 3 / PL e.

*Note: Enabling current paths can also be used for signaling purposes.*

3SK1 safety relays are only equipped with enabling circuits with NO functionality. This means that when the safety function is triggered, or a fault is detected, the enabling circuits will always transfer to the safe state (NO contact open).

#### 4.3.4 Signaling circuit

A current signaling path provides a safety-related output signal.

With 3SK1 relays, the signaling circuits are always implemented as NC circuits. This means that when the safety function is triggered, or a fault is detected, the signaling circuits will close.

With 3SK1 semiconductor devices, the signaling circuits are always implemented as NO circuits. This means that when the safety function is triggered, or a fault is detected, the signaling circuits will open.

#### 4.3.5 Feedback circuit

A feedback circuit is used to monitor controlled actuators (e.g. relays or load contactors) with positively-driven contacts or mirror contacts. The safety-related outputs can only be activated if the feedback circuit is closed.

---

##### Note

When 3SK1 expansion units are used on 3ZY12 device connectors with 3SK1 Advanced basic units, it is not necessary to incorporate the expansion modules in the feedback circuit wiring. This is implemented internally via the device connector.

---

#### 4.3.6 Stop categories

##### Stop category 0

Non-controlled shutdown by immediately switching off the power to the machine's drive elements.

##### Stop category 1

Controlled stopping where the energy feed is interrupted with a time delay, or is only interrupted once standstill has been reached.

---

##### Note

Time-delayed shutdown of safety-related outputs in accordance with Stop category 1 is not ensured under all operating states.

In the case of some internal device faults, and when disconnecting the supply voltage, these safety-related outputs are switched off **instantaneously**.

---

### 4.3.7 Automatic start

For an automatic start, the device is started without manual confirmation, but only after the input image has been checked and a positive test of the safety relay has been conducted. This function is also known as dynamic operation and is not permissible for EMERGENCY STOP devices. Safety devices for prohibited danger zones (e.g. position switches, light arrays, safety shutdown mats) can use the automatic start function if this does not pose any risk.

---

#### Note

An automatic start is not permitted for EMERGENCY STOP devices.

Information about start response in the system configuration 3SK1 Advanced units can be found in the chapter "Explanations of device function (Page 190)".

---

### 4.3.8 Manual start

For a manual start, the device is started by operating the START button, but only after the input image has been checked and a positive test of the safety relay has been conducted. On a manual start, the START button is not monitored for correct operation, a positive edge of the START button is sufficient for starting.

---

#### Note

The "Manual start" function is only available with the 3SK1111 safety relays (slide switch at Autostart position).

---

#### Note

Manual start is not permitted for EMERGENCY STOP devices.

---

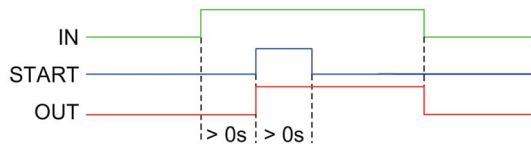


Figure 4-3 Start function "Manual start"



### 4.3.9 Monitored start

For a monitored start, the device is started by operating the START button, but only after the input image has been checked and a positive test of the safety relay has been conducted.

Contrary to the manual start, the monitored start evaluates a **signal change** of the START button. This means that the START button cannot be bypassed (misuse). For PL e (ISO 13849-1) as well as SIL 3 (IEC 62061), the monitored start must be used in the case of EMERGENCY STOP. For other safety sensors/functions, the necessity for a monitored start command depends on the risk assessment.

If the START button is operated for more than 2 seconds, the 3SK1 basic unit detects a wiring short-circuit in the START button and switches to the fault state (Device = green; SF = flashing red; Out = flashing yellow; IN = off)

---

#### Note

In the delivery state of the 3SK1 safety relays, the start type is set to "Monitored start".

---

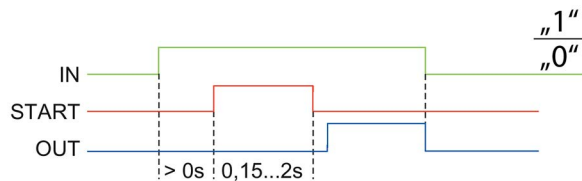


Figure 4-4 Start function "Monitored start"

### 4.3.10 Two-hand operation/synchronism

Synchronous sensor operation is a special form of simultaneity of sensors.

In this case, it is not sufficient for sensor contacts 1 and 2 to be switched to the closed state at different times, they must be closed within 0.5 seconds.

Synchronism of sensors is required, in particular, in the case of two-hand operation of presses. This ensures that the presses only become active when the sensors are operated simultaneously with both hands. This minimizes the risk of the operator getting a hand in the press.

When 3SK1 safety relays are used, you can achieve applications up to type IIIc in compliance with EN 574 (applications up to PL e/Cat. 4 in compliance with EN 13849-1 or SILCL 3 in compliance with IEC 62061).

---

#### Note

In the delivery state of 3SK1 safety relays, monitoring of time synchronism is deactivated. Time synchronism can be activated using the following adjustable parameter for 3SK112 Advanced and 3SK122 Advanced:

- Jumper T1/PAR (NO/NC evaluation)
  - DIP switches (1) Autostart
  - DIP switches (3) 2 x single-channel
- 

#### Note

The 3SK1 Advanced safety relays exclusively support two-hand control units with two NO contacts.

---

#### Note

The two-hand circuit must be marked in compliance with EN 574. You can find information on determining the response time in the section entitled Response times (Page 194).

---

### 4.3.11 Cascading

Cascading of safety relays is used for tripping safety relays in series.

Several safety functions can then be logically connected to a shared shutdown path. Several safety-related outputs can be created for selective shutdown of drive elements.

The connection between the individual modules must be arranged on one side only, because cascading from the last relay to the first one would create a loop which would prevent starting.

Cascading is implemented within a control cabinet in a single-channel configuration; this is even permissible with SIL 3 / PL e, because cable routing within a control cabinet is protected against short-circuits and short-circuiting to P potential (fault exclusion in accordance with ISO 13849-2).

The 3SK1 Advanced device series offers an extremely convenient solution for cascading. Input expansions can be easily connected to the evaluation unit by means of device connectors.

### 4.3.12 Startup testing

The sensor or protection equipment must be opened and closed again after the supply voltage is restored before the enables for the 3SK1 safety relay can be switched through.

Startup testing ensures that any errors in the sensors are detected (again), because safety relays lose their ability to store errors at zero voltage.

Unauthorized manipulation of the protection equipment can also be detected through startup testing.

The plant operator decides whether startup testing should be performed (risk assessment). No general statements apply.

---

#### Note

In the delivery state of 3SK1 safety relays, startup testing is deactivated.

---

### 4.3.13 Connection of actuators

---

**Note**

To achieve the Performance Level / Safety Integrity Level given in the following examples, the actuators shown must be monitored in the feedback circuit of the corresponding safety relay.

---

**Note**

For capacitive and inductive loads, we recommend an adequate protective circuit. In this way, electromagnetic interference can be suppressed and contact service life increased.

You can find additional information in SIRIUS Innovations - SIRIUS 3RT2

Contactors/Contactor Assemblies manual

(<http://support.automation.siemens.com/WW/view/en/60306557>).

---

Actuator wiring up to PL c / Cat. 2 in accordance with ISO 13849-1 or SILCL 1 in accordance with IEC 62061

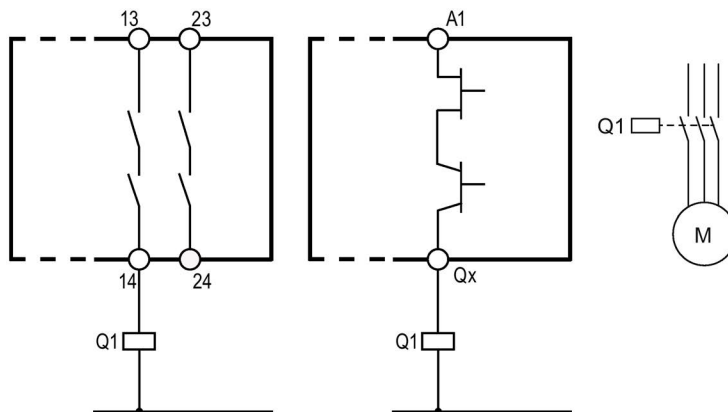


Figure 4-5 PL c / Cat. 2 in accordance with ISO 13849-1 or SILCL 1 in accordance with IEC 62061

Actuator wiring up to PL e / Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061

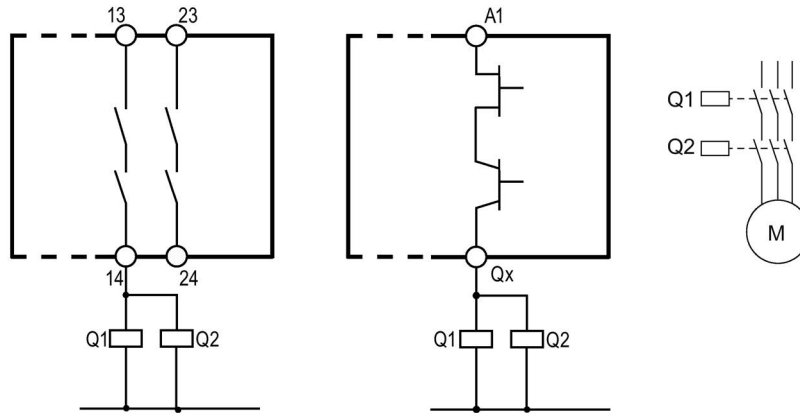


Figure 4-6 PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061  
With units that have semiconductor outputs, this wiring is only possible from E02/V1.1.0.

**! WARNING**

PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061 can only be achieved with cross-circuit-proof/short-circuit to P-proof laying of the control cables from the relay output (e.g. 14) to the control relays/contactors (Q1 and Q2) (e.g. as a separately sheathed cable or in its own cable duct).

**Note**

In the case of 3SK1..2 and 3SK1120 (devices with semiconductor outputs with firmware (FW) version V1.0.0 and product version E01) it is not possible to achieve PL d/e/Cat. 3/4 in accordance with ISO 13849-1 or SILCL 2/3 in accordance with IEC 62061 with the wiring shown above.

**Actuator wiring up to PL e / Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061**

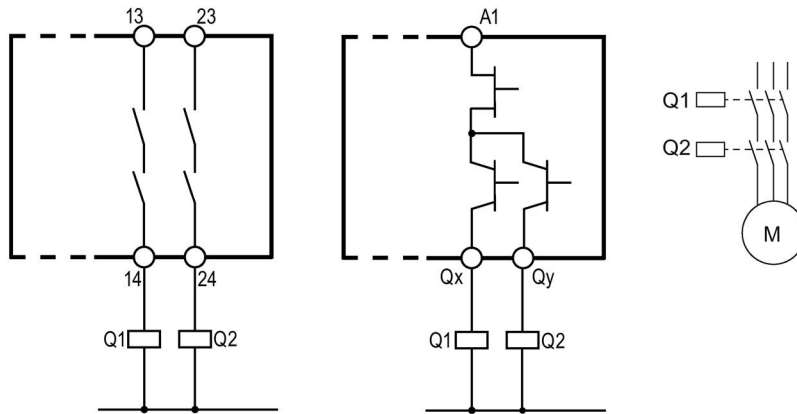


Figure 4-7 PL e / Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061

Refer to the information on the function test interval in section General safety notes (Page 15).

### Actuator wiring with 3RM1 up to PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061

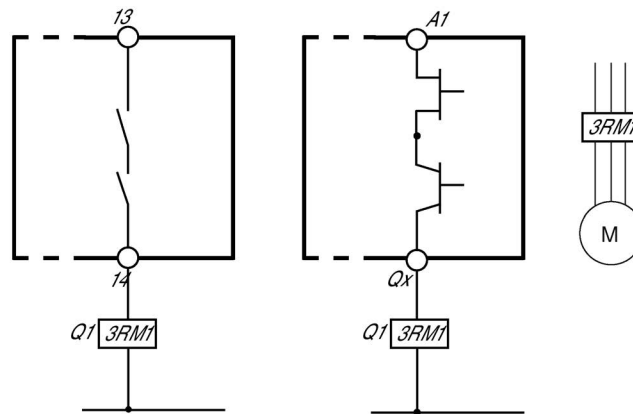


Figure 4-8 PL e / Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061

#### Note

PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061 can only be achieved with cross-circuit-proof/short-circuit to P-proof laying of the control cables from the relay output (e.g. 14) to the 3RM1 Failsafe motor starter (e.g. as a separately sheathed cable or in its own cable duct). Thanks to the intrinsic safety of the 3RM1 Failsafe motor starter, monitoring by the upstream 3SK1 safety relay (via feedback circuit) is not necessary here.

#### Note

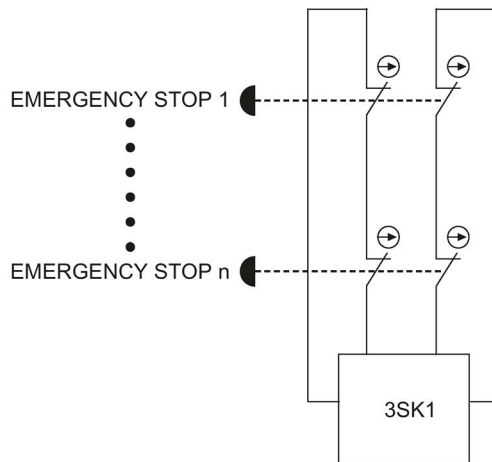
In the case of 3SK1..2 and 3SK1120 (devices with semiconductor outputs with firmware (FW) version V1.0.0 and product version E01) it is not possible to achieve PL d/e/Cat. 3/4 in accordance with ISO 13849-1 or SILCL 2/3 in accordance with IEC 62061 with the wiring shown above.

More detailed technical information is available in the "SIRIUS 3RM1 motor starters (<http://support.automation.siemens.com/WW/view/en/66295730>)" manual on the Internet.

### 4.3.14 Series connection of sensors

#### Series connection of EMERGENCY STOP command devices

It is possible to connect EMERGENCY STOP command elements in series up to the highest safety level (SILCL 3 in accordance with IEC 62061, SIL 3 in accordance with IEC 61508 and PL e (Cat. 4) in accordance with ISO 13849-1), because it is assumed that only one EMERGENCY STOP is operated at a time. This ensures that errors and defects can be detected.

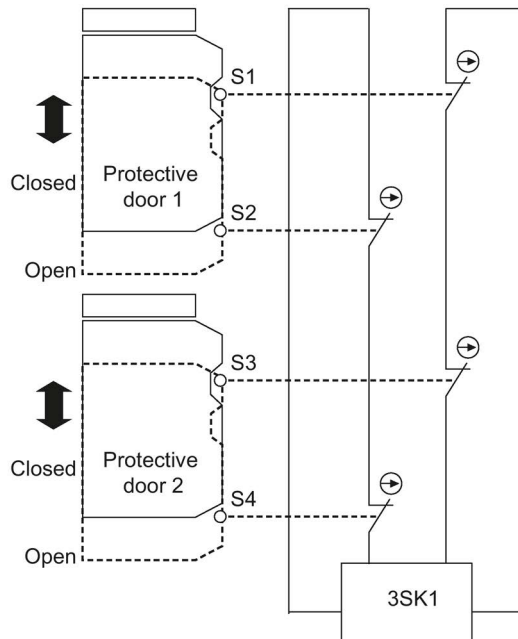




### Series connection of mechanical position switches

In general, position switches may be connected in series if measures ensure that several protective doors are not regularly opened simultaneously (otherwise a fault cannot be detected).

For safety level SILCL3 in accordance with IEC 62061, SIL3 in accordance with IEC 61508, and PL e (Cat. 4) in accordance with ISO 13849-1, however, they must **never** be connected in series, because every hazardous error must be detected (independently of the operating personnel).



#### 4.3.15 Use of magnetically operated switches

If magnetically operated switches are used, the magnetic contacts may weld on account of capacitive effects. The reason for this is that a high peak current may occur when switching these loads (e.g. also cable capacitances). A corresponding fuse protection with the rated current of the magnetically operated switch must be provided if the device/sensor combinations have not been explicitly enabled.

For more details, please refer to the documentation of the magnetically operated switch.



## 3SK1 devices

### 5.1 3SK1 standard

#### 5.1.1 General information

The safety relays of the Standard series can be configured as stand-alone devices or as an expansion solution with conventional wiring technology.

**The focus of the Standard series is on:**

- Single devices for simple safety applications
- Output-side expansion by means of expansion units and external wiring
- No expansion on the input side

#### 5.1.2 Applications

- EMERGENCY OFF / EMERGENCY STOP monitoring.
- Monitoring of protective doors with electromechanical position switches, solid-state position switches, or solenoid switches.
- Monitoring of contact-free protection equipment, e.g. light arrays/light barriers, or laser scanners.

3SK1 Standard safety relays can be used in EMERGENCY OFF/EMERGENCY STOP devices in accordance with ISO 13850 and in safety circuits in accordance with VDE 0113-1 and/or DIN EN 60204-1. Depending on the external circuit, it is possible to achieve SILCL 3 in accordance with IEC 62061, SIL 3 in accordance with IEC 61508 and PL e (Cat. 4) in accordance with ISO 13849-1.

The safety relays comply with DIN EN 50156-1:2004 (Electrical equipment for furnaces).

### 5.1.3 3SK1111 Standard basic unit instantaneous (with relay outputs)

#### 5.1.3.1 General information

Article number (MLFB):

|               |  |
|---------------|--|
| 3SK1111-xAB30 | 24 V AC/DC                                   |
| 3SK1111-xAW20 | 110 ... 240 V AC / DC<br>(wide-range supply) |

(x) 1 = screw-type terminal; 2 = push-in terminal

#### Device features:

- 2 sensor inputs (channels 1 and 2)
- 1 input for feedback circuit and START button
- 3 safety-related outputs (NO contacts),
- 1 semiconductor signaling circuit (non-safety-related circuit, NC contact)
- 2 LEDs for displaying the operating states
- Slide switch for function setting
- Single-channel or two-channel connection
- Cross-circuit detection between sensor channels 1 and 2
- Enclosure width 22.5 mm
- Removable terminals

#### 5.1.3.2 Function description

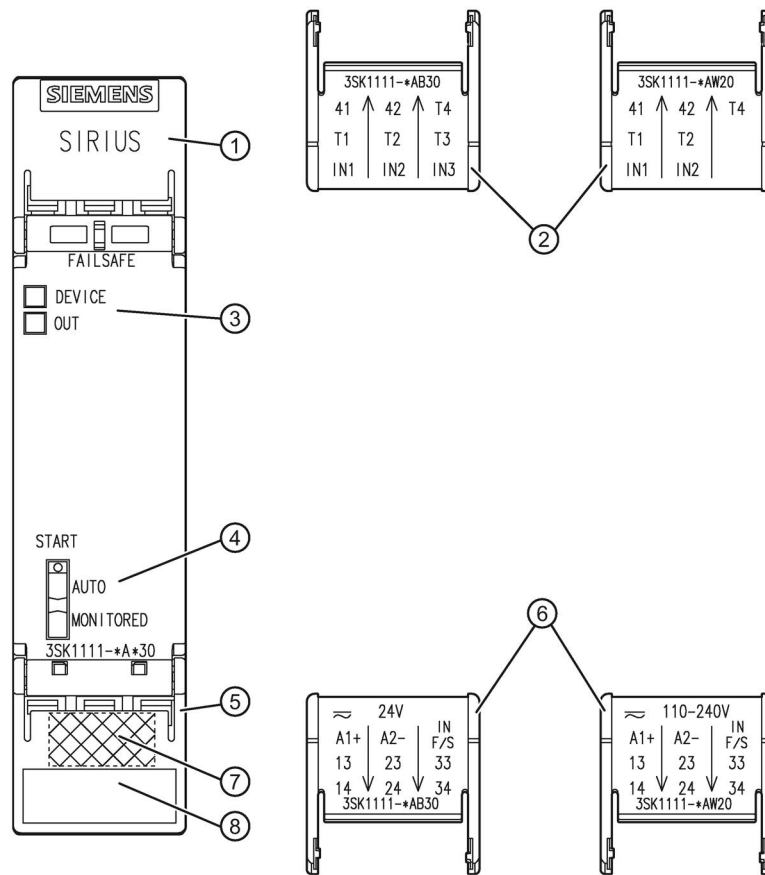
The device is a 2-channel safety relay for EMERGENCY OFF and EMERGENCY STOP equipment in accordance with EN 60204-1.

The 3SK1111 Standard basic unit is equipped with a positively-driven relay and monitors itself during every ON/OFF cycle.

The safety relay has three safety-related outputs as NO circuits and one semiconductor signaling circuit (non-safety-related circuit, NC contact).

On the front of the device there is a slide switch for function setting and two LEDs for displaying the operating states.

### 5.1.3.3 Design



- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ Slide switch
- ⑤ Bottom cover flap
- ⑥ Bottom cover flap; internal inscription
- ⑦ DataMatrix code
- ⑧ Device identification label

5.1.3.4 Terminal assignment

| Terminal                      | Explanation  |
|-------------------------------|--|
| A1                            | L+   |
| A2                            | N-   |
| IN1                           | Sensor channel 1                                   |
| IN2                           | Sensor channel 2                                   |
| IN3                           | Non-floating sensor evaluation <sup>1)</sup>       |
| INF/S                         | Feedback circuit/START button                      |
| T1                            | Test output 1 (for IN1)                            |
| T2                            | Test output 2 (for IN2)                            |
| T3                            | Test output 3 (for IN3) <sup>1)</sup>              |
| T4                            | Test output 4 (for INF/S)                          |
| 13 - 14<br>23 - 24<br>33 - 34 | Safety-related outputs (NO contact, relay contact) |
| 41 - 42                       | Relay signaling circuits (NC contacts)             |
| Floating:                     | Sensors T1/IN1 and T2/IN2<br>Jumper T3/IN3         |
| Non-floating                  | Sensors IN1 and IN3 <sup>1)</sup><br>Jumper T2/IN2 |

<sup>1)</sup> For 24 V AC/DC variant only

### 5.1.3.5 Inputs

The device has three or four inputs for safe signal processing: IN1, IN2 or IN3 (only 24 V devices for connecting floating sensors) INF/S:

The inputs IN1 and IN2 can be operated in two-channel mode with cross-circuit detection. A single-channel control is also possible and is described in chapter Typical circuits (Page 121), tables 7- 1 to 7- 4.

If no feedback circuit is to be used in the application, this must be jumpered with the corresponding test output.

#### Voltage variant 24 V:

##### Connecting floating sensors:

When floating sensors are used, sensor inputs T1/IN1 and T2/IN2 must be used and T3/IN3 must additionally be jumpered for two-channel sensor connection.

##### Connecting non-floating sensors:

With non-floating sensors, cross-circuit detection must be deactivated. This is implemented by the following pin assignment on the 3SK1111-.AB30:

IN1 and IN3 must be used as the input terminal for the two-channel non-floating sensor. In addition, T2/IN2 must be jumpered.

#### Voltage variant 110 V ... 240 V AC/DC:

Only **floating sensors** can be connected to the 3SK1111-.AW20 device version.

The 2-channel sensor is connected via T1/IN1 and T2/IN2.

#### Connection of magnetically operated switches

When connecting magnetically operated switches to the inputs, observe the information in chapter Use of magnetically operated switches (Page 45).

### 5.1.3.6 Outputs

The safety relay has the following outputs:

- Safety-related outputs (relays), NO contacts: 13/14, 23/24, 33/34
- Non-safety-related outputs (semiconductor signaling circuit; relays), NC contacts: 41/42

**5.1.3.7 Display of the operating state**

Two LEDs and a slide switch indicate the operating state and functioning of the device:

- DEVICE
- OUT

**LED displays**

| LED    |       | Operation                        |             |              |                       |
|--------|-------|----------------------------------|-------------|--------------|-----------------------|
| DEVICE | OUT   | Line supply                      | Sensor      | START button | Safety-related output |
| Green  | Green | ON                               | Not pressed | Pressed      | Closed                |
| Green  | OFF   |                                  | Pressed     | ---          | Open                  |
| Green  | OFF   |                                  | Not pressed | ---          | Open                  |
|        |       | Error                            |             |              |                       |
| OFF    | OFF   | Cross-circuit or no power supply |             |              | Open                  |

**5.1.3.8 Function setting**

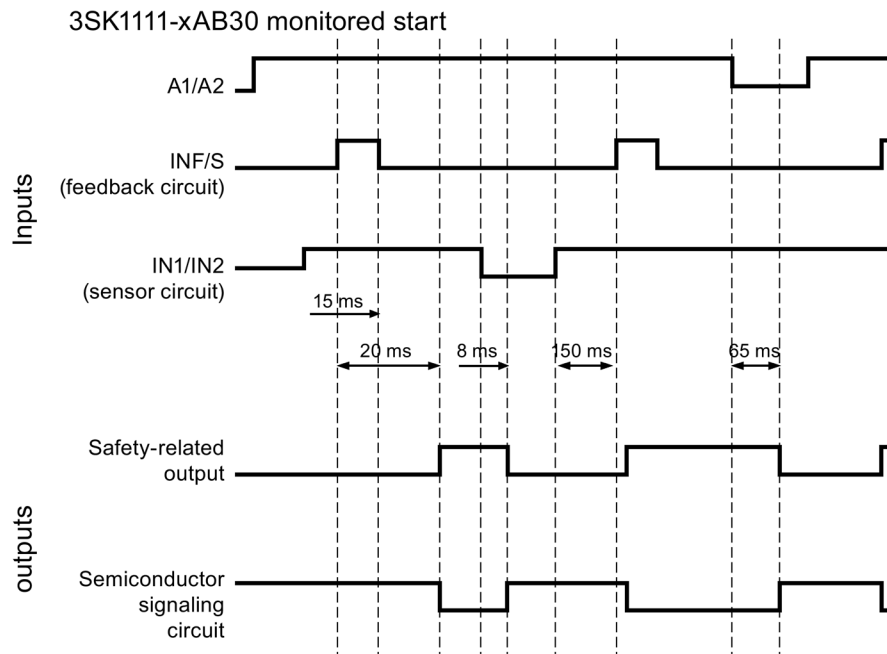
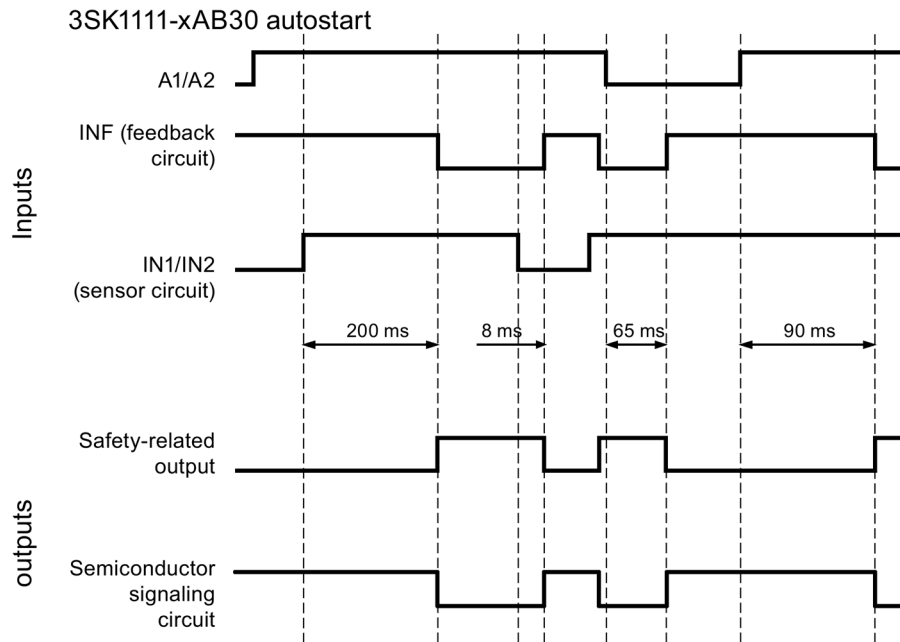
**Setting the functions**

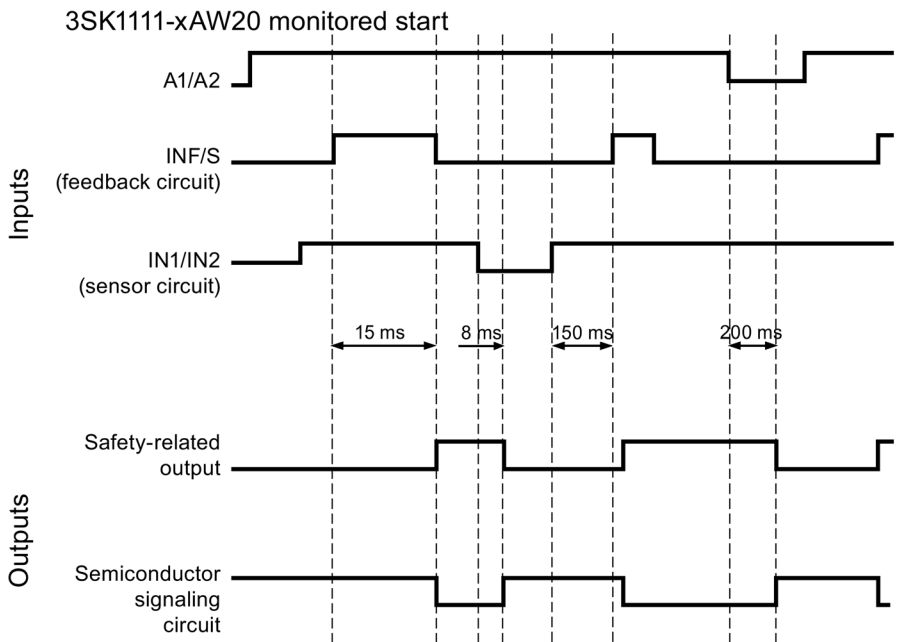
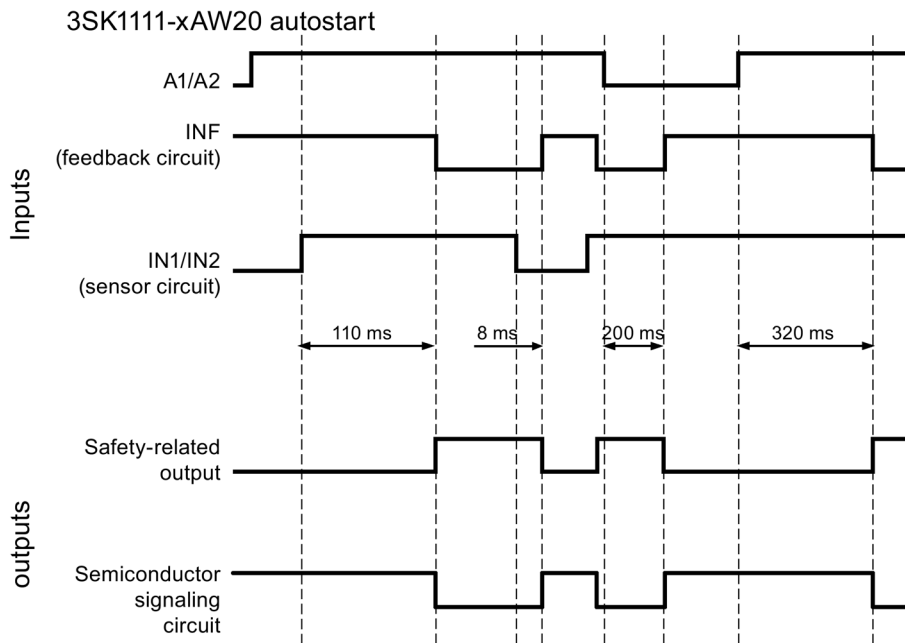
| Slide switch   |           |                 |
|--|-----------|-----------------|
| Start  | AUTO      | Autostart       |
| <input type="checkbox"/> AUTO<br><input checked="" type="checkbox"/> MONITORED | MONITORED | Monitored start |

In the delivery state, the slide switch is at the bottom (monitored start).



## State diagrams 3SK1111





## 5.1.4 3SK1112 Standard basic unit instantaneous (with semiconductor outputs)

### 5.1.4.1 General information


#### Article number MLFB:

|               |         |
|---------------|---------|
| 3SK1112-xBB40 | 24 V DC |
|---------------|---------|

(x) 1 = screw-type terminal; 2 = push-in terminal

#### Device features:

- 4-way DIP switch for function setting (parameterization)
- SET/RESET button
- 4 LEDs for status and function display
- 2 sensor inputs (channels 1 and 2)
- 1 input (cascading circuit)
- 1 input (START pushbutton circuit)
- 1 input (feedback circuit)
- 2 test outputs
- 2 semiconductor outputs
- 1 semiconductor signaling circuit
- Enclosure width 22.5 mm
- Removable terminals

|  |
|--|
|  <b>WARNING</b>   |
| <b>Continuous operation</b><br>Devices up to E01/V1.0.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) $\leq 1$ year.<br>Devices from E02/V1.1.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) $\leq 20$ years. |

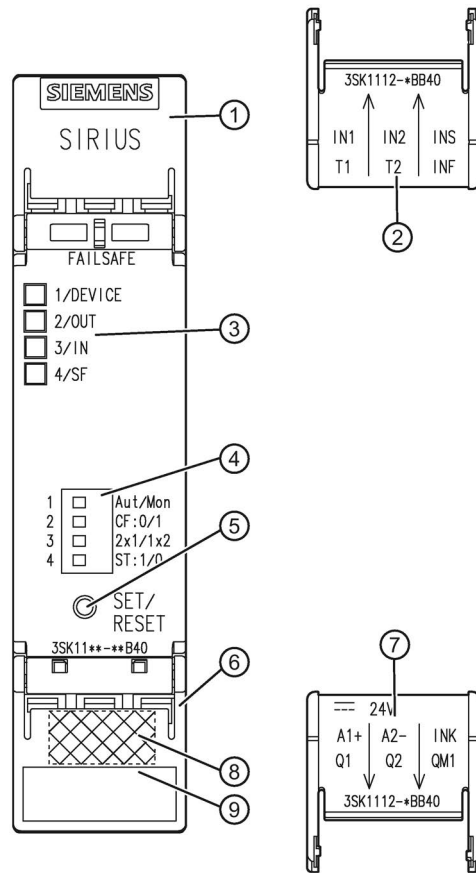
#### 5.1.4.2 Function description

The 3SK1112 safety relay has two safety-related semiconductor outputs and one non-safety-related signaling circuit.

On the front of the device there is a 4-way DIP switch for function setting and 4 LEDs for status and function display.

The SET/RESET button is used to load function settings and to restart the device (reset). On commissioning, the device runs through a self-test. This checks that the internal electronics and firmware are functioning correctly. All internal safety-critical parts of the circuit are cyclically monitored for faults during operation. The semiconductor outputs cyclically run through a light/dark test for up to 2.5 ms (dynamically) to verify their correct functioning.

### 5.1.4.3 Design



- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ DIP switch
- ⑤ SET/RESET button
- ⑥ Bottom cover flap
- ⑦ Bottom cover flap; internal inscription
- ⑧ DataMatrix code
- ⑨ Device identification label

#### 5.1.4.4 Terminal assignment

| Terminal | Explanation   |
|----------|---|
| A1       | +   |
| A2       | -   |
| IN1      | Sensor channel 1  |
| IN2      | Sensor channel 2  |
| INS      | START pushbutton circuit  |
| INF      | Feedback circuit  |
| INK      | Cascading circuit   |
| T1       | Test output 1 (for IN1)   |
| T2       | Test output 2 (for IN2, INF)  |
| Q1       | Semiconductor output 1 (switching to P potential, 24 V DC)            |
| Q2       | Semiconductor output 2 (switching to P potential, 24 V DC)            |
| QM1      | Semiconductor signaling circuit 1 (switching to P potential, 24 V DC) |

#### 5.1.4.5 Inputs

The device has five inputs for safe signal processing: IN1, IN2, INS, INF, INK:

- IN1: sensor input channel 1
- IN2: sensor input channel 2
- INS: START pushbutton circuit (start after rising and falling edge)
- INF: feedback circuit (checked for closed state: before switching on)
- INK: cascading circuit (cascading input/normal switching duty)
- The cascading circuit is AND-connected with the IN1 and IN2 sensor inputs.
- START button circuit and cascading circuit are activated with a static +24 V DC signal.
- With cross-circuit detection activated, the following inputs are checked for cross-circuits and short-circuits to P: IN1/T1 to IN2/T2 and INF/T2. The inputs then receive their supplies from the test outputs T1 and T2.
- If "without cross-circuit detection" is set on the device, inputs IN1 and IN2 are not checked for cross-circuits. Inputs IN1 and IN2 must not be supplied via T1/T2 here, otherwise a fault will be generated via input INF. It is therefore essential that inputs IN1 and IN2 are supplied via an external + 24 V DC current source from which the device is also supplied.
- If the unit is parameterized to 2 x 1-channel with DIP switch 3, the sensor circuit that is not used (T1/IN1 or T2/IN2) must be bypassed.

---

**Note**

**Observe the following special points during commissioning of the 3SK1112 safety relay:**

The cascading input must be connected to terminal A1 if it is not to be used.

Monitoring of the feedback circuits is not optional.

---

#### 5.1.4.6 Outputs

The safety relay has the following outputs:

- Q1, Q2: safety-related semiconductor outputs with dynamic monitoring, switching to P potential
- QM1: non-safety-related semiconductor signaling circuit, switching to P potential

The safety-related semiconductor outputs and the safety-related semiconductor signaling circuit are short-circuit-proof.

#### 5.1.4.7 Display of the operating state

Four LEDs and one DIP switch indicate the operating state and functioning of the device:

- (1) DEVICE
- (2) OUT
- (3) IN
- (4) SF

The four LEDs show the following:

- Operating mode: Diagnostics
- Configuration mode: DIP setting

For an explanation of the operating state display, see Section Display and diagnostics (Page 199)

### 5.1.4.8 Function setting

Table 5- 1 DIP switch

| Switch position: left                | Schematic | DIP switch No. | Switch position: right            |
|--------------------------------------|-----------|----------------|-----------------------------------|
| Autostart                            |           | 1              | Monitored start                   |
| Cross-circuit detection deactivated  |           | 2              | Cross-circuit detection activated |
| 2 x single-channel sensor connection |           | 3              | 1 x two-channel sensor connection |
| Start-up test ON                     |           | 4              | Start-up test OFF                 |

In the delivery state, all the DIP switches are in switch position: right.

Table 5- 2 SET/RESET button

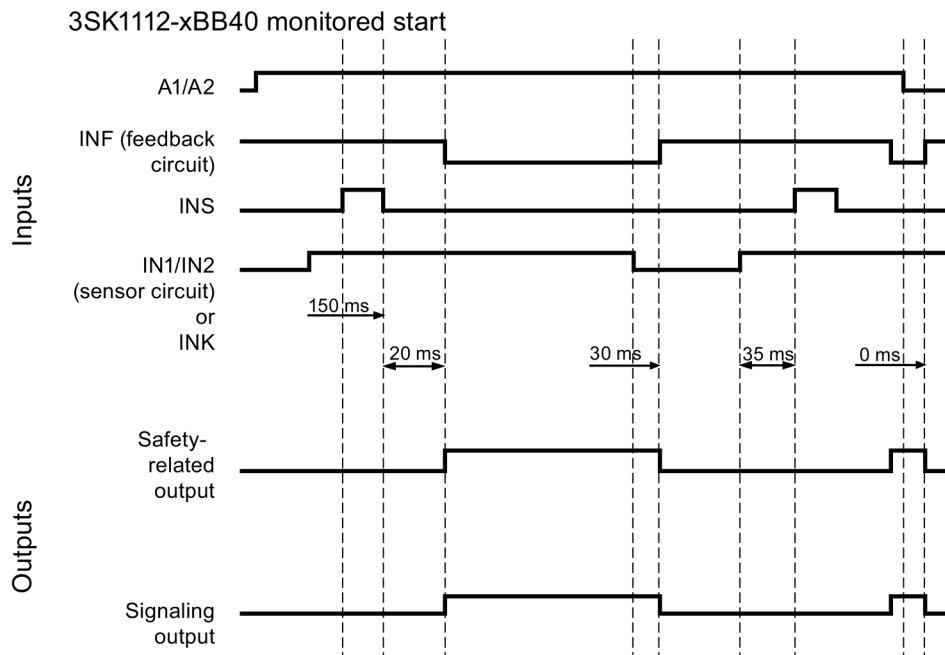
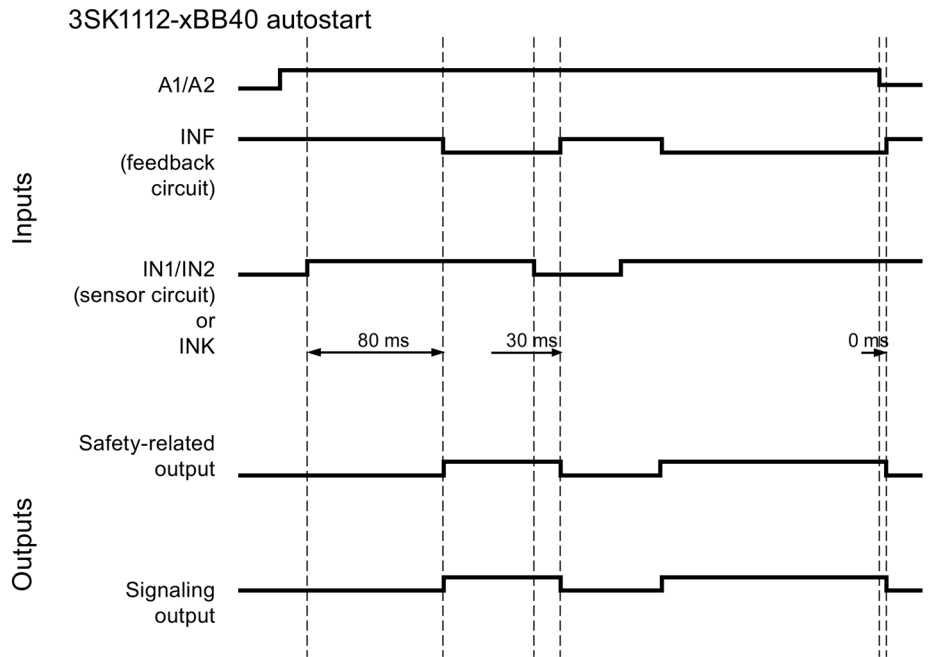
| Function of the SET/RESET button | Status of the indicating LEDs      | Function  |
|----------------------------------|------------------------------------|---|
| SET                              | "DEVICE" LED flashing yellow       | <ul style="list-style-type: none"> <li>• <b>Press key for about 1 s</b><br/>The parameterization is loaded</li> </ul>   |
| RESET                            | "DEVICE" LED red                   | <ul style="list-style-type: none"> <li>• <b>Press key for about 1 s</b><br/>=&gt; The device restarts without the supply voltage having to be switched off</li> </ul> |
|                                  | "DEVICE" LED flashing green yellow |   |
|                                  | "SF" LED red                       |   |

**Note**

The SET/RESET pushbutton only triggers a reset for the device on which the button is pressed.



State diagrams 3SK1112



## 5.2 3SK1 Advanced

### 5.2.1 General information

The safety relays of the Advanced device series comprise basic devices and input and output expansions. The Advanced safety relays can be connected by means of a 3ZY12 device connector.

When configuring the system, it must be ensured that input expansions are always mounted on the left, and output expansions (3SK121 or 3RM1 Failsafe motor starter) on the right of the basic unit. For control supply voltages of 110 ... 240 V AC/DC, the Advanced device series can be supplied with the necessary 24 V DC voltage from the 3SK1230 power supply (which must be positioned on the extreme left in the system).

**The focus of the Advanced relay series is on:**

- Single devices that can be flexibly parameterized
- Expandability using 3ZY12 device connector on both input and output side
- Basic units with time-delayed safety-related outputs

### 5.2.2 Applications

- EMERGENCY OFF / EMERGENCY STOP monitoring.
- Monitoring of protective doors with electromechanical position switches, solid-state position switches, or solenoid switches.
- Monitoring of contact-free protection equipment, e.g. light arrays/light barriers, or laser scanners.

The 3SK1 safety relays Advanced can be used in EMERGENCY OFF and EMERGENCY STOP devices in accordance with EN 60204-1 and in safety circuits in accordance with VDE 0113-1 and/or EN 60204-1, e.g. in circuits in which controlled shutdown, STOP Category 1, is necessary. Depending on the external circuit, it is possible to achieve SILCL 3 in accordance with IEC 62061, SIL 3 in accordance with IEC 61508 and PL e (Cat. 4) in accordance with ISO 13849-1.

The safety relays comply with DIN EN 50156-1:2004 (Electrical equipment for furnaces). You can use the 3SK1 safety relays Advanced to achieve two-hand switching applications up to type IIIc in compliance with EN 574:1996+A1:2008.

### 5.2.3 General device features

#### Device properties:

- 4-way DIP switch for function setting (parameterization)
- SET/RESET button
- 4 LEDs for status and function display
- 2 sensor inputs (channels 1 and 2)
- 1 input (cascading circuit)
- 1 input (START pushbutton circuit)
- NO contact/NC contact evaluation via external jumper (T1/PAR)
- Connecting interface for 3ZY12 device connectors
- Removable terminals

### 5.2.4 Function description

There is a 4-way DIP switch for function setting and 4 LEDs for status and function display on the front of the 3SK1 Advanced basic units. A SET/RESET button can be used to load function settings and to perform a device restart (reset). On commissioning, the devices runs a self-test in which the internal electronics and firmware are checked for correct functioning. All internal parts of the circuit are cyclically monitored for faults during operation. In the case of units with semiconductor outputs, they cyclically run through a light/dark test for up to 2.5 ms (dynamically) to verify their correct functioning. The safety relays can be expanded using 3ZY12 device connectors with input and output expansions.

#### **3SK1 Advanced basic unit time-delayed only:**

These basic units have two time-delayed and two instantaneous safety-related outputs (NO circuits) or outputs switching to P potential.

Four LEDs and one DIP switch indicate the operating state and functioning of the device:

- (1) DEVICE
- (2) OUT
- (3) IN
- (4) SF

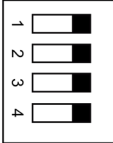
The four LEDs show the following:

- Operating mode: Diagnostics
- Configuration mode: DIP setting

For an explanation of the operating state display, see Section Display and diagnostics (Page 199)

### 5.2.5 Functions

Table 5- 3 DIP switch

| Switch position: left                | Schematic   | DIP switch No. | Switch position: right            |
|--------------------------------------|---|----------------|-----------------------------------|
| Autostart                            |  | 1              | Monitored start                   |
| Cross-circuit detection deactivated  |   | 2              | Cross-circuit detection activated |
| 2 x single-channel sensor connection |   | 3              | 1 x two-channel sensor connection |
| Start-up test ON                     |   | 4              | Start-up test OFF                 |

In the delivery state, all the DIP switches are in switch position: right.

#### Terminal parameterization:

Jumper on terminals T1/PAR = NO/NC evaluation

Table 5- 4 SET/RESET button

| Function of the SET/RESET button | Status of the indicating LEDs      | Function   |
|----------------------------------|------------------------------------|--|
| SET                              | "DEVICE" LED flashing yellow       | <ul style="list-style-type: none"> <li>Press key for about 1 s<br/>The parameterization is loaded</li> </ul>   |
| RESET                            | "DEVICE" LED red                   | <ul style="list-style-type: none"> <li>Press key for about 1 s<br/>=&gt; The device restarts without the supply voltage having to be switched off</li> </ul> |
|                                  | "DEVICE" LED flashing green yellow |  |
|                                  | "SF" LED red                       |  |

---

#### Note

The SET/RESET pushbutton only triggers a reset for the device on which the button is pressed.

---

## Potentiometer for time setting

Potentiometer for infinite time setting of the time-delayed safety-related outputs on the Advanced basic units (with time-delayed safety-related outputs).

- 3SK112.-.CB41 setting range: 0.05 ... 3 s
- 3SK112.-.CB42 setting range: 0.5 ... 30 s
- 3SK112.-.CB44 setting range: 5 ... 300 s

---

### Note

The delay time ends when the voltage is disconnected. The time-delayed contacts change switch position.

---

## Using the cascading input

The cascading input must be controlled with a 24 V DC signal. The voltage source of the 24 V DC signal must correspond to the voltage source of the safety relay's supply voltage (A1).

---

### Note

**Observe the following during commissioning of 3SK1 Advanced safety relays:**

The cascading input must be connected to terminal A1 if it is not to be used.

Monitoring of the feedback circuits is not optional.

---

## "2 x single-channel" parameterization

If the unit is parameterized to 2 x 1-channel with DIP switch 3, the sensor circuit that is not used (T1/IN1 or T2/IN2) must be bypassed.

## 5.2.6 3SK1121 Advanced basic unit instantaneous (with relay outputs)

### 5.2.6.1 Device features

#### Article number (MLFB):

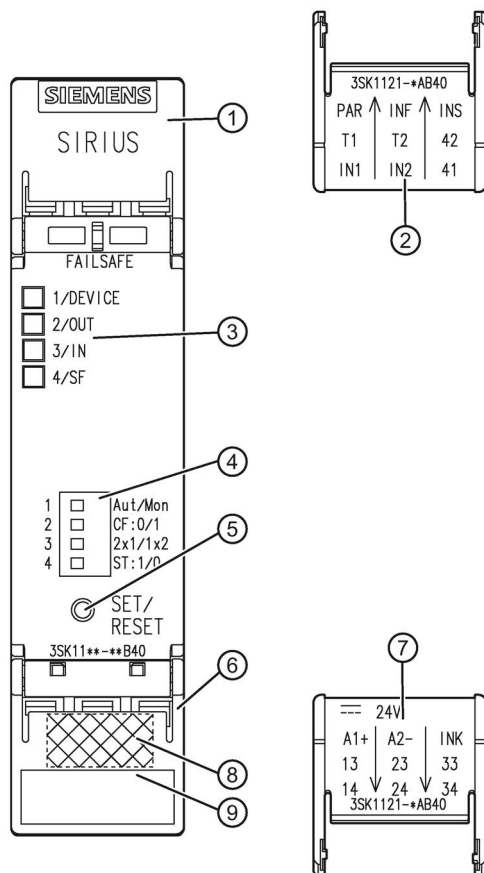
|               |         |
|---------------|---------|
| 3SK1121-xAB40 | 24 V DC |
|---------------|---------|

(x) 1 = screw-type terminal; 2 = push-in terminal

### 5.2.6.2 Function description

The 3SK1121 Advanced basic unit has three safety-related relay outputs and one non-safety-related signaling circuit.

### 5.2.6.3 Design

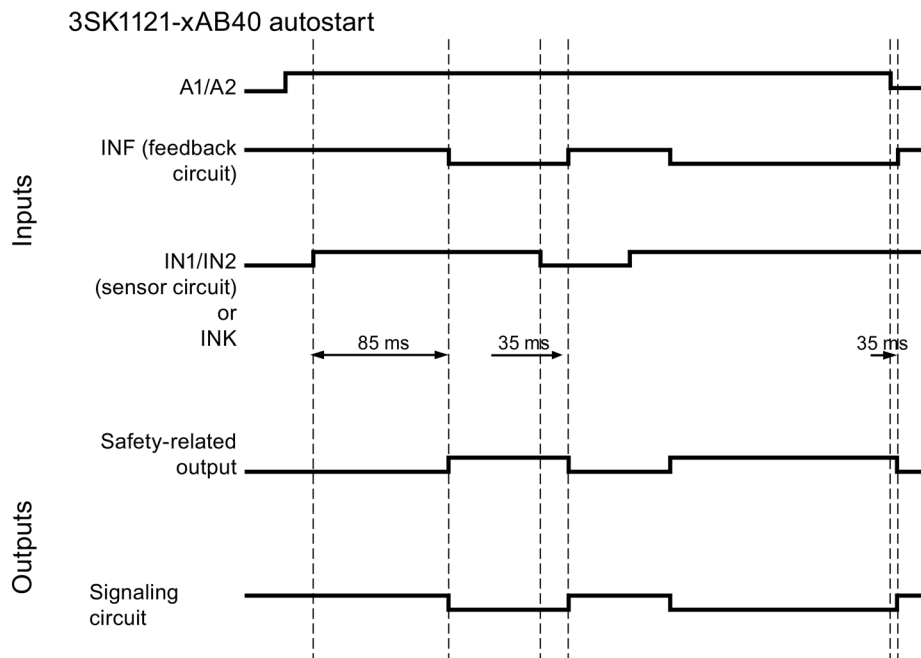


- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ DIP switch
- ⑤ SET/RESET button
- ⑥ Bottom cover flap
- ⑦ Bottom cover flap; internal inscription
- ⑧ DataMatrix code
- ⑨ Device identification label

### 5.2.6.4 Terminal assignment

| Terminal                      | Explanation  |
|-------------------------------|--|
| A1                            | +  |
| A2                            | -  |
| IN1                           | Sensor channel 1   |
| IN2                           | Sensor channel 2   |
| PAR                           | NO contact/NC contact evaluation                             |
| INS                           | START pushbutton circuit                                     |
| INF                           | Feedback circuit   |
| INK                           | Cascading circuit  |
| T1                            | Test output 1 (for IN1, PAR)                                 |
| T2                            | Test output 2 (for IN2, INF)                                 |
| 13 - 14<br>23 - 24<br>33 - 34 | Safety-related outputs (NO contact, relay contact)           |
| 41 - 42                       | Semiconductor signaling circuits (NC contact, relay contact) |

### State diagram 3SK1121



## 5.2.7 3SK1121 Advanced basic unit time-delayed (with relay outputs)

### 5.2.7.1 Device features

Article number (MLFB):

|               |         |
|---------------|---------|
| 3SK1121-xCB4y | 24 V DC |
|---------------|---------|

(x) 1 = screw-type terminal; 2 = push-in terminal

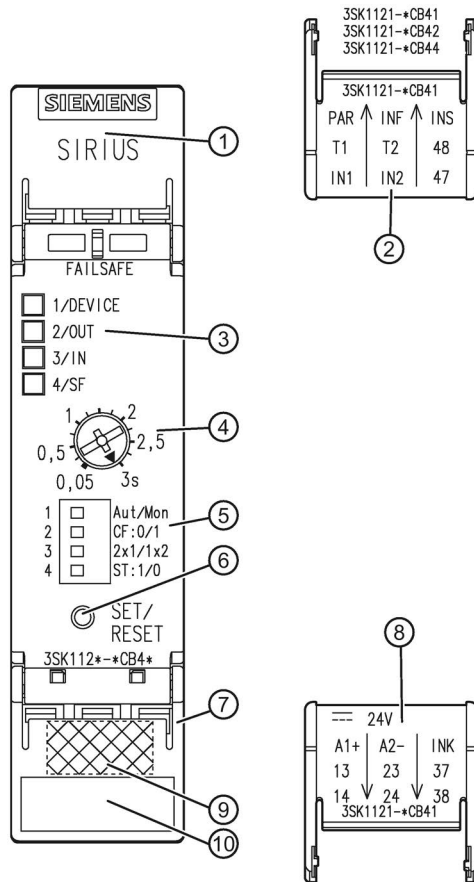
(y) time delay 1 = 0.05 ... 3 s; 2 = 0.5 ... 30 s; 4 = 5 ... 300 s

#### Additional / alternative device characteristics

- 2 instantaneous safety-related outputs (NO contacts)
- 2 time-delayed safety-related outputs (NO contacts),
- Potentiometer for setting the delay time
- Time function: With OFF-delay



### 5.2.7.2 Design

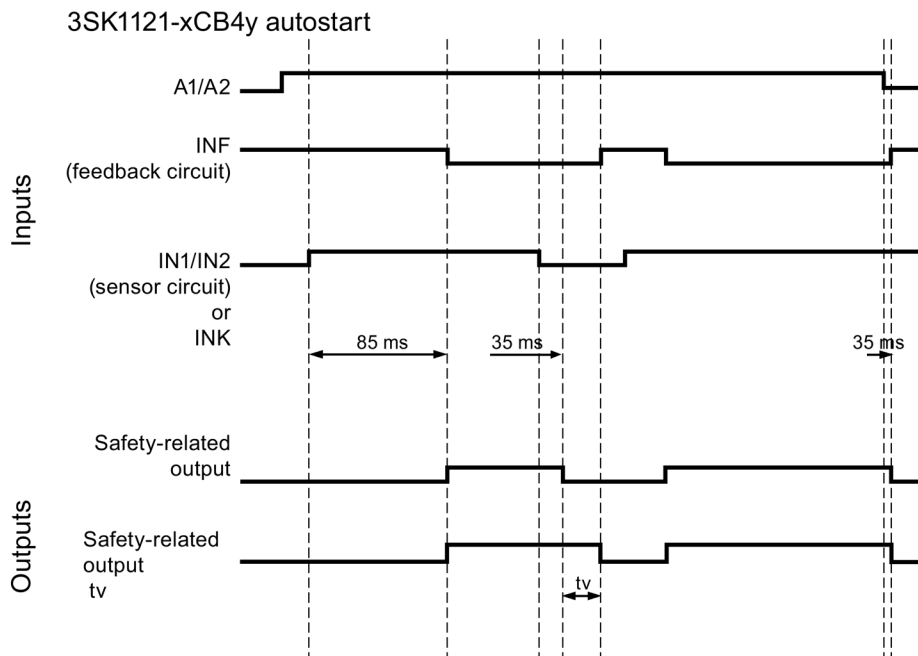


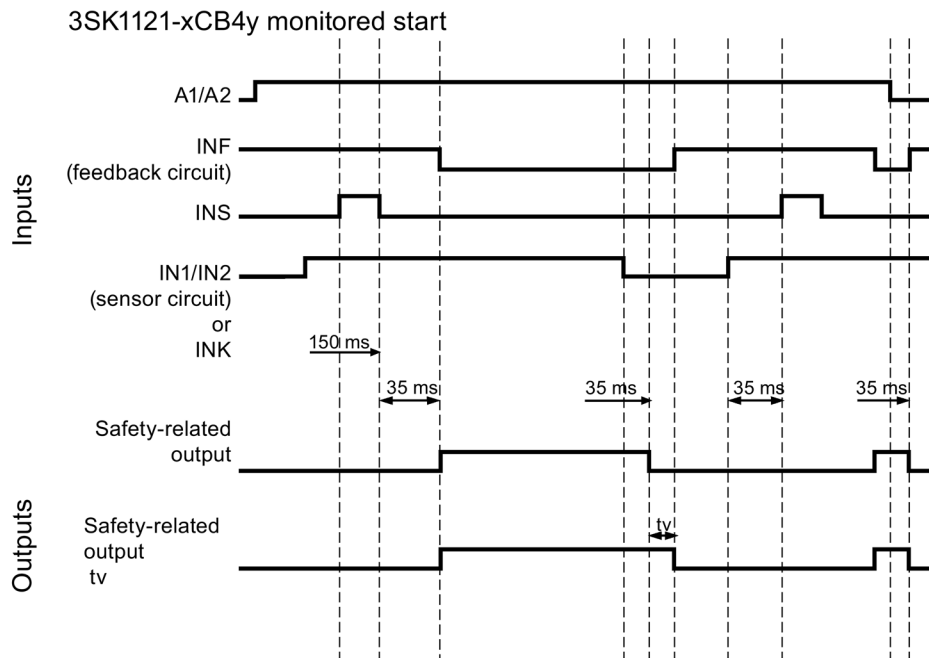
- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ Potentiometer for setting the delay time
- ⑤ DIP switch
- ⑥ SET/RESET button
- ⑦ Bottom cover flap
- ⑧ Bottom cover flap; internal inscription
- ⑨ DataMatrix code
- ⑩ Device identification label

5.2.7.3 Terminal assignment

| Terminal | Explanation   |
|----------|---|
| A1       | +   |
| A2       | -   |
| IN1      | Sensor channel 1  |
| IN2      | Sensor channel 2  |
| PAR      | NO contact/NC contact evaluation                                  |
| INS      | START pushbutton circuit  |
| INF      | Feedback circuit  |
| INK      | Cascading circuit   |
| T1       | Test output 1 (for IN1, PAR)                                      |
| T2       | Test output 2 (for IN2, INF)                                      |
| 13 - 14  | Instantaneous safety-related output 1 (NO contact, relay contact) |
| 23 - 24  | Instantaneous safety-related output 2 (NO contact, relay contact) |
| 37 - 38  | Delayed safety-related output 1 (NO contact, relay contact)       |
| 47 - 48  | Delayed safety-related output 2 (NO contact, relay contact)       |

State diagrams 3SK1121-xCB4y





## 5.2.8 3SK1122 Advanced basic unit instantaneous (with semiconductor outputs)

### 5.2.8.1 Device features


Article number (MLFB):

|               |         |
|---------------|---------|
| 3SK1122-xAB40 | 24 V DC |
|---------------|---------|

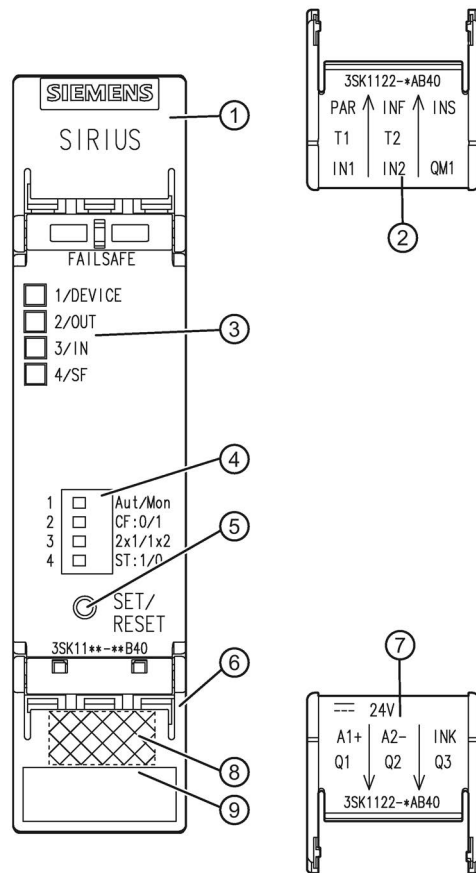
(x) 1 = screw-type terminal; 2 = push-in terminal

#### Additional or alternative device features

- 3 safety-related semiconductor outputs
- 1 semiconductor signaling circuit

|  |
|--|
|  <b>WARNING</b>   |
| <b>Continuous operation</b><br>Devices up to E01/V1.0.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) ≤ 1 year.<br><br>Devices from E02/V1.1.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) ≤ 20 years. |

### 5.2.8.2 Design

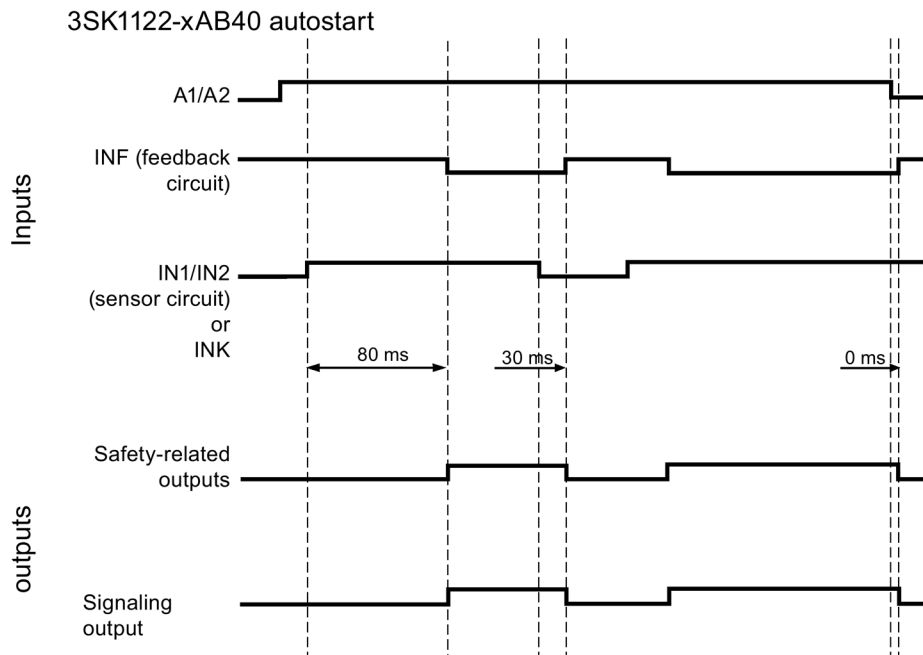


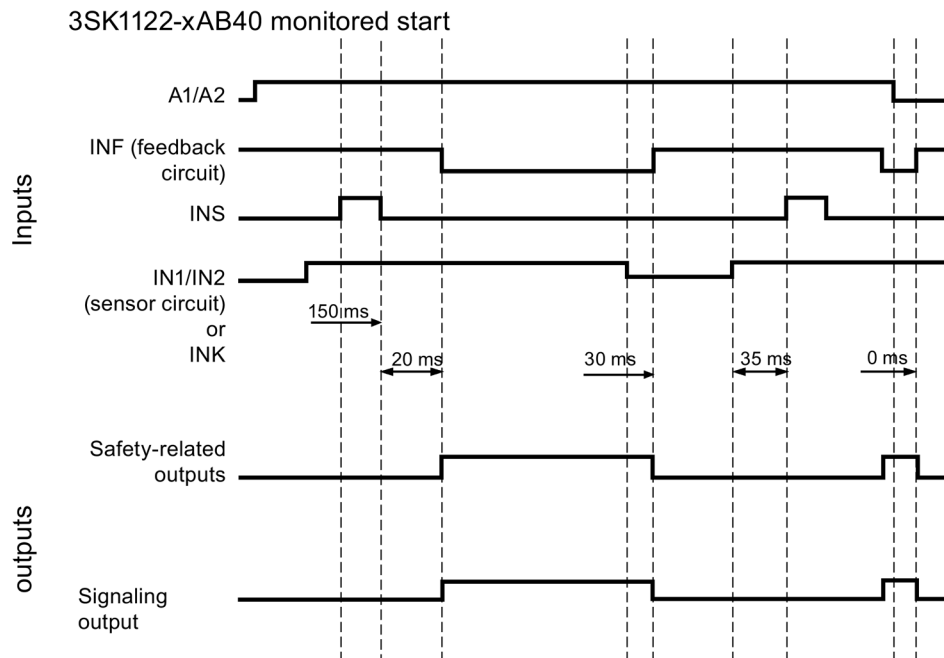
- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ DIP switch
- ⑤ SET/RESET button
- ⑥ Bottom cover flap
- ⑦ Bottom cover flap; internal inscription
- ⑧ DataMatrix code
- ⑨ Device identification label

### 5.2.8.3 Terminal assignment

| Terminal | Explanation  |
|----------|--|
| A1       | +  |
| A2       | -  |
| IN1      | Sensor channel 1   |
| IN2      | Sensor channel 2   |
| PAR      | NO contact/NC contact evaluation   |
| INS      | START pushbutton circuit   |
| INF      | Feedback circuit   |
| INK      | Cascading circuit  |
| T1       | Test output 1 (for IN1, PAR)   |
| T2       | Test output 2 (for IN2, INF)   |
| Q1       | Safety-related output 1<br>(switching to P potential, 24 V DC)           |
| Q2       | Safety-related output 2<br>(switching to P potential, 24 V DC)           |
| Q3       | Safety-related output 3<br>(switching to P potential, 24 V DC)           |
| QM1      | Semiconductor signaling circuit 1<br>(switching to P potential, 24 V DC) |

### State diagrams 3SK1122-xAB40





## 5.2.9 3SK1122 Advanced basic unit time-delayed (with semiconductor outputs)

### 5.2.9.1 Device features

Article number (MLFB):


|               |         |
|---------------|---------|
| 3SK1122-xCB4y | 24 V DC |
|---------------|---------|

(x) 1 = screw-type terminal; 2 = push-in terminal

(y) time delay 1 = 0.05 ... 3 s; 2 = 0.5 ... 30 s; 4 = 5 ... 300 s

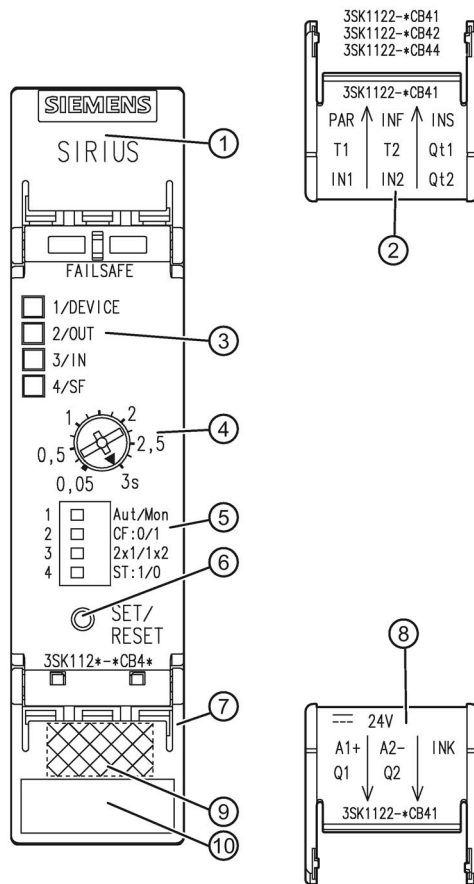
#### Additional / alternative device characteristics

- 2 instantaneous semiconductor outputs
- 2 time-delayed semiconductor outputs
- Potentiometer for setting the delay time
- Time function: With OFF-delay

|  |
|--|
|  <b>WARNING</b>  |
| <b>Continuous operation</b><br>Devices up to E01/V1.0.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) $\leq$ 1 year.<br>Devices from E02/V1.1.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) $\leq$ 20 years. |



## 5.2.9.2 Design

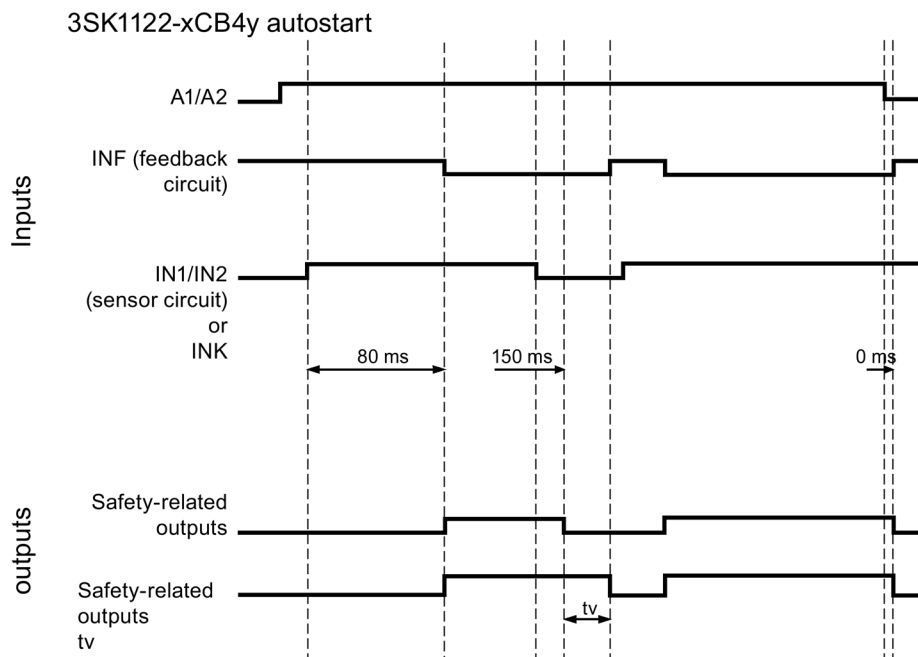


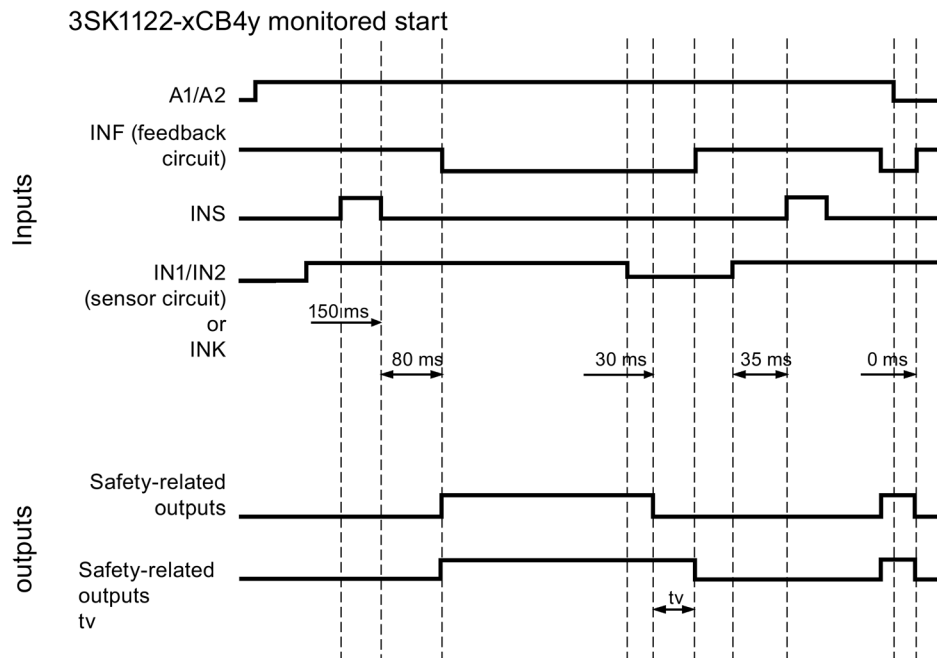
- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ Potentiometer for setting the delay time
- ⑤ DIP switch
- ⑥ SET/RESET button
- ⑦ Bottom cover flap
- ⑧ Bottom cover flap; internal inscription
- ⑨ DataMatrix code
- ⑩ Device identification label

### 5.2.9.3 Terminal assignment

| Terminal | Explanation   |
|----------|---|
| A1       | +   |
| A2       | -   |
| IN1      | Sensor channel 1  |
| IN2      | Sensor channel 2  |
| PAR      | NO contact/NC contact evaluation  |
| INS      | START pushbutton circuit  |
| INF      | Feedback circuit  |
| INK      | Cascading circuit / normal switching duty                                 |
| T1       | Test output 1 (for IN1, PAR)  |
| T2       | Test output 2 (for IN2, INF)  |
| Q1       | Instantaneous safety-related output 1 (switching to P potential, 24 V DC) |
| Q2       | Instantaneous safety-related output 2 (switching to P potential, 24 V DC) |
| Qt1      | Time-delayed safety-related output 1 (switching to P potential, 24 V DC)  |
| Qt2      | Time-delayed safety-related output 2 (switching to P potential, 24 V DC)  |

### State diagrams 3SK1122-xCB4y





## 5.2.10 3SK1120 Advanced basic unit instantaneous (with semiconductor outputs)

### 5.2.10.1 Device features


Article number (MLFB):

|               |         |
|---------------|---------|
| 3SK1120-xAB40 | 24 V DC |
|---------------|---------|

(x) 1 = screw-type terminal; 2 = push-in terminal


#### Additional or alternative device features

- 1 safety-related semiconductor output
- The following design variants are possible for the 3SK1120 Advanced basic unit:
  - In operation without using device connectors, up to PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061 can be achieved for devices from E02/V 1.1.0.

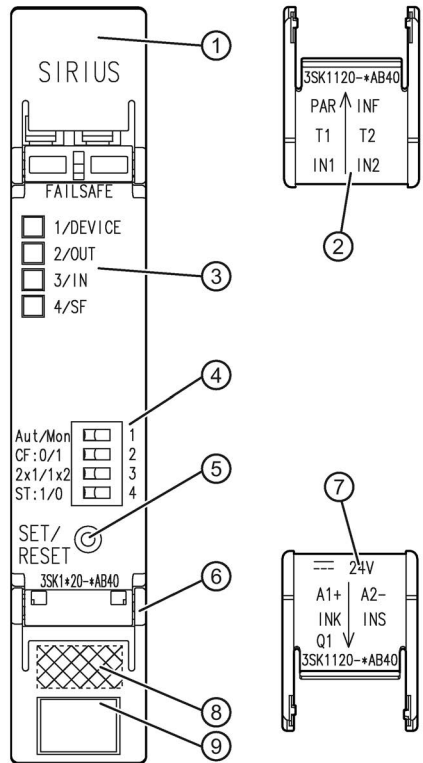
|   |
|---|
|  <b>WARNING</b>  |
| <b>Operation without using device connectors for E01/V1.0.0 devices</b>   |
| In operation without using device connectors, up to PL c / Cat. 2 in accordance with ISO 13849-1 or SILCL 2 in accordance with IEC 62061 can be achieved. |

- Operation using device connectors
 

In operation using device connectors and using at least one output expansion (3SK1211, 3SK1213) or one 3RM1 Failsafe motor starter, up to PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061 can be achieved.

|  |
|--|
|  <b>WARNING</b>   |
| <b>Continuous operation</b>  |
| Devices up to E01/V1.0.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) ≤ 1 year.  |
| Devices from E02/V1.1.0:<br>In continuous operation for PL e/Cat. 4 in accordance with ISO 13849-1 or SILCL 3 in accordance with IEC 62061, the key safety values apply where the function test interval (state change of the outputs) ≤ 20 years. |

### 5.2.10.2 Design



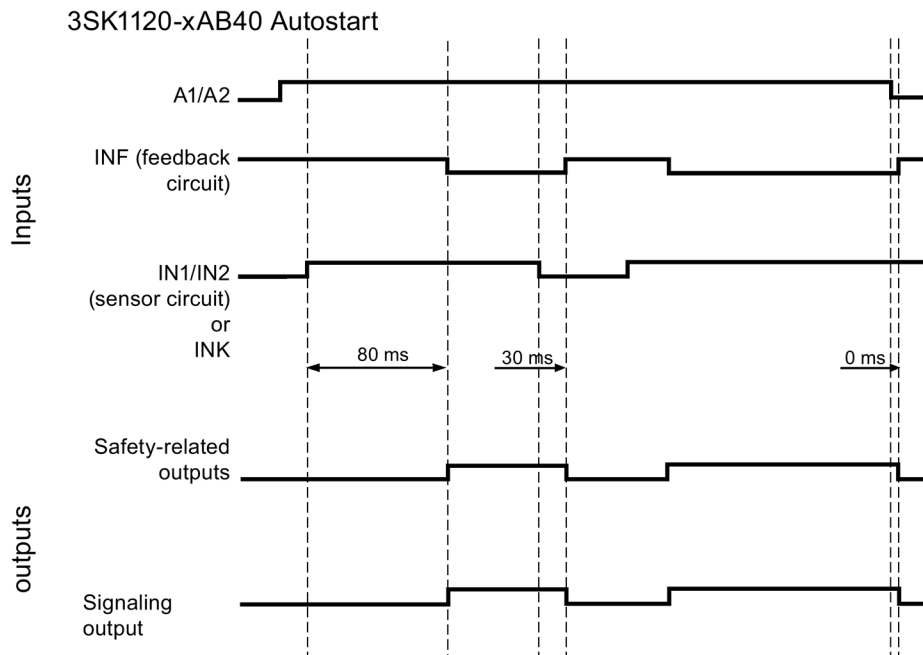
- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ DIP switch
- ⑤ SET/RESET button
- ⑥ Bottom cover flap
- ⑦ Bottom cover flap; internal inscription
- ⑧ DataMatrix code
- ⑨ Device identification label

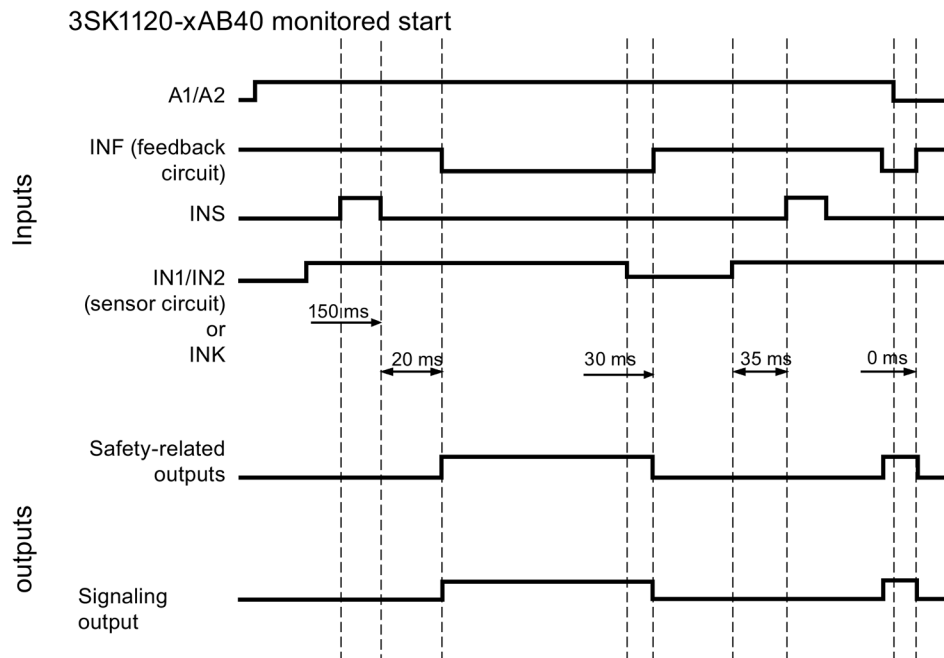
5.2.10.3 Terminal assignment

| Terminal | Explanation  |
|----------|--|
| A1       | +  |
| A2       | -  |
| IN1      | Sensor channel 1   |
| IN2      | Sensor channel 2   |
| PAR      | NO contact/NC contact evaluation                               |
| INS      | START pushbutton circuit                                       |
| INF      | Feedback circuit   |
| INK      | Cascading circuit  |
| T1       | Test output 1 (for IN1, PAR)                                   |
| T2       | Test output 2 (for IN2, INF)                                   |
| Q1       | Safety-related output 1<br>(switching to P potential, 24 V DC) |

5.2.10.4 Status diagrams

State diagrams 3SK1120-xAB40





## 5.3 3SK1 output expansions

### 5.3.1 Applications

The 3SK1 output expansions are used to expand the safety-related outputs. The maximum achievable Performance Level PL/Cat. in accordance with ISO 13849-1, SILCL in accordance with IEC 62061, SIL in accordance with IEC 61508 corresponds to the Performance Level PL and SIL of the basic unit when the external wiring (connection between basic unit and output expansion) is configured as fail-safe (e.g. basic unit and output expansion are connected using 3ZY12 device connector).

The output expansions can be activated via the supply voltage (A1/A2) or using 3ZY12 device connectors<sup>1)</sup>.

1) For 24 V DC variant only

---

#### Note

If expansion units are controlled via the 3ZY12 device connector, additional feeding of the control supply voltage (A1/A2) at one of the output expansions leads to a fault in the system configuration.

---

#### Note

##### Use of the output expansions on 3ZY12 device connectors

You can switch between instantaneous or delayed control of the basic unit using the slide switch of the output expansion (see also the chapter "System configuration rules (Page 109)").

---

#### Note

##### Using the output expansions with conventional wiring

The slide switch has **no** function here.

If you require Stop category 1 outputs for the output expansion, terminals A1/A2 of the output expansion must be connected to outputs 38 or 48 on 3SK1 basic units with relay outputs or to Q1t/Q2t (in the case of 3SK1 with semiconductor outputs).

---



### 5.3.2 Function description

The operating state of the 3SK1 output expansions is displayed on the DEVICE LED.

The 3SK1211 output expansions (4RO) have four safety-related outputs as NO circuits, and the 3SK1213 output expansions (3RO) have three. They each have one positively-driven NC circuit. The output expansions can be activated via any output of the basic unit via (A1). The NC circuit 51/52 of 3SK1211 (4RO) or 41/42 of 3SK1213 (3RO) is used for monitoring the output expansions.

In the 24 V DC variants, the expansion units can be activated and evaluated via the 3ZY12 device connectors.

### 5.3.3 Display of the operating state

#### Display of the operating state

The operating state and functioning of the device are indicated by an LED:

- (1) DEVICE

#### Operating states

| LED    | State                  | Meaning                |
|--------|------------------------|------------------------|
| DEVICE | Control supply voltage | Safety-related outputs |
| OFF    | OFF                    | Open                   |
| Green  | ON                     | Closed                 |

### 5.3.4 Function setting

#### Setting the activation (slide switch only for 24 V variants)

The interface input for activating the output expansion can be selected using a slide switch on the front of the device.

| Slide switch | Interface input                                   |
|--------------|---|
| Top          | Outputs switch with time delay (as in basic unit) |
| Bottom       | Outputs switch instantaneously                    |

When using an instantaneous basic unit, the slide switch must be in the instantaneous position (bottom).

### 5.3.5 Output expansion 3SK1211

#### 5.3.5.1 Device features

**Article number (MLFB):**

|               |   |
|---------------|---|
| 3SK1211-xBB00 | 24 V AC                                   |
| 3SK1211-xBB40 | 24 V DC                                   |
| 3SK1211-xBW20 | 110 ... 240 V AC / DC (wide-range supply) |

(x) 1 = screw-type terminal; 2 = push-in terminal

**Supply:**

**24 V AC:**

- Activation via 24 V transformer is possible

**24 V DC:**

- An SELV / PELV power supply must be used for the infeed

**110 ... 240 V AC/DC:**

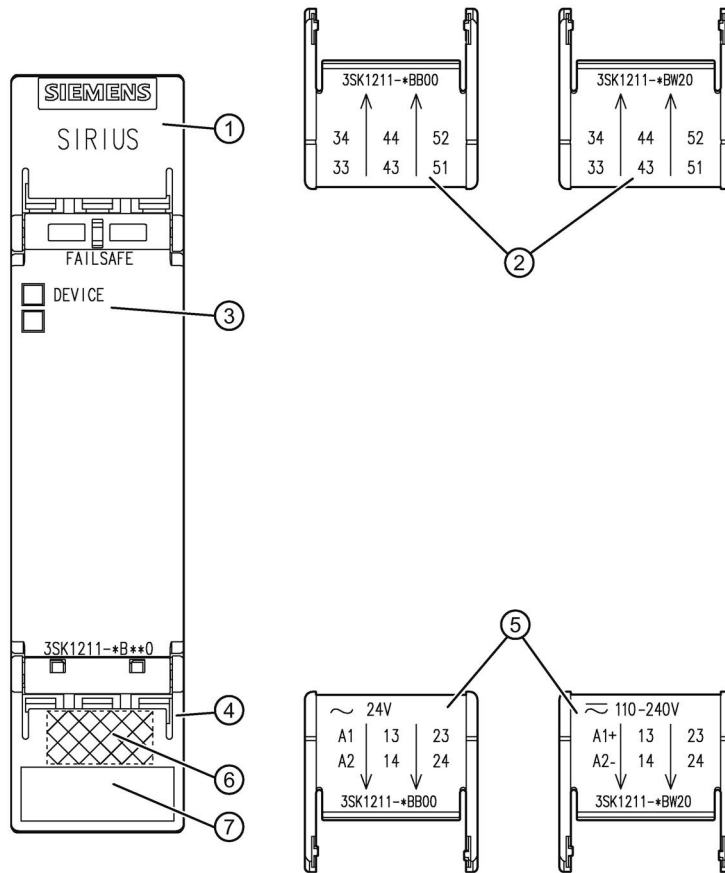
- Direct line supply connection L/N

**Device properties:**

- Slide switch for selecting the activation type (time-delayed / instantaneous)\*
- 1 LED for status display
- 4 safety-related outputs (NO contacts),
- 1 NC circuit as feedback contact for the 3SK1211 output expansion to the upstream basic unit
- 3ZY12\* device connectors
- Enclosure width 22.5 mm
- Removable terminals

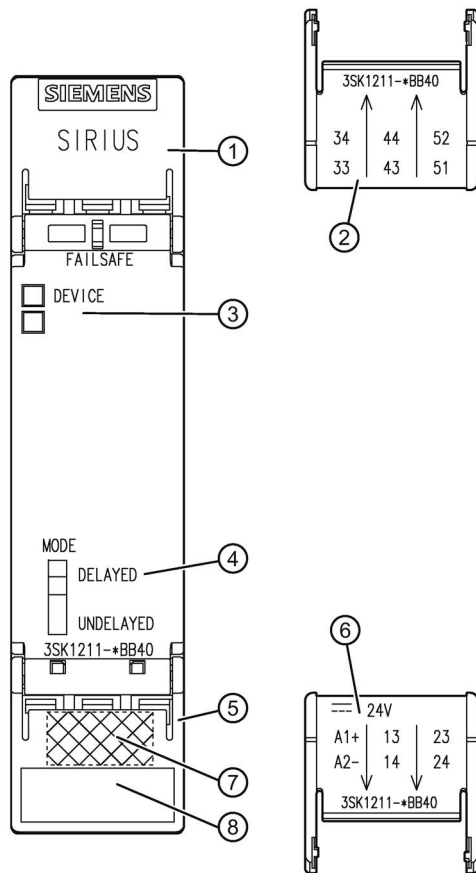
\* For 24 V DC variant only

5.3.5.2 Design of 3SK1211-.B..0



- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ Bottom cover flap
- ⑤ Bottom cover flap; internal inscription
- ⑥ DataMatrix code
- ⑦ Device identification label

5.3.5.3 Design of 3SK1211-.BB40



- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ Slide switch
- ⑤ Bottom cover flap
- ⑥ Bottom cover flap; internal inscription
- ⑦ DataMatrix code
- ⑧ Device identification label

### 5.3.5.4 Terminal assignment

| Terminal | Explanation   |
|----------|---|
| A1       | + (L+ for 3SK1211-.BW20)                            |
| A2       | - (N- for 3SK1211-.BW20)                            |
| 13 - 14  | Safety-related output 1 (NO contact, relay contact) |
| 23 - 24  | Safety-related output 2 (NO contact, relay contact) |
| 33 - 34  | Safety-related output 3 (NO contact, relay contact) |
| 43 - 44  | Safety-related output 4 (NO contact, relay contact) |
| 51 - 52  | NC circuit as feedback contact (NC, relay contact)  |

### 5.3.6 Output expansion 3SK1213

#### 5.3.6.1 Device features

Article number (MLFB):

|               |          |
|---------------|----------|
| 3SK1213-xAB40 | 24 V DC  |
| 3SK1213-xAJ20 | 115 V AC |
| 3SK1213-xAL20 | 230 V AC |

(x) 1 = screw-type terminal; 2 = spring-loaded terminal

Supply:

#### 24 V DC:

- An SELV / PELV power supply must be used for the infeed

#### 115 V AC and 230 V AC

- Direct line supply connection L/N

Device properties:

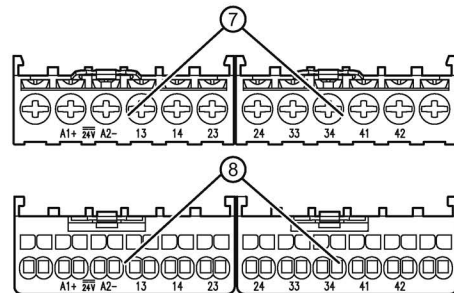
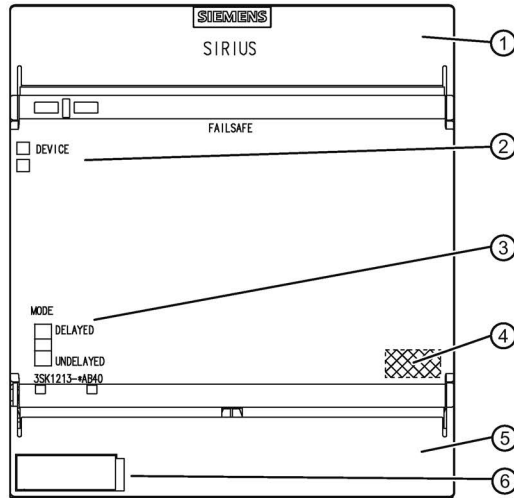
- Slide switch for selecting the activation type (time-delayed / instantaneous)\*
- 1 LED for status display
- 3 safety-related outputs (NO contacts),
- 1 NC circuit as feedback contact for the 3SK1213 output expansion for the upstream basic unit
- 3ZY12\* device connectors
- Enclosure width 90 mm
- Removable terminals

\* For 24 V DC variant only

Using 3ZY12 device connectors

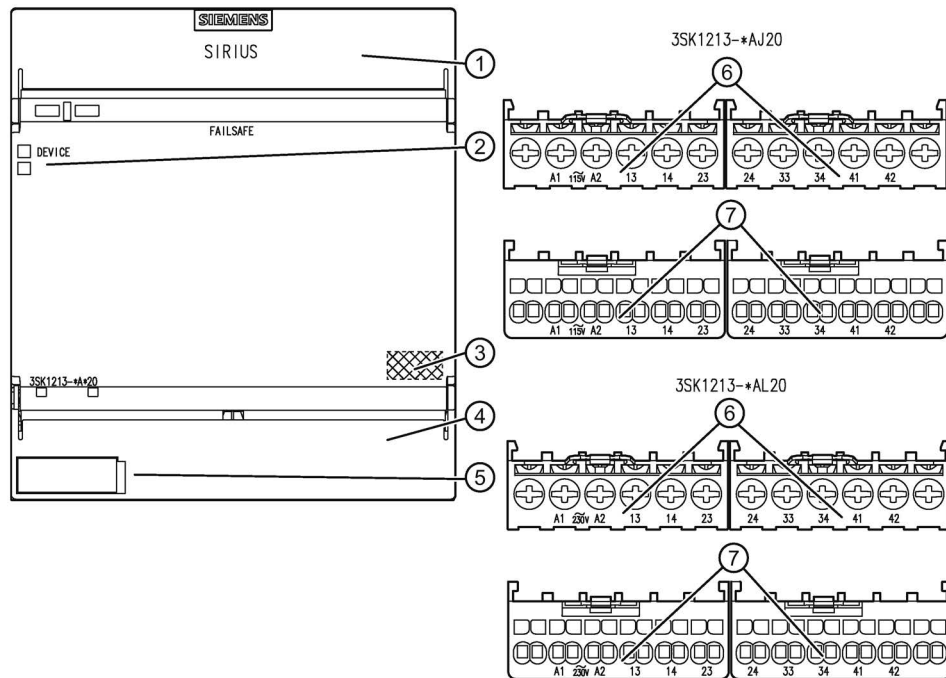
The 3SK1213 output expansion must always be terminated with a device termination connector set for the 3SK1 safety relay, size > 45 mm (3ZY1212-0FA01). Expansion on the right-hand side is then no longer possible.

5.3.6.2 Design of 3SK1213-.AB40



- ① Top cover flap
- ② Display LEDs
- ③ Slide switch
- ④ DataMatrix code
- ⑤ Bottom cover flap
- ⑥ Device identification label
- ⑦ Screw-type terminals
- ⑧ Spring-loaded terminals

### 5.3.6.3 Design of 3SK1213-A.20



- ① Top cover flap
- ② Display LEDs
- ③ DataMatrix code
- ④ Bottom cover flap
- ⑤ Device identification label
- ⑥ Screw-type terminals
- ⑦ Spring-loaded terminals

### 5.3.6.4 Terminal assignment

| Terminal | Description   |
|----------|---|
| A1       | +   |
| A2       | -   |
| 13 - 14  | Safety-related output 1 (NO contact, relay contact) |
| 23 - 24  | Safety-related output 2 (NO contact, relay contact) |
| 33 - 34  | Safety-related output 3 (NO contact, relay contact) |
| 41 - 42  | NC circuit as feedback contact (NC, relay contact)  |

### 5.3.7 3RM1 Failsafe motor starters

3RM1 Failsafe motor starters can be used wherever combinations of contactors and overload relays were previously used.

3RM1 Failsafe motor starters are used in the following areas, for example:

- Conveyor technology
- Logistics systems
- Production machines
- Machine tools
- Small elevators

Thanks to the additional functionality of safety-related shutdown, the 3RM11 Failsafe and 3RM13 Failsafe motor starter variants are ideally suited to safety-related applications in the 3SK1 system up to SILCL 3 in accordance with IEC 62061 and PL e/Cat. 4 in accordance with ISO 13849-1.

The maximum achievable Performance Level PL/Cat. in accordance with ISO 13849-1, SILCL in accordance with IEC 62061, SIL in accordance with IEC 61508 corresponds to the Performance Level PL and SIL of the 3SK1 basic unit when the external wiring (connection between basic unit and output expansion) is configured as fail-safe (e.g. basic unit and 3RM1 Failsafe motor starter are connected using 3ZY12 device connector).

3RM1 Failsafe motor starters can be controlled via the supply voltage (A1/A2) or via 3ZY12 device connectors (24 V DC variant only).

---

#### Note

If expansion units are controlled via the 3ZY12 device connector, additional feeding of the control supply voltage (A1/A2) at one of the output expansions leads to a fault in the system configuration.

---

#### Note

In the configuration with a 3SK1 Advanced basic unit on a 3ZY12 device connector, 3RM1 Failsafe motor starters can only be controlled by the instantaneous enable signal of the 3SK1 unit. If control of the 3RM1 Failsafe motor starters by means of the time-delayed output is desired, this can only be done by wiring the time-delayed safety-related output of the 3SK1 basic unit.

---

More detailed technical information is available in the SIRIUS 3RM1 motor starters (<http://support.automation.siemens.com/WW/view/en/66295730>) manual on the Internet.



## 5.4 3SK1 input expansions

### 5.4.1 Input expansion 3SK1220

#### 5.4.1.1 Device features

##### Article number (MLFB):

|               |         |
|---------------|---------|
| 3SK1220-xAB40 | 24 V DC |
|---------------|---------|

(x) 1 = screw-type terminal; 2 = push-in terminal

##### Device properties:

- 4-way DIP switch for function setting (parameterization)
- NO contact/NC contact evaluation via external jumper
- SET/RESET button
- 4 LEDs for status and function display
- 1 input (ON button circuit)
- 2 test outputs
- Enclosure width 17.5 mm
- Removable terminals
- Mounting exclusively on 3ZY12 device connectors

#### 5.4.1.2 Applications

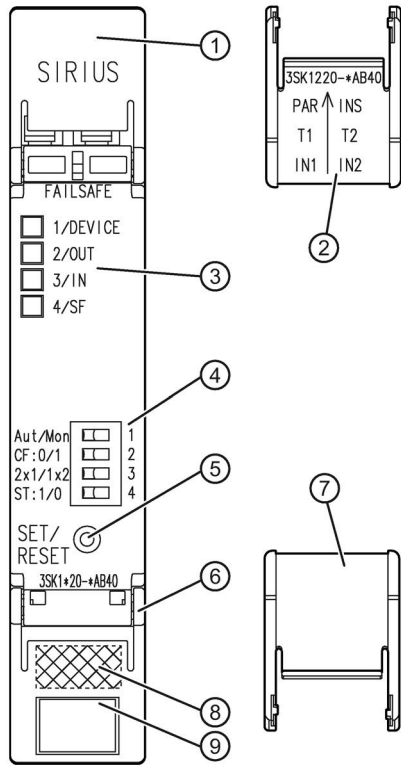
The number of sensor inputs for a basic unit can be expanded using input expansions. Input expansions must always be mounted to the left of a basic unit.

The input expansion 3SK1220 is certified to SIL 3/PL e.

The SILCL/PL achieved by the overall system depends on the external connection of sensors and actuators.

The input expansion 3SK1220 is supplied via the 3ZY12 device connectors.

5.4.1.3 Design



- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ DIP switch
- ⑤ SET/RESET button
- ⑥ Bottom cover flap
- ⑦ Bottom cover flap; internal inscription
- ⑧ DataMatrix code
- ⑨ Device identification label

5.4.1.4 Terminal assignment

| Terminal | Explanation                      |
|----------|----------------------------------|
| IN1      | Sensor channel 1                 |
| IN2      | Sensor channel 2                 |
| PAR      | NO contact/NC contact evaluation |
| INS      | ON button circuit                |
| T1       | Test output 1 (for IN1, PAR)     |
| T2       | Test output 2 (for IN2, INF)     |

### 5.4.1.5 Display of the operating state

You can find additional information on this under "Advanced" in the Chapter Function description (Page 63).

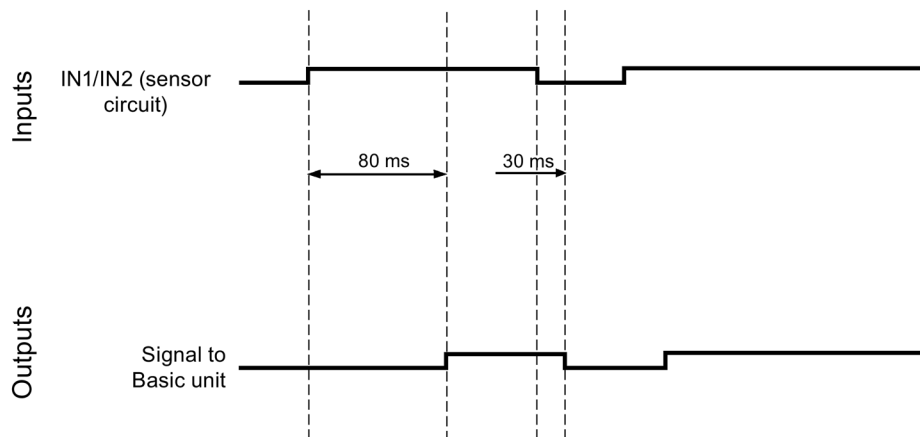
### 5.4.1.6 Function setting

#### DIP switch settings

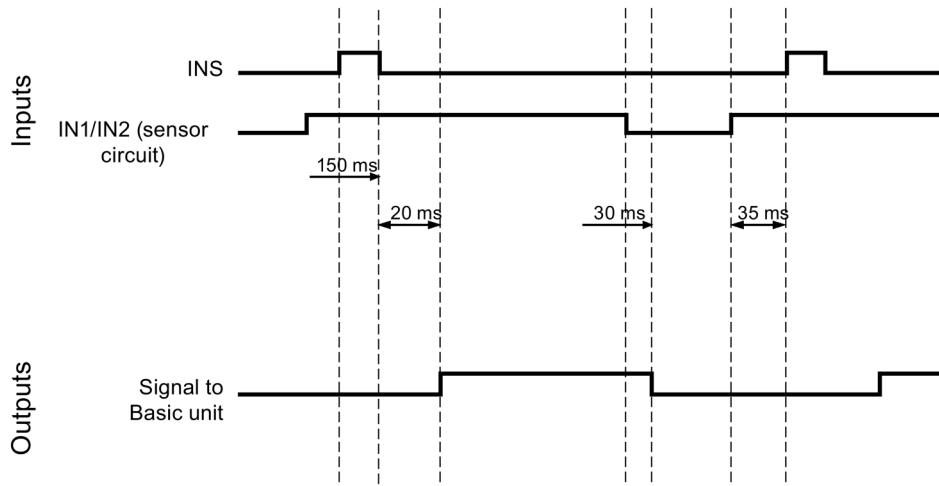
You can find additional information on this under "Advanced" in the Chapter Functions (Page 64).

### State diagrams 3SK1220

3SK1220 Autostart



3SK1220 Monitored start



## 5.4.2 Power supply 3SK1230

### 5.4.2.1 Device features

#### Article number (MLFB):

|               |                     |
|---------------|---------------------|
| 3SK1230-xAW20 | 110 ... 240 V AC/DC |
|---------------|---------------------|

(x) 1 = screw-type terminal; 2 = push-in terminal

#### Device properties:

- Wide-range input: 110 ... 240 V AC/DC
- Rated output voltage: 24 V DC
- Rated output current: 0.6 A
- 1 LED for status display
- Connection interface
- Enclosure width 22.5 mm
- Removable terminals

#### Note

Due to the output current of the 3SK1230 power supply (= 0.6 A), the use of 3SK1 basic units with **semiconductor outputs** is only possible to a limited extent. The output current of all semiconductor outputs can be **up to 0.4 A** here (depending on the system configuration).

### 5.4.2.2 Applications

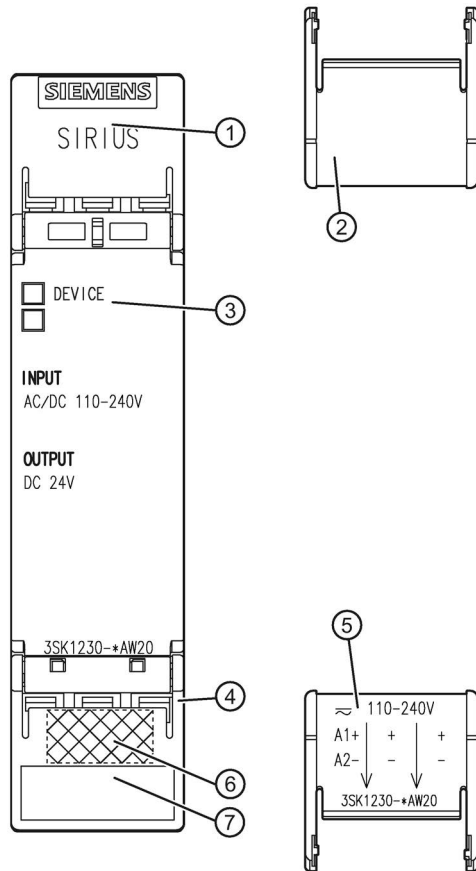
The 3SK1230 power supply generates a stabilized output voltage of 24 V DC from 110 ... 240 V AC/DC. The 3SK1230 power supply can supply the 3SK1 Advanced device series with 24 V DC via 3ZY12 device connectors or via the +/- output terminals.

The "INS" START pushbutton input of the 3SK1 device series must be supplied from the 3SK1230 power supply.

#### NOTICE

Two power supplies in parallel are not permissible! Only one 3SK1230 power supply is permitted in each system configuration.

5.4.2.3 Design



- ① Top cover flap
- ② Top cover flap; internal inscription
- ③ Display LEDs
- ④ Bottom cover flap
- ⑤ Bottom cover flap; internal inscription
- ⑥ DataMatrix code
- ⑦ Device identification label

#### 5.4.2.4 Terminal assignment

| Terminal | Explanation |
|----------|-------------|
| A1       | L+          |
| A2       | N-          |
| +        | +24 V DC    |
| +        | +24 V DC    |
| -        | - Mass      |
| -        | - Mass      |

#### 5.4.2.5 Display of the operating state

##### Display of the operating state

The operating state and functioning of the device are indicated by an LED:

- (1) DEVICE

##### Operating states

| LED    | State    | Meaning           |
|--------|----------|-------------------|
| DEVICE | Green    | Output voltage OK |
|        | Flashing | Overload          |
|        | OFF      | No voltage        |





# System configuration

## 6.1 General information

### 6.1.1 General notes on the Standard system

- Expanding safety-related outputs using external wiring.
- Output expansions must be activated via a safety-related output of the basic unit.
- The NC circuit (51/52 for 3SK1211; 41/42 for 3SK1213) of the output expansion must be looped into the feedback circuit (T4-INF/S) of the basic unit.

### 6.1.2 General information on the Advanced system

- Expansion of the safety-related outputs of 3SK1 Advanced basic units by means of external wiring is always possible.
- Expandable using 3ZY12 device connectors on both the input and output sides.
- The output expansions are activated and the feedback circuit is evaluated via the connection interface. Therefore, external wiring of the output expansions in the feedback circuit is not necessary.
- When using the Advanced device series with output expansion on the device connector described, all enabling and signaling circuits of the basic unit and output expansion can be used as required.
- The input expansions, as well as the output expansions mounted on the 3ZY12 device connector, are supplied with voltage via the 3ZY12 device connector. The supply voltage is only connected once on the basic unit (24 V DC) or the 3SK1230 power supply (110 ... 240 V AC/DC).
- Motor feeders up to 3 kW (400 V) can be implemented quickly and easily using 3RM1 Failsafe motor starters. The motor starters can be easily connected as output expansions in the 3SK1 system.

---

#### Note

In the configuration with a 3SK1 Advanced basic unit on a 3ZY12 device connector, 3RM1 Failsafe motor starters can only be controlled by the instantaneous enable signal of the 3SK1 unit. If control of the 3RM1 Failsafe motor starter by means of the time-delayed output is desired, this can only be done by wiring the time-delayed safety-related outputs of the 3SK1 basic unit.

Information about start response in the system configuration of 3SK1 Advanced units can be found in the chapter "Explanations of device function (Page 190)".


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### 6.1.3 Maximum system configuration

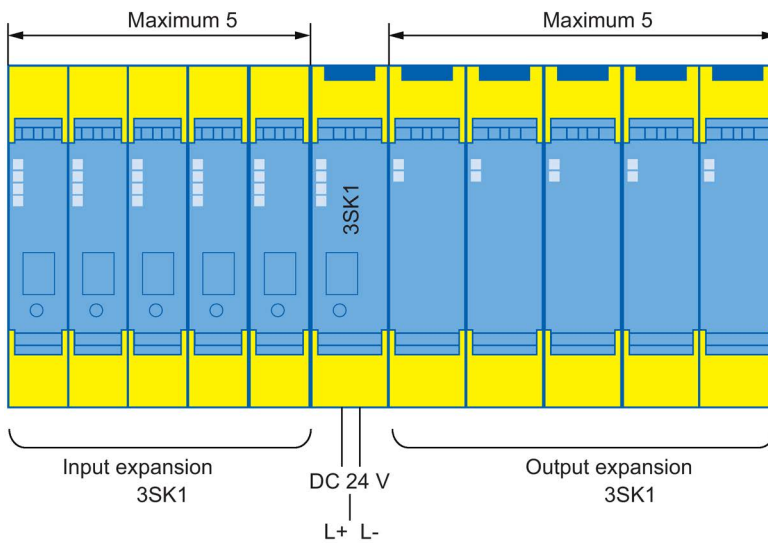
#### Changes to the system configuration

Changes to the system configuration in safety mode always result in a device error. Restarting, by disconnecting and reconnecting the operating voltage (Power OFF/ON), is a mandatory requirement.

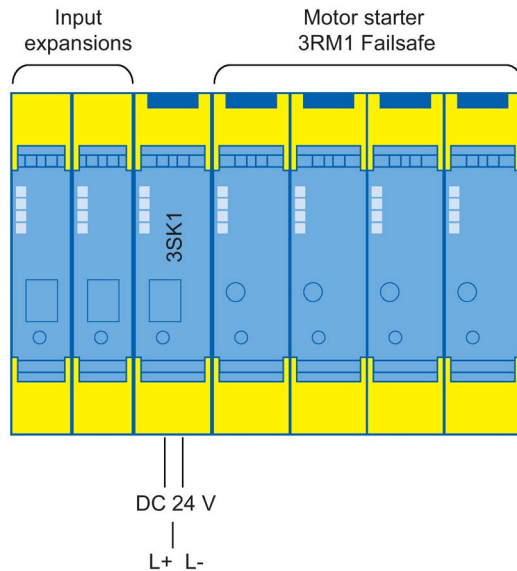
#### Maximum system configuration when supplying with 24 V DC on the basic unit

|  |
|--|
|  <b>WARNING</b> |
| <b>Only one 3SK1 basic unit is permitted per system</b>  |
| The safety function is not guaranteed when more than one basic unit is used.                     |

Connection of 24 V DC to the basic unit:  
up to 5 expansions are permitted to the left of the basic unit and 5 expansions are permitted on the right.



Example of a configuration with connection of 24 V DC on the basic unit and 3RM1 Failsafe motor starter



### Maximum system configuration when supplying with 24 V DC using the 3SK1230 power supply

When using the 3SK1230 power supply, the maximum system configuration can be calculated as follows:

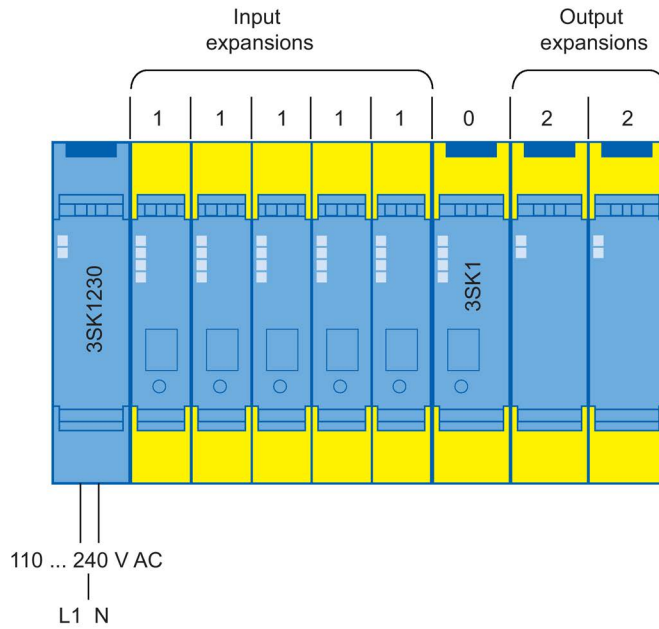
Up to 10 "system units" can be connected to a 3SK1230 power supply.  
Individual devices occupy a different number of system units.

#### Note

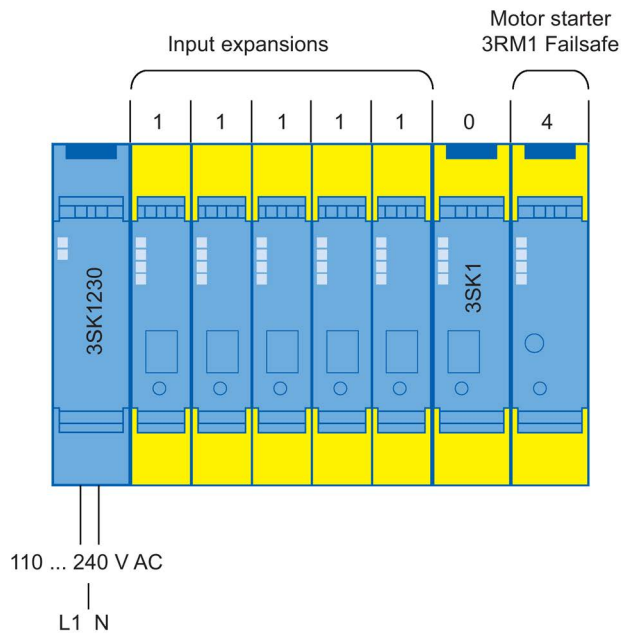
With this configuration too, up to 5 expansions are permitted to the left of the basic unit and 5 expansions are permitted on the right.

| Device                       | System unit |
|------------------------------|-------------|
| 3SK1220 input expansion      | 1           |
| 3SK1230 power supply         | 0           |
| 3SK112 basic units           | 0           |
| 3SK1211 output expansion     | 2           |
| 3SK1213 output expansion     | 2           |
| 3RM1 Failsafe motor starters | 4           |

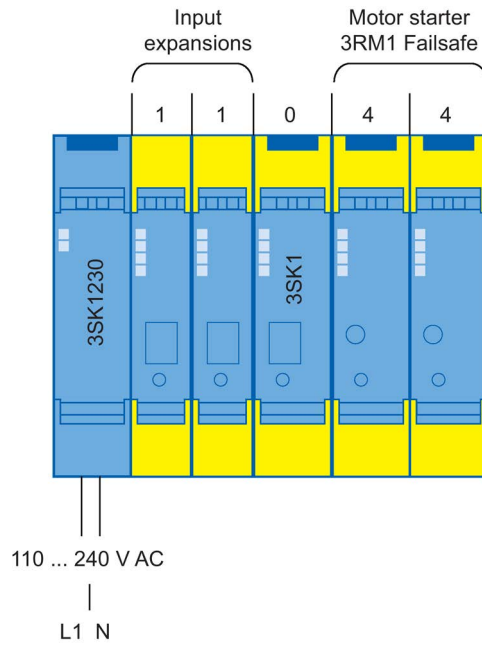
Example 1)  
 1 x 3SK1230 power supply; 5 x 3SK1220 input expansion; 1 x 3SK112 basic unit; 2 x 3SK1211 output expansion



Example 2)  
 1 x 3SK1230 power supply; 5 x 3SK1220 input expansion; 1 x 3SK112 basic unit; 1 x 3RM1 Failsafe motor starter



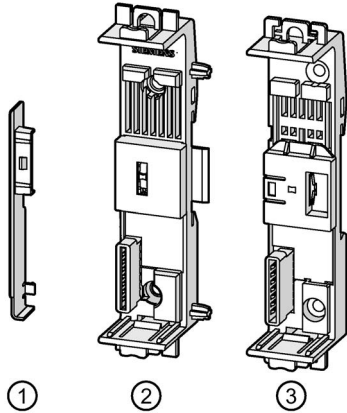
Example 3)  
1 x 3SK1230 power supply; 2 x 3SK1220 input expansion; 1 x 3SK112 basic unit; 2 x 3RM1  
Failsafe motor starter



## 6.2 3ZY12 device connector

### 6.2.1 Device features

Article number:



- ① Cover (included in the scope of supply of each device termination connector.)
- ② 3ZY12 device connectors
- ③ 3ZY12 device termination connectors

| Article number | Type of device connector   |
|----------------|--|
| 3ZY1212-1BA00  | Device connector for 3SK1 safety relay, 17.5 mm wide   |
| 3ZY1212-2BA00  | Device connector for 3SK1 safety relay, 22.5 mm wide   |
| 3ZY1212-2EA00  | Device connector for 3RM1 motor starters, 22.5 mm wide   |
| 3ZY1212-2FA00  | Device termination connector for 3RM1 motor starters, 22.5 mm wide   |
| 3ZY1212-2DA00  | Device termination connector for 3SK1 safety relay, 22.5 mm wide   |
| 3ZY1212-0FA01  | Device termination connector set for 3SK1 safety relay, > 45 mm wide (set consists of 3ZY1212-2FA00 device connector and 3ZY1210-2AA00 device connector) |
| 3ZY1212-2AB00  | Device connector for looping through signals, 22.5 mm wide   |
| 3ZY1210-2AA00  | Device connector without a function, 22.5 mm wide  |

## Use of device connectors

- A device connector is always necessary when other devices have to be plugged in.
- A device termination connector is always required in the system for the last module on the right.

---

### Note

Use of the device connectors to expand the Advanced basic units is optional.  
The device connectors cannot be used with the Standard series.

---

### Note

Only safety relays with a supply voltage of **24 V DC** may be used on the 3ZY12 device connectors.

---

### Note

If expansion units are controlled via the 3ZY12 device connector, additional feeding of the control supply voltage (A1/A2) at one of the output expansions leads to a fault in the system configuration.

---

The following device connectors are required for the various enclosure widths of the Advanced device series:

| Devices                             | Device connector for<br>3SK1 safety relay<br>17.5 mm<br>3ZY1212-1BA00 | Device connector for<br>3SK1 safety relay<br>22.5 mm<br>3ZY1212-2BA00 | Device termination connector for<br>3SK1 safety relay<br>22.5 mm<br>3ZY1212-2DA00 |
|-------------------------------------|---|---|---|
| <b>3SK1 Advanced basic units</b>    |   |   |   |
| 3SK1121                             | -   | x   | x   |
| 3SK1122                             | -   | x   | x   |
| 3SK1120                             | x   | -   | -   |
| <b>Output expansions 3SK1</b>       |   |   |   |
| 3SK1211 (4RO)                       | -   | x   | x   |
| 3SK1213 (3RO)                       | -   | -   | -   |
| <b>Input expansions 3SK1</b>        |   |   |   |
| 3SK1220                             | x   | -   | -   |
| 3SK1230<br>power supply             | -   | x   | -   |
| <b>3RM1 Failsafe motor starters</b> |   |   |   |
| 3RM1                                | -   | -   | -   |

| Devices                             | Device connectors for 3RM1 motor starter 22.5 mm 3ZY1212-2EA00 | Device termination connectors for 3RM1 motor starter 22.5 mm 3ZY1212-2FA00 | Device termination connector, set for enclosures > 45 mm <sup>1)</sup> 3ZY1212-0FA01 | Device connector for looping through signals 22.5 mm 3ZY1212-2AB00 |
|-------------------------------------|--|--|--|--|
| <b>3SK1 Advanced basic units</b>    |  |  |  |  |
| 3SK1121                             | -  | -  | -  | -  |
| 3SK1122                             | -  | -  | -  | -  |
| 3SK1120                             | -  | -  | -  | -  |
| <b>Output expansions 3SK1</b>       |  |  |  |  |
| 3SK1211 (4RO)                       | -  | -  | -  | -  |
| 3SK1213 (3RO)                       | -  | -  | X  | -  |
| <b>Input expansions 3SK1</b>        |  |  |  |  |
| 3SK1220                             | -  | -  | -  | -  |
| 3SK1230 power supply                | -  | -  | -  | -  |
| <b>3RM1 Failsafe motor starters</b> |  |  |  |  |
| 3RM1                                | X  | X  | -  | X  |

<sup>1)</sup> Set consists of 3ZY1212-2FA00 device connector and 3ZY1210-2AA00 device connector

**Note**

If a basic unit is expanded on the right, the last output expansion must be terminated with a device termination connector of the corresponding device.

If a basic unit is only expanded on the left, a device termination connector for 3SK1 safety relays must be mounted below the basic unit.

**6.2.2 Applications**

The 3SK1 Advanced basic unit can be expanded on the input and output sides using 3ZY12 device connectors (connecting plugs) without any additional wiring outlay. When configuring the system, it is important to ensure that input expansions are connected on the left and output expansions/3RM1 Failsafe motor starters on the right of a basic unit.



## 6.3 System configuration rules

### General information

- If a basic unit is operated as a stand-alone device, no device connector or device termination connector is necessary.
- 3SK1220 input expansions and the 3SK1230 power supply must always be connected on the left of the basic unit and output expansions (3SK121 and 3RM1 Failsafe motor starters) on the right.

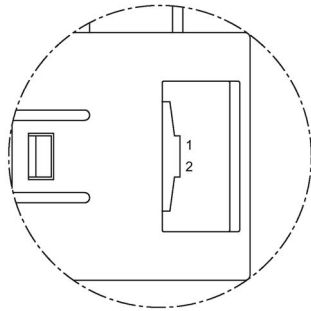
### Expansion on the input side

- The 3SK1230 power supply must always be plugged into the system on the extreme left.
- No more than one 3SK1230 power supply is admissible for each system.
- If a 3SK1230 power supply is used, **no** additional, external 24 V DC voltage is permitted to be connected to a basic unit.
- If an (additional) input expansion is detected on the left when the basic device or an input expansion powers up, it will be loaded into the device configuration.
- An input expansion evaluates the sensor states and generates an enable signal for the basic unit depending on the start condition. The enable signal is then acquired by an input expansion on the right-hand side, or acquired by the basic unit and ANDed with its sensor statuses.  
You can find information on the start characteristics in the system configuration of the 3SK1 Advanced in the chapter "Explanation of the device's function (Page 190)".
- The 3ZY12 device connector used below the final device must be fitted with a cover on the left side (included with the device termination connectors).

### Output expansion

- If an output expansion is detected on the right when the device powers up, this will be loaded into the device configuration. The internal feedback circuit of the contact extension is evaluated and checked.
- If both 3SK1211 and 3RM1 Failsafe motor starters are used in one system, the 3RM1 Failsafe motor starters must be placed on the right of the 3SK1211 devices.
- If a 3SK1213 output expansion is used in the system, this must always be the final station in the system (on the right) and must be fitted with a 3ZY1212-0FA01 device termination connector. Only one 3SK1213 output expansion can be used in the system with a device connector; further 3SK1213 output expansions can be optionally interfaced by wiring.
- On the 3SK121 output expansions, a slide switch on the device front must be used to set whether the UNDELAYED, or DELAYED output signal of the basic unit is to trigger a response. If a purely instantaneous 3SK112 basic unit is used, the slide switch **MUST** be set to the "UNDELAYED" position.
- In the case of a change to the device configuration during operation, error mode is activated immediately. Restarting must be triggered via Power OFF/ON.

- If output expansions are used, a device termination connector for the 3SK1 safety relay must ALWAYS be used under the final device on the right (for 3SK1211) with the switch setting: "1" (switch in top position), device termination connector set for 3SK1 safety relay, > 45 mm wide (for 3SK1213) or device termination connectors for 3RM1 motor starters must be used
- 22.5 mm device termination connector for 3SK1 safety relays:
  - Below basic unit: the switch of the device termination connector must be open, i.e. in position 2 at the bottom.
  - Below 3SK1211 output expansion: the switch of the device termination connector must be closed, i.e. in position 1 at top



- No switch needs to be set on the device termination connector for 3RM1 motor starters
- As from certain load limits/temperature ranges, clearances must be observed for 3RM1 Failsafe motor starters. To this end, there are appropriate device connectors for looping through signals (3ZY1212-2AB00).
- In the configuration with a 3SK1 Advanced basic unit on a 3ZY12 device connector, 3RM1 Failsafe motor starters can only be controlled by the instantaneous enable signal of the 3SK1 unit. If control of the 3RM1 Failsafe motor starter by means of the time-delayed output is desired, this can only be done by wiring the time-delayed safety-related output of the 3SK1 basic unit.

You will find further information on the configuration guidelines for 3RM1 Failsafe motor starters in the SIRIUS 3RM1 motor starters

(<http://support.automation.siemens.com/WW/view/en/66295730>) manual, in the section entitled "Load feeders - protection against short circuit".

### Configuration notes for using device connectors

3ZY12 device connectors can only be used with devices of the Advanced device series.

Further configuration notes:

|  |
|--|
| <b>NOTICE</b>  |
| <b>Only one 3SK1 Advanced basic unit is permitted in each system</b>         |
| The safety function is not guaranteed when more than one basic unit is used. |

|   |
|---|
|  <b>WARNING</b>                |
| <b>Supply voltage must only be fed in on the basic unit</b>   |
| The supply voltage of 24 V DC must only be fed in on the basic unit, otherwise the safety function is bypassed. |

---

#### Note

If expansion units are controlled via the 3ZY12 device connector, additional feeding of the control supply voltage (A1/A2) at one of the output expansions leads to a fault in the system configuration.

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#### Power supply by means of the 3SK1230 power supply

- When device connectors are used, only one 3SK1230 power supply is permitted in each system.
- The 3SK1230 power supply must always be located on the extreme left.
- If a 3SK1230 power supply is used, an additional (external) 24 V DC connection is not permitted (this also applies to the cascading input, as well as to non-floating sensors).

#### 24 V DC supply voltage from an external power supply unit

- It is only permitted to connect a voltage of 24 V DC to the terminals on the basic unit.
- It is not permitted to supply 24 V DC to an expansion component or 3RM1 Failsafe motor starter.

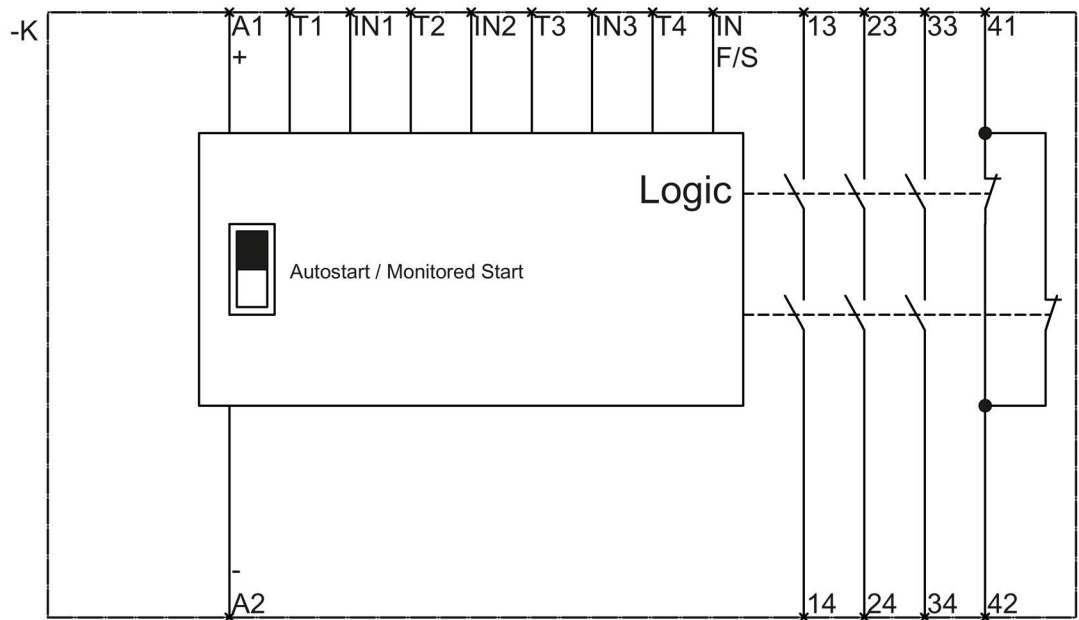


## Circuit diagrams

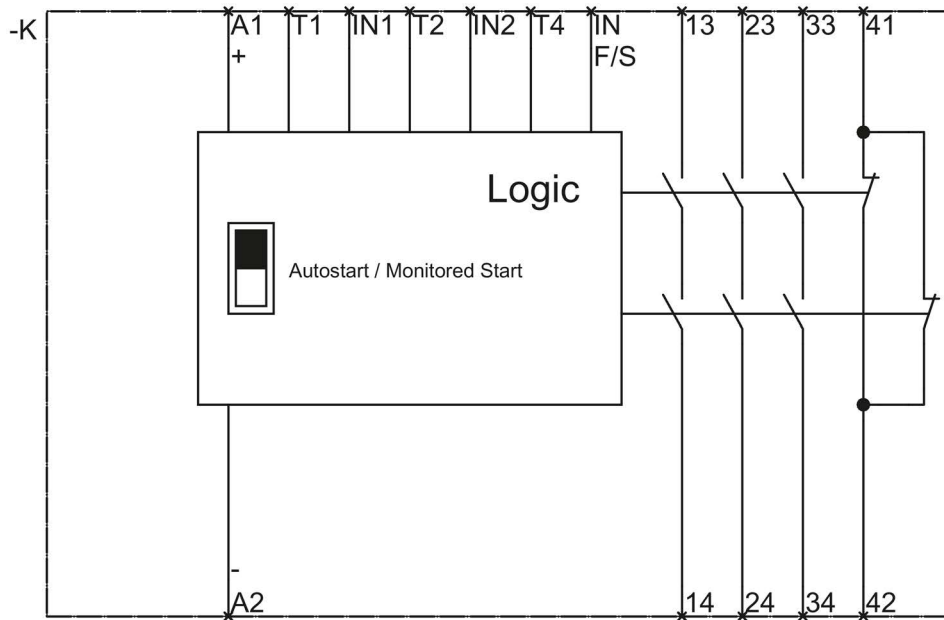
### 7.1 Internal circuit diagrams

#### 7.1.1 Internal circuit diagrams for 3SK1 Standard basic units

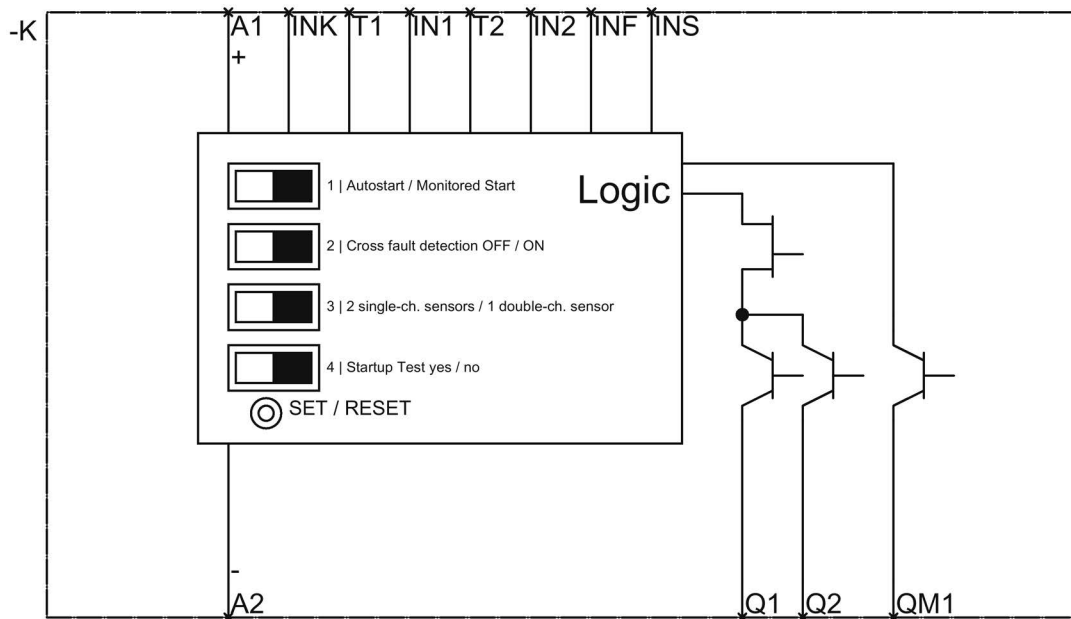
##### Basic unit 3SK1111-.AB30 Standard relay instantaneous (24 V)



**Basic unit 3SK1111-AW20 Standard relay instantaneous (110 - 240 V)**

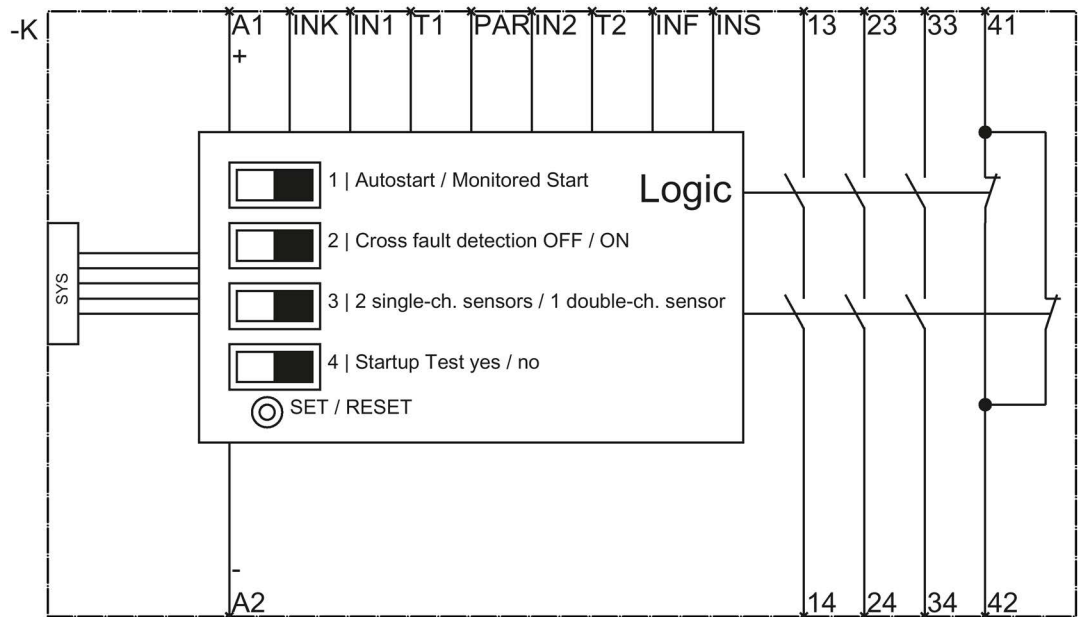


**Basic unit 3SK1112-BB40 Standard instantaneous**

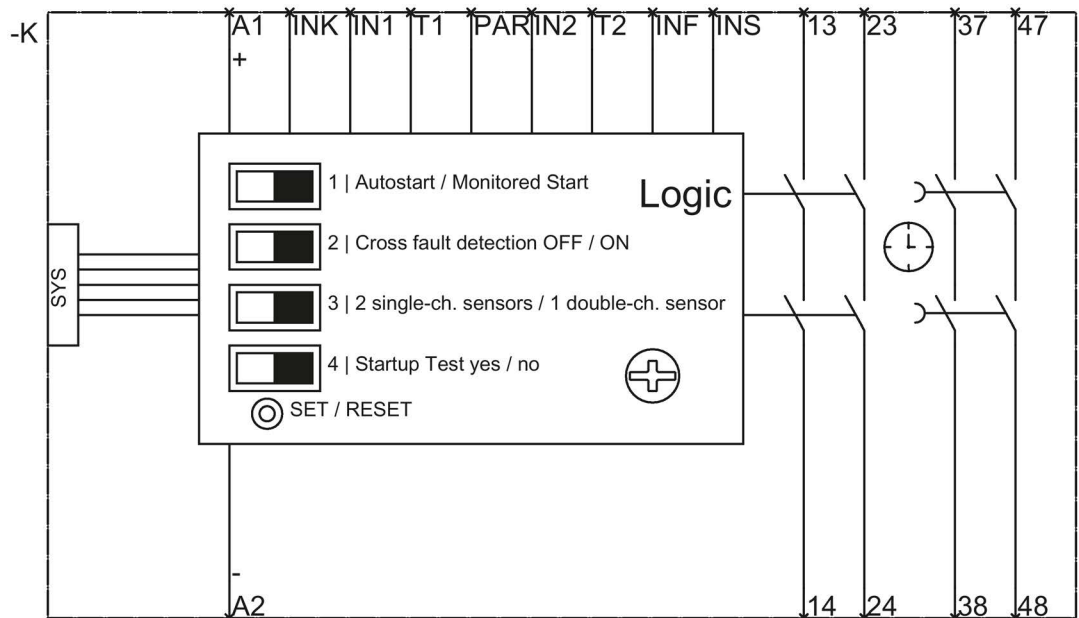


## 7.1.2 Internal circuit diagrams for 3SK1 Advanced basic units

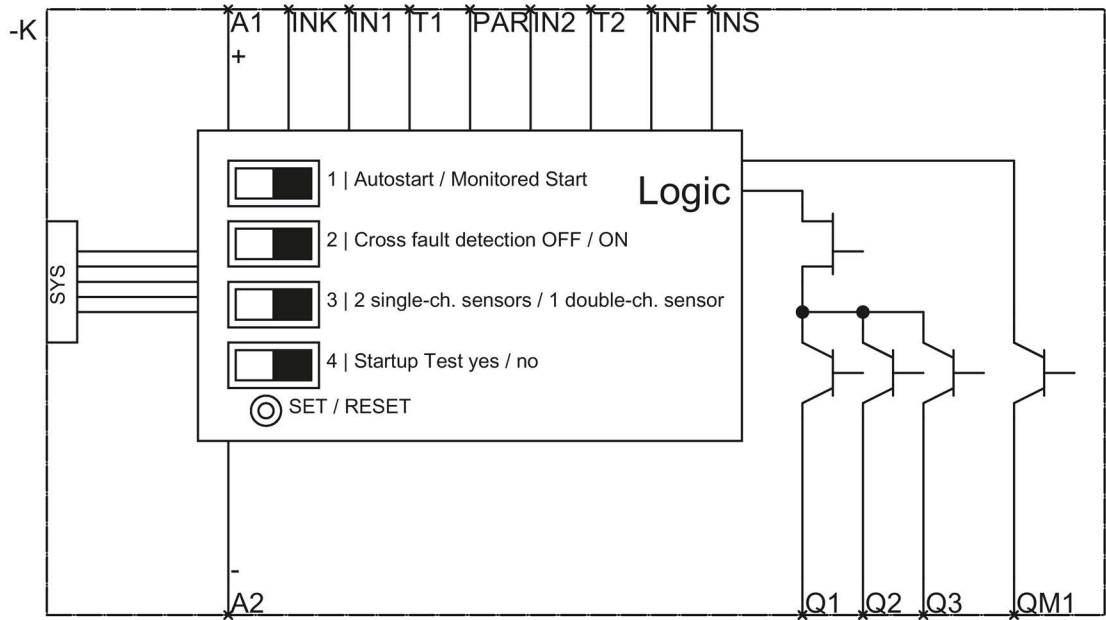
### Basic unit 3SK1121-.AB40 Advanced relay instantaneous



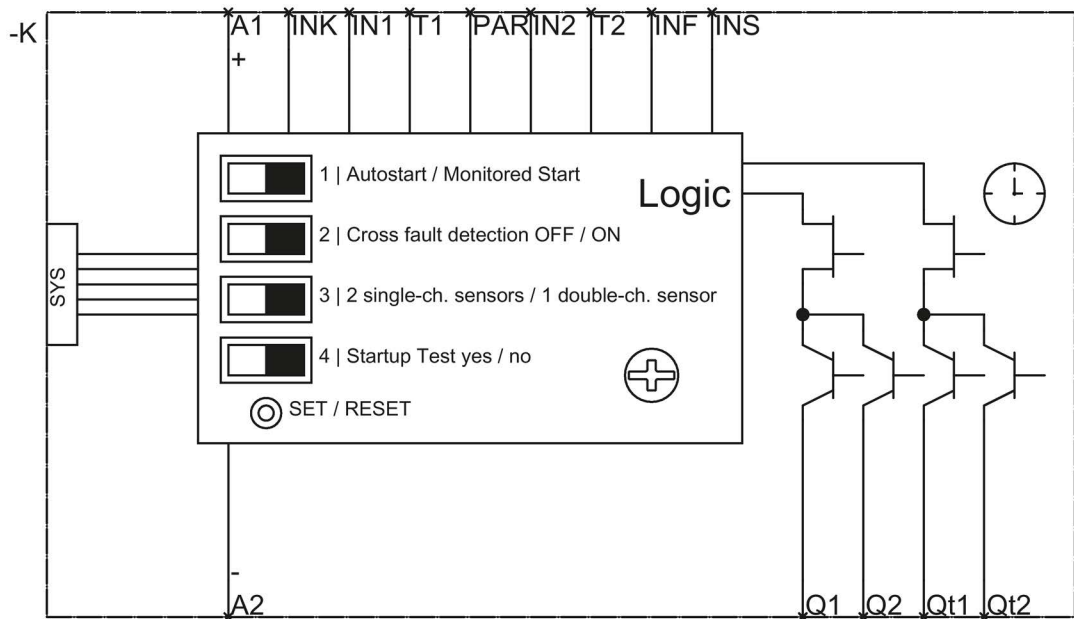
### Basic unit 3SK1121-.CB4. Advanced relay time-delayed



**Basic unit 3SK1122-AB40 Advanced solid-state instantaneous**

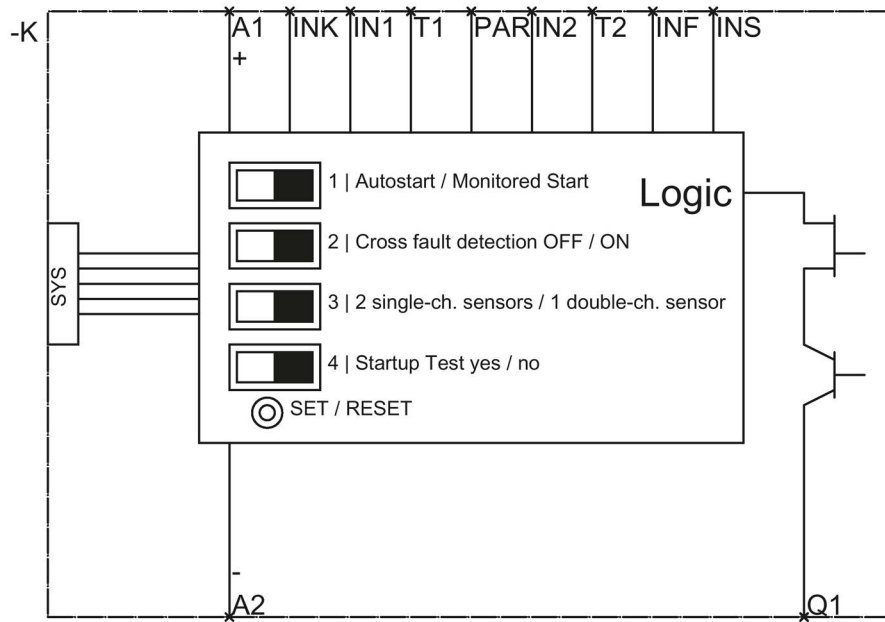


**Basic unit 3SK1122-CB4. Advanced solid-state time-delayed**



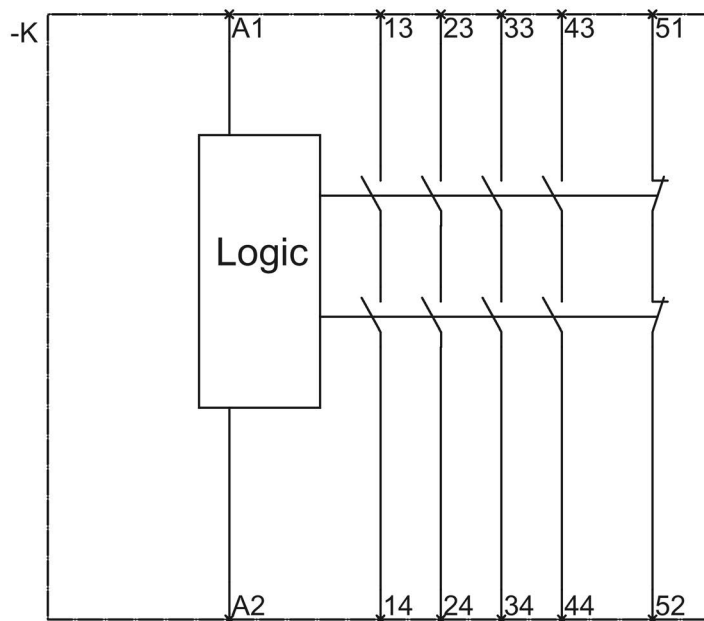


**Basic unit 3SK1120-.AB40 Advanced 17.5 mm solid-state instantaneous**

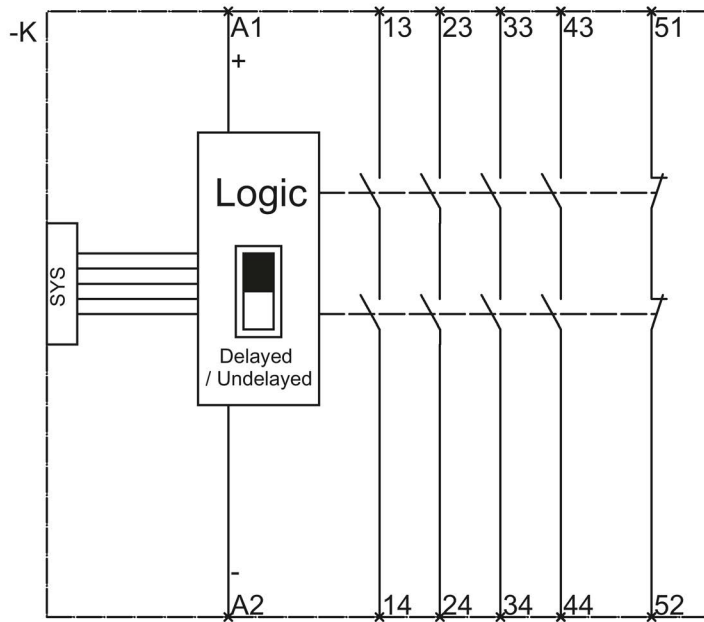


**7.1.3 Internal circuit diagrams for expansion units**

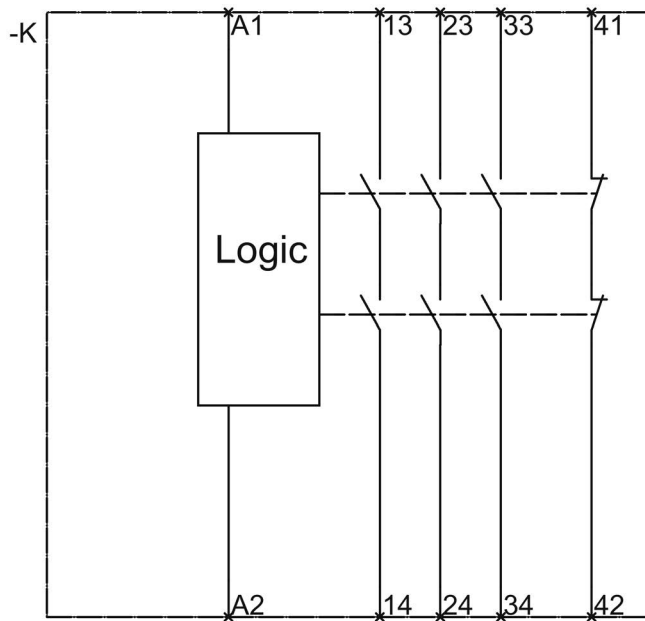
**3SK1211 output expansion (110 - 240 V)**



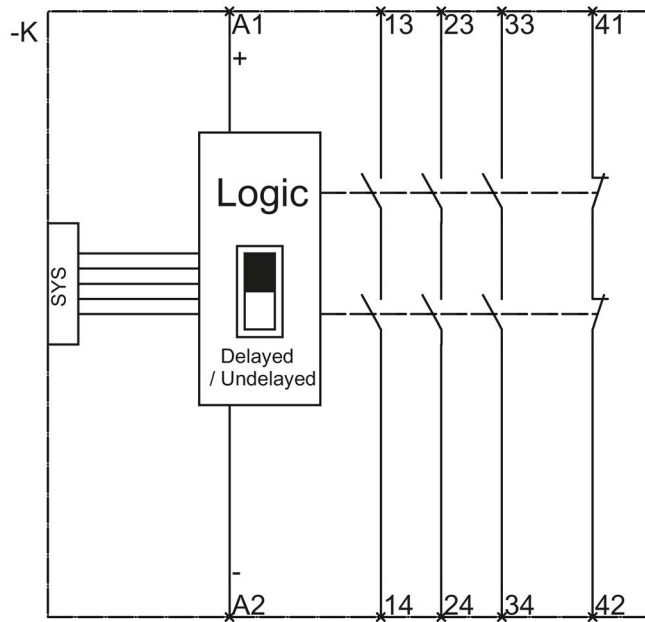
**3SK1211 output expansion (24 V DC)**



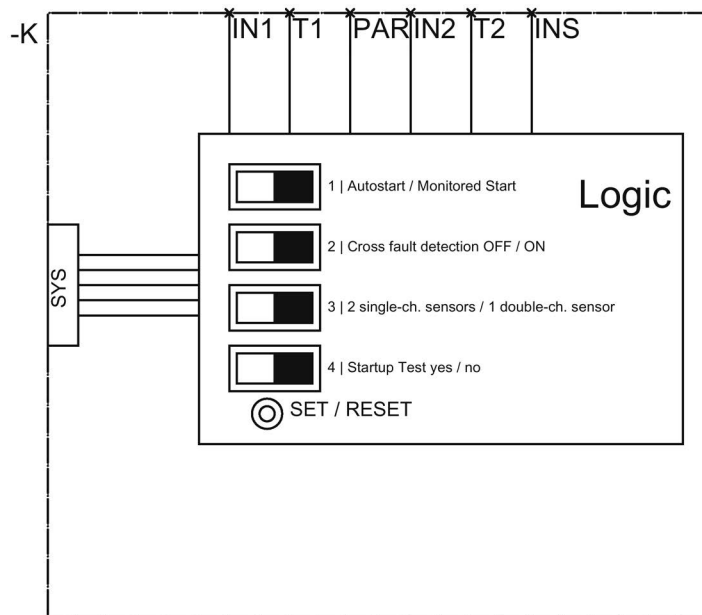
**3SK1213-.A.20 output expansion (110 - 240 V)**



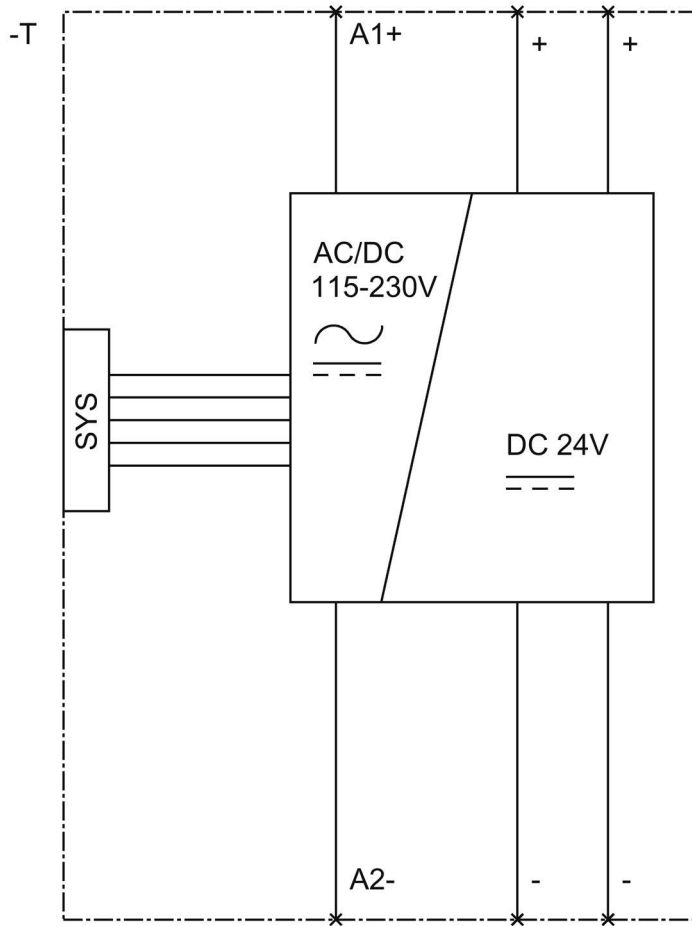
### 3SK1213-AB40 output expansion (24 V DC)



### 3SK1220 input expansion



3SK1230 power supply



## 7.2 Typical circuits

### 7.2.1 Typical circuits

The black fields show the positions of the switches. Here, "Autostart" in each case.



If use of the feedback circuit is not desired for the application, this has to be jumpered with the corresponding test output.

### Typical circuits for 3SK1111 Standard basic unit relays

Table 7- 1 Typical circuit 1:  
Single-channel, with monitored start

| <p>* For 3SK1111-.AB30 basic unit only</p>        | <ul style="list-style-type: none"> <li>• Monitored start</li> <li>• 3SK1111 Standard relay</li> <li>• Sensor: 1 NC contact</li> </ul>              |           |           |   |           |
|---|--|-----------|-----------|---|-----------|
|   | Slide switch   |           |           |   |           |
|   | <table border="1"> <thead> <tr> <th>Auto</th> <th>Monitored</th> </tr> </thead> <tbody> <tr> <td>—</td> <td>ON bottom</td> </tr> </tbody> </table> | Auto      | Monitored | — | ON bottom |
|   | Auto   | Monitored |           |   |           |
|   | —  | ON bottom |           |   |           |
| Up to PL in accordance with ISO 13849-1           | c  |           |           |   |           |
| Up to Safety Integrity Level (SILCL) to IEC 62061 | 1  |           |           |   |           |

7.2 Typical circuits

Table 7- 2 Typical circuit 2:  
Single-channel, with monitored start

|   |   |                  |
|---|---|------------------|
|   | <ul style="list-style-type: none"> <li>• Monitored start</li> <li>• 3SK1111-.AB30 Standard relay</li> <li>• Sensor: 1 NC contact</li> </ul> |                  |
|   | Slide switch  |                  |
|   | <b>Auto</b>   | <b>Monitored</b> |
|   | —   | ON<br>bottom     |
|   | Up to PL in accordance with ISO 13849-1   | c                |
| Up to Safety Integrity Level (SILCL) to IEC 62061 | 1   |                  |

Table 7- 3 Typical circuit 3:  
single-channel, with autostart

|   |   |                  |
|---|---|------------------|
|   | <ul style="list-style-type: none"> <li>• Autostart</li> <li>• 3SK1111 Standard relay</li> <li>• Sensor: 1 NC contact</li> </ul> |                  |
|   | Slide switch  |                  |
|   | <b>Auto</b>   | <b>Monitored</b> |
|   | ON<br>top   | —                |
|   | Up to PL in accordance with ISO 13849-1   | c                |
| Up to Safety Integrity Level (SILCL) to IEC 62061 | 1   |                  |

\* For 3SK1111-.AB30 basic unit only

Table 7- 4 Typical circuit 4:  
single-channel, with autostart

|   |   |                  |
|---|---|------------------|
|   | <ul style="list-style-type: none"> <li>Autostart</li> <li>3SK1111-.AB30 Standard relay</li> <li>Sensor: 1 NC contact</li> </ul> |                  |
|   | Slide switch  |                  |
|   | <b>Auto</b>   | <b>Monitored</b> |
|   | ON top  | —                |
|   | Up to PL in accordance with ISO 13849-1   | c                |
| Up to Safety Integrity Level (SILCL) to IEC 62061 |   | 1                |

Table 7- 5 Typical circuit 5:  
2-channel EMERGENCY STOP, with cross-circuit detection, with monitored start

|   |  |                  |
|---|--|------------------|
|   | <ul style="list-style-type: none"> <li>Monitored start</li> <li>With cross-circuit detection</li> <li>Sensor: 2 NC contacts</li> <li>3SK1111 Standard relay</li> </ul> |                  |
|   | Slide switch   |                  |
|   | <b>Auto</b>  | <b>Monitored</b> |
|   | —  | ON bottom        |
|   | Up to PL in accordance with ISO 13849-1  | e                |
| Up to Safety Integrity Level (SILCL) to IEC 62061 |  | 3                |

\* For 3SK1111-.AB30 basic unit only

When connecting magnetically operated switches as sensors, observe the information in chapter Use of magnetically operated switches (Page 45).

7.2 Typical circuits

Table 7-6 Typical circuit 6:  
Two-channel, with cross-circuit detection, with autostart

| <p>* For 3SK1111-.AB30 basic unit only</p>        | <ul style="list-style-type: none"> <li>• Autostart</li> <li>• With cross-circuit detection</li> <li>• Sensor: 2 NC contacts</li> <li>• 3SK1111 Standard relay</li> </ul> <table border="1"> <tr> <th colspan="2">Slide switch</th> </tr> <tr> <th>Auto</th> <th>Monitored</th> </tr> <tr> <td>ON top</td> <td>—</td> </tr> <tr> <td>Up to PL in accordance with ISO 13849-1</td> <td>e</td> </tr> <tr> <td>Up to Safety Integrity Level (SILCL) to IEC 62061</td> <td>3</td> </tr> </table> | Slide switch |  | Auto | Monitored | ON top | — | Up to PL in accordance with ISO 13849-1 | e | Up to Safety Integrity Level (SILCL) to IEC 62061 | 3 |
|---|---|--------------|--|------|-----------|--------|---|---|---|---|---|
| Slide switch                                      |   |              |  |      |           |        |   |   |   |   |   |
| Auto  | Monitored   |              |  |      |           |        |   |   |   |   |   |
| ON top  | —   |              |  |      |           |        |   |   |   |   |   |
| Up to PL in accordance with ISO 13849-1           | e   |              |  |      |           |        |   |   |   |   |   |
| Up to Safety Integrity Level (SILCL) to IEC 62061 | 3   |              |  |      |           |        |   |   |   |   |   |

Table 7-7 Typical circuit 7:  
Sensors with solid-state outputs, without cross-circuit detection, with autostart

|   | <ul style="list-style-type: none"> <li>• Autostart</li> <li>• Without cross-circuit detection</li> <li>• Sensor: 2-channel non-floating</li> <li>• 3SK1111-.AB30 Standard relay</li> </ul> <table border="1"> <tr> <th colspan="2">Slide switch</th> </tr> <tr> <th>Auto</th> <th>Monitored</th> </tr> <tr> <td>ON top</td> <td>—</td> </tr> <tr> <td>Up to PL in accordance with ISO 13849-1</td> <td>e</td> </tr> <tr> <td>Up to Safety Integrity Level (SILCL) to IEC 62061</td> <td>3</td> </tr> </table> | Slide switch |  | Auto | Monitored | ON top | — | Up to PL in accordance with ISO 13849-1 | e | Up to Safety Integrity Level (SILCL) to IEC 62061 | 3 |
|---|---|--------------|--|------|-----------|--------|---|---|---|---|---|
| Slide switch                                      |   |              |  |      |           |        |   |   |   |   |   |
| Auto  | Monitored   |              |  |      |           |        |   |   |   |   |   |
| ON top  | —   |              |  |      |           |        |   |   |   |   |   |
| Up to PL in accordance with ISO 13849-1           | e   |              |  |      |           |        |   |   |   |   |   |
| Up to Safety Integrity Level (SILCL) to IEC 62061 | 3   |              |  |      |           |        |   |   |   |   |   |



Typical circuits for 3SK1 Standard solid-state basic units or 3SK1 Advanced basic units

Table 7- 8 Typical circuit 8: EMERGENCY STOP two-channel, with cross-circuit detection, with monitored start

|   | <ul style="list-style-type: none"> <li>• Monitored start</li> <li>• With cross-circuit detection</li> <li>• 1 x two-channel</li> <li>• Sensor: 2 NC contacts</li> <li>• 3SK1112 Standard solid-state and 3SK112/3SK122 Advanced</li> </ul>  |            |   |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
|---|---|------------|---|--|--|---|---|---|---|----------|----------|----------|---|---|--|--|---|---|--|--|
|   | <table border="1"> <thead> <tr> <th colspan="4">DIP switch</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>ON right</td> <td>ON right</td> <td>ON right</td> <td>—</td> </tr> <tr> <td colspan="3">Up to PL in accordance with ISO 13849-1</td> <td>e</td> </tr> <tr> <td colspan="3">Up to Safety Integrity Level (SILCL) to IEC 62061</td> <td>3</td> </tr> </tbody> </table> | DIP switch |   |  |  | 1 | 2 | 3 | 4 | ON right | ON right | ON right | — | Up to PL in accordance with ISO 13849-1 |  |  | e | Up to Safety Integrity Level (SILCL) to IEC 62061 |  |  |
| DIP switch  |   |            |   |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| 1   | 2   | 3          | 4 |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| ON right  | ON right  | ON right   | — |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| Up to PL in accordance with ISO 13849-1           |   |            | e |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| Up to Safety Integrity Level (SILCL) to IEC 62061 |   |            | 3 |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |

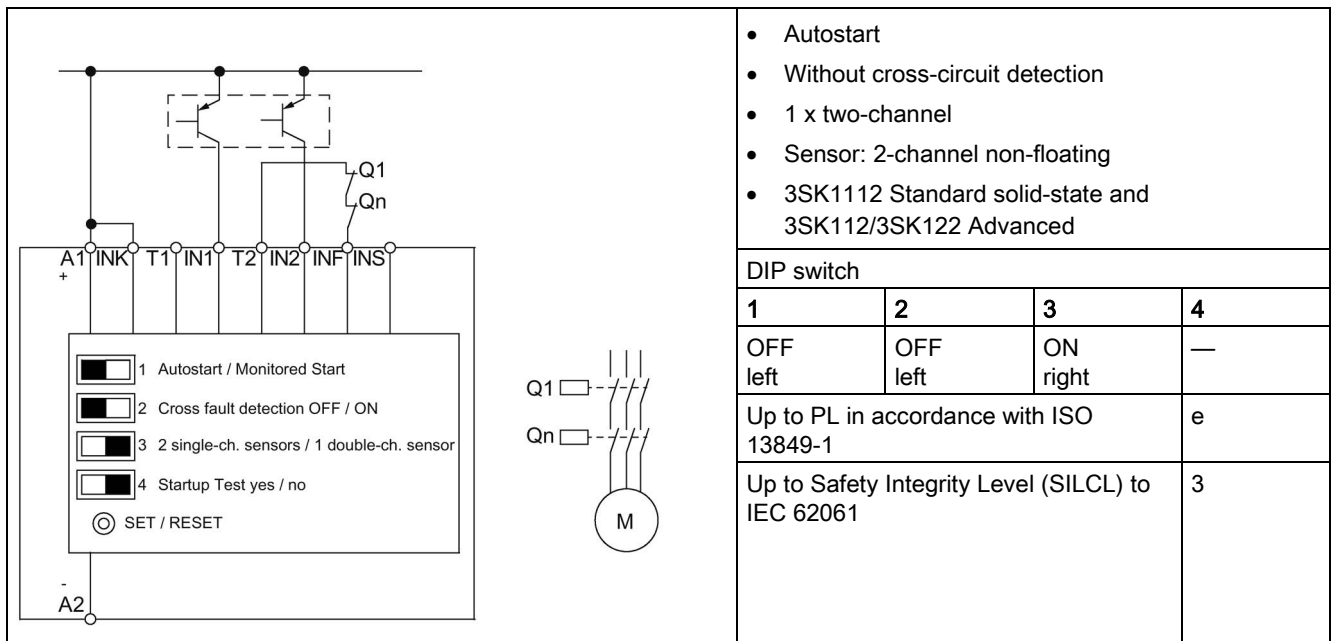
Table 7- 9 Typical circuit 9: Two-channel, with cross-circuit detection, with autostart

|   | <ul style="list-style-type: none"> <li>• Autostart</li> <li>• With cross-circuit detection</li> <li>• 1 x two-channel</li> <li>• Sensor: 2 NC contacts</li> <li>• 3SK1112 Standard solid-state and 3SK112/3SK122 Advanced</li> </ul>  |            |   |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
|---|---|------------|---|--|--|---|---|---|---|----------|----------|----------|---|---|--|--|---|---|--|--|
|   | <table border="1"> <thead> <tr> <th colspan="4">DIP switch</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>OFF left</td> <td>ON right</td> <td>ON right</td> <td>—</td> </tr> <tr> <td colspan="3">Up to PL in accordance with ISO 13849-1</td> <td>e</td> </tr> <tr> <td colspan="3">Up to Safety Integrity Level (SILCL) to IEC 62061</td> <td>3</td> </tr> </tbody> </table> | DIP switch |   |  |  | 1 | 2 | 3 | 4 | OFF left | ON right | ON right | — | Up to PL in accordance with ISO 13849-1 |  |  | e | Up to Safety Integrity Level (SILCL) to IEC 62061 |  |  |
| DIP switch  |   |            |   |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| 1   | 2   | 3          | 4 |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| OFF left  | ON right  | ON right   | — |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| Up to PL in accordance with ISO 13849-1           |   |            | e |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |
| Up to Safety Integrity Level (SILCL) to IEC 62061 |   |            | 3 |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |

Table 7- 10 Typical circuit 10:  
Electronic sensor, 2-channel, without cross-circuit detection, with monitored start

| DIP switch  |          |          |   |
|---|----------|----------|---|
| 1   | 2        | 3        | 4 |
| ON right  | OFF left | ON right | — |
| Up to PL in accordance with ISO 13849-1           |          |          | e |
| Up to Safety Integrity Level (SILCL) to IEC 62061 |          |          | 3 |

Table 7- 11 Typical circuit 11:  
Electronic sensor, two-channel, without cross-circuit detection, with autostart



**Note**

**Single-channel connection**

If only one single-channel sensor is used, the other sensor circuit must be jumpered.

Table 7- 12 Typical circuit 12: 2 x single-channel, without cross-circuit detection, with monitored start

|            | <ul style="list-style-type: none"> <li>• Monitored start</li> <li>• Without cross-circuit detection</li> <li>• 2 x single-channel</li> <li>• Sensor: two single-channel NC sensors</li> <li>• 3SK1112 Standard solid-state and 3SK112/3SK122 Advanced</li> </ul> <table border="1" data-bbox="850 527 1442 670"> <tr> <th colspan="4">DIP switch</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> <tr> <td>ON right</td> <td>OFF left</td> <td>OFF left</td> <td>—</td> </tr> </table> <p>Up to PL in accordance with ISO 13849-1</p> <p>Up to Safety Integrity Level (SILCL) to IEC 62061</p> | DIP switch |   |  |  | 1 | 2 | 3 | 4 | ON right | OFF left | OFF left | — |
|------------|---|------------|---|--|--|---|---|---|---|----------|----------|----------|---|
| DIP switch |   |            |   |  |  |   |   |   |   |          |          |          |   |
| 1          | 2   | 3          | 4 |  |  |   |   |   |   |          |          |          |   |
| ON right   | OFF left  | OFF left   | — |  |  |   |   |   |   |          |          |          |   |

Table 7- 13 Typical circuit 13: 2x single-channel, without cross-circuit detection, with autostart

|            | <ul style="list-style-type: none"> <li>• Autostart</li> <li>• Without cross-circuit detection</li> <li>• 2 x single-channel</li> <li>• Sensor: two single-channel NC contacts</li> <li>• 3SK1112 Standard solid-state and 3SK112/3SK122 Advanced</li> </ul> <table border="1" data-bbox="850 1344 1442 1487"> <tr> <th colspan="4">DIP switch</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> <tr> <td>OFF left</td> <td>OFF left</td> <td>OFF left</td> <td>—</td> </tr> </table> <p>Up to PL in accordance with ISO 13849-1</p> <p>Up to Safety Integrity Level (SILCL) to IEC 62061</p> | DIP switch |   |  |  | 1 | 2 | 3 | 4 | OFF left | OFF left | OFF left | — |
|------------|--|------------|---|--|--|---|---|---|---|----------|----------|----------|---|
| DIP switch |  |            |   |  |  |   |   |   |   |          |          |          |   |
| 1          | 2  | 3          | 4 |  |  |   |   |   |   |          |          |          |   |
| OFF left   | OFF left   | OFF left   | — |  |  |   |   |   |   |          |          |          |   |

Also possible: 2 x single-channel with T1-IN1, T2-IN2 and DIP switch 2 cross-circuit detection to ON.

Typical circuits for 3SK1 Advanced basic units only

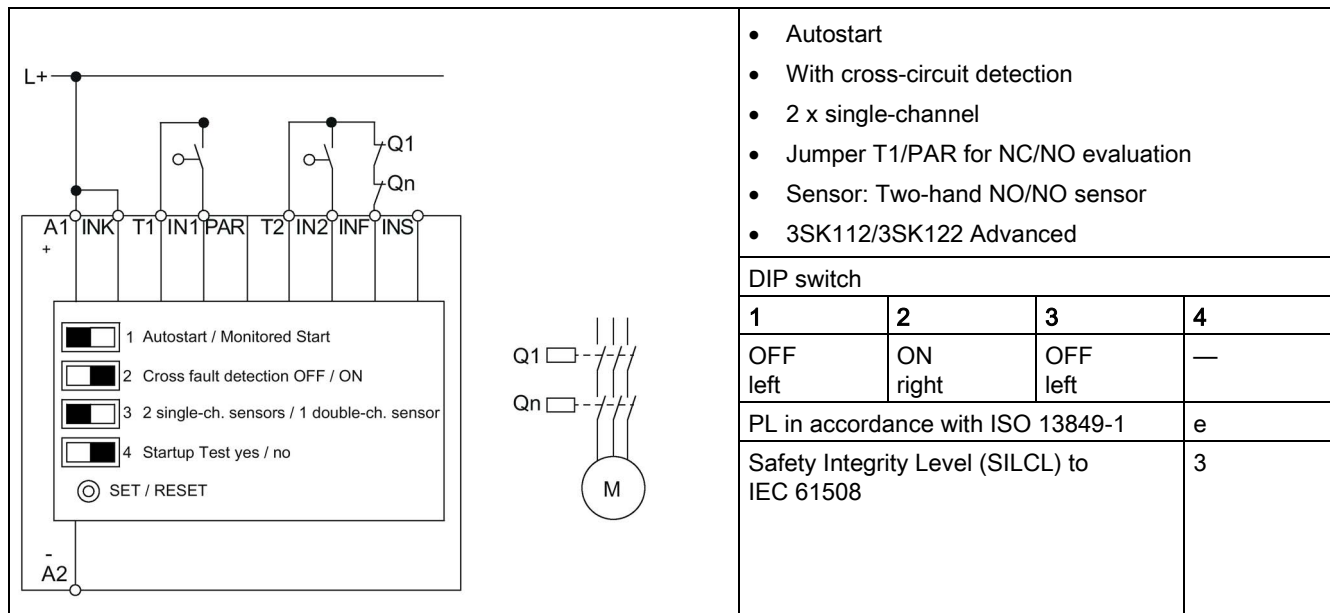
Table 7- 14 Typical circuit 14:  
1NC/1NO sensor, with cross-circuit detection, with monitored start

|   | <ul style="list-style-type: none"> <li>• Monitored start</li> <li>• With cross-circuit detection</li> <li>• 1 x two-channel</li> <li>• Jumper T1/PAR for NC/NO evaluation</li> <li>• Sensor: NC/NO sensor</li> <li>• 3SK112/3SK122 Advanced</li> </ul> <table border="1"> <thead> <tr> <th colspan="4">DIP switch</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>ON right</td> <td>ON right</td> <td>ON right</td> <td>—</td> </tr> <tr> <td colspan="3">Up to PL in accordance with ISO 13849-1</td> <td>e</td> </tr> <tr> <td colspan="3">Up to Safety Integrity Level (SILCL) to IEC 61508</td> <td>3</td> </tr> </tbody> </table> | DIP switch |   |  |  | 1 | 2 | 3 | 4 | ON right | ON right | ON right | — | Up to PL in accordance with ISO 13849-1 |  |  | e | Up to Safety Integrity Level (SILCL) to IEC 61508 |  |  | 3 |
|---|--|------------|---|--|--|---|---|---|---|----------|----------|----------|---|---|--|--|---|---|--|--|---|
| DIP switch  |  |            |   |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |   |
| 1   | 2  | 3          | 4 |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |   |
| ON right  | ON right   | ON right   | — |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |   |
| Up to PL in accordance with ISO 13849-1           |  |            | e |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |   |
| Up to Safety Integrity Level (SILCL) to IEC 61508 |  |            | 3 |  |  |   |   |   |   |          |          |          |   |   |  |  |   |   |  |  |   |

Table 7- 15 Typical circuit 15:  
1NC/1NO sensor, with cross-circuit detection, with autostart

|   | <ul style="list-style-type: none"> <li>• Autostart</li> <li>• With cross-circuit detection</li> <li>• 1 x two-channel</li> <li>• Jumper T1/PAR for NC/NO evaluation</li> <li>• Sensor: NC/NO sensor</li> <li>• 3SK112/3SK122 Advanced</li> </ul> <table border="1"> <thead> <tr> <th colspan="4">DIP switch</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>OFF left</td> <td>ON right</td> <td>ON right</td> <td>—</td> </tr> <tr> <td colspan="3">PL in accordance with ISO 13849-1</td> <td>e</td> </tr> <tr> <td colspan="3">Safety Integrity Level (SILCL) to IEC 61508</td> <td>3</td> </tr> </tbody> </table> | DIP switch |   |  |  | 1 | 2 | 3 | 4 | OFF left | ON right | ON right | — | PL in accordance with ISO 13849-1 |  |  | e | Safety Integrity Level (SILCL) to IEC 61508 |  |  | 3 |
|---|--|------------|---|--|--|---|---|---|---|----------|----------|----------|---|-----------------------------------|--|--|---|---|--|--|---|
| DIP switch                                  |  |            |   |  |  |   |   |   |   |          |          |          |   |                                   |  |  |   |   |  |  |   |
| 1   | 2  | 3          | 4 |  |  |   |   |   |   |          |          |          |   |                                   |  |  |   |   |  |  |   |
| OFF left                                    | ON right   | ON right   | — |  |  |   |   |   |   |          |          |          |   |                                   |  |  |   |   |  |  |   |
| PL in accordance with ISO 13849-1           |  |            | e |  |  |   |   |   |   |          |          |          |   |                                   |  |  |   |   |  |  |   |
| Safety Integrity Level (SILCL) to IEC 61508 |  |            | 3 |  |  |   |   |   |   |          |          |          |   |                                   |  |  |   |   |  |  |   |

Table 7- 16 Typical circuit 16:  
Two-hand operation with cross-circuit detection, with autostart



You can find further information on two-hand operation in chapter Two-hand operation/synchronism (Page 38).

Further information:

- SIRIUS Safety Integrated application manual (<https://support.industry.siemens.com/cs/ww/en/view/81366718>)
- FAQs on 3SK1 (<https://support.industry.siemens.com/cs/ww/en/ps/16382/faq>)

## 7.3 Typical circuits of 3SK1 safety relays with 3RM1 Failsafe motor starters

### 7.3.1 3SK1 safety relay with 3RM1 Failsafe motor starter via device connector

The 3RM13 Failsafe motor starter (24 V DC variant) is connected to a 3SK112 safety relay via a 3ZY12 device connector.

The two directions of rotation are switched on and off operationally via IN1 and IN2, e.g. with a PLC.

The control supply voltage (L+ and L-) to the motor starters is deactivated by the 3SK112 safety relay and the system is in a safe state.

---

#### Note

**SILCL 3 in accordance with EN 62061/PL e in accordance with EN ISO 13849-1**

A safety-related application up to SILCL 3 to EN 62061:2005, PL e/Cat. 4 to EN ISO 13849-1 can be realized in this way.

To achieve SILCL 3/PL e/Cat. 4 for the safety-related application, all components of the safety functions (detecting/evaluating/reacting) must be designed accordingly.

---

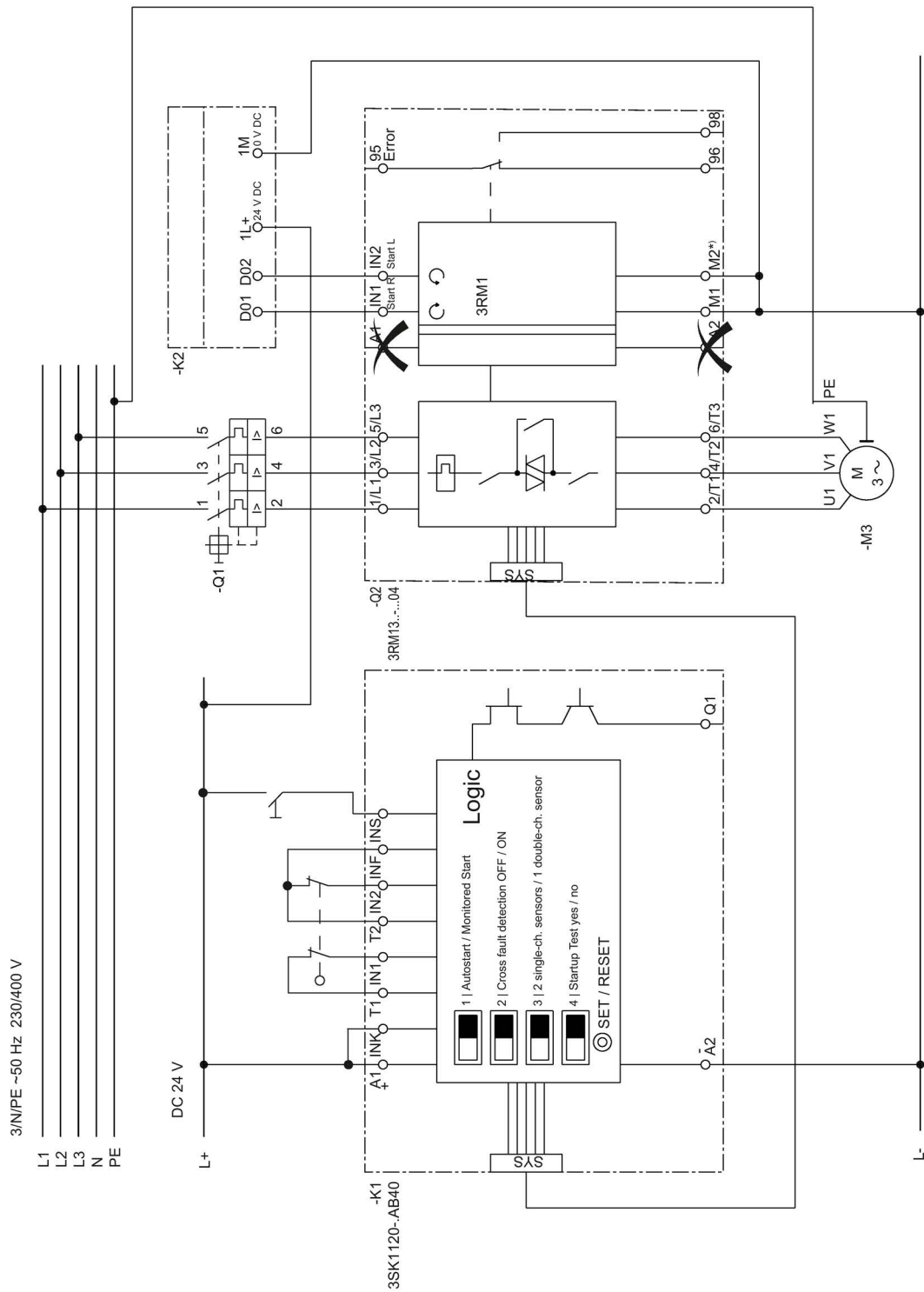
|  |
|--|
|  <b>WARNING</b> |
|--|

|   |
|---|
| <b>Bypassing the safety function when using device connectors</b> |
|---|

|   |
|---|
| When operating with a 3SK112 safety relay and a device connector, the supply voltage for 3RM1 Failsafe motor starters is established via the device connectors. |
|---|

|   |
|---|
| To prevent bypassing of the safety function, do not connect anything to terminals A1 and A2 of the Failsafe 3RM1 motor starters in this case. |
|---|

7.3 Typical circuits of 3SK1 safety relays with 3RM1 Failsafe motor starters



- \*) If there is a common reference potential for the two inputs, it suffices to establish a ground connection.  
 If there are separate potentials or controls, both connections must be assigned.



### 7.3.2 3SK1 safety relay wired with 3RM1 Failsafe motor starter

The 3RM13 Failsafe motor starter (230 V supply voltage) is connected to a 3SK1 safety relay.

The two directions of rotation are switched on and off operationally via IN1 and IN2, e.g. with separate switches.

 **WARNING**

**Bypassing the safety function in the event of a fault in the case of 3RM11/3RM13 Failsafe motor starters with 110 to 230 V AC/110 V DC control supply voltage**

The control signal for the control inputs in the case of 3RM11/3RM13 Failsafe motor starters with 110 to 230 V AC control supply voltage must come from A1. Otherwise, the safety function is bypassed in the event of a fault. Thus, only relay outputs are admissible when using a PLC.

Do not use a separate control voltage. Only use the relay outputs when using a PLC.

The control supply voltage (L1 and N) to the motor starters is deactivated by the 3SK1 safety relay and the system is in a safe state.

**Note**

**SILCL 3 in accordance with EN 62061, PL e/Cat. 4 in accordance with EN ISO 13849-1**

A safety-related application up to SILCL 3 to EN 62061, PL e/Cat. 4 to EN ISO 13849-1 can be realized in this way.

To achieve SILCL 3/PL e/Cat. 4 for the safety-related application, all components of the safety functions (detecting/evaluating/reacting) must be designed accordingly.

**Note**

A fuse must be fitted as short-circuit protection (4 A gL/gG) in the supply line to the supply voltage of 3RM1 (L1).

7.3 Typical circuits of 3SK1 safety relays with 3RM1 Failsafe motor starters

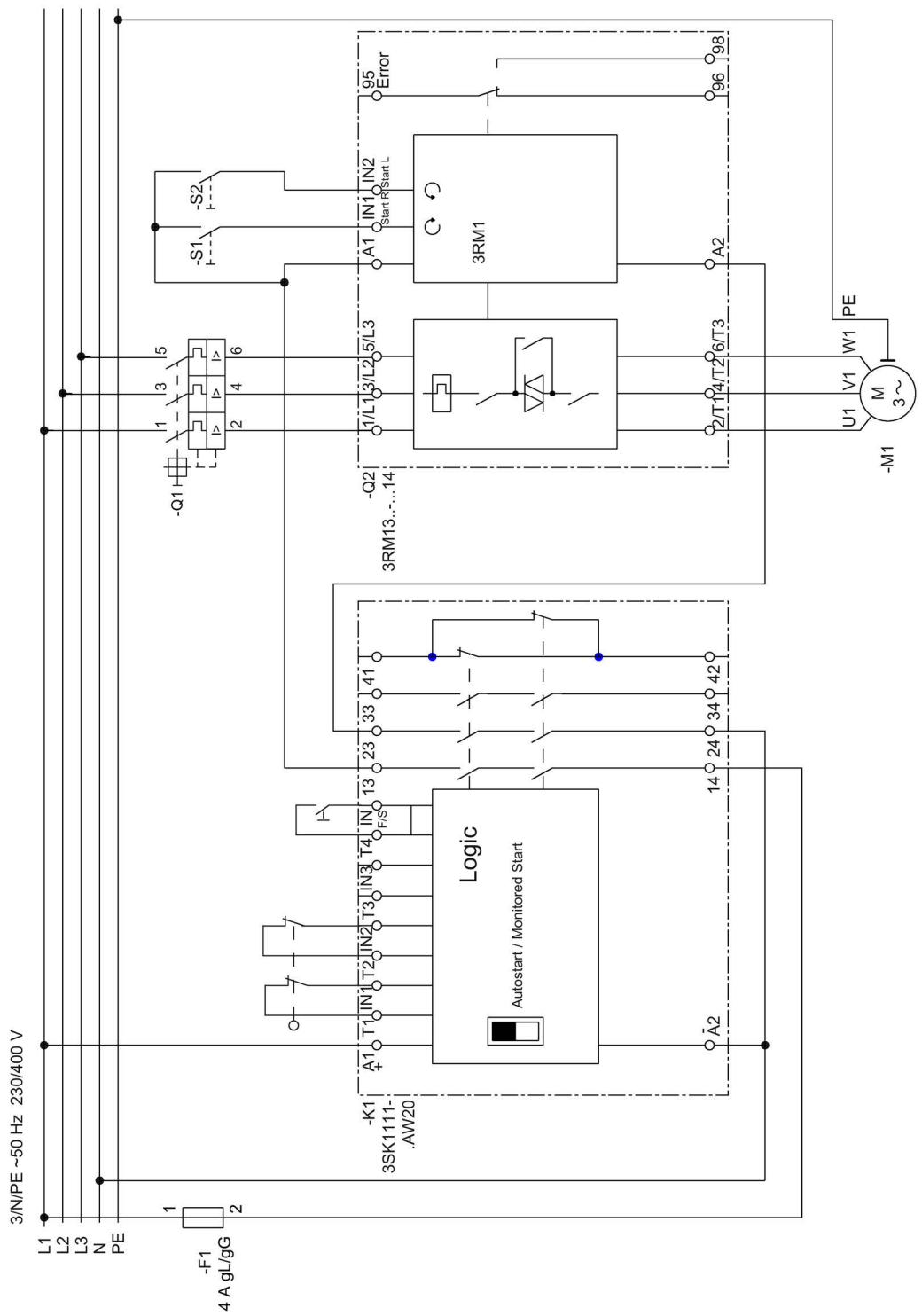


Figure 7-1 3SK1 safety relay with 3RM13 reversing starter

## **7.4 Additional applications**

You can find additional applications in the SIRIUS Safety Integrated application manual on the internet (<https://support.industry.siemens.com/cs/document/83150405?lc=en-WW>).



# Mounting

## 8.1 Warning notices

### Warning notices before installation, wiring, and commissioning

**! WARNING**

Hazardous voltage! Can cause electric shock and burns. Turn off and lock out all power supplying this device before working on this device.

## 8.2 Terminal coding

You can provide the terminals with coding pins (3ZY1440-1AA00). This helps you to avoid errors when replacing the terminals.

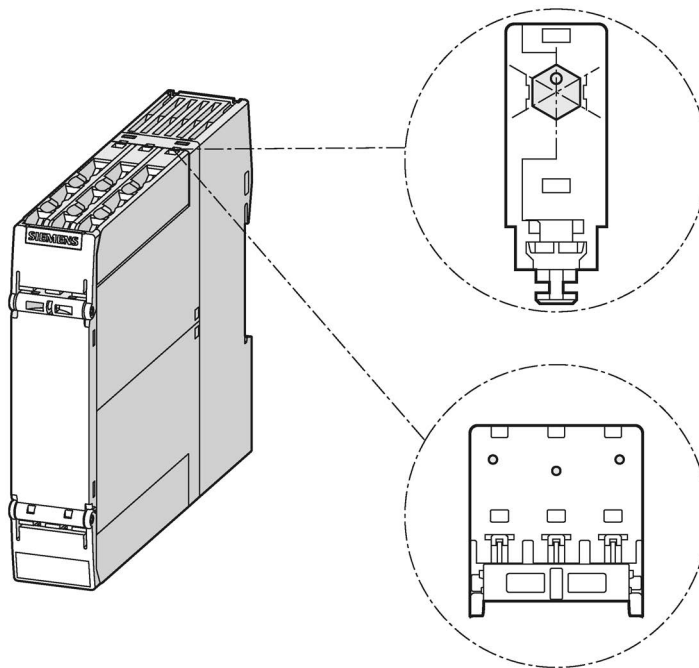


Figure 8-1 Module with coding pins

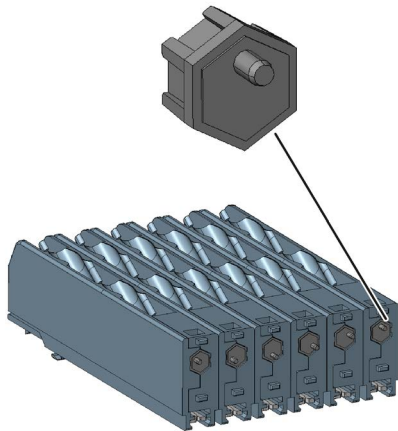


Figure 8-2 Stud position rotated by 60° in each case

## 8.3 Mounting the devices on a level surface

### Requirements

Please note the following requirements for mounting on a level surface:

- Please observe the information about the mounting position in the chapter "General technical data (Page 203)".

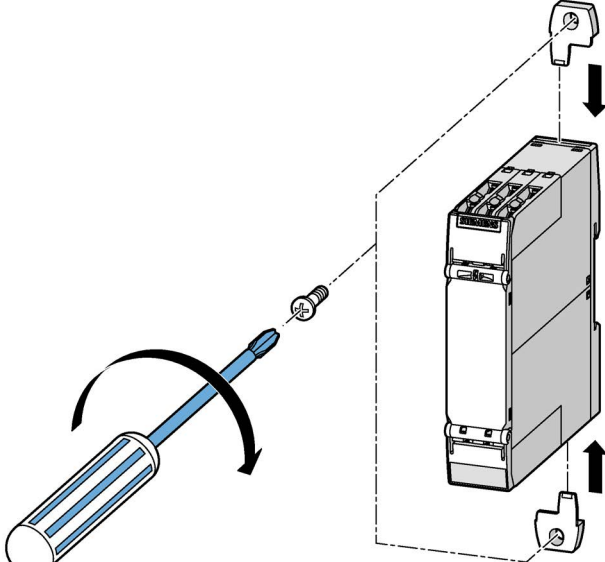
- Two properly executed drill holes with thread or plug on the level surface.

For details of the distances between the drilled holes, please refer to the relevant dimension drawings in the chapter "Dimension drawings for 3SK1 devices (Page 209)".

- Two screws (17.5 mm or 22.5 mm devices)/or four screws (90 mm devices) to fit the holes M4 x 12 in accordance with DIN 784.
- Two plastic push-in lugs.

Refer to the accessories list for the relevant article number in the chapter "Accessories (Page 223)".

Procedure

| Step | Instructions   | Figure  |
|------|--|---|
| 1    | Insert the push-in lugs into the openings provided on the device until they engage.      |  <p>17.5 mm and 22.5 mm devices</p> |
| 2    | Hold the device up to the surface prepared for screw fastening.                          |   |
| 3    | Insert the screws through the elongated holes into the push-in lugs.                     |   |
| 4    | Screw the device onto the level surface so that it is secure.<br>Tightening torque: 1 Nm |   |

## 8.4 Disassembling devices from a level surface



### **WARNING**

#### **Hazardous Voltage**

**Can Cause Death, Serious Injury, or Property Damage.**

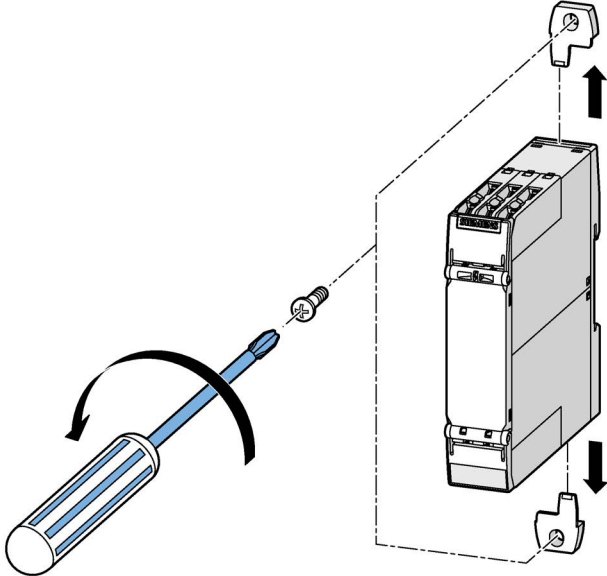
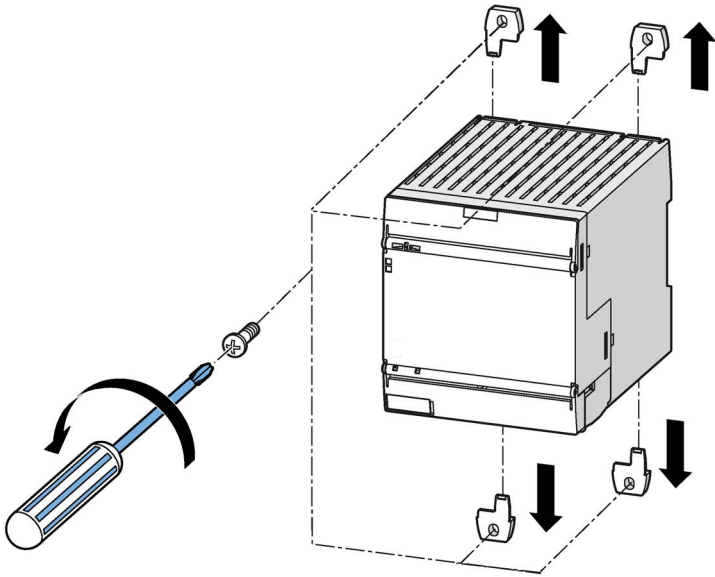
Before starting work, therefore, disconnect the system and devices from the power supply.

### Requirements

- The terminals have been removed or disconnected.



Procedure

| Step | Instructions                             | Figure   |
|------|--|--|
| 1    | Hold the device firmly.                  |  <p data-bbox="715 995 1209 1027">Disassembling 17.5 mm and 22.5 mm devices</p>  <p data-bbox="715 1698 1042 1730">Disassembling 90 mm devices</p> |
| 2    | Unscrew the cap screws.                  |  |
| 3    | Lift the device from the level surface.  |  |
| 4    | Remove the push-in lugs from the device. |  |

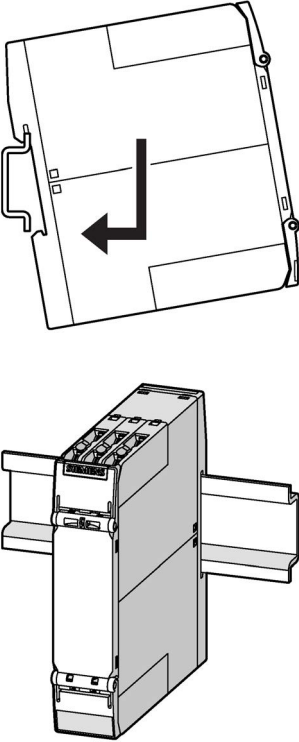
## 8.5 Mounting 22.5 mm/17.5 mm devices on a standard mounting rail

### Requirements

- A horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured at the installation location.
- Please observe the information about the mounting position in the chapter "General technical data (Page 203)".

### Procedure

The figures show 22.5 mm devices. The 17.5 mm devices are mounted correspondingly.

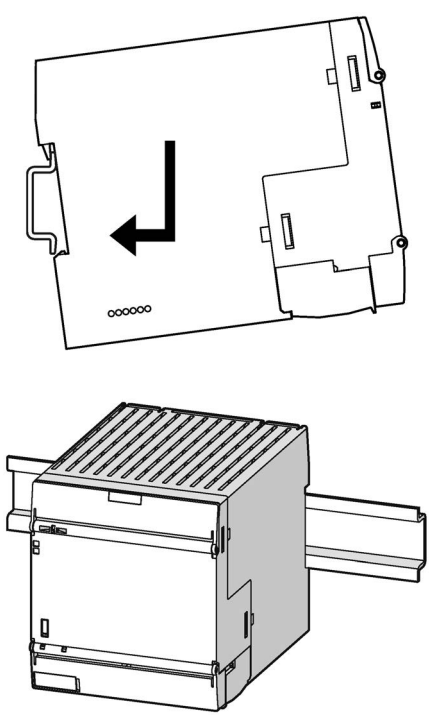
| Step | Instructions  | Figure  |
|------|---|---|
| 1    | Place the back of the device onto the upper edge of the standard mounting rail.   |  |
| 2    | Press the lower half of the device against the DIN rail until the device engages. |   |

## 8.6 Mounting the 90 mm devices on a standard mounting rail

### Requirements

- A horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured at the installation location.
- Please observe the information about the mounting position in the chapter "General technical data (Page 203)".

### Procedure

| Step | Instructions  | Figure  |
|------|---|---|
| 1    | Place the back of the device onto the upper edge of the standard mounting rail.   |  |
| 2    | Press the lower half of the device against the DIN rail until the device engages. |   |

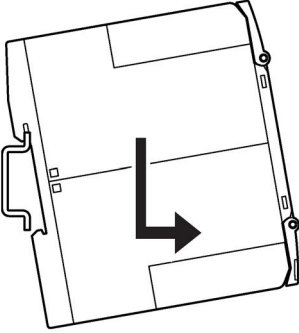
## 8.7 Removing devices from a standard mounting rail

|   |
|---|
| <b>⚠ WARNING</b>  |
| <b>Hazardous Voltage</b><br><b>Can Cause Death, Serious Injury, or Property Damage.</b>   |
| Before starting work, therefore, disconnect the system and devices from the power supply. |

### Requirements

- The terminals have been removed or disconnected.

### Procedure

| Step | Instructions  | Figure  |
|------|---|---|
| 1    | Press the device downwards.   |  |
| 2    | Pull the lower half of the device away from the standard mounting rail. |   |
| 3    | Lift the device from the upper edge of the standard mounting rail.      |   |

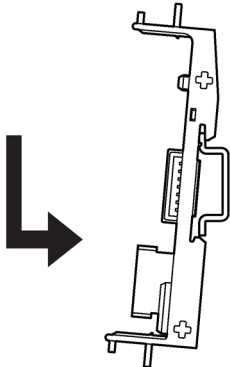
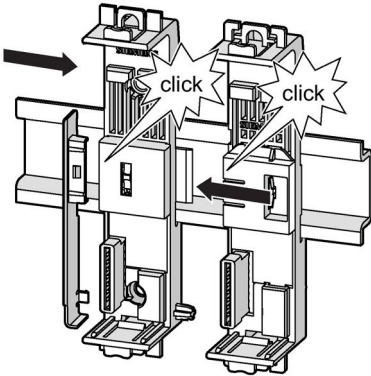
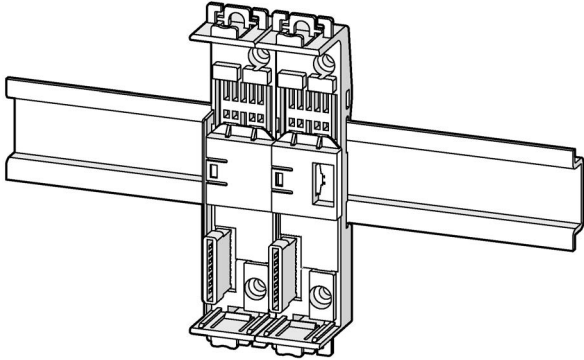
## 8.8 Mounting 22.5 mm/17.5 mm devices with device connectors on a standard mounting rail

### Requirements

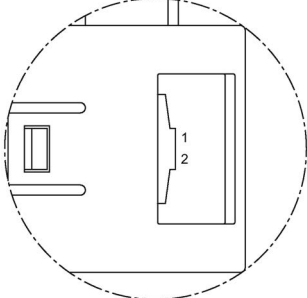
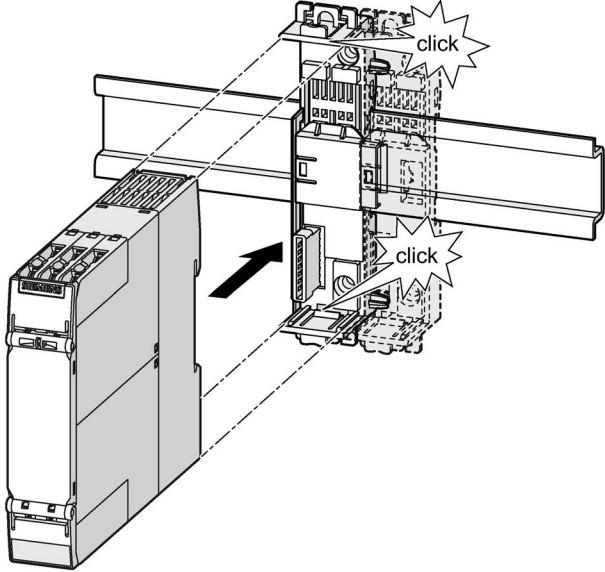
- A horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured at the installation location.
- Please observe the information about the mounting position in the chapter "General technical data (Page 203)".
- Device connectors:  
Refer to the accessories list for the relevant article number in the chapter "Accessories (Page 223)".

**Procedure**

The figures show 22.5 mm devices. The 17.5 mm devices are mounted correspondingly.

| Step | Instructions  | Figure   |
|------|---|--|
| 1    | Place the back of the device connector on the upper edge of the standard mounting rail.   |    |
| 2    | Press the lower half of the device connector against the standard mounting rail until the connector engages.                      |  |
| 3    | Repeat the procedure with all the required device connectors.   |  |
| 4    | Push the device connectors together until they engage.  |   |
| 5    | Mount the cover on the left of the first device connector. The cover is included in the scope of supply of the device terminator. |  |
|      |   |  |

8.8 Mounting 22.5 mm/17.5 mm devices with device connectors on a standard mounting rail

| Step   | Instructions   | Figure   |
|--|--|--|
| <p>6<br/>(not applicable when mounting 3RM1 Failsafe motor starters)</p> | <p>Set the slide switch in the device termination connector for the 3SK1 safety relay to the following positions:</p> <ul style="list-style-type: none"> <li>• below 3SK1 basic device position 2 (bottom; i.e. open)</li> <li>• Below 3SK1211 output expansion position 1 (top; i.e. closed)</li> </ul> |  <p>A circular inset diagram showing a slide switch mechanism. The switch is shown in two positions: position 1 (top) and position 2 (bottom). Position 1 is labeled '1' and position 2 is labeled '2'.</p>  |
| <p>7</p>   | <p>Mount the device on the device connector.</p>   |  <p>A 3D cutaway diagram showing a device being inserted into a rail connector. An arrow points to the device, and two 'click' labels with starburst symbols indicate the locking mechanism. The device is shown partially inserted, with the rail connector's locking mechanism engaged.</p> |
| <p>8</p>   | <p>Mount all the devices required for the system configuration in accordance with the respective installation guidelines on the device connectors.</p>   |  |

## 8.9 Removing 22.5 mm/17.5 mm devices with device connectors from a standard mounting rail



### **WARNING**

**Hazardous Voltage  
Can Cause Death, Serious Injury, or Property Damage.**

Before starting work, therefore, disconnect the system and devices from the power supply.

### Requirements

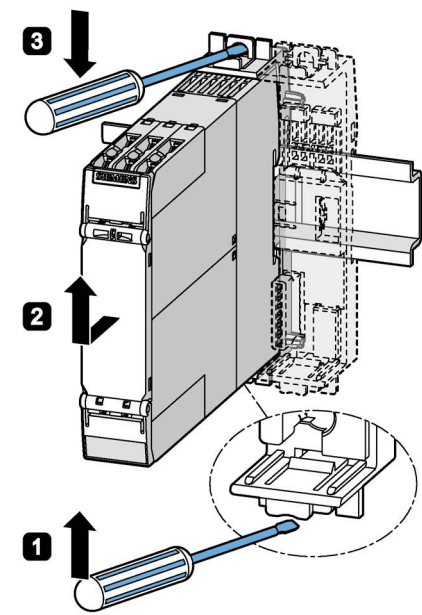
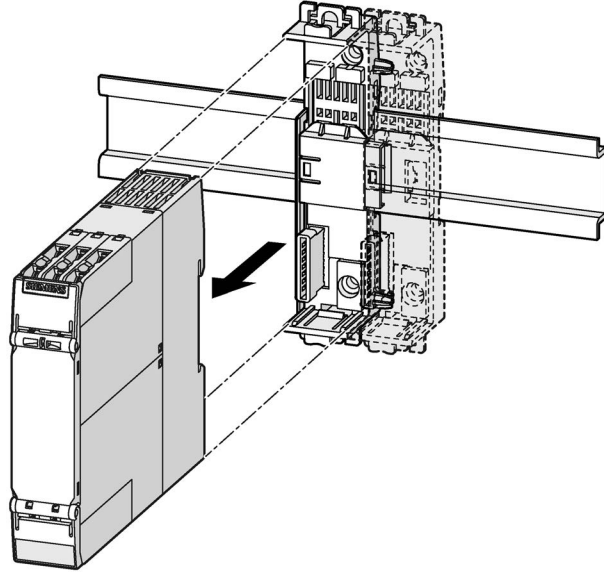
- The terminals have been removed or disconnected.



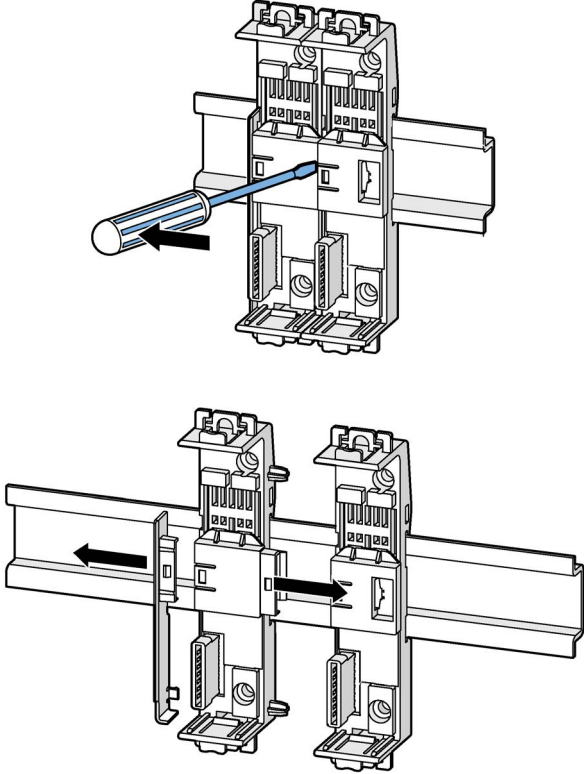
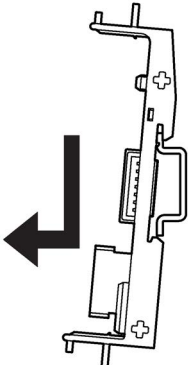
8.9 Removing 22.5 mm/17.5 mm devices with device connectors from a standard mounting rail

Procedure

The figures show 22.5 mm devices. The 17.5 mm devices are removed correspondingly.

| Step | Instructions  | Figure   |
|------|---|--|
| 1    | Unlock the device using a screwdriver.                            |   |
| 2    | Pull the lower half of the device away from the device connector. |  |
| 3    | Unlock the device using a screwdriver.                            |  |
| 4    | Pull the device away from the device connector.                   |  |

8.9 Removing 22.5 mm/17.5 mm devices with device connectors from a standard mounting rail

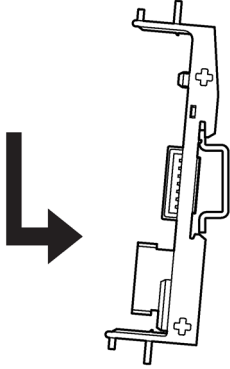
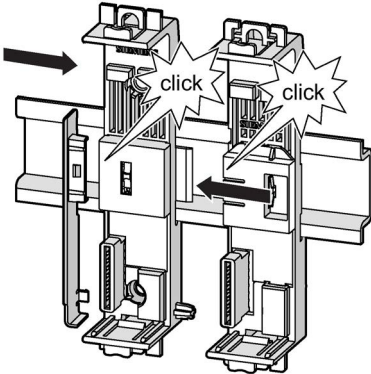
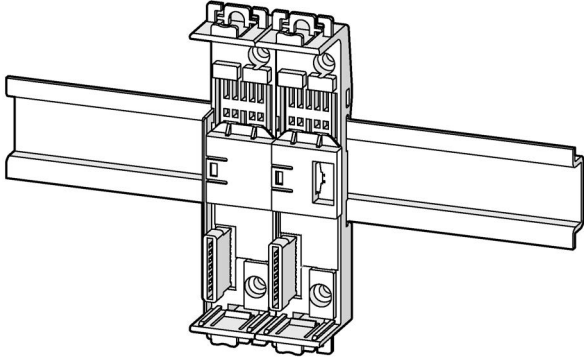
| Step | Instructions  | Figure   |
|------|---|--|
| 5    | Separate the device connectors using a screwdriver.                               |   |
| 6    | Remove the cover.   |  |
| 7    | Press the device connector down.  |  |
| 8    | Pull the lower half of the device connector away from the standard mounting rail. |  |
| 9    | Lift the device connector from the upper edge of the standard mounting rail.      |  |

## **8.10 Mounting 90 mm devices with device connectors on a standard mounting rail**

### **Requirements**

- A horizontal 35-mm wide mounting rail in accordance with DIN EN 60715 has been properly secured at the installation location.
- Please observe the information about the mounting position in the chapter "General technical data (Page 203)".
- Use the device termination connector set for 3SK1 safety relays, > 45 mm wide. Refer to the accessories list for the relevant article number in the chapter "Accessories (Page 223)".
- Please observe the obligatory mounting rules in Section: "System configuration rules (Page 109)".

Procedure

| Step | Instructions   | Figure   |
|------|--|--|
| 1    | Hang the back of the device connector onto the upper edge of the standard mounting rail.   |    |
| 2    | Press the lower half of the device connector against the standard mounting rail until the connector engages.   |  |
| 3    | Repeat the procedure with all the required device connectors.  |  |
| 4    | Push the device connectors together until they engage.   |   |
| 5    | Mount the cover on the left of the first device connector piece and the device connectors supplied in the set for enclosures of 45 mm upwards (right-hand side). |  |
|      |  |  |

8.10 Mounting 90 mm devices with device connectors on a standard mounting rail

| Step | Instructions  | Figure   |
|------|---|--|
| 6    | Note the clearances required for the 90 mm devices. | <p>The figure is a technical drawing showing three SIRIUS 3SK1 safety relays mounted on a standard mounting rail. The drawing is a front view. Dimensions are indicated with arrows and numbers: the total width of the three devices is 112,5 mm; the distance between the center of the first and second device is 22,5 mm; the distance between the center of the second and third device is 90 mm; and the distance between the center of the second and third device is also indicated as 45 mm. The rail is shown as a horizontal bar with mounting slots on both sides.</p> |

8.10 Mounting 90 mm devices with device connectors on a standard mounting rail

| Step | Instructions  | Figure  |
|------|---|---|
| 7    | Mount the 3SK1213 output expansion on the device connectors.  | <p>The figure consists of two parts. The upper part is a perspective view showing a 3SK1213 output expansion being pushed onto a standard mounting rail. Four starburst callouts labeled 'click' indicate the points where the expansion's lugs engage with the rail's slots. A dashed line and an arrow point from the expansion to the rail. The lower part is a perspective view of the 3SK1213 output expansion fully mounted on the rail, showing its top surface with multiple connection points.</p> |
| 8    | Mount all the devices required for the system configuration in accordance with the respective installation guidelines on the device connectors. |   |

## 8.11 Removing 90 mm devices with device connectors from a standard mounting rail

|   |
|---|
| <b>⚠ WARNING</b>  |
| <p><b>Hazardous Voltage</b><br/> <b>Can Cause Death, Serious Injury, or Property Damage.</b></p> <p>Before starting work, therefore, disconnect the system and devices from the power supply.</p> |

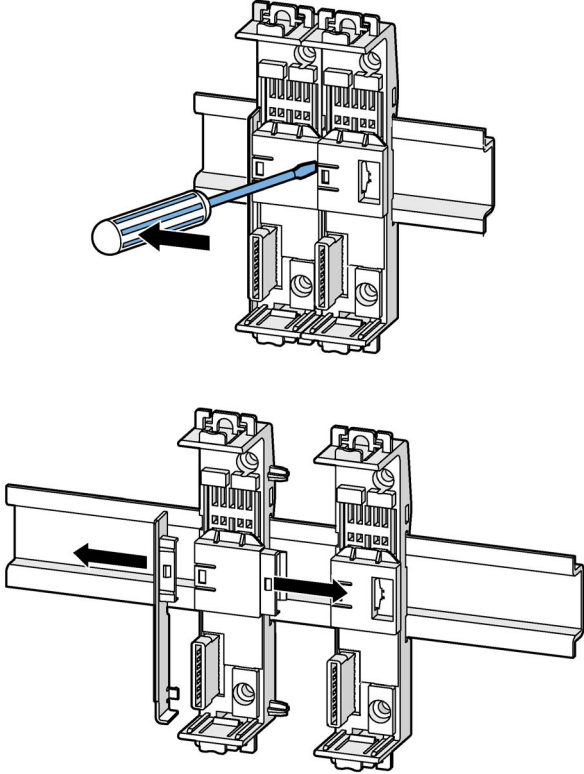
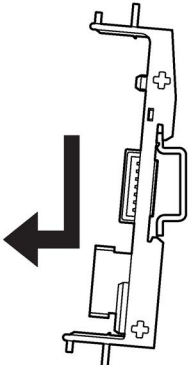
### Requirements

- The terminals have been removed or disconnected.

### Procedure

| Step | Instructions  | Figure |
|------|---|--------|
| 1    | Unlock the device using a screwdriver.                            |        |
| 2    | Pull the lower half of the device away from the device connector. |        |
| 3    | Unlock the device using a screwdriver.                            |        |
| 4    | Pull the device away from the device connector.                   |        |

8.11 Removing 90 mm devices with device connectors from a standard mounting rail

| Step | Instructions  | Figure   |
|------|---|--|
| 5    | Separate the device connectors using a screwdriver.                               |   |
| 6    | Disassemble the terminating section.  |  |
| 7    | Press the device connector down.  |  |
| 8    | Pull the lower half of the device connector away from the standard mounting rail. |  |
| 9    | Lift the device connector from the upper edge of the standard mounting rail.      |  |



## 8.12 Mounting 22.5 mm/17.5 mm devices with device connectors on the wall

### Requirements

Please note the following requirements for mounting on a level surface:

- Please observe the information about the mounting position in the chapter "General technical data (Page 203)".
- Two properly executed drill holes (per device connector) with thread or plug on the level surface.

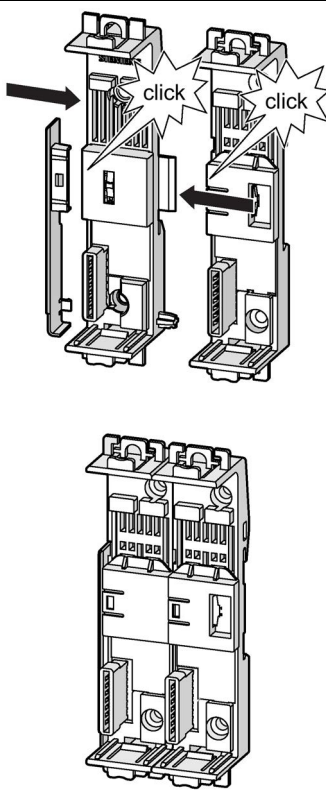
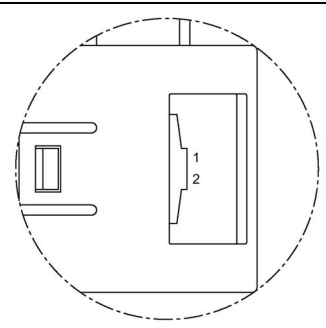
For details of the distances between the drilled holes, please refer to the relevant dimension drawings in the chapter "Dimension drawings 3SK1 device connectors".

- Two screws (per device connector) to fit the holes M4 x12 in accordance with DIN 784.
- Device connector

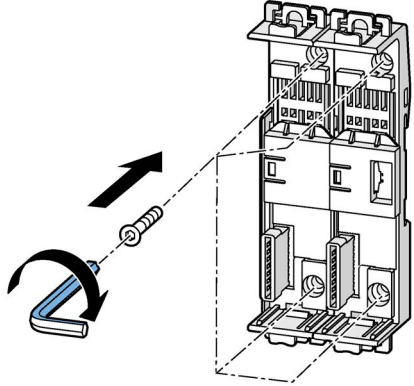
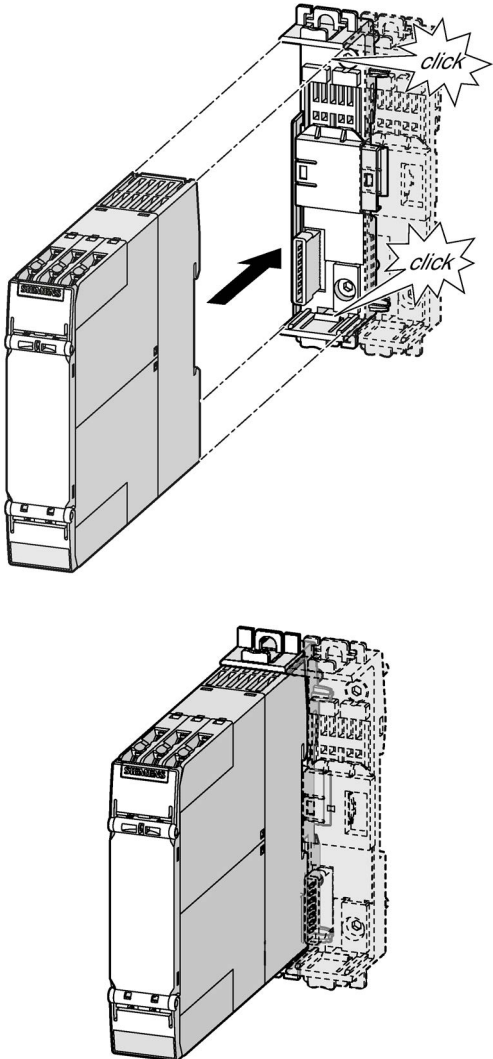
Refer to the accessories list for the relevant article number in the chapter "Accessories (Page 223)".

**Procedure for mounting on a level surface**

The figures show 22.5 mm devices. The 17.5 mm devices are mounted correspondingly.

| Step   | Instructions  | Figure   |
|--|---|--|
| 1  | Push the device connectors together until they engage.  |   |
| 2  | Mount the cover on the left of the first device connector. The cover is included in the scope of supply of the device terminator.   |  |
| 3<br>(not applicable when mounting 3RM1 Failsafe motor starters) | <p>Set the slide switch in the device termination connector for the 3SK1 safety relays to the following positions:</p> <ul style="list-style-type: none"> <li>• below 3SK1 basic device position 2 (bottom; i.e. open)</li> <li>• below 3SK1211 output expansion position 1 (top; i.e. closed)</li> </ul> |  |

8.12 Mounting 22.5 mm/17.5 mm devices with device connectors on the wall

| Step | Instructions  | Figure  |
|------|---|---|
| 4    | Hold the device connector against the level surface prepared for screw fastening.   |   |
| 5    | Insert the screws through the holes in the device connectors.   |   |
| 6    | Screw the device connector securely onto the level surface.<br>Tightening torques: <ul style="list-style-type: none"> <li>• Top: &lt; 0.1 Nm</li> <li>• Bottom: 1 Nm</li> </ul> |   |
| 7    | Mount the device on the device connector.   |  |
| 8    | Mount all the devices required for the system configuration in accordance with the respective installation guidelines on the device connectors.                                 |   |

## 8.13 Removing 22.5 mm/17.5 mm devices with device connectors from the wall

|  |
|--|
|  <b>WARNING</b> |
|--|

|   |
|---|
| <b>Hazardous Voltage<br/>Can Cause Death, Serious Injury, or Property Damage.</b> |
|---|

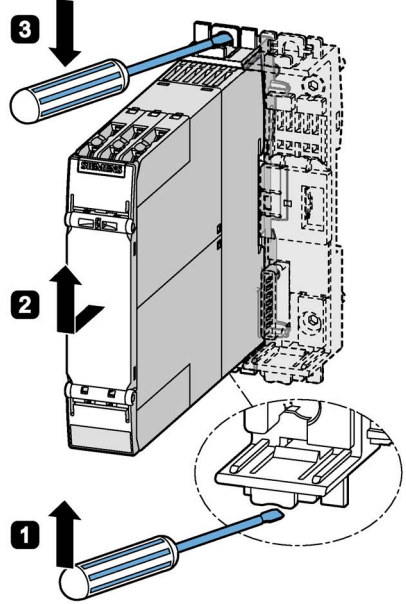
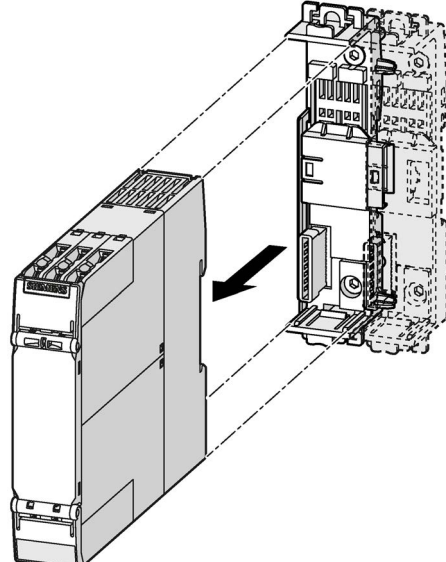
|   |
|---|
| Before starting work, therefore, disconnect the system and devices from the power supply. |
|---|

### Requirements

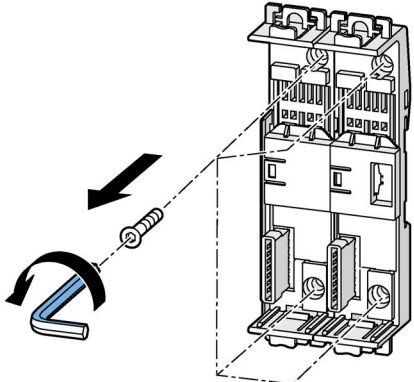
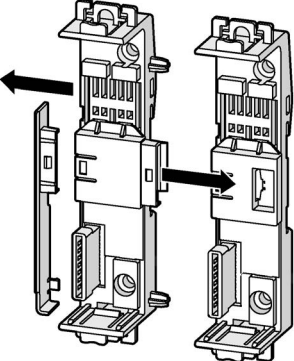
- The terminals have been removed or disconnected.

**Procedure**

The figures show 22.5 mm devices. The 17.5 mm devices are removed correspondingly.

| Step | Instructions  | Figure   |
|------|---|--|
| 1    | Unlock the device (below) using a screwdriver.                    |   |
| 2    | Pull the lower half of the device away from the device connector. |  |
| 3    | Unlock the device (above) using a screwdriver.                    |  |
| 4    | Pull the device away from the device connector.                   |  |

8.13 Removing 22.5 mm/17.5 mm devices with device connectors from the wall

| Step | Instructions                    | Figure  |
|------|---------------------------------|---|
| 5    | Release the screws.             |   |
| 6    | Separate the device connectors. |  |
| 7    | Remove the cover.               |   |

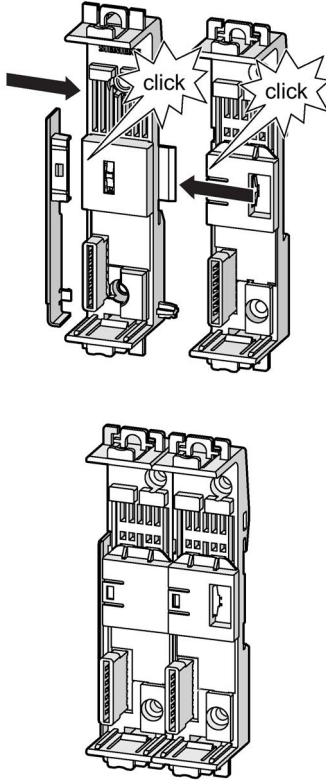
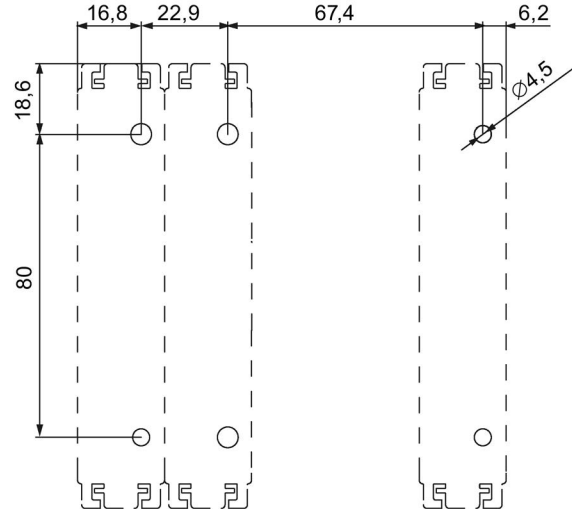
## 8.14 Mounting 90 mm devices with device connectors on the wall

### Requirements

Please note the following requirements for mounting on a level surface:

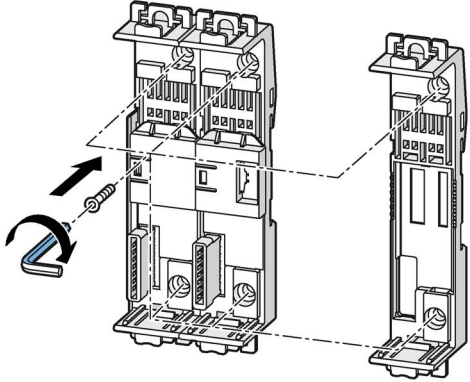
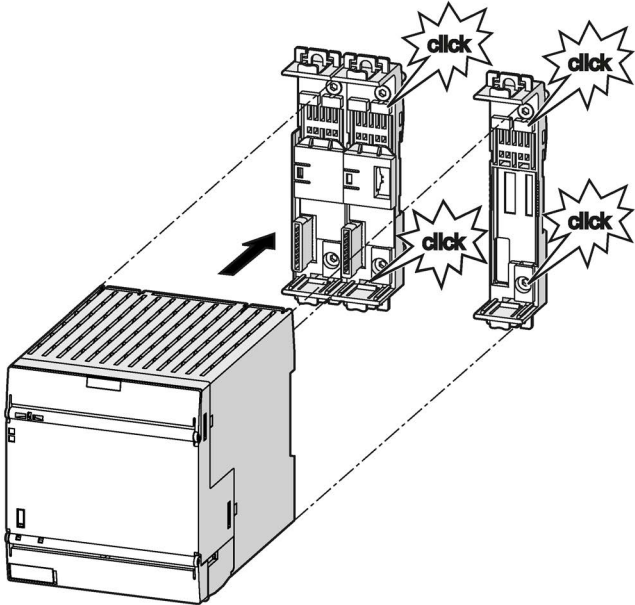
- Please observe the information about the mounting position in the chapter "General technical data (Page 203)".
- Two properly executed drill holes with thread or plug on the level surface (per device connector).
- Two M4 x 12 screws in accordance with DIN 784 (per device connector) to fit the holes.
- Use the device termination connector set for 3SK1 safety relays, > 45 mm wide. Refer to the accessories list for the relevant article number in the chapter "Accessories (Page 223)".

Procedure

| Step           | Instructions  | Figure  |
|----------------|---|---|
| <p>1<br/>2</p> | <p>1 Push the device connectors together until they engage.</p> <p>2 Mount the cover on the left of the first device connector.</p>   | <p>Figure</p>  |
| <p>3</p>       | <p>Note the clearances required for the 90 mm devices.</p> <p>Mount the device connector supplied in the set for enclosures of 45 mm upwards (right-hand side).</p> <p>Tightening torques:</p> <ul style="list-style-type: none"> <li>• Top: &lt; 0.1 Nm</li> <li>• Bottom: 1 Nm</li> </ul> |               |



8.14 Mounting 90 mm devices with device connectors on the wall

| Step | Instructions  | Figure  |
|------|---|---|
| 4    | Hold the device connector against the level surface prepared for screw fastening.   |   |
| 5    | Insert the screws through the holes in the device connectors.   |   |
| 6    | Screw the device connector securely onto the level surface.   |   |
| 7    | Mount the 3SK1213 output expansion on the device connectors   |  |
| 8    | Mount all the devices required for the system configuration in accordance with the respective installation guidelines on the device connectors. |   |

## 8.15 Removing 90 mm devices with device connectors from wall

**⚠ WARNING**

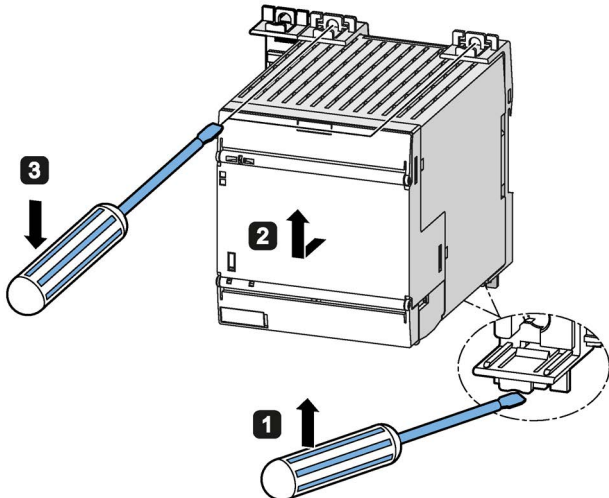
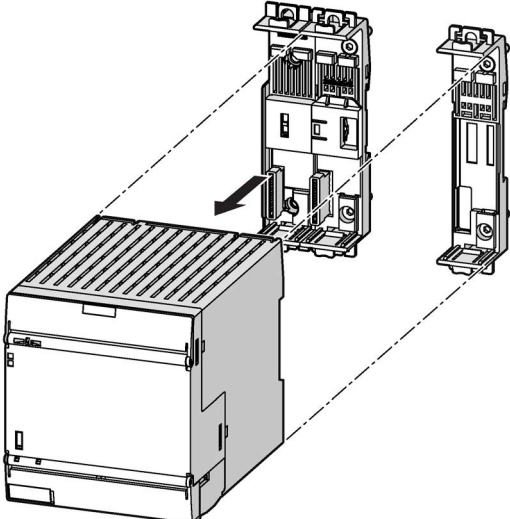
**Hazardous Voltage  
Can Cause Death, Serious Injury, or Property Damage.**

Before starting work, therefore, disconnect the system and devices from the power supply.

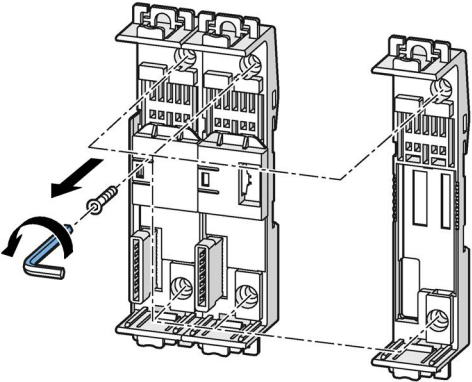
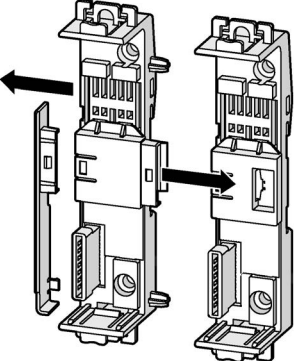
### Requirements

- The terminals have been removed or disconnected.

### Procedure

| Step | Instructions  | Figure   |
|------|---|--|
| 1    | Unlock the device (bottom) using a screwdriver.                   |   |
| 2    | Pull the lower half of the device away from the device connector. |  |
| 3    | Unlock the device (top) using a screwdriver.                      |  |
| 4    | Pull the device away from the device connector.                   |  |

8.15 Removing 90 mm devices with device connectors from wall

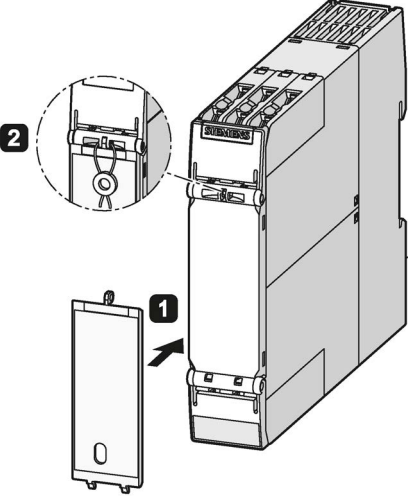
| Step | Instructions                    | Figure  |
|------|---------------------------------|---|
| 5    | Release the screws.             |   |
| 6    | Separate the device connectors. |  |
| 7    | Remove the cover.               |   |

## 8.16 Mounting the sealable cover

The sealable cover (3ZY1321-1AA00 for 17.5 mm devices, 3ZY1321-2AA00 for 22.5 mm devices) can be used to secure the DIP switches (and, if present, the potentiometers for setting the delay time) of the safety relays against unauthorized or unintended readjustment.

As an alternative, Siemens also offers a sealable membrane (3TK2820-0AA00) for securing the safety relays. The sealable membrane is fixed to the front of the safety relay and secures the DIP switches and the buttons (and potentiometers) against unintentional readjustment.

### Mounting the sealable cover

| Step | Instructions  | Figure  |
|------|---|---|
| 1    | Attach the hooks on the cover to the openings on the device and fold the cover up.          |  |
| 2    | Seal the cover to secure it against unauthorized removal. Sealing wire diameter, max.: 2 mm |   |

## Connection

### 9.1 22.5 mm/17.5 mm devices

#### 9.1.1 Terminal assignment

##### Location of the connections

The inside faces of the terminal covers are labeled with the designations of the relevant terminals. The position of the label corresponds to the position of the respective terminal.

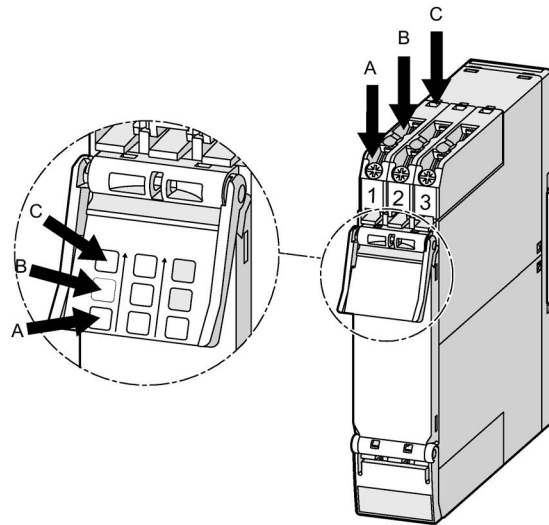


Figure 9-1 Upper terminal cover

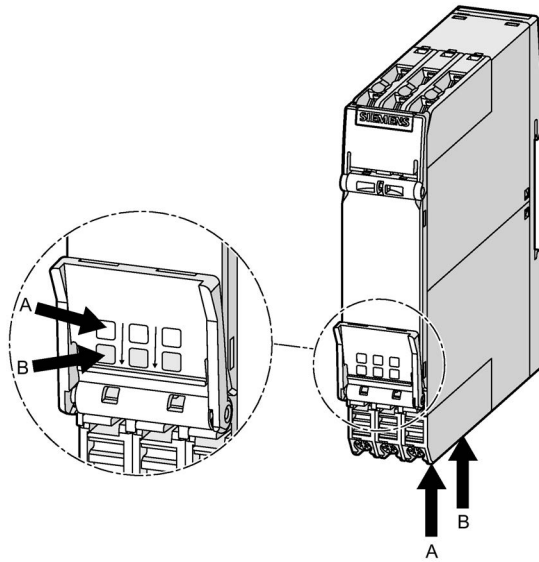
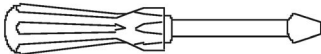
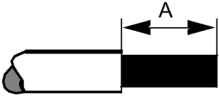

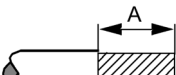


Figure 9-2 Lower terminal cover

### 9.1.2 Connection data for terminals

|   |  | <b>Specification and value<br/>in the case of removable terminals with screw-type terminals</b> |
|---|--|---|
| Screwdriver<br><br>                        |  | Cross-tip screwdriver<br>Size: PZ 1x80 (ø 4.5 mm)<br>Torque: 0.6 to 0.8 Nm                      |
| Rigid cable<br><br>                        |  | A = 10 mm<br>1 x 0.5 ... 2.5 mm <sup>2</sup><br>2 x 1.0 ... 1.5 mm <sup>2</sup>                 |
| Flexible conductor with end sleeve<br><br> |  | A = 10 mm<br>1 x 0.5 ... 2.5 mm <sup>2</sup><br>2 x 0.5 ... 1.0 mm <sup>2</sup>                 |
| Flexible cable<br><br>                     |  | Not permissible   |
| AWG   |  | 1 x 20 to 14<br>2 x 18 to 16  |

### 9.1.3 Connecting the screw-type terminals

|   |
|---|
| <p><b>! WARNING</b></p> <p><b>Hazardous Voltage</b><br/> <b>Can Cause Death, Serious Injury, or Property Damage.</b></p> <p>Before starting work, therefore, disconnect the system and devices from the power supply.</p> |
|---|

#### Requirements

- Cross-tip screwdriver size PZ 1 x 80.
- For suitable connection cross-sections of the cables, see the chapter "Connection data for terminals (Page 170)".

#### Procedure

| Step | Instructions   | Figure |
|------|--|--------|
| 1    | Insert the relevant cable into square on the screw-type terminal until it engages. |        |
| 2    | Hold the cable in the screw-type terminal.   |        |
| 3    | Tighten the screw with a torque of 0.6 ... 0.8 Nm.                                 |        |
| 4    | Pull on the cable to ensure it is screwed tight.                                   |        |

### 9.1.4 Disconnecting the screw-type terminals

|   |
|---|
| <p><b>! WARNING</b></p> <p><b>Hazardous Voltage</b><br/> <b>Can Cause Death, Serious Injury, or Property Damage.</b></p> <p>Before starting work, therefore, disconnect the system and devices from the power supply.</p> |
|---|

#### Requirements

- Cross-tip screwdriver size PZ 1 x 80

**Procedure**

| Step | Instructions   | Figure |
|------|--|--------|
| 1    | Unscrew the screw of the screw-type terminal.            |        |
| 2    | Remove the cable from the unscrewed screw-type terminal. |        |

**9.1.5 Wiring rules for spring-loaded terminals (with push-in technology)**

| Wiring rules for ...                                     |   | Control current terminals   |
|--|---|---|
| Connectable cross-sections for solid cables              |   | 2 x 0.5 ... 2 x 1.5 mm <sup>2</sup><br>(AWG <sup>1)</sup> : 20 ... 16)    |
| Connectable cross-sections for flexible cables           | Without end sleeve                                | 2 x 0.5 ... 2 x 1.5 mm <sup>2</sup><br>(AWG <sup>1)</sup> : 20 ... 16)    |
|  | With end sleeve (with and without plastic sleeve) | 2 x 0.5 ... 2 x 1.0 mm <sup>2</sup> 2)<br>(AWG <sup>1)</sup> : 20 ... 18) |
|  | With TWIN end sleeve                              | ---<br>---  |
| Cable stripping length                                   |   | 10 ... 11 mm  |
| End sleeves according to DIN 46228-4 with plastic sleeve |   | 10 mm   |

1) AWG: American Wire Gauge (AWG does not define use of end sleeves)

2) When 2 x 1.0 mm<sup>2</sup> end sleeves with a plastic sleeve are used, space problems may arise with the sleeves; as an alternative, you are advised to use end sleeves without plastic sleeves

**Notes on handling spring-loaded terminals with push-in technology**

The terminal area of the spring-loaded terminals is rectangular, and the maximum overall dimensions of the conductor to be wired must not exceed 1.5 x 2.4 mm (control current terminals).

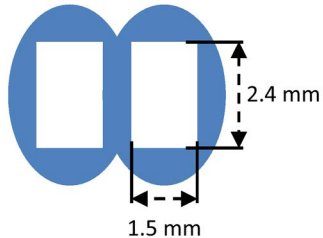
Attention must be paid to the orientation of the terminal area, which may call for vertical fitting of rectangularly crimped cables.

To make optimum use of available terminal area, you are advised to choose a form of crimping that creates a corresponding rectangular contour. Trapezoidal crimping is generally very highly suitable in this case.



When use is made of a cable that utilizes the full overall height, the terminal's spring is deflected to the maximum. Therefore, removal of this cable may become a problem because it requires further deflection of the spring.

Control current terminals



Terminal area of control current terminals

### 9.1.6 Connecting the push-in terminals

**! WARNING**

**Hazardous Voltage  
Can Cause Death, Serious Injury, or Property Damage.**

Before starting work, therefore, disconnect the system and devices from the power supply.

Push-in connections are a form of spring-loaded terminals allowing wiring without tools for rigid conductors or conductors equipped with end sleeves.

For wiring finely-stranded or stranded conductors without end sleeves on push-in connections, a screwdriver is required.

#### Requirements

- 0.5 x 3 mm screwdriver DIN 5264 (for finely-stranded conductors only).
- For suitable connection cross-sections of the cables, see the chapter "Connection data for terminals (Page 170)".

**Procedure**

Table 9- 1 Rigid conductors or conductors equipped with end sleeves

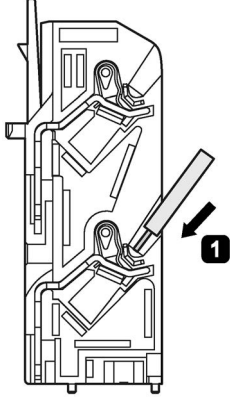
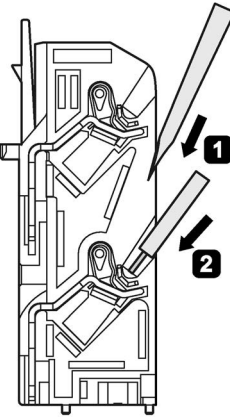

| Step | Instructions   | Figure   |
|------|--|--|
| 1    | Insert the cable into the oval opening as far as it will go. |  |
| 2    | Pull on the cable to ensure it is tight.                     |  |

Table 9- 2 Finely-stranded conductors

| Step | Instructions  | Figure   |
|------|---|--|
| 1    | Insert the screwdriver in the rectangular opening to open the terminal (oval opening).  |  |
| 2    | Insert the cable as far as it will go into the oval opening and remove the screwdriver. |  |
| 3    | Pull on the cable to ensure it is tight.  |  |

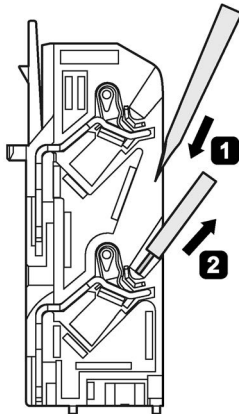
### 9.1.7 Disconnecting the push-in terminals

|  |
|--|
|  <b>WARNING</b>   |
| <b>Hazardous Voltage</b><br><b>Can Cause Death, Serious Injury, or Property Damage.</b><br>Before starting work, therefore, disconnect the system and devices from the power supply. |

#### Requirements

- Screwdriver DIN 5264 of the size 0.5 x 3 mm

#### Procedure

| Step | Instructions  | Figure   |
|------|---|--|
| 1    | Insert the screwdriver into the rectangular opening of the spring-loaded terminal until it engages. |  |
| 2    | Remove the cable from the oval opening.   |  |
| 3    | Remove the screwdriver.   |  |

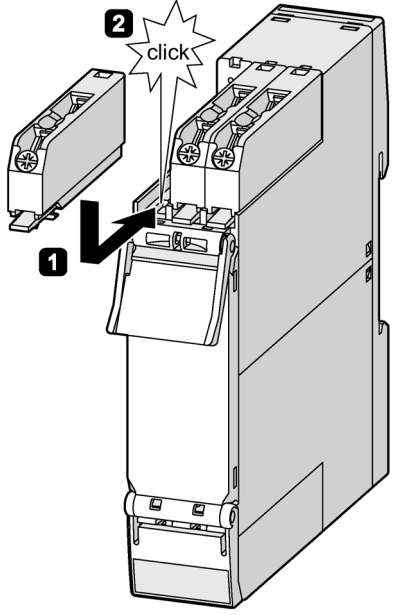
### 9.1.8 Attaching the terminals

|   |
|---|
| <b>! WARNING</b>  |
| <b>Hazardous voltage</b>  |
| <b>Can Cause Death, Serious Injury, or Property Damage.</b>                               |
| Before starting work, therefore, disconnect the system and devices from the power supply. |


#### Requirements

You must have removed the terminals, for the purpose of replacing a device, for example.

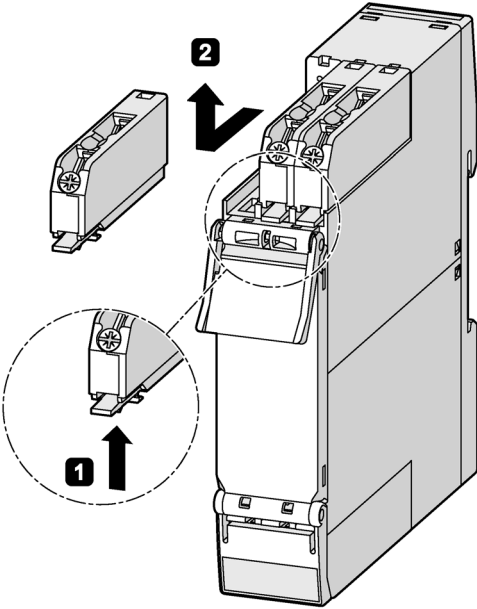
#### Procedure when plugging in the terminals

| Step | Instructions   | Figure  |
|------|--|---|
| 1    | Insert the detachable terminals into the guide rail of the device. |  |
| 2    | Slide the detachable terminals back until they audibly engage.     |   |

### 9.1.9 Disconnecting

|   |
|---|
|  <b>WARNING</b>  |
| <b>Hazardous Voltage</b><br>Can Cause Death, Serious Injury, or Property Damage.<br>Before starting work, therefore, disconnect the system and devices from the power supply. |

#### Removing terminals from the device

| Step | Instructions  | Figure  |
|------|---|---|
| 1    | Press the clip of the terminals upwards.                |  <p>The diagram illustrates the removal of terminals from a device. It shows a side view of the terminal block with a terminal being pushed upwards (indicated by arrow 1) and then pulled out of the front (indicated by arrow 2). A circular inset provides a magnified view of the terminal's clip mechanism.</p> |
| 2    | Pull the terminals out to the front.                    |   |
| 3    | Lift the terminals out of the guide rail of the device. |   |

**Screw terminals: Disconnecting the conductor**


| Step | Instructions   | Figure |
|------|--|--------|
| 1    | Unscrew the screw of the screw-type terminal.            |        |
| 2    | Remove the cable from the unscrewed screw-type terminal. |        |

**Push-in terminals: Disconnecting the conductor**

| Step | Instructions  | Figure |
|------|---|--------|
| 1    | Insert the screwdriver into the rectangular opening of the push-in terminal until it engages. Please observe a 10° horizontal angular deviation of the screwdriver to the oval opening. |        |
| 2    | Remove the cable from the oval opening.   |        |
| 3    | Remove the screwdriver.   |        |

## 9.2 Devices 90 mm

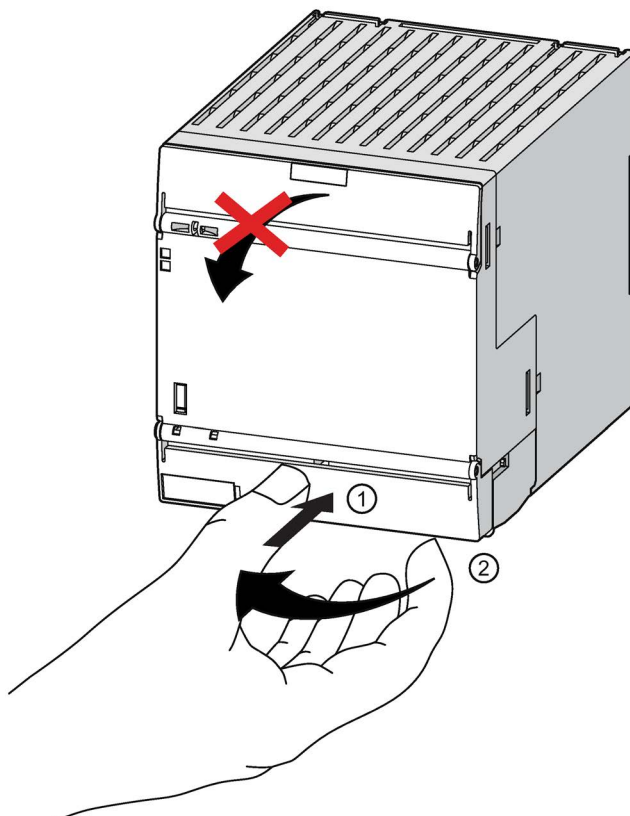
### 9.2.1 Opening the terminal cover

|  |
|--|
|  <b>WARNING</b>   |
| <b>Hazardous Voltage</b><br><b>Can Cause Death, Serious Injury, or Property Damage.</b><br>Before starting work, therefore, disconnect the system and devices from the power supply. |

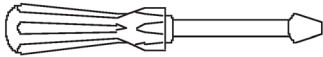
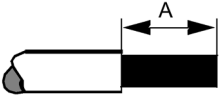
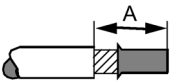
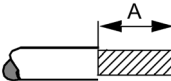
#### Positions of the terminals and opening the terminal cover

The removable terminals are located under the **lower** terminal cover.

To open the terminal cover, press on it in the middle ① and lift it up ②.




### 9.2.2 Connection data for terminals

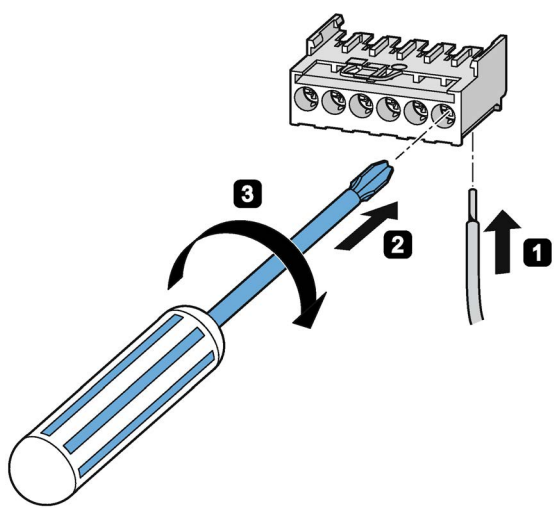
|   | <b>Screwdriver<br/>for removable terminals with screw-type<br/>terminals</b>    | <b>Screwdriver<br/>for removable terminals with spring-loaded<br/>terminals</b>                     |
|---|---|---|
| Screwdriver<br>                              | Cross-tip screwdriver<br>Size: PZ 1 (∅ 4 mm)<br>Torque: 0.8 to 1.2 Nm           | Screwdriver<br>Size: 0 or 1 (width to 3 mm) for raising the terminal springs<br>DIN 5264-A; 0.5 x 3 |
| Rigid cable<br>                              | A = 10 mm<br>1 x 0.5 ... 4.0 mm <sup>2</sup><br>2 x 0.5 ... 2.5 mm <sup>2</sup> | A = 10 mm<br>1 x 0.5 ... 1.5 mm <sup>2</sup><br>2 x 0.5 ... 1.5 mm <sup>2</sup>                     |
| Flexible cable with end sleeve/cable lug<br> | A = 10 mm<br>1 x 0.5 ... 2.5 mm <sup>2</sup><br>2 x 0.5 ... 1.5 mm <sup>2</sup> | A = 10 mm<br>1 x 0.5 ... 1.5 mm <sup>2</sup><br>2 x 0.5 ... 1.5 mm <sup>2</sup>                     |
| Flexible cable<br>                         | Not permissible   | A = 10 mm<br>1 x 0.5 ... 1.5 mm <sup>2</sup><br>2 x 0.5 ... 1.5 mm <sup>2</sup>                     |
| AWG   | 1 x 20 to 12<br>2 x 18 to 14  | 1 x 20 to 16<br>2 x 20 to 16  |



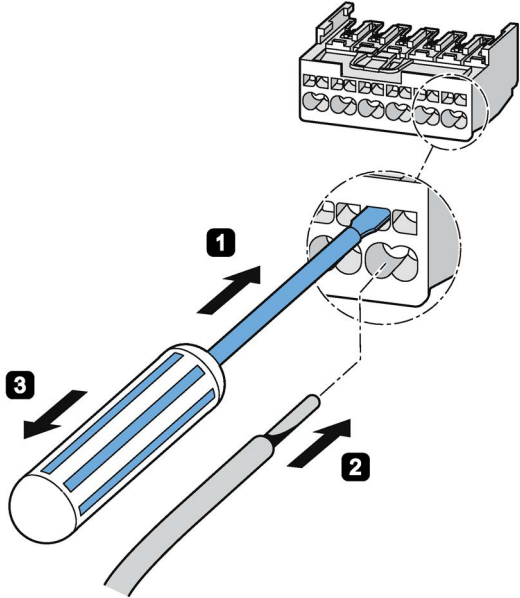
### 9.2.3 Connecting terminals

|  |
|--|
|  <b>WARNING</b>   |
| <b>Hazardous Voltage</b><br><b>Can Cause Death, Serious Injury, or Property Damage.</b><br>Before starting work, therefore, disconnect the system and devices from the power supply. |

#### Procedure for screw-type terminal blocks

| Step | Instructions   | Figure  |
|------|--|---|
| 1    | Insert the relevant cable into square on the screw-type terminal until it engages. |  |
| 2    | Hold the cable in the screw-type terminal.   |   |
| 3    | Tighten the screw of the terminal in which the cable is inserted.                  |   |
| 4    | Pull on the cable to ensure it is screwed tight.                                   |   |

### Procedure for spring-loaded terminals

| Step | Instructions   | Figure   |
|------|--|--|
| 1    | To release the clamping springs, insert the screwdriver as far as it will go into the rectangular opening of the spring-loaded terminal. Please observe a 10° horizontal angular deviation of the screwdriver to the oval opening. |  |
| 2    | Insert the cable into the oval opening as far as it will go.   |  |
| 3    | Hold the cable in the spring-loaded terminal.  |  |
| 4    | Remove the screwdriver.  |  |
| 5    | Pull on the cable to ensure it is tight.   |  |

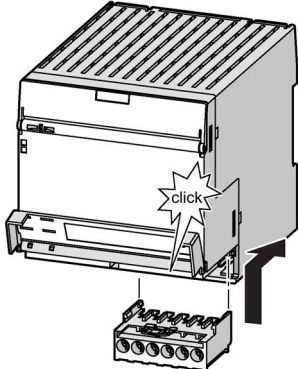
## 9.2.4 Mounting terminals

|   |
|---|
| <p><b>! WARNING</b></p> <p><b>Hazardous voltage</b></p> <p><b>Can Cause Death, Serious Injury, or Property Damage.</b></p> <p>Before starting work, therefore, disconnect the system and devices from the power supply.</p> |
|---|

### Requirements

You must have removed the terminals, for the purpose of replacing a device, for example.

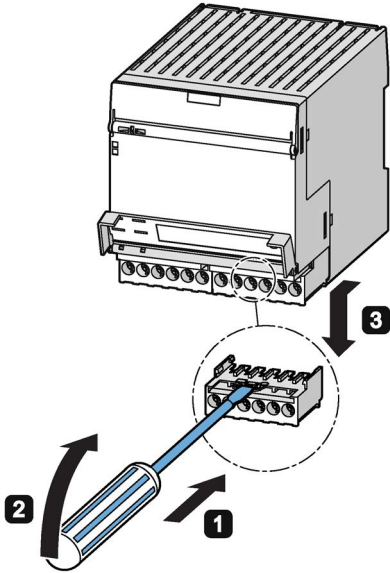
### Procedure for mounting terminals

| Step | Instructions  | Figure  |
|------|---|---|
| 1    | Insert the detachable terminals into the guide rail of the device.                |  |
| 2    | Slide the detachable terminals back until they audibly engage.                    |   |
| 3    | Check that the clip of the removable terminals closes flush with the front panel. |   |

### 9.2.5 Disconnecting

|   |
|---|
| <b>⚠ WARNING</b>  |
| <b>Hazardous Voltage</b><br><b>Can Cause Death, Serious Injury, or Property Damage.</b>   |
| Before starting work, therefore, disconnect the system and devices from the power supply. |

#### Removing terminals from the device

| Step | Instructions  | Figure  |
|------|---|---|
| 1    | Insert a flat-head screwdriver between the clip of the terminals and the front panel. |  |
| 2    | Pull the terminals out to the front.  |   |
| 3    | Lift the terminals out of the guide rail of the device.                               |   |

### Disconnecting screw-type terminals

| Step | Instructions   | Figure |
|------|--|--------|
| 1    | Insert the screwdriver into the screw-type terminal.     |        |
| 2    | Unscrew the screw of the screw-type terminal.            |        |
| 3    | Remove the cable from the unscrewed screw-type terminal. |        |

### Disconnecting spring-loaded terminals

| Step | Instructions  | Figure |
|------|---|--------|
| 1    | Insert the flat-head screwdriver into the rectangular opening of the spring-loaded terminal until it engages. Please observe a 10° horizontal angular deviation of the screwdriver to the oval opening. |        |
| 2    | Remove the cable from the oval opening.   |        |
| 3    | Remove the screwdriver.   |        |

## 9.3 Device replacement

 **WARNING**

**Hazardous Voltage  
Can Cause Death, Serious Injury, or Property Damage.**

Before starting work, therefore, disconnect the system and devices from the power supply.

When replacing a device, you do not need to re-wire it. The terminals can be disconnected from the defective device and then connected to the new device.

You can provide the terminals with coding pins. These are to help you avoid errors when replacing the terminals (see the chapter "Terminal coding (Page 137)" for more details).

### Replacing the module

 **WARNING**

**Hazardous Voltage  
Can Cause Death, Serious Injury, or Property Damage.  
Carry out function test of the plant**

To ensure the safety of the system, a full functional test must be conducted and a successful result obtained after a device has been replaced.

#### Note

Only replace a defective device with a device of an identical article number.

1. Disconnect the defective device at the terminals.
  - Chapter for 22.5 mm devices Disconnecting (Page 177)
  - Chapter for 90 mm devices Disconnecting (Page 184)
2. Deinstall the defective device.
  - Chapter "Removing devices from a standard mounting rail (Page 144)"
  - Chapter "Removing 22.5 mm/17.5 mm devices with device connectors from a standard mounting rail (Page 148)"
  - Chapter "Removing 90 mm devices with device connectors from a standard mounting rail (Page 155)"

3. Mount the new device
  - Chapter "Mounting the devices on a level surface (Page 138)"
  - Chapter "Mounting 22.5 mm/17.5 mm devices on a standard mounting rail (Page 142)"
  - Chapter "Mounting the 90 mm devices on a standard mounting rail (Page 143)"
  - Chapter "Mounting 22.5 mm/17.5 mm devices with device connectors on the wall (Page 157)"
  - Chapter "Mounting 90 mm devices with device connectors on the wall (Page 163)"
4. Connect the defective device at the terminals
  - Chapter for 22.5 mm devices "Connecting the screw-type terminals (Page 171)", "Connecting the push-in terminals (Page 173)" and "Attaching the terminals (Page 176)"
  - Chapter for 90 mm devices "Connecting terminals (Page 181)" and "Mounting terminals (Page 183)"
5. Set the DIP switches/slide switches and, if applicable, the times according to the defective device.

After applying the supply voltage, the new 3SK1 basic unit checks whether the hardware configuration matches the device configuration.

If there are no deviations, the system re-enters safety mode.





## Configuration / operation

### 10.1 Procedure for configuration

#### General information:

- It is only possible to change the configuration (DIP switch, NC/NO evaluation, potentiometer, input and output expansion) in configuration mode. Modifications during operation are not accepted.
- A configuration change (DIP switch, NC/NO evaluation, potentiometer) is indicated in safety mode by the "DEVICE" LED flashing green/yellow, but does not change the device function.
- In safety mode, if a change in the system configuration (input and output expansion) is detected, the device switches to error mode ("DEVICE" LED and "SF" LED red). A restart is only possible using Power OFF/ON.

#### Procedure for configuring a basic unit

1. Set the configuration (DIP, PAR, potentiometer, input expansion, output expansion) in accordance with the desired function.
2. Connect the power supply.
3. If the device detects a modified configuration, it remains in configuration mode (LEDs flash) during power up.
4. Confirm the new configuration by operating the SET/RESET pushbutton for more than 1s.
5. The configuration has been accepted and the device changes to safety mode.

---

#### Note

##### Configuration and setting the delay time

A change to the configuration must only ever be carried out when the system is disconnected from the power.

In safety mode, an adjustment to the potentiometer does not result in a change to the parameterized delay time.

A change to the potentiometer setting made during operation is not accepted and is indicated in safety mode by a yellow/green flashing "DEVICE" LED. The device can be restarted by performing a RESET (pressing the SET/RESET button) or by disconnecting and reconnecting the supply voltage. Following a restart, the device remains in safety configuration mode during power up (all safety-related outputs are shut down) until the new delay time is accepted by pressing the SET/RESET button.

---

## 10.2 Explanation of the device's functions

### Explanation of the device functions (DIP switches)

| DIP switch | Parameter               | Function  |
|------------|-------------------------|---|
| 1          | Start type              | <ul style="list-style-type: none"> <li>• <b>Autostart:</b> The safety-related outputs are switched to the active position as soon as the switch-on condition is satisfied at the sensor inputs IN1, IN2, INF and INK. The START button connecting terminal INS is not queried.</li> <li>• <b>Monitored start:</b> The safety-related outputs are switched to the active position as soon as the switch-on condition is met at the IN1, IN2, INF and INK sensor inputs and the START button at the INS terminal is actuated (start with the falling edge).</li> </ul>  |
| 2          | Cross-circuit detection | <p>Cross-circuit detection is only possible with floating sensors. The sensors must be connected between T1 - IN1 and T2 – IN2. At the terminals IN1 and PAR (if used), the test signal of terminal T1 is expected; at the terminals IN2 and INF , the test signal of T2 is expected. The device detects a sensor fault if the signal at the terminals IN1, PAR or IN2, INF does not match the test signals T1, T2.</p> <p>Cross-circuit detection must be deactivated if electronic sensors such as light arrays or laser scanners are connected. The 3SK1 now no longer monitors the sensor inputs for cross-circuit detection. Usually, the outputs of safety sensors (OSSD) are already monitored for cross-circuits in the sensor.</p> <p>Devices with PAR terminals expect the test signal T2 at the parameterization input. A 24 V signal at the PAR or INF terminals results in a fault (cross-circuit at the input).</p> |
| 3          | Type of connection      | <ul style="list-style-type: none"> <li>• <b>1 sensor with 2 contacts</b> (1 x 2-channel) (NC/NC).<br/>It is expected here that both contacts be open simultaneously.<br/>With the additional connection of T1 to PAR, this DIP parameterization applies to ONE 2-channel sensor with NC/NO contacts.</li> <li>• <b>2 sensors with one contact each</b> (2 x single-channel) (NC/NC).<br/>It is expected that both sensors are ANDed. Simultaneity is not monitored.</li> </ul>  |
| 4          | Startup testing         | After a power failure, startup testing requires that the sensors at IN1 and IN2 are actuated once by the system operator.   |

## Function of the cascading input (INK terminal)

### 1. Safe combination of safety relays

In this application, a higher-level safety relay switches off the 3SK1 safety relay via the cascading input via a safe output.

Example:

an EMERGENCY STOP circuit is to deactivate the entire installation as a higher-level circuit.

Several function groups (e.g., protective doors) that disconnect locally can be operated as subordinate units.



### WARNING

#### Application / safety relay safety level

The safety level (PL/SIL) of the application corresponds to the lowest safety level of a subsystem of the application when errors are excluded (protected wiring of the control cable).

### 2. Additional safety sensor circuit

The INK cascading input is ANDed with sensor inputs IN1, IN2 .

PL c in accordance with ISO 13849-1, or SIL1 in accordance with IEC 62061 can be achieved if the cascading input is wired with single-channel (positive opening) safety sensors (supply via A1 / +24 V (identical potential to A1) and if the connecting cable is laid in a protected fashion. The start function for the cascading input INK corresponds to the start response of sensor inputs IN1 and IN2 (autostart or monitored start).

The cascading input INK can be triggered with floating or solid-state contact blocks (switching to P potential). Floating contact blocks must be connected between A1 / +24 V (identical potential to A1) and the cascading input.

### 3. Normal switching duty

The INK cascading input can also be used for normal switching duty (not safe). The INK cascading input can be activated in this case with floating contact blocks or with solid-state contact blocks (switching to P potential).

Floating contact blocks must be connected between A1 / +24 V and INK .

It is important to note that the start function of cascading input INK corresponds to the start function of sensor inputs IN1, IN2 .

When using a 3SK1 safety relay with instantaneous and time-delayed contacts, the two following safety notes must always be observed:

|   |
|---|
| <b>NOTICE</b>   |
| <b>In the event of external faults such as:</b> <ul style="list-style-type: none"><li>• Cross-circuit fault</li><li>• Short circuit to ground</li><li>• Current-source short circuit</li></ul> and to access the configuration mode for copying a delay time after a reset, the following device behavior must always be taken into account:<br><br>The outputs of stop category 0 switch instantaneously, while the outputs of stop category 1 have a time delay.<br>The sequence cannot be interrupted.<br>Exception: Switching off the power supply. |

|  |
|--|
| <b>NOTICE</b>  |
| <b>Saving the starting command:</b> <ol style="list-style-type: none"><li>1. If the safe state is restored during the time delay, (e.g. the protective door is closed) and the START button is actuated, the safety-related outputs switch to the active position immediately after the delay time has elapsed.<br/>The actuation of the START button is saved.<br/>The OFF-delayed enabling contacts or outputs of the safety relays 3SK112*-*CB4* (relay and semiconductor outputs) cannot be retriggered. This means that if an OFF command in the sensor circuit is canceled before the delay time has elapsed, the delay time still elapses in full length. If a start command has been issued during this time or if autostart has been set, after this time has elapsed the OFF-delayed enabling contacts switch off briefly and switch on again immediately with the instantaneous enabling contacts (start command is saved).</li><li>2. If a sensor is actuated at an input expansion within the system configuration, the entire system is disconnected. If the START button on the basic unit is then pressed while the sensor on the input expansion is actuated (for instance, if the protective door is open), the command will be saved by the basic unit. This results in an automatic start of the system once the sensor at the input expansion is reset (for example, a protective door is closed again). This system response is identical in the system configuration for all 3SK1 basic units.</li></ol> For additional notes/explanations on this topic, see the following FAQ ( <a href="https://support.industry.siemens.com/cs/ww/en/view/103655974">https://support.industry.siemens.com/cs/ww/en/view/103655974</a> ) |

|  |
|--|
| <b>NOTICE</b>  |
| <b>Observe the following in the case of protective doors with tumblers:</b><br><br>If the voltage $U_s$ is disconnected on devices with time-delayed outputs between switching the instantaneous outputs and the time-delayed outputs, the delay time expires when the voltage $U_s$ is restored, and the time-delayed contacts change their switch positions. |

## 10.3 Modes

The 3SK1 safety relays have four main operating modes:

- Power-up
- Configuration mode
- Safety mode
- Error mode

### Power-up

On powering up (up to 7 seconds), the 3SK1 safety relay runs through a complete function test.

### Configuration mode

A saved configuration can only be modified in configuration mode.

The configuration must only ever be modified after disconnecting the power supply.

If the device detects a configuration change during the restart (DIP, PAR, potentiometer, input expansion, output expansion), it does not change automatically to safety mode after power up, but instead remains in configuration mode.

In configuration mode, the LEDs (yellow) whose DIP switch position is ON (right) flash; all other parameter settings are not explicitly indicated.

The configuration is accepted by pressing the SET/RESET button for approximately 1s.

In configuration mode, the device is in the safe state. No monitoring functions are active.

---

#### Note

A configuration change made during operation is not accepted, and in safety mode, this is indicated by a yellow/green flashing "DEVICE" LED. The device can be restarted by performing a RESET (pressing the SET/RESET button) or by disconnecting and reconnecting the supply voltage.

---

### Safety mode (DEVICE LED: green)

In safety mode, all monitoring functions are active in accordance with the set configuration.

---

#### Note

Parameterized startup testing is indicated by a green flashing "DEVICE" LED. Only when this has been successfully executed does the "DEVICE" LED show a green light.

---

### Error mode

Error mode is indicated by a red "DEVICE" LED or by a red "SF" LED. In error mode, the device **ALWAYS** changes to the safe state.

## 10.4 Response times

### Verification of response times in the case of safety circuits

When safety equipment is commissioned, steps must be taken to verify that a safety-related output will switch off within a maximum permissible response time if the input signal changes at the relevant input.

To provide this verification, you must determine the total response time of the application you have configured.

---

#### Note

Note that the calculation of the response time affects the level of safety and governs the overall design of the system.

---

You can find the response data of the safety relays in the technical specifications of the respective devices in the chapter "Technical data (Page 203)".

You can find the response data of the 3RM1 Failsafe motor starters in the technical specifications in the manual "SIRIUS 3RM1 motor starters (<http://support.automation.siemens.com/WW/view/EN/66295730>)".

### Calculation of the response times

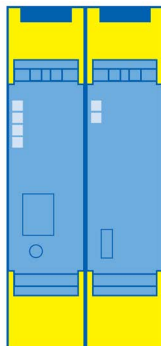
To calculate the response times of the overall system configuration, you must add up the individual response times of all input expansions affected by deactivation and also the response time of the basic unit.

If output expansions are used, the response times of the relevant output module are also added to the total time from the sensor to the actuator.

### Examples

#### Example 1

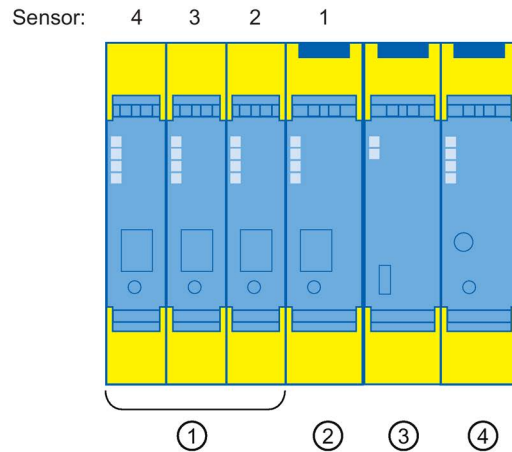
3SK1121-.AB40 + 3SK1211.BB40



Response time: 40 ms 50 ms

**Example 2**

3 x 3SK1220 + 3SK1122-AB40 + 3SK1211-BB40 + 3RM1 Failsafe motor starter



- ① 3SK1220 input expansions
- ② 3SK1122 basic unit
- ③ 3SK1211 output expansion
- ④ 3RM1 Failsafe motor starters

Abbreviations in the following formulas:

GG = basic unit; EE = input expansion; AE = output expansion

In the event of shutdown by sensor 1, the total response time is calculated as follows:

- Basic unit = 40 ms
- 3SK1211 output expansion =  $GG + AE = 40 \text{ ms} + 10 \text{ ms} = 50 \text{ ms}$
- 3RM1 Failsafe =  $GG + 3RM1 \text{ Failsafe} = 40 \text{ ms} + 3RM1 \text{ Failsafe motor starter response time}$

In the event of shutdown by sensor 3, the total response time is calculated as follows:

- Basic unit =  $GG + EE 1 + EE 2 = 3 \times 40 \text{ ms} = 120 \text{ ms}$
- 3SK1211 output expansion =  $GG + EE 1 + EE 2 + AE 3SK1211 = 120 \text{ ms} + 10 \text{ ms} = 130 \text{ ms}$
- 3RM1 Failsafe =  $120 \text{ ms} + 3RM1 \text{ Failsafe motor starter response time}$

In the event of shutdown by sensor 4, the total response time is calculated as follows:

- Basic unit =  $3 \times \text{response time EE} + \text{response time GG} = 160 \text{ ms}$
- 3SK1211 output expansion =  $\text{total response time EE with GG} + AE = 170 \text{ ms}$
- 3RM1 Failsafe =  $160 \text{ ms} + 3RM1 \text{ Failsafe motor starter response time}$





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**Note**

Since commissioning of the 3SK1 safety relays is an important, safety-related step, it must be carried out by qualified personnel.

---

** WARNING****Hazardous Voltage**

**Can Cause Death, Serious Injury, or Property Damage.  
Carry out function test of the plant.**

To ensure the safety of the system, a full functional test of the system must be conducted after commissioning, and a successful result obtained.

## Commissioning 3SK1 safety relays

3SK1 safety relays are commissioned by applying the operating voltage.

After the supply voltage has been applied, all LEDs show a green light for about 1 s (lamp test). The LEDs then go out for approx. 0.5 s. The configuration of the device is then displayed on the configuration LEDs for approx. 3 s.

If no configuration change (DIP, PAR, potentiometer, input expansion, output expansion) has been detected, the device changes automatically to safety mode and is ready for operation. However, if the device detects a deviation of the set parameters from the saved configuration, it remains in safe configuration mode until the new configuration is accepted by pressing the SET/RESET button.

---

**Note****Observe the following during commissioning:**

The cascading input must be jumpered ( 24 V DC) if it is not to be used.

Monitoring of the feedback circuits is not optional.

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## Display and diagnostics

### 12.1 LED display

The LED indications of the Advanced safety relays are shown in the tables below. You can find the LED indications of the Standard safety relays in the chapter "Display of the operating state (Page 52)".

| LED        | Display               | Explanation   |
|------------|-----------------------|---|
| (1) DEVICE | OFF*                  | No voltage, group error<br>Configuration mode DIP (1) position: <b>left</b>   |
|            | Green                 | Device is ready for operation<br>Power-up: hardware test  |
|            | Green flashing        | Missing startup testing<br>Short-circuit on the SET/RESET button  |
|            | Yellow                | Power-up DIP (1) position: <b>right</b>   |
|            | Yellow flashing       | Configuration mode DIP (1) position: <b>right</b>   |
|            | Green/yellow flashing | Configuration changed   |
|            | Red                   | Device error  |
| (2) OUT    | OFF*                  | Output inactive<br>Configuration mode DIP (2) position: <b>left</b>   |
|            | Green                 | Output active<br>Power-up: hardware test  |
|            | Green flashing        | Feedback circuit error<br>Short-circuit on the SET/RESET button   |
|            | Yellow                | Power-up DIP (2) position: <b>right</b>   |
|            | Yellow flashing       | Configuration mode DIP (2) position: <b>right</b><br>START button pressed too long  |
|            | Green/yellow flashing | Instantaneous outputs inactive, delayed outputs active  |
| (3) IN     | OFF*                  | Start conditions not fulfilled<br>Configuration mode DIP (3) position: <b>left</b>  |
|            | Green                 | Start conditions fulfilled<br>Power-up: hardware test   |
|            | Green flashing        | <ul style="list-style-type: none"> <li>• For 1x2-channel: Simultaneity of sensors not fulfilled</li> <li>• Two-hand operation: time monitoring violated</li> <li>• For monitored start: START button not yet pressed</li> </ul> Short-circuit on the SET/RESET button |
|            | Yellow                | Power-up DIP (3) position: <b>right</b>   |
|            | Yellow flashing       | Short-circuit of T1/T2 to ground or 24 V<br>With input expansion: missing enabling signal of input expansion<br>Group error: Cross-circuit at input<br>Configuration mode DIP (3) position: <b>right</b>  |
|            | Flickering yellow     | Configuration mode: Special two-hand operation configuration  |
|            | Flickering red        | Configuration mode: impermissible configuration   |

| LED    | Display         | Explanation  |
|--------|-----------------|--|
| (4) SF | OFF*            | No group error<br>Configuration mode DIP (4) position: <b>left</b>   |
|        | Green           | Power-up: hardware test  |
|        | Green flashing  | Short-circuit on the SET/RESET button  |
|        | Yellow          | Power-up DIP (4) position: <b>right</b>  |
|        | Yellow flashing | Configuration mode DIP (4) position: <b>right</b>  |
|        | Red             | Group error (e.g. cross-circuit at input, short-circuit to P, device configuration changed)  |
|        | Red flashing    | Error message (e.g. short-circuit T1/T2, violation of simultaneity, violation of two-hand operation timeout, feedback circuit error, START-button pressed too long), connection of control supply voltage (A1/A2) to an expansion unit that is connected via a device connector) |

\* LED flashes briefly in configuration mode due to lamp test

## 12.2 Power-up

### Display mode during power-up / parameterization in configuration mode

| LED        | Display                   | Explanation  |
|------------|---------------------------|--|
| (1) DEVICE | Yellow or yellow flashing | Monitored start  |
|            | Off                       | Autostart  |
| (2) OUT    | Yellow or yellow flashing | Cross-circuit detection ON                                   |
|            | Off                       | Cross-circuit detection off                                  |
| (3) IN     | Yellow or yellow flashing | 1 x two-channel  |
|            | Flickering yellow         | Configuration mode: Special two-hand operation configuration |
|            | Flickering red            | Configuration mode: impermissible configuration              |
|            | Off                       | 2 x single-channel   |
| (4) SF     | Yellow or yellow flashing | Startup testing off  |
|            | Off                       | Startup testing ON   |

## 12.3 Error statuses

| LED        | Display      | Explanation   |
|------------|--------------|---------------|
| (1) DEVICE | Red          | Device error  |
| (4) SF     | Red          | Group error   |
|            | Red flashing | Fault message |

## 12.4 Diagnostics

### Power-up

| Explanation   | DEVICE   | OUT            | IN             | SF             |
|---|--|----------------|----------------|----------------|
| Hardware test<br>(note: (input expansions remain in this state until acknowledged by the device on the right-hand side)           | Green  | Green          | Green          | Green          |
| The SET/RESET button is stuck, or has been pressed too long. The device remains in this state until the button is released again. | Green flashing   | Green flashing | Green flashing | Green flashing |
| Display of DIP switch configuration   | If the DIP switch position is at ON (right), the relevant LED shows a yellow light |                |                |                |

### Configuration

| Explanation  | DEVICE   | OUT  | IN                | SF   |
|--|--|--|-------------------|--|
| Indication of a modified configuration                                       | If the DIP switch position is at ON (right), the relevant LED flashes yellow |  |                   |  |
| Special configuration, two-hand operation<br>(NC/NO, autostart, 2x1-channel) | Off  | If the DIP switch position is at ON (right), the relevant LED flashes yellow | Flickering yellow | If the DIP switch position is at ON (right), the relevant LED flashes yellow |
| Impermissible configuration<br>(NC/NO, monitored start, 2x1-channel)         | Yellow flashing  | If the DIP switch position is at ON (right), the relevant LED flashes yellow | Flickering red    | If the DIP switch position is at ON (right), the relevant LED flashes yellow |
| All DIP switches are at OFF (left)   | All LEDs light up briefly (yellow) at intervals                              |  |                   |  |

**Safety mode**

| Explanation  | DEVICE                | OUT                   | IN              | SF              |
|--|-----------------------|-----------------------|-----------------|-----------------|
| No startup testing   | Green flashing        | Off                   | Off             | Off             |
| Device ready for operation, all outputs OFF  | Green                 | Off                   | Off             | Off             |
| Device ready for operation, all outputs ON   | Green                 | Green                 | Green           | Off             |
| Device ready for operation, instantaneous outputs OFF, time-delayed outputs ON             | Green                 | Green/yellow flashing | Off             | Off             |
| For monitored start: START button not yet pressed  | Green                 | Off                   | Green flashing  | Off             |
| With input expansion: missing enabling signal of input expansion                           | Green                 | Off                   | Yellow flashing | Off             |
| Configuration has been changed (PAR, DIP switch, potentiometer)                            | Green/yellow flashing | — <sup>1)</sup>       | — <sup>1)</sup> | — <sup>1)</sup> |
| For 1x2-channel: Simultaneity violated<br>For two-hand operation: time monitoring violated | Green                 | Off                   | Green flashing  | Red flashing    |
| Short-circuit test clock output T1 or T2   | Green <sup>2)</sup>   | Off                   | Yellow flashing | Red flashing    |
| For monitored start: START button was pressed too long or has a short-circuit              | Green                 | Yellow flashing       | Off             | Red flashing    |
| Feedback circuit error   | Green                 | Green flashing        | Green           | Red flashing    |

<sup>1)</sup> Dependent on device status

<sup>2)</sup> Green flashing DEVICE LED: No startup testing

**Error mode**

| Explanation   | DEVICE            | OUT               | IN                            | SF                |
|---|-------------------|-------------------|-------------------------------|-------------------|
| Device fault (restart possible by pressing the SET/RESET button)                            | Red               | Off <sup>3)</sup> | Off <sup>3)</sup>             | Off <sup>3)</sup> |
| Group error (restart possible by pressing the SET/RESET button)                             | Off <sup>3)</sup> | Off <sup>3)</sup> | Off <sup>3)</sup>             | Red               |
| Group error, cross-circuit at the input (restart possible by pressing the SET/RESET button) | Off <sup>3)</sup> | Off <sup>3)</sup> | Flashing yellow <sup>3)</sup> | Red               |
| System stop (restart possible by disconnecting and re-connecting the operating voltage)     | Red               | Off <sup>3)</sup> | Off <sup>3)</sup>             | Red               |

<sup>3)</sup> On time-delayed devices, the LED flashes green/yellow provided the time-delayed outputs are still switched on

## Technical data

### 13.1 Data sheet

You can find all the technical data of the product in the Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/>).

1. Enter the full article number of the desired device in the "Product" field, and confirm with the Enter key.
2. Click the "Technical data link."

### 13.2 General technical data

Technical data valid for all 3SK1 products in this manual.

|  |     |   |
|--|-----|---|
|  |     |   |
| <b>Product brand name</b>  |     | SIRIUS                                  |
| <b>Product designation</b>   |     | Safety relay                            |
| <b>Type of product</b>   |     | for EMERGENCY STOP and protective doors |
| <b>IP degree of protection of the enclosure</b>  |     | IP20                                    |
| <b>Touch protection against electric shock</b>   |     | Safe from finger-touch                  |
| <b>Ambient temperature</b>   |     |   |
| <ul style="list-style-type: none"> <li>• During storage</li> <li>• During operation</li> </ul> | °C  | -40 ... +80<br>-25 ... +60              |
| <b>Air pressure</b>  |     |   |
| Comply with the instructions given for the respective devices                                  |     |   |
| <ul style="list-style-type: none"> <li>• According to SN 31205</li> </ul>                      | hPa | 900 ... 1060                            |

13.2 General technical data

|   |    |  |                                    |
|---|----|--|------------------------------------|
|   |    |  |                                    |
| <b>Relative air humidity</b><br>• During operation without condensation   | %  | 10 ... 95  |                                    |
| <b>Maximum installation altitude above sea level</b>  | m  | 2000   |                                    |
| <b>Vibration resistance according to IEC 60068-2-6</b>  |    | 5 ... 500 Hz: 0.75 mm  |                                    |
| <b>Degree of pollution</b>  |    | 3  |                                    |
| <b>Overvoltage category</b>   |    | III  |                                    |
| <b>Distance to be maintained at the side with side-by-side mounting</b>   | mm | 0  |                                    |
| <b>Distance to be maintained at the side from grounded parts</b>  | mm | 5  |                                    |
| <b>DC<sub>avg</sub></b><br>average diagnostics coverage level   |    | > 99 %   |                                    |
| <b>MTTF<sub>d</sub></b><br>Mean Time To dangerous Failure   |    | > 30 years   |                                    |
| <b>Reference designation</b><br>in accordance with DIN 40719, expanded in accordance with IEC 204-2 and IEC 750 |    | -  |                                    |
| <b>Reference designation</b><br>in accordance with DIN EN 61346-2   |    | F  |                                    |
| <b>Hardware failure tolerance</b><br>in accordance with IEC 61508   |    | 1  |                                    |
| <b>Mounting position</b>  |    | Any (except 3SK1213)<br>3SK1213: +/- 22.5° lateral inclination                   |                                    |
| <b>Type of mounting</b>   |    | Snap-on mounting<br>Comply with the instructions given for the respective device |                                    |
| <b>Type of electrical connection</b>  |    | 3SK...-1....<br>screw connection   | 3SK...-2....<br>push-in connection |
| <b>Maintenance</b>  |    | The 3SK1 safety relays are maintenance-free                                      |                                    |
| <b>Certificate of suitability</b><br>• TÜV approval<br>• UL certification<br>• CSA approval                     |    | Yes (except 3SK1230)<br>Yes<br>Yes   |                                    |



### Electrical service life of 3SK1 safety relays

#### Note

When using the devices to equip furnaces to DIN EN 50156-1, the load (utilization category) listed below must not be exceeded.

Electrical service life  $\geq 250000$  operating cycles at:

| Utilization category | 3SK111; 3SK1121; 3SK1211 | 3SK1213 |
|----------------------|--------------------------|---------|
| AC-1, 240 V          | 1.5 A                    | 10.0 A  |
| AC-15, 240 V         | 0.2 A                    | 10.0 A  |
| DC-13, 24 V          | 2.0 A                    | 3.0 A   |

#### Device versions

3SK1121-.AB40  
3SK1111-.AB30  
3SK1111-.AW20  
3SK1211-.BB40  
3SK1211-.BB00  
3SK1211-.BW20

| Utilization category | Ue (V) | Ie (A) | B10 <sub>d</sub> value<br>(operating cycles) | Electrical endurance<br>of safety-related outputs<br>(typical) |
|----------------------|--------|--------|--|--|
| AC-1                 | 240    | 5      | 500000                                       | 85000  |
|                      |        | 4      | 860000                                       | 140000   |
|                      |        | 2      | 1300000                                      | 210000   |
| AC-15                | 240    | 4      | 300000                                       | 50000  |
|                      |        | 3      | 850000                                       | 85000  |
|                      |        | 1      | 1100000                                      | 120000   |
| DC-13                | 24     | 5      | 300000                                       | 50000  |
|                      |        | 2      | 2000000                                      | 230000   |
|                      |        | 1      | 7000000                                      | 1100000  |
| DC-1                 | 24     | 5      |  | 500000   |

13.2 General technical data

Device version:  
3SK1121-.CB4.

| Utilization category | Ue (V) | Ie (A) | B10 <sub>d</sub> value<br>(operating cycles) | Electrical endurance<br>of safety-related outputs<br>(typical) |
|----------------------|--------|--------|--|--|
| AC-1                 | 240    | 5      | 500000                                       | 100000   |
|                      |        | 4      | 600000                                       | 100000   |
|                      |        | 2      | 1000000                                      | 170000   |
| AC-15:               | 240    | 3      | 400000                                       | 70000  |
|                      |        | 0.1    | 10000000                                     | 1500000  |
| DC-13                | 24     | 3      | 450000                                       | 110000   |
|                      |        | 1      | 2000000                                      | 480000   |
| DC-1                 | 24     | 5      |  | 500000   |

Device versions:  
3SK1213-.AB40  
3SK1213-.AJ20  
3SK1213-.AL20

| Utilization category | Ue (V) | Ie (A) | B10 <sub>d</sub> value<br>(operating cycles) | Electrical endurance<br>of safety-related outputs<br>(typical) |
|----------------------|--------|--------|--|--|
| AC-1                 | 240    | 10     | 1370000                                      | 1000000  |
| AC-15:               | 240    | 10     | 1370000                                      | 1000000  |
| DC-13                | 24     | 6      | 1370000                                      | 1000000  |

**PFH and PFDavg values of 3SK1 safety relays**

The table below shows the values of the:

- Average frequency of a hazardous failure of the safety function per hour (**PFH**) at a high demand rate in accordance with IEC 61508.
- Average probability of failure of the safety function upon demand (**PFDavg**) at a low demand rate in accordance with IEC 61508.

| Safety relay  | PFH [1/h]<br>less than | PFDavg<br>less than  |
|---------------|------------------------|----------------------|
| 3SK1111-.AB30 | 1.7 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1111-.AW20 | 1.5 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1112-.BB40 | 1.0 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1121-.AB40 | 2.5 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1121-.CB41 | 3.7 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1121-.CB42 | 3.7 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1121-.CB44 | 3.7 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1122-.AB40 | 1.3 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1122-.CB41 | 1.5 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1122-.CB42 | 1.5 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1122-.CB44 | 1.5 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1120-.AB40 | 1.3 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |
| 3SK1211-.BB40 | 1.7 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1211-.BB00 | 1.7 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1211-.BW20 | 1.7 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1213-.AB40 | 1.0 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1213-.AJ20 | 1.0 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1213-.AL20 | 1.0 E <sup>-09</sup>   | 1.0 E <sup>-06</sup> |
| 3SK1220-.AB40 | 1.0 E <sup>-09</sup>   | 7.0 E <sup>-06</sup> |



## Dimension drawings

### 14.1 Dimension drawings for 3SK1 devices

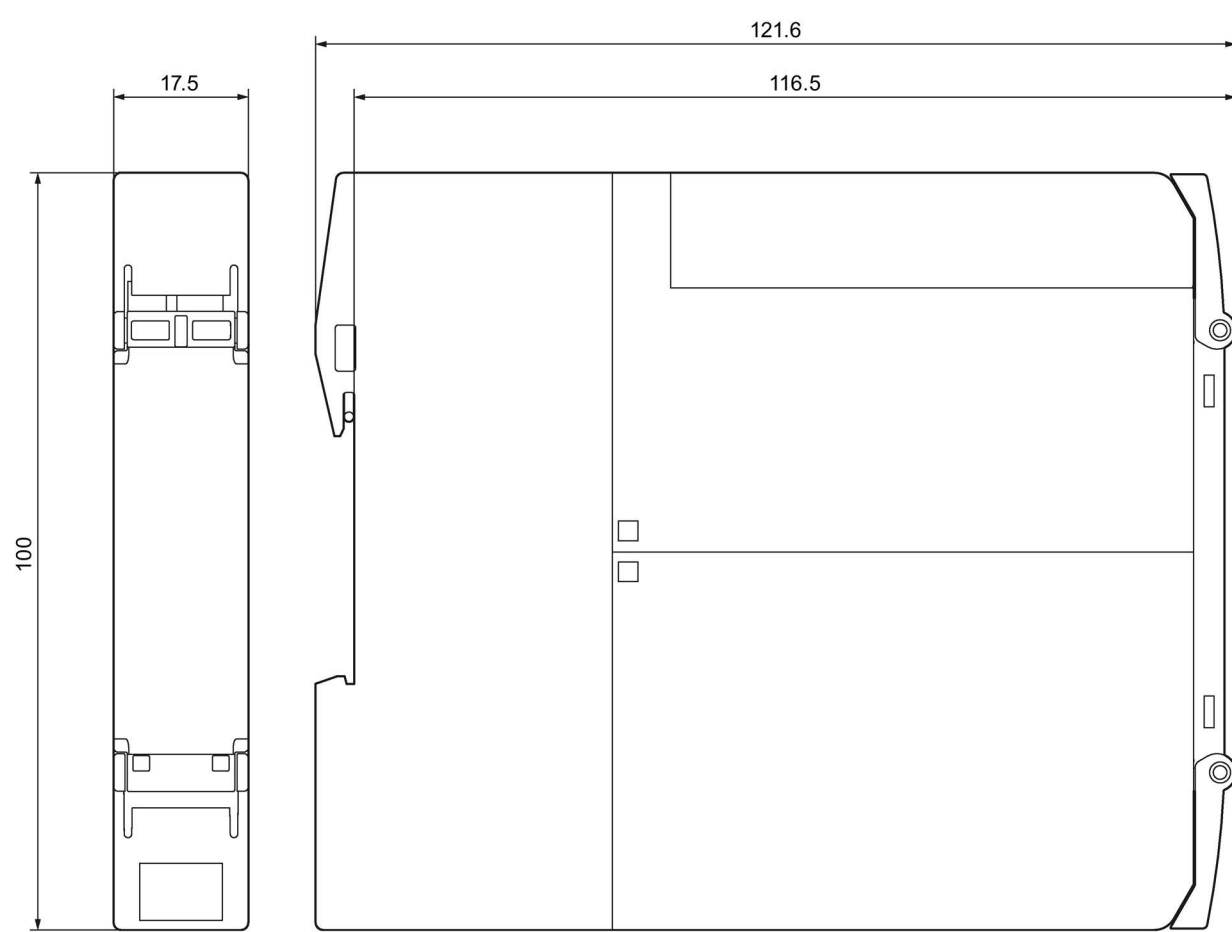


Figure 14-1 Enclosure 17.5 mm for safety relays:  
3SK1120-..... ; 3SK1220-.....

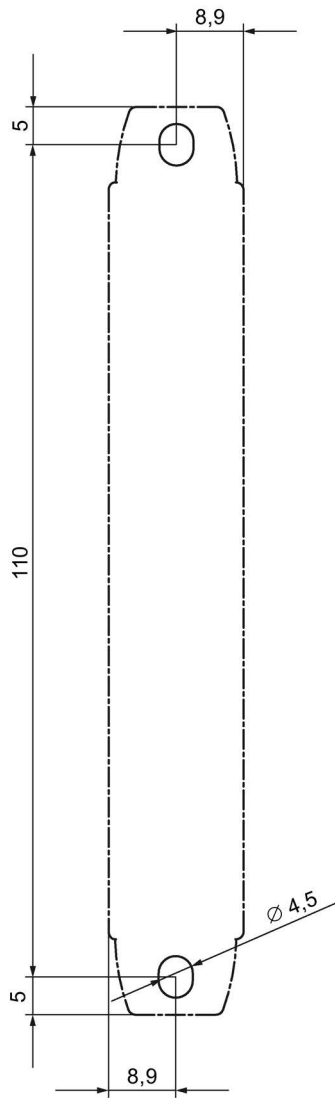


Figure 14-2 Drilling diagram, enclosure 17.5 mm

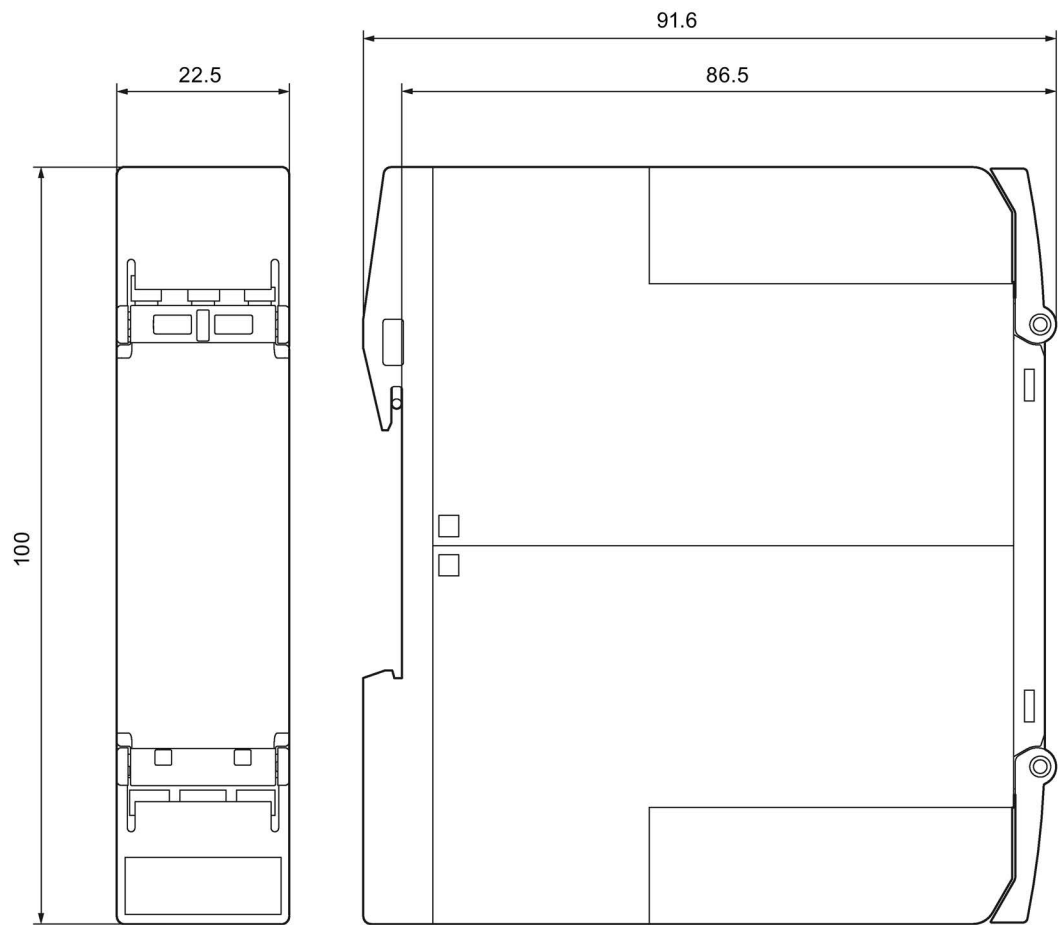


Figure 14-3 Enclosure 22.5 mm (short) for safety relays:  
3SK1112-.....

14.1 Dimension drawings for 3SK1 devices

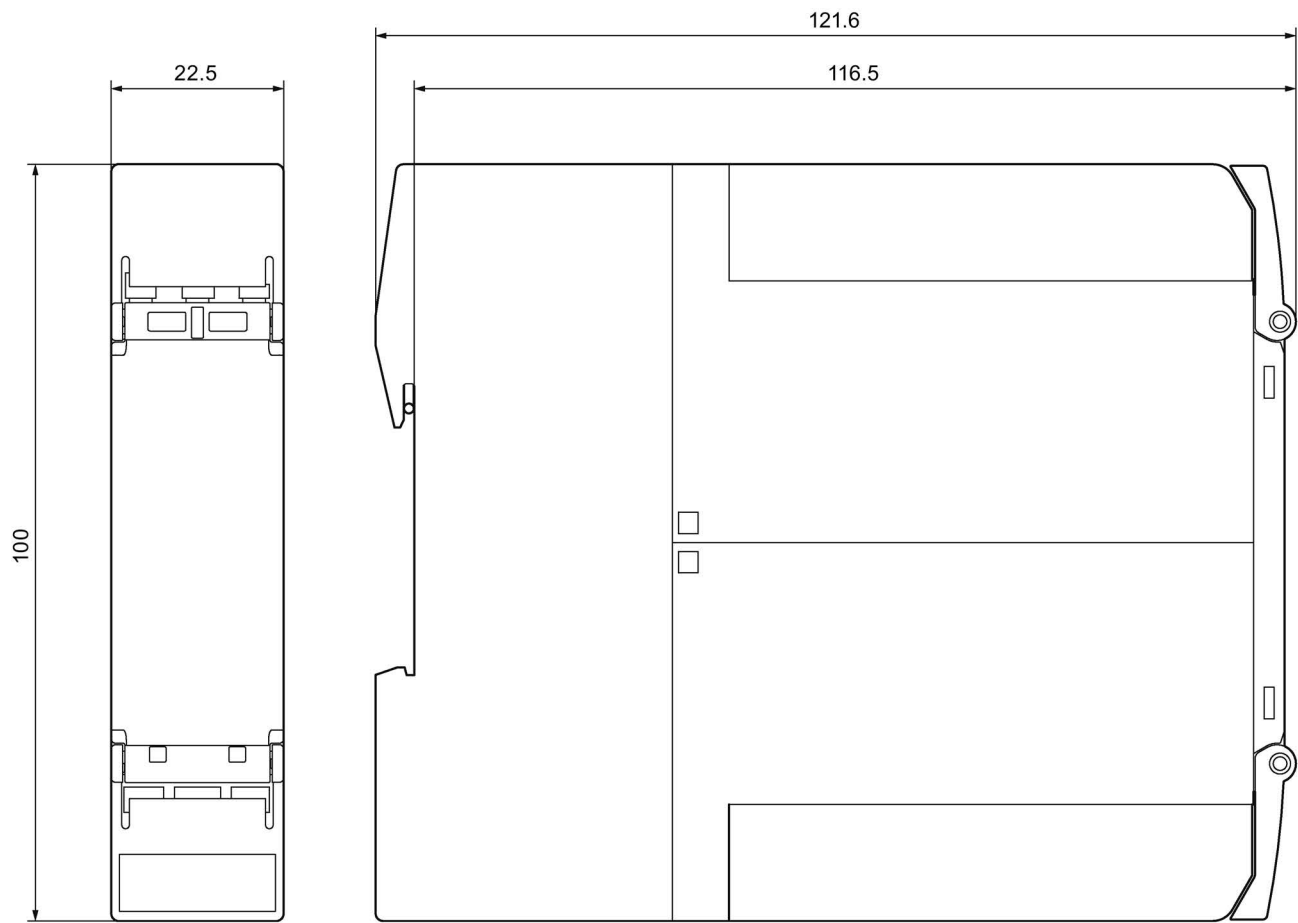


Figure 14-4 Enclosure 22.5 mm (long) for safety relays:  
3SK1111-..... ; 3SK1121-..... ; 3SK1122-..... ; 3SK1211-..... ; 3SK1230-.....



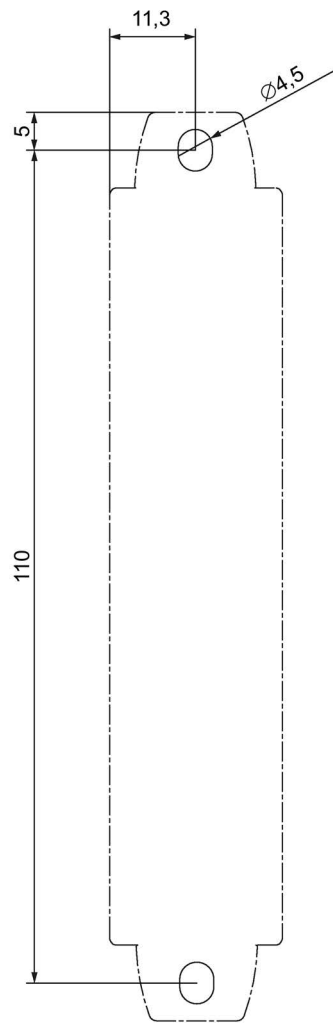


Figure 14-5 Drilling diagram, enclosure 22.5 mm

14.1 Dimension drawings for 3SK1 devices

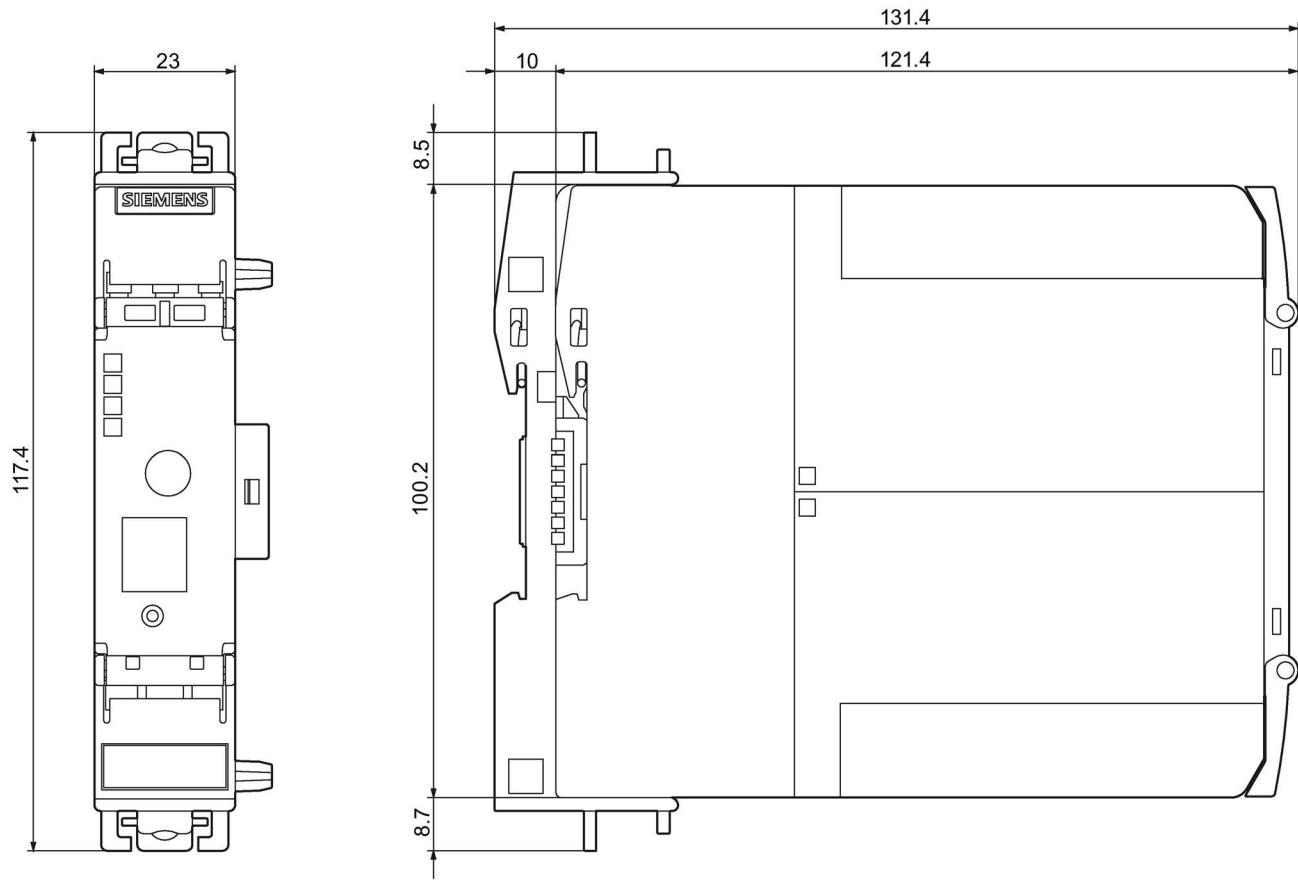


Figure 14-6 3SK1 device on device connector

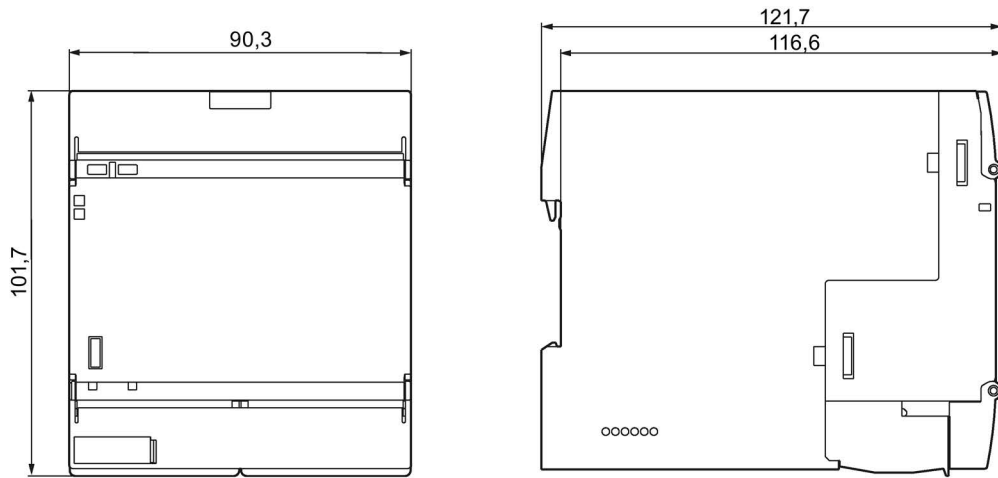


Figure 14-7 Enclosure 90 mm for safety relays:  
3SK1213-.....

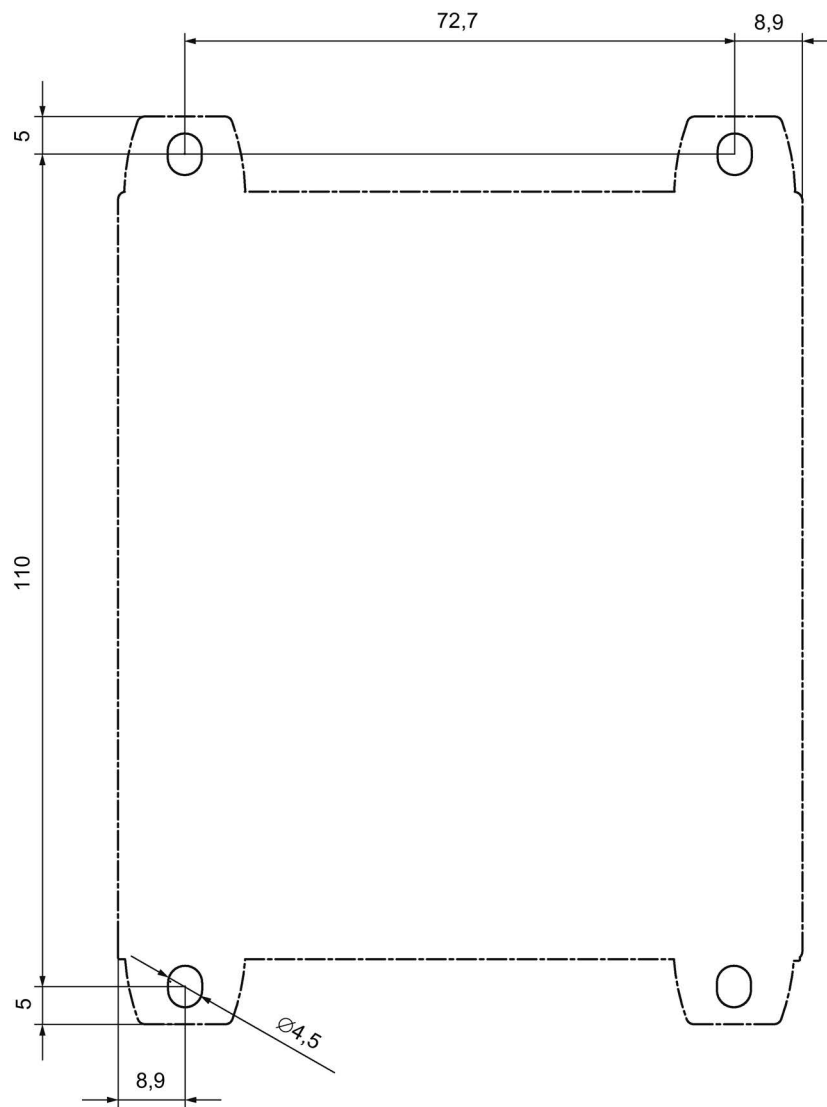


Figure 14-8 Drilling diagram, enclosure 90 mm

14.1 Dimension drawings for 3SK1 devices

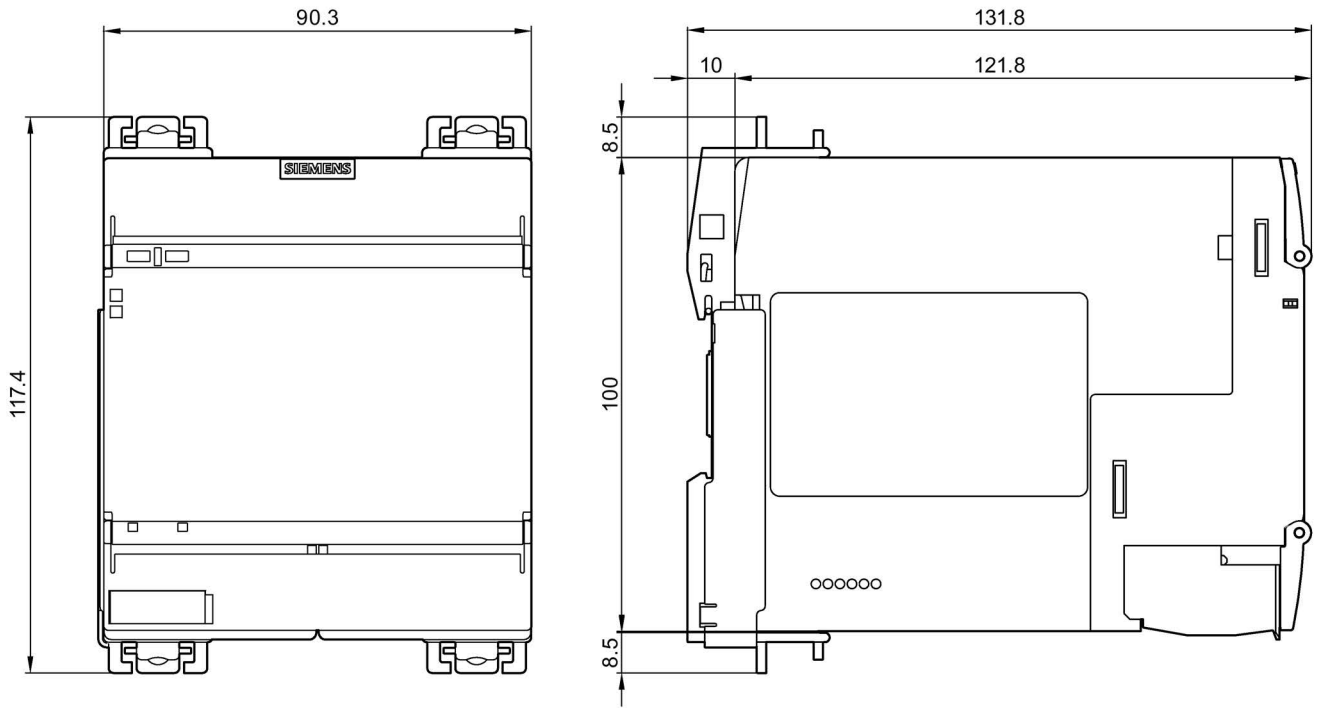


Figure 14-9 3SK1213 device on device connector

## 14.2 Dimension drawings for 3SK1 device connector

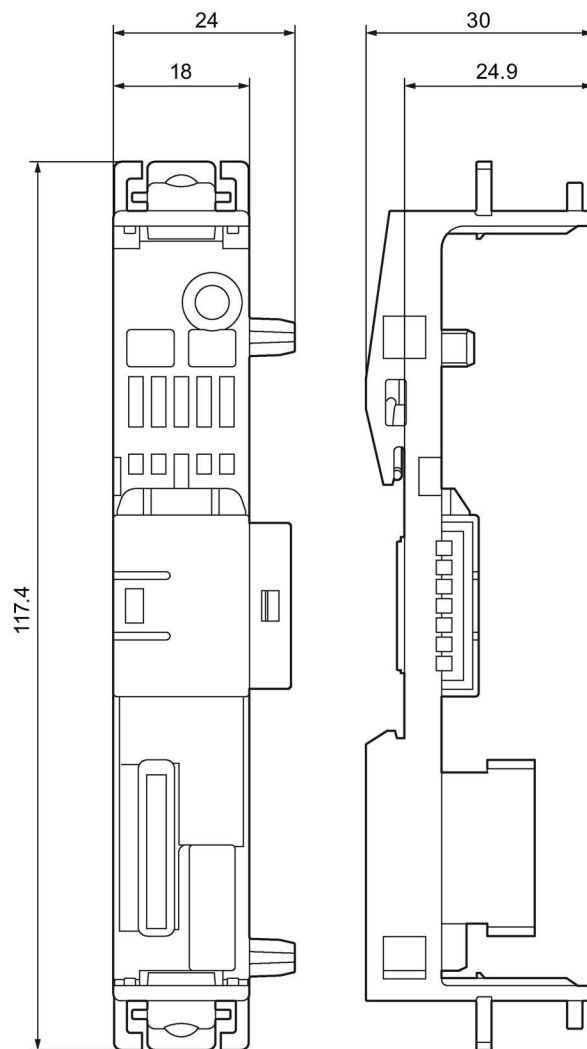


Figure 14-10 Device connector for 3SK1 safety relays, width: 17.5 mm

14.2 Dimension drawings for 3SK1 device connector

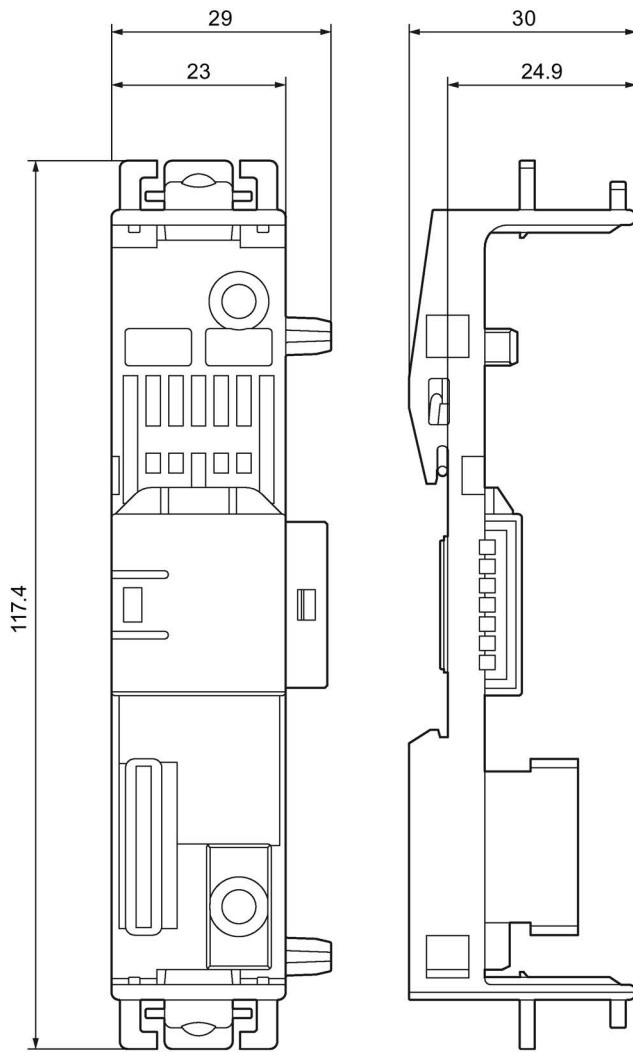


Figure 14-11 Device connector for 3SK1 safety relays, width: 22.5 mm

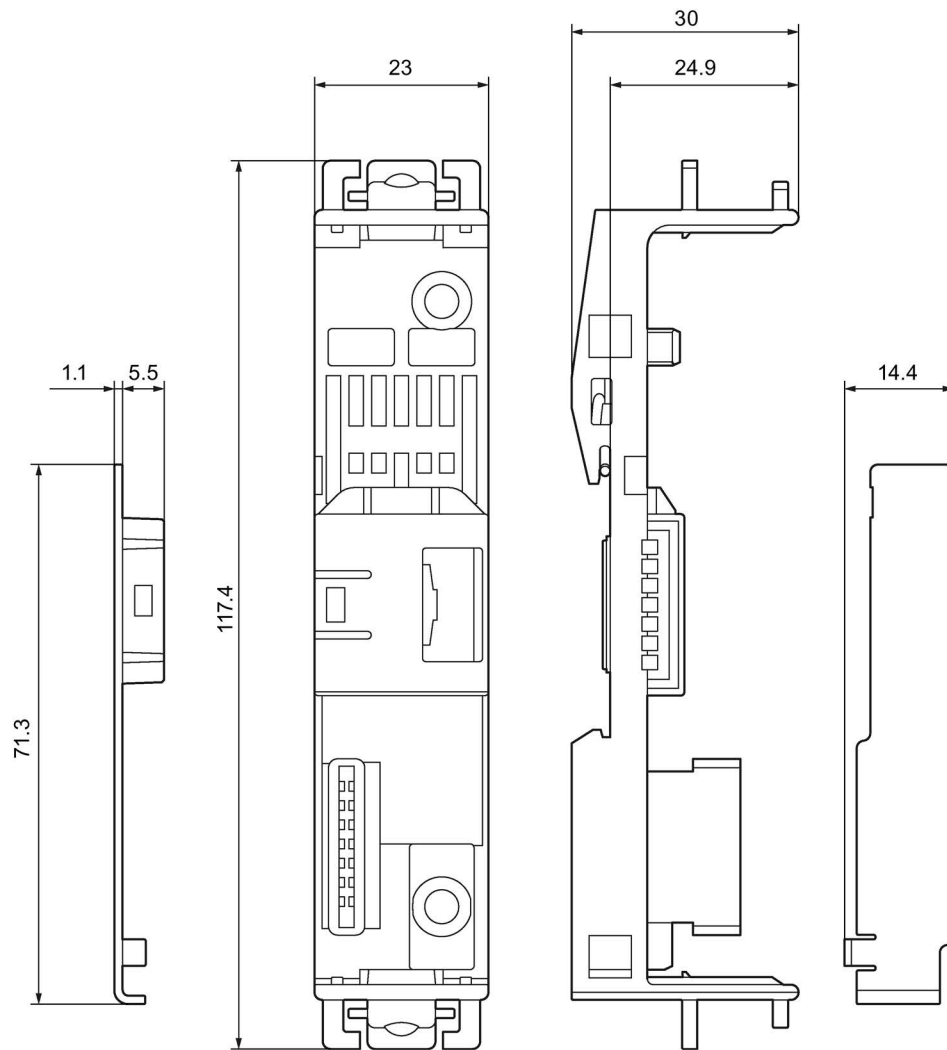


Figure 14-12 Device termination connector for 3SK1 safety relays, width: 22.5 mm

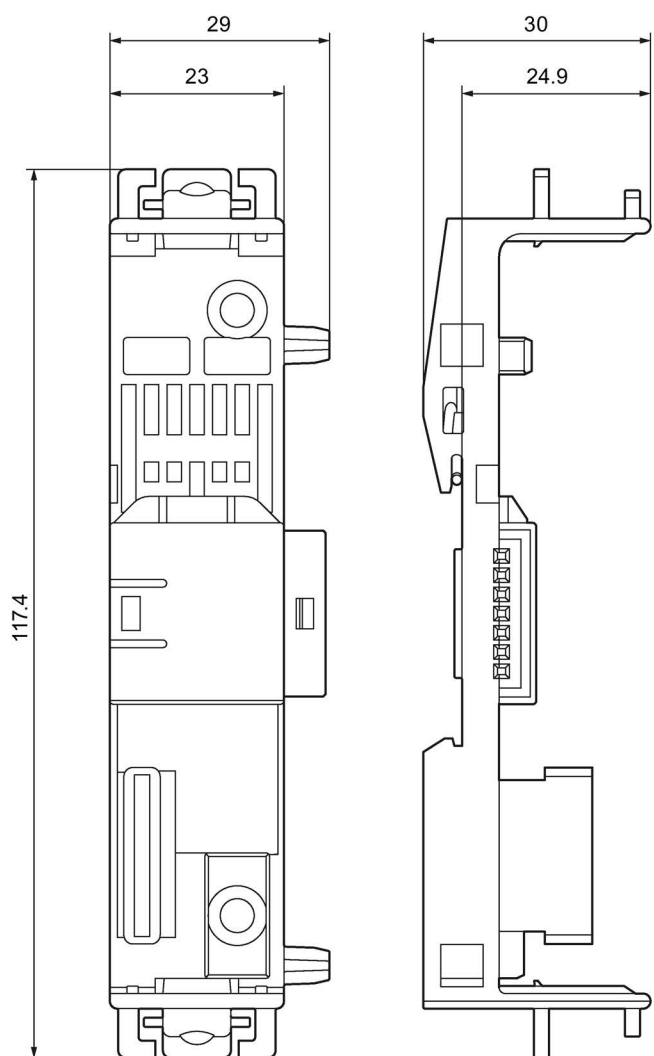


Figure 14-13 Device connector for 3RM1 motor starters, width: 22.5 mm



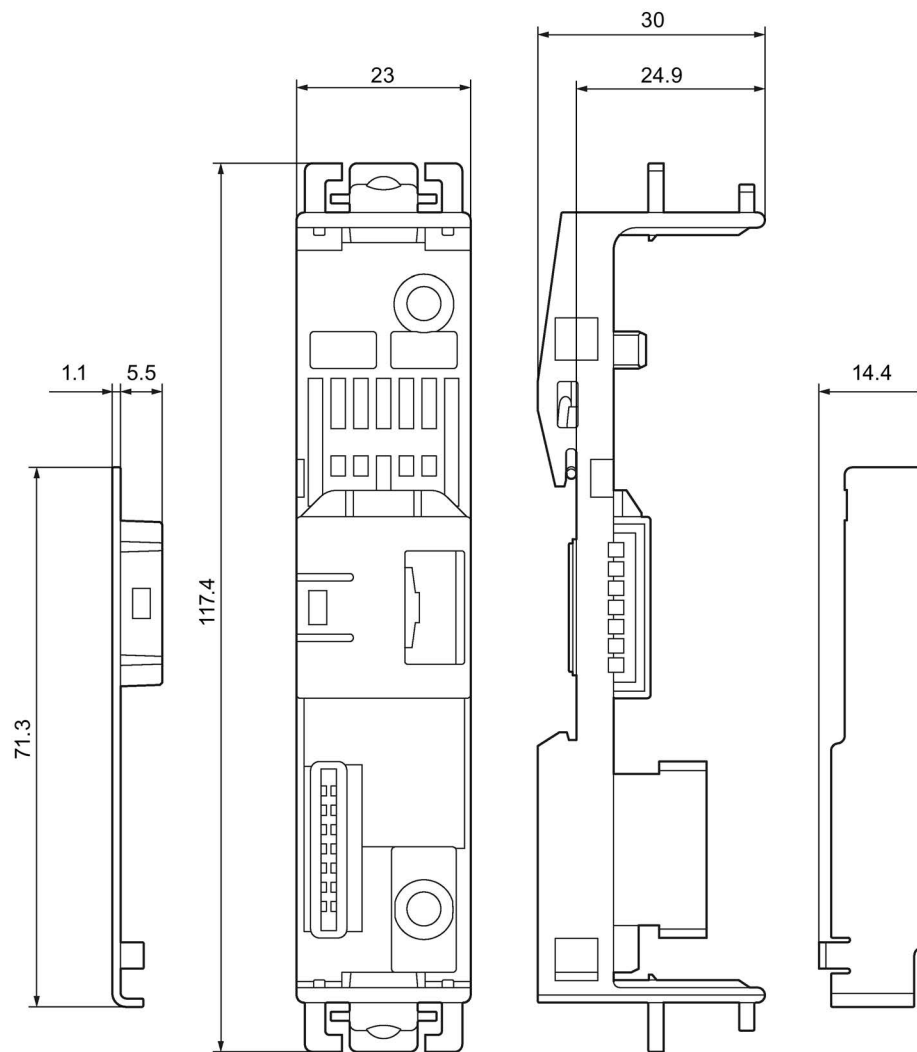


Figure 14-14 Device termination connector for 3RM1 motor starters, width: 22.5 mm

14.2 Dimension drawings for 3SK1 device connector

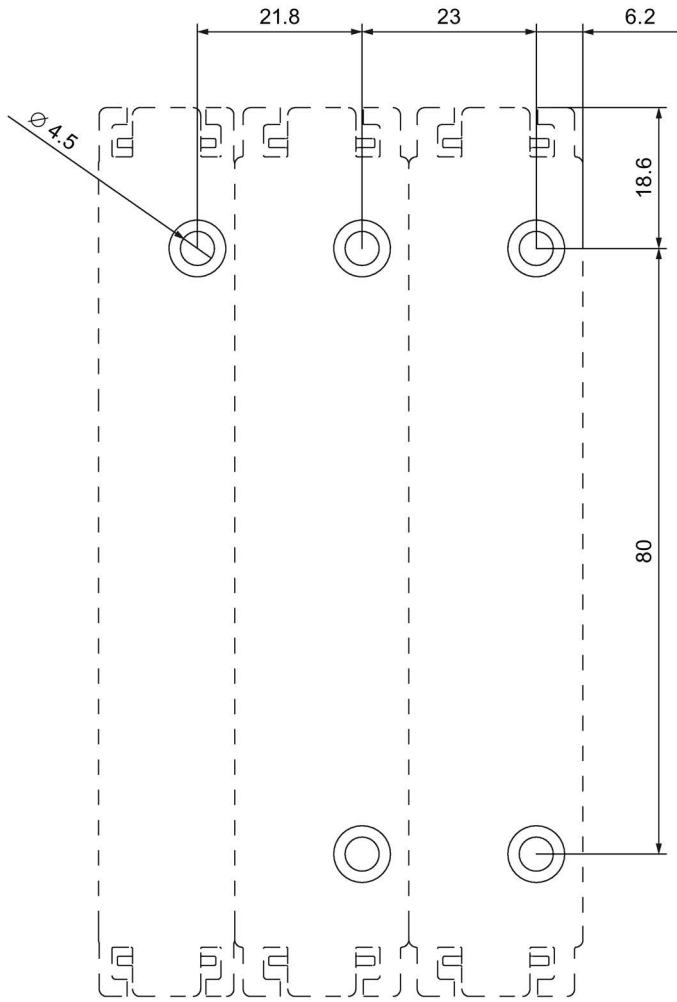


Figure 14-15 Drilling plan for 17.5 mm and 22.5 mm device connectors

## Accessories

The following accessories are available for the 3SK1 safety relay system.

| Designation  | Article number (MLFB) |
|--|-----------------------|
| SIRIUS terminal, 2-pole, screw-type, 1 x 2.5 mm <sup>2</sup>                                   | 3ZY1121-1BA00         |
| SIRIUS terminal, 3-pole, screw-type, 1 x 2.5 mm <sup>2</sup>                                   | 3ZY1131-1BA00         |
| SIRIUS terminal, 2-pole, push-in, 1 x 2.5 mm <sup>2</sup>                                      | 3ZY1121-2BA00         |
| SIRIUS terminal, 3-pole, push-in, 1 x 2.5 mm <sup>2</sup>                                      | 3ZY1131-2BA00         |
| SIRIUS device connector for 3SK1 safety relay,<br>17.5 mm wide                                 | 3ZY1212-1BA00         |
| SIRIUS device connector for 3SK1 safety relay,<br>22.5 mm wide                                 | 3ZY1212-2BA00         |
| SIRIUS device termination connector for 3SK1 safety relay,<br>22.5 mm wide                     | 3ZY1212-2DA00         |
| SIRIUS device connector for 3RM1 motor starters,<br>22.5 mm wide                               | 3ZY1212-2EA00         |
| SIRIUS device termination connector for 3RM1 motor starters,<br>22.5 mm wide                   | 3ZY1212-2FA00         |
| SIRIUS device termination connector set for 3SK1 safety relay,<br>≥ 45 mm wide                 | 3ZY1212-0FA01         |
| SIRIUS device connector for looping through signals,<br>22.5 mm wide (for 3RM1 motor starters) | 3ZY1212-2AB00         |
| SIRIUS device connector without a function,<br>22.5 mm wide                                    | 3ZY1210-2AA00         |
| SIRIUS push-in lugs for wall mounting (Contents: 12 units)                                     | 3ZY1311-0AA00         |
| SIRIUS sealable cover, 17.5 mm   | 3ZY1321-1AA00         |
| SIRIUS sealable cover, 22.5 mm   | 3ZY1321-2AA00         |
| Coding pins for SIRIUS terminals   | 3ZY1440-1AA00         |
| Sealable membrane 22.5 mm<br>1 pack = 12 membranes   | 3TK2820-0AA00         |
| SIRIUS device identification label<br>17 sheets of 48 labels; size 10 x 7 mm                   | 3RT2900-1SB10         |
| SIRIUS device identification label<br>17 sheets of 20 labels; size 20 x 7 mm                   | 3RT2900-1SB20         |
| SIRIUS device identification label<br>10 sheets of 306 adhesive labels; size 19 x 6 mm         | 3RT2900-1SB60         |

**Use of removable terminals for 3SK1**

The following removable terminals are available for safety relays for the prewiring of terminals in the control cabinet or for terminal replacement:

| 3SK1 safety relays               | Screw terminals |               | Spring-type terminals (push-in) |               |
|----------------------------------|-----------------|---------------|---------------------------------|---------------|
|                                  | 2-pin           | 3-pin         | 2-pin                           | 3-pin         |
|                                  | 3ZY1121-1BA00   | 3ZY1131-1BA00 | 3ZY1121-2BA00                   | 3ZY1131-2BA00 |
| <b>3SK1 Advanced basic units</b> |                 |               |                                 |               |
| 3SK1111                          | ---             | ✓             | ---                             | ✓             |
| 3SK1112                          | ✓               | ---           | ✓                               | ---           |
| 3SK1120                          | ---             | ✓             | ---                             | ✓             |
| 3SK1121                          | ---             | ✓             | ---                             | ✓             |
| 3SK1122                          | ✓ bottom        | ✓ top         | ✓ bottom                        | ✓ top         |
| <b>Output expansions</b>         |                 |               |                                 |               |
| 3SK1211                          | ✓               | ---           | ✓                               | ---           |
| 3SK1213                          | ---             | ---           | ---                             | ---           |
| <b>Input expansions</b>          |                 |               |                                 |               |
| 3SK1220                          | ---             | ✓ top         | ---                             | ✓ top         |
| 3SK1230                          | ✓ bottom        | ---           | ✓ bottom                        | ---           |

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