# PSR-...- 24UC/ESA4/3X1/1X2/B




## Safety relay for emergency stop and safety door monitoring

Data sheet
100013_en_07

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## 1 Description

### Intended Use

The safety relay is used to monitor two-channel signal generators and to control actuators.

When the sensor circuit is interrupted, the safety relay initiates the safe state.

The safety relay interrupts circuits in a safety-related way.

### Possible signal generators

- Emergency stop button
- Safety door monitoring

### Contact switching type

- 3 undelayed enabling current paths
- 1 non-delayed signaling current path

The enabling current paths drop out without delay as per stop category 0 in accordance with EN 60204-1.

### Control

- 2-channel
- Automatic start

### Achievable safety integrity

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061)

### Additional features

- Cross circuiting detection
- Optional pluggable screw or Push-in terminal blocks
- 22.5 mm housing width

### Approvals

c UL us LISTED

TÜVRheinland CERTIFIED Product Safety Functional Safety

**Observe these notes**

**WARNING: Risk of electric shock**
Observe the safety regulations and installation notes in the corresponding section.

Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.com/products.

This document is valid for the products listed in the “Ordering data” chapter.
This document meets the same requirements as the original operating instructions with respect to the contents.

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# 3 Ordering data

| Description | Type | Item no. | Pcs./Pkt. |
|---|---|---|---|
| Safety relay for emergency stop and safety door monitoring up to SIL 3 or Cat. 4, PL e in accordance with EN ISO 13849, 2-channel operation, 3 enabling current paths, nominal input voltage: 24 V DC, plug-in screw terminal block | PSR-SCP- 24UC/ESA4/3X1/1X2/B | 2963763 | 1 |
| Safety relay for emergency stop and safety door monitoring up to SIL 3 or Cat. 4, PL e in accordance with EN ISO 13849, 2-channel operation, 3 enabling current paths, nominal input voltage: 24 V DC, pluggable Push-in terminal block | PSR-SPP- 24UC/ESA4/3X1/1X2/B | 2963941 | 1 |

| Accessories | Type | Item no. | Pcs./Pkt. |
|---|---|---|---|
| Coding profile, is inserted into the slot on the plug or inverted header, red insulating material | CP-MSTB | 1734634 | 100 |
| Coding section, inserted into the recess in the header or the inverted plug, red insulating material | CR-MSTB | 1734401 | 100 |
| Crimping pliers, for ferrules without insulating collar according to DIN 46228 Part 1 and ferrules with insulating collar according to DIN 46228 Part 4, 0.25 mm² ... 6.0 mm², lateral entry, trapezoidal crimp | CRIMPFOX 6 | 1212034 | 1 |
| Actuator with anti-lock collar for modular emergency stop switches, for combination with module holder and contact module as a functional unit, panel installation, bayonet lock | PSR-ESS-M0-H110 | 1221757 | 1 |
| Module holder for modular emergency stop switches, connects the contact block and actuator with bayonet lock, suitable for 3 elements | PSR-ESS-ACC-CB1-C3 | 1221747 | 1 |
| Contact module for modular emergency stop switches with force-guided N/C contact for safety-related shutdown, in conjunction with appropriate evaluation unit suitable for use up to PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061) | PSR-ESS-ACC-CB1-NC-SC | 1221752 | 1 |

# 4 Technical data

| | |
|---|---|
| **Hardware/firmware version** | |
| HW/FW | ≥ 13/-- (2963763)<br>≥ 10/-- (2963941) |
| The technical data and safety characteristics are valid as of the specified HW/FW version. | |

| | |
|---|---|
| **Supply:** | |
| Rated control circuit supply voltage $U_S$ | 24 V DC -15 % / +10 % |
| Rated control supply current $I_S$ | typ. 70 mA (at $U_S$) |
| Power consumption at $U_S$ | typ. 1.68 W |
| Inrush current | < 3.5 A (typ. with $U_S$, Δt = 3 ms) |
| Filter time | 5 ms (in the event of voltage dips at $U_s$) |
| Protective circuit | Serial protection against polarity reversal, Suppressor diode |

| | |
|---|---|
| **Digital inputs: Logic (S12, S22)** | |
| Number of inputs | 2 |
| Description of the input | safety-related |
| Input voltage range "0" signal | 0 V DC ... 5 V DC (S12) |
| Input current range "0" signal | 0 mA ... 2 mA |
| Input voltage range "1" signal | 20.4 V ... 26.4 V (S12) |
| Inrush current | < 100 mA (typ. with $U_S$ at S12)<br>> -100 mA (typ. with $U_S$ at S22) |
| Current consumption | 38 mA (typ. with $U_S$ at S12)<br>-38 mA (typ. with $U_S$ at S22) |
| Filter time | No test pulses permitted |
| Max. permissible overall conductor resistance | 50 Ω |
| Concurrence | ∞ |
| Protective circuit | Suppressor diode |

| | |
|---|---|
| **Digital inputs: Start circuit (S34)** | |
| Number of inputs | 1 |
| Description of the input | non-safety-related |
| Input voltage range "1" signal | 20.4 V ... 26.4 V |
| Inrush current | < 6 mA (typ. with $U_S$) |
| Current consumption | 1 mA (typ. with $U_S$) |
| Filter time | No test pulses permitted |
| Max. permissible overall conductor resistance | 50 Ω |
| Protective circuit | Suppressor diode |

| Relay outputs: Enabling current paths (13/14, 23/24, 33/34) | |
|---|---|
| Number of outputs | 3 |
| Output description | 2 N/O contacts in series, safety-related, floating |
| Contact material | $AgSnO_2$ |
| Switching voltage<br>(see section “Relay data”) | min. 10 V AC/DC<br>max. 250 V AC/DC |
| Limiting continuous current<br>(see section “Relay data”) | 6 A |
| Inrush current | min. 10 mA<br>max. 6 A |
| Sq. Total current<br>$I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$ | 72 $A^2$ (observe derating) |
| Switching capacity | min. 100 mW |
| Switching frequency | max. 0.5 Hz |
| Service life electrical | See section “Electrical service life” |
| Mechanical service life | $10^7$ cycles |
| Switching capacity | 5 A (AC15)<br>6 A (DC13) |
| Output fuse | 10 A gL/gG (High demand)<br>4 A gL/gG (Low demand) |

| Relay outputs: Signaling current path (41/42) | |
|---|---|
| Number of outputs | 1 |
| Output description | 2 N/C contacts parallel, non-safety-related, floating |
| Contact material | $AgSnO_2$ |
| Switching voltage | min. 10 V AC/DC<br>max. 250 V AC/DC |
| Limiting continuous current | 6 A (Signaling current path) |
| Inrush current | min. 10 mA<br>max. 6 A |
| Sq. Total current<br>$I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$ | 36 $A^2$ |
| Switching capacity | min. 100 mW |
| Switching frequency | max. 0.5 Hz |
| Interrupting rating (ohmic load) max. | Observe derating and load limit curve |
| Service life electrical | See section “Electrical service life” |
| Mechanical service life | $10^7$ cycles |
| Switching capacity | 1.5 A (AC15)<br>2 A (DC13) |
| Output fuse | 6 A gL/gG |

| Times | |
|---|---|
| Typical starting time with $U_s$ | typ. 250 ms (with Us / when controlled via A1) |
| Typical response time at $U_s$ | typ. 150 ms (For $U_s$ autostart) |
| Typical release time with $U_s$ | typ. 20 ms (At Us on demand via sensor circuit)<br>typ. 45 ms (At Us/on demand via A1) |
| Restart time | < 1 s (Boot time) |
| Recovery time | < 1 s (following demand of the safety function) |

| General data | |
|---|---|
| Relay type | Electromechanical relay with force-guided contacts in accordance with IEC/EN 61810-3 |
| Nominal operating mode | 100% operating factor |
| Degree of protection | IP20 |
| Min. degree of protection of inst. location | IP54 |
| Mounting type | DIN rail mounting |
| Mounting position | vertical or horizontal |
| Assembly note | See derating curve |
| Type of housing | PA zinc yellow (RAL 1018) |
| Operating voltage display | 1 x LED (green) |
| Status display | 3 x LED (green) |
| Rated insulation voltage | 250 V |
| Rated surge voltage/insulation | See “Insulation coordination” |
| Degree of pollution | 2 |
| Overvoltage category | III |
| Maximum power dissipation for nominal condition | 16.44 W ($U_S$ = 26.4 V, $I_L^2$ = 72 A²,<br>$P_{Total\ max}$ = 2.04 W + 14.4 W) |
| Note on power dissipation | See “Calculating the power dissipation” |

| Dimensions | Screw connection | Push-in connection |
|---|---|---|
| W x H x D | 22.5 x 99 x 114.5 mm | 22.5 x 112 x 114.5 mm |

| Connection data | Screw connection | Push-in connection |
|---|---|---|
| Conductor cross section rigid | 0.2 mm² ... 2.5 mm² | 0.2 mm² ... 1.5 mm² |
| Conductor cross section flexible | 0.2 mm² ... 2.5 mm² | 0.2 mm² ... 1.5 mm² |
| Conductor cross-section AWG | 24 ... 12 | 24 ... 16 |
| Conductor cross section flexible, with ferrule without plastic sleeve | - | 0.25 mm² ... 1.5 mm² (only together with CRIMPFOX 6) |
| Conductor cross section flexible, with ferrule with plastic sleeve | - | 0.25 mm² ... 1.5 mm² (only together with CRIMPFOX 6) |
| Stripping length | 7 mm | 8 mm |
| Screw thread | M3 | - |
| Tightening torque | 0.5 Nm ... 0.6 Nm | -- |

| Ambient conditions | |
|---|---|
| Ambient temperature (operation) | -20 °C ... 55 °C (observe derating) |
| Ambient temperature (storage/transport) | -40 °C ... 70 °C |
| Max. permissible relative humidity (operation) | 75 % (on average, 85% infrequently, non-condensing) |
| Max. permissible humidity (storage/transport) | 75 % (on average, 85% infrequently, non-condensing) |
| Maximum altitude | ≤ 2000 m (Above sea level) |
| Information on operating height | See the “Using PSR devices at altitudes greater than 2000 m above sea level” section |
| Shock | 15g |
| Vibration (operation) | 10 Hz ... 150 Hz, 2g |

| Approvals and manufacturer's declarations | |
|---|---|
| The latest documents can be found at: | www.phoenixcontact.com/product/2963763<br>www.phoenixcontact.com/product/2963941 |

| Safety data | |
|---|---|
| Stop category according to IEC 60204 | 0 |

| Safety parameters in accordance to IEC 61508 - high demand | |
|---|---|
| IEC 61508 - High demand | |
| Equipment type | Type A |
| HFT | 1 |
| SIL | 3 |
| $PFH_D$ | $5.5 \times 10^{-10}$ (5 A DC13; 5 A AC15; 8760 switching cycles/ year) |
| Demand rate | < 12 Months |
| Proof test interval | 240 Months |
| Mission time | 240 Months |

| Safety parameters according to IEC 61508 - low demand | |
|---|---|
| Equipment type | Type A |
| HFT | 1 |
| SIL | 3 |
| $PFD_{avg}$ | $1.37 \times 10^{-4}$ |
| Proof test interval | 66 Months |
| Mission time | 240 Months |

| Safety parameters according to EN ISO 13849-1 | |
|---|---|
| Category | 4 |
| Performance level | e (5 A DC13; 5 A AC15; 8760 switching cycles/year) |
| Mission time | 240 Months |
| For applications in PL e, the required demand rate for the safety function is once per month. | |

| Safety parameters according to EN IEC 62061 | |
|---|---|
| SIL | 3 |
| For applications in SIL 3 the required demand rate for the safety function is once per month. | |

# 5 Interface type (ZVEI classification)

| Digital inputs : Logic ( S12, S22 ) | | | | |
|---|---|---|---|---|
| **Source/destination** | **Interface type** | **Additional measure** | **Source/destination** | **Suitable interface type** |
| Destination | A | M | Source | A |

| Interface type A - Destination | | | |
|---|---|---|---|
| **Parameter** | **min.** | **typ.** | **max.** |
| Input current $I_i$ (in the ON-state) | 27 mA (S12)<br>-100 mA<br>(Δt = 500 ms,<br>with $U_s/I_x$ at S22) | - | 100 mA (Δt = 500 ms,<br>with $U_s/I_x$ at S12)<br>-27 mA (S22) |
| Output voltage $U_i$ | 19 V | - | 26 V |
| Input capacitance $C_i$ | - | - | - |
| Additional measure M | - The inputs are not types in accordance with IEC 61131-2.<br>- $T_G$ is S11 for S12 (24 V without cycle)<br>- $T_G$ is S21 for S22 (0 V without cycle) | | |

| Digital inputs : Start circuit ( S34 ) | | | | |
|---|---|---|---|---|
| **Source/destination** | **Interface type** | **Additional measure** | **Source/destination** | **Suitable interface type** |
| Destination | A | M | Source | A |
| Destination | C0 | M | Source | C1, C2, C3 |

| Interface type A - Destination | | | |
|---|---|---|---|
| **Parameter** | **min.** | **typ.** | **max.** |
| Input current $I_i$ (in the ON-state) | 0 mA (S34) | - | 7 mA (S34) |
| Output voltage $U_i$ | 19 V | - | 26 V |
| Input capacitance $C_i$ | - | - | - |
| Additional measure M | - The inputs are not types in accordance with IEC 61131-2.<br>- $T_G$ is S33 (24 V without cycle). | | |

| Interface type C0 - Destination | | | |
|---|---|---|---|
| **Parameter** | **min.** | **typ.** | **max.** |
| Test pulse duration $t_i$ | - | - | - |
| Test pulse interval T | - | - | - |
| Input resistance R | 3.9 kΩ - 10.7 kΩ | - | - |
| Input capacitance $C_L$ | - | - | - |
| Inductive load $L_L$ | - | - | - |
| Additional measure M | - The inputs are not types in accordance with IEC 61131-2.<br>- Switch-on pulses should be switched off for safety applications. | | |

| Relay outputs : Enabling current paths 13/14, 23/24, 33/34 | | | | |
|---|---|---|---|---|
| **Source/destination** | **Interface type** | **Additional measure** | **Source/destination** | **Suitable interface type** |
| Source | A | M | Destination | A |
| Source | C0 | M | Destination | - |

| Interface type A - Source | | | |
|---|---|---|---|
| **Parameter** | **min.** | **typ.** | **max.** |
| Switching current $I_i$ | 10 mA | - | 6 A |
| Switching voltage $U_i$ | 10 V | - | 250 V AC |
| Internal resistance $R_i$ (in the switched state) | Load ≥ 1 A<br>≤ 200 mΩ | - | Load ≥ 10 mA<br>≤ 40 Ω |
| Load capacitance $C_L$ | - | - | see switching capacity |
| Inductive load $L_L$ | - | - | see switching capacity |
| Electrical isolation | yes | | |
| Additional measure M | - The outputs are not types in accordance with IEC 61131-2. | | |

| Interface type C0 - Source | | | |
|---|---|---|---|
| **Parameter** | **min.** | **typ.** | **max.** |
| Test pulse duration $t_i$ | - | - | - |
| Test pulse interval T | - | - | - |
| Nominal current $I_N$ | - | - | 6 A |
| Load capacitance $C_L$ | - | - | see switching capacity |
| Inductive load $L_L$ | - | - | see switching capacity |
| Additional measure M | - The outputs are not types in accordance with IEC 61131-2.<br>- No test pulses are emitted at the output. | | |

| Relay outputs : Signaling current path 41/42 | | | | |
|---|---|---|---|---|
| **Source/destination** | **Interface type** | **Additional measure** | **Source/destination** | **Suitable interface type** |
| Source | A | M | Destination | A |
| Source | C0 | M | Destination | - |

| Interface type A - Source | | | |
|---|---|---|---|
| **Parameter** | **min.** | **typ.** | **max.** |
| Switching current $I_i$ | 10 mA | - | 6 A |
| Switching voltage $U_i$ | 10 V | - | 250 V AC |
| Internal resistance $R_i$ (in the switched state) | Load ≥ 1 A<br>≤ 100 mΩ | - | Load ≥ 10 mA<br>≤ 20 Ω |
| Load capacitance $C_L$ | - | - | see switching capacity |
| Inductive load $L_L$ | - | - | see switching capacity |
| Electrical isolation | yes | | |
| Additional measure M | - The outputs are not types in accordance with IEC 61131-2. | | |

| Interface type C0 - Source | | | |
|---|---|---|---|
| **Parameter** | **min.** | **typ.** | **max.** |
| Test pulse duration $t_i$ | - | - | - |
| Test pulse interval T | - | - | - |
| Nominal current $I_N$ | - | - | 6 A |
| Load capacitance $C_L$ | - | - | see switching capacity |
| Inductive load $L_L$ | - | - | see switching capacity |
| Additional measure M | - The outputs are not types in accordance with IEC 61131-2.<br>- No test pulses are emitted at the output. | | |

# 6 Notes regarding documentation

## 6.1 Identification of warning notes



This symbol indicates hazards that could lead to personal injury.

There are three signal words indicating the severity of a potential injury.

**DANGER** Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

**WARNING** Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

**CAUTION** Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.



This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.



Here you will find additional information or detailed sources of information.

## 6.2 Validity

This data sheet is valid for the described product(s) from the hardware/firmware version specified in the technical data.

## 6.3 Target group

This data sheet is therefore aimed at:

- Qualified personnel who plan and design safety equipment for machines and systems and are familiar with regulations governing occupational safety and accident prevention.
- Qualified personnel who install and operate safety equipment in machines and systems.

**Qualified personnel:**

Qualified personnel are people who, because of their education, experience, and instruction and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized by those responsible for the safety of the system to carry out any required operations and who are able to recognize and avoid any possible dangers.

**Requirements:**

Knowledge of the following topics is required:

- Handling safety components
- Valid EMC regulations
- Valid regulations governing occupational safety and accident prevention

# 7 Safety regulations and installation notes

**WARNING: Death, serious personal injury or damage to equipment**

Depending on the application, incorrect handling of the device may pose serious risks for the user or cause damage to equipment.

- Observe all the safety notes and warning instructions provided in this chapter and elsewhere in this document.

**Safety notes for installation and mounting in other languages:**
PACKB.SAFETY NOTES INSTALLATION MOUNTING
They can be downloaded from the product page at www.phoenixcontact.com/products.

### Direct/indirect contact

- Protection against direct and indirect contact according to VDE 0100 Part 410 must be ensured for all components connected to the system.

In the event of an error, parasitic voltages must not occur (single-fault tolerance).

### Power supply units for 24 V supply

- Only use power supply units with safe isolation and SELV/PELV.
- Protect the 24 V area with a suitable external fuse.
- Make sure that the power supply unit is able to supply **four times** the nominal current of the external fuse, to ensure that it trips in the event of an error.
- Make sure that the output voltage of the voltage supply does not exceed 32 V even in the event of error.

### Startup, mounting, and modifications

Startup, mounting, modifications, and upgrades may only be carried out by qualified personnel.

- Before working on the device, disconnect the power.
- Ensure that the device is disconnected from the power supply.
- Carry out wiring according to the application. Refer to the “Application examples” section for this.

Reliable operation is only ensured if the device is installed in housing protected from dust and humidity.

- Install the device in housing protected from dust and humidity (min. IP54).

### Mismatching and polarity reversal of connections

- Take measures to prevent mismatching, polarity reversal, and manipulation of connections.

### In operation

During operation, parts of electrical switching devices carry hazardous voltages.

- Protective covers must not be removed when operating electrical switching devices.

For emergency stop applications, automatic startup of the machine can pose serious risks for the user.

- The machine must be prevented from restarting automatically by a higher-level controller.

With the manual, monitored reset device, a machine start may not be triggered in accordance with EN ISO 13849-1.

Inductive loads can lead to welded relay contacts.

- Connect a suitable and effective protective circuit to inductive loads.
- Implement the protective circuit parallel to the load and not parallel to the switch contact.

Magnetic fields can influence the device. The magnetic field strength of the environment must not exceed 30 A/m.

- Do not use the device in the vicinity of strong magnetic fields (e.g., caused by transformers or magnetic iron).

### EMC notes

Noise emission may occur when operating relay modules. Wireless reception may be disrupted in residential areas.

The device is a Class A product.

- Observe the requirements for noise emission for electrical and electronic equipment (EN 61000-6-4).
- Implement appropriate precautions against noise emission.

**Faulty devices**

The devices may be damaged following an error. Correct operation can no longer be ensured.

- Replace any defective devices.

Only the manufacturer or their authorized representative may perform the following activities. Otherwise the warranty is invalidated.

– Repairs to the device
– Opening the housing

**Replacing the device**

- Dispose of the device in the following circumstances:

– At the end of its mission time

See “Technical data” section.

– At the end of its electrical service life

See section “Electrical service life”.

– In the event of a fault

### 7.1 Safety of machines or systems

**Draw up and implement a safety concept**

The machine or system manufacturer and the operator are responsible for the safety of the machine or system and the application in which the machine or system is used. In order to use the device described in this document, you must have drawn up an appropriate safety concept for your machine or system. This includes a risk assessment in accordance with the directives and standards specified in the EC Declaration of Conformity, as well as other standards.

**Risk assessment, validation and function test**

- Before using the device, perform a risk assessment on the machine or system.
- Validate your entire safety system.
- Carry out a new validation every time you make a safety-related modification.
- Perform a function test on a regular basis.

**Achievable safety integrity**

The functional safety is ensured for the device as a single component. However, this does not guarantee functional safety for the entire machine or system. In order to be able to achieve the desired safety level for the entire machine or system, define the safety requirements for the machine or system as well as how to implement them from both a technological and an organizational perspective.

# 8 Transport, storage, and unpacking

### 8.1 Transport

The device is delivered in cardboard packaging.

- Observe the instructions on how to handle the package indicated on the packaging.

**Suitable transport packaging**

- Only transport the device in its original packaging or in packaging suitable for transport.

**Technical data and environmental conditions**

- For transport, observe the humidity and air pressure specifications, and the temperature range.
  See Section “Technical data”.

### 8.2 Storage

**Suitable storage location**

The storage location must meet the following requirements:

– Dry
– Protected against unauthorized access
– Protected against harmful environmental influences such as UV light

**Technical data and environmental conditions**

- For storage, observe the humidity and air pressure specifications, and the temperature range.
  See Section “Technical data”.

### 8.3 Unpacking

The device is delivered in packaging together with a packing slip that provides installation instructions.

**Observing the packing slip**

- Read the entire packing slip carefully.
- Retain the packing slip.

**Checking the delivery**

- Check the delivery for damage and completeness.
- Submit any claims for transport damage immediately.

**Scope of supply**

Refer to the ordering data for the standard scope of supply for the product.
See Section “Ordering data”.

# 9 Function description

## 9.1 Two-channel sensor circuit

The connection of the two-channel sensor circuit is equivalent with cross-circuit detection.

See “Signal generator connection versions” section.

## 9.2 Automatic start

The device starts automatically after the sensor circuit has been closed.

See “Start and feedback circuit connection versions” section.

See section “Function and time diagrams”.

## 9.3 Safe shutdown

When the sensor circuit opens, the enabling current paths open without delay.

When the enabling current paths are open, the device is in the safe state.

The signaling current path closes.

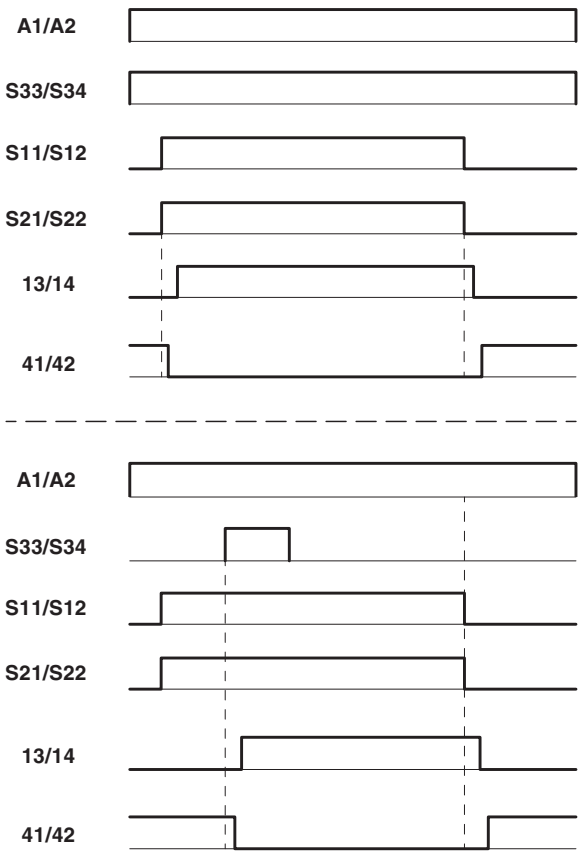
# 10 Function and time diagrams

**Key:**

| | |
|---|---|
| **A1/A2** | Power supply |
| **S33/S34** | Automatic start |
| **S11/S12** | Sensor inputs |
| **S21/S22** | Sensor inputs |
| **13/14** | Enabling current path, undelayed |
| **41/42** | Signaling current path |

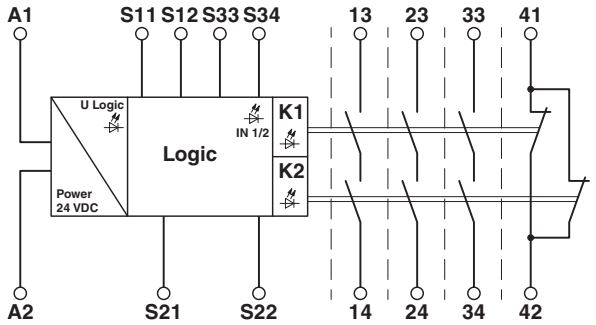
## 10.1 Time diagram for automatic start

Figure 1 Time diagram for automatic start



# 11 Block diagram

Figure 2 Block diagram




**Key:**

| | |
|---|---|
| **A1/A2** | Safety relay input voltage |
| **S11/S12** | Input sensor circuit (channel 1) |
| **S21/S22** | Input sensor circuit (channel 2) |
| **S33/S34** | Automatic start circuit |
| **13/14** | Undelayed enabling current path 1 |
| **23/24** | Undelayed enabling current path 2 |
| **33/34** | Undelayed enabling current path 3 |
| **41/42** | Signaling current path |

## 11.1 Insulation coordination

| | Housing | A1/A2, Logic | 13/14 | 23/24 | 33/34 | 41/42 |
|---|---|---|---|---|---|---|
| **Housing** | - | 4 kV BI | 4 kV BI | 4 kV BI | 4 kV BI | 4 kV BI |
| **A1/A2, Logic** | - | - | 6 kV ST | 6 kV ST | 6 kV ST | 6 kV ST |
| **13/14** | - | - | - | 4 kV BI | 4 kV BI | 4 kV BI |
| **23/24** | - | - | - | - | 4 kV BI | 4 kV BI |
| **33/34** | - | - | - | - | - | 4 kV BI |
| **41/42** | - | - | - | - | - | - |

**Key:**

| | |
|---|---|
| **BI** | Basic insulation |
| **ST** | Safe isolation |

**Basic insulation**

(rated surge voltage of 4 kV)

A mixture of SELV and PELV is strictly prohibited. Only switch 250 V AC at one of the enable contacts if the adjacent contact/enabling current path carries the same potential.

**Safe isolation/reinforced insulation**

(rated surge voltage of 6 kV)

Reinforced insulation (e.g., thanks to greater air clearances and creepage distances between conductive paths) is designed for one overvoltage category higher than basic insulation. This means that SELV circuits of $U \leq 25$ V AC or $U \leq 60$ V DC and circuits with higher voltages can be mixed.

# 12 Derating

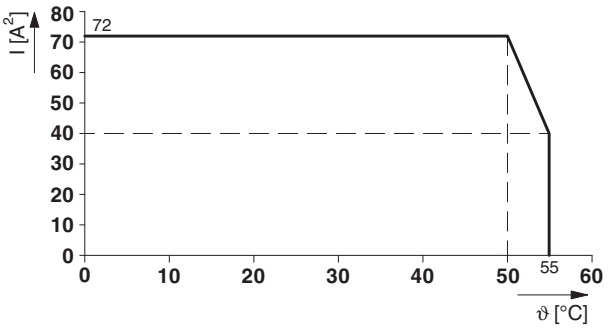
The temperature is measured at a 5 cm clearance below or to the side of the device.

## 12.1 Horizontal mounting position

The derating curve applies for the following conditions:

– Devices mounted next to each other without spacing
– at $U_S$ up to max. 26.4 V DC
– $I_{max}^2 = I_1^2 + I_2^2 + I_3^2$

Figure 3 Derating curve - horizontal mounting position, without spacing

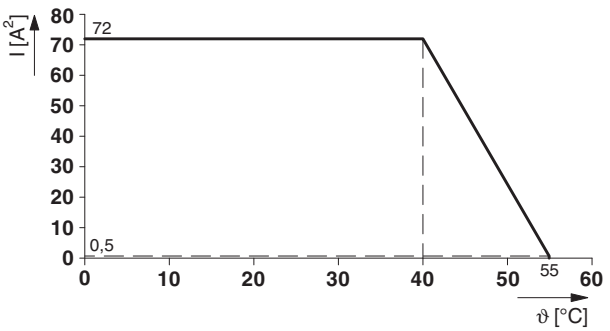



## 12.2 Vertical mounting position

The derating curve applies for the following conditions:

– Devices mounted next to each other without spacing
– at $U_S$ up to max. 26.4 V DC
– $I_{max}^2 = I_1^2 + I_2^2 + I_3^2$

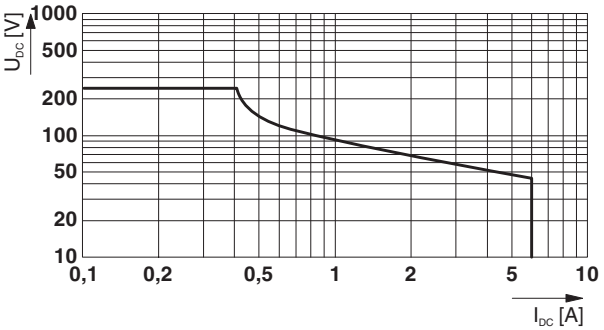
Figure 4 Derating curve - vertical mounting position, without spacing




# 13 Relay data

## 13.1 Load limit curve at DC load

Figure 5 Relay load limit curve – resistive load




## 13.2 Electrical service life

Figure 6 Number of switching cycles for AC-1

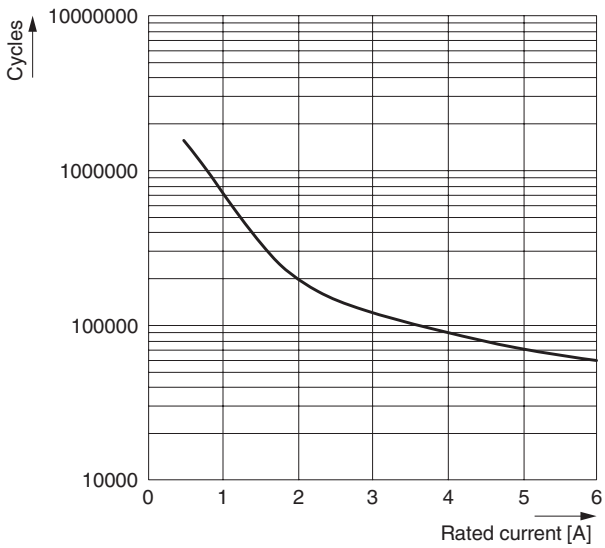


Figure 7 Number of switching cycles for AC-15

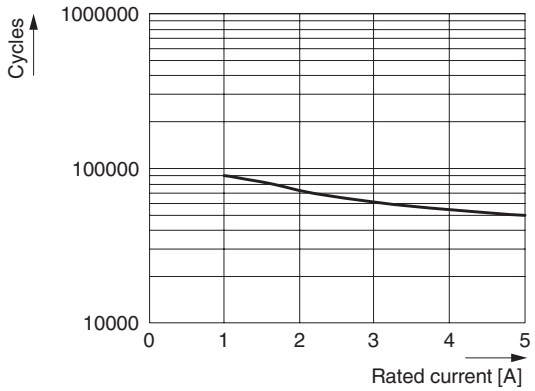



Figure 8 Number of switching cycles for DC-1

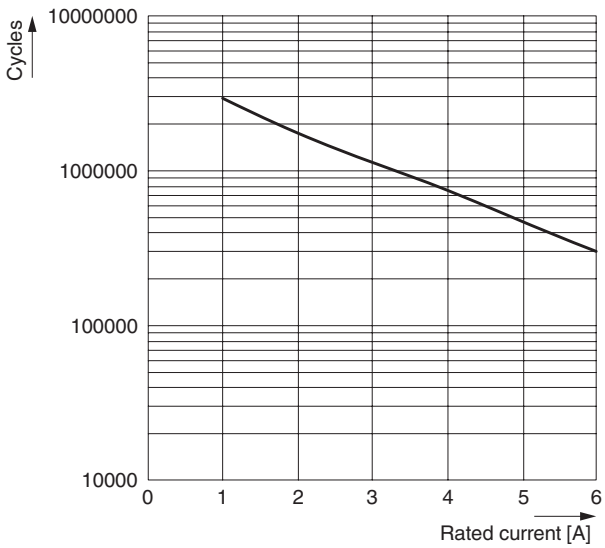
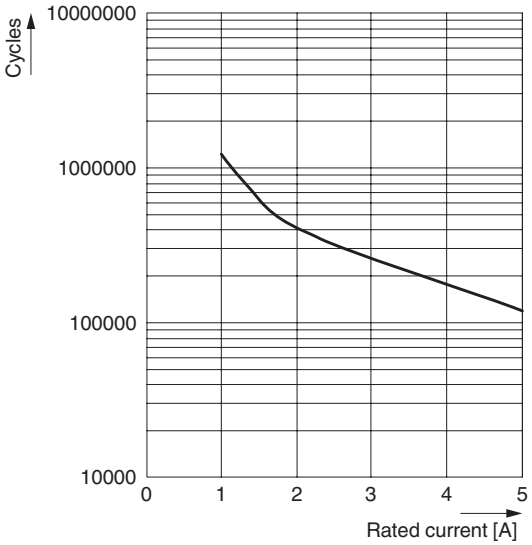



Figure 9 Number of switching cycles for DC-13




**Behavior of the electrical service life**

The service life curves indicate the number of switching cycles after which wear-related failures must be expected.

They depend on the utilization category and the expected load current.

**Example:**

Let's assume:

– Inductive load = 1 A
– Utilization category = AC15

This results in a contact service life of 90000 switching cycles.

**WARNING: Loss of functional safety**

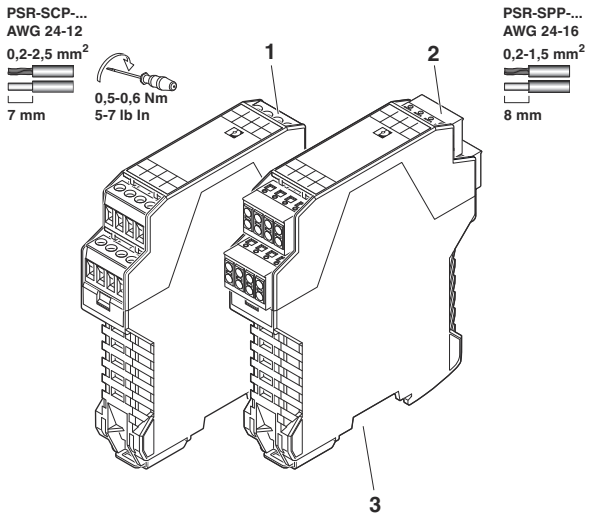
At the end of the electrical service life, there is an increased risk of loss of functional safety.

- Replace the device in good time before the end of the electrical service life.

# 14 Operating and indication elements

## 14.1 Connection versions

Figure 10 Connection versions



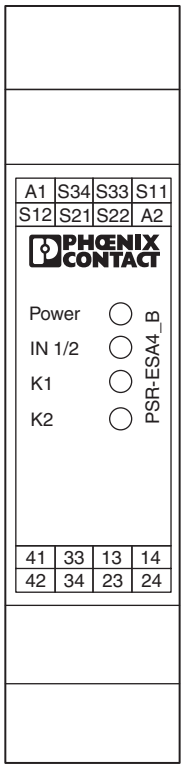

**1** COMBICON plug-in screw terminal block
**2** Pluggable COMBICON Push-in terminal block
**3** Metal lock for fixing to DIN rail

See section "Optional terminal coding".

The year the device was constructed can be found underneath the CE designation on the housing.

XX/XX = Calendar week / year

## 14.2 Connection assignment




**A1/A2** 24 V DC power supply
**S11/S12** Input sensor circuit (channel 1)
**S21/S22** Input sensor circuit (channel 2)
**S33/S34** Start circuit for autostart

**Power** Power, LED (green)
**IN 1/2** Status indicator for the inputs, LED (green)
**K1** Status indicator safety circuit, LED (green)
**K2** Status indicator safety circuit, LED (green)

**13/14**
**23/24** Undelayed enabling current paths
**33/34**
**41/42** Signaling current path

### 14.3 Optional terminal coding

The device connection terminal blocks are **not** coded as standard.

The optional coding accessories can provide you with increased safety against connection mismatching and reverse polarity.
See section “Ordering data”.

**If you do not use the coding accessories, ensure that alternative validation measures are taken.**

#### Coding system

The terminal blocks can be coded by using coding sections and coding profiles.

Coding sections are plugged onto the terminal block header in the device housing.

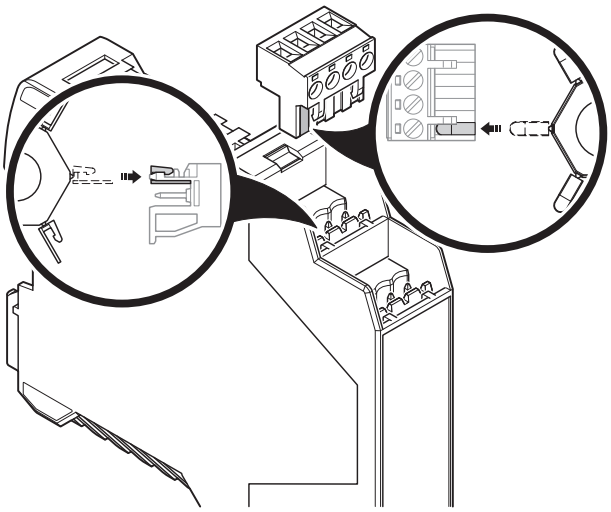
Coding profiles are plugged into the groove of the pluggable terminal block.

Various combinations can be used to create a coding system for the device terminal blocks.

#### Attaching coding elements

1. Push a coding section onto the terminal block header in the device housing.
   Remove the coding section from the coding star.
2. Push a coding profile into the groove of the terminal block.
   Remove the coding profile from the coding star.

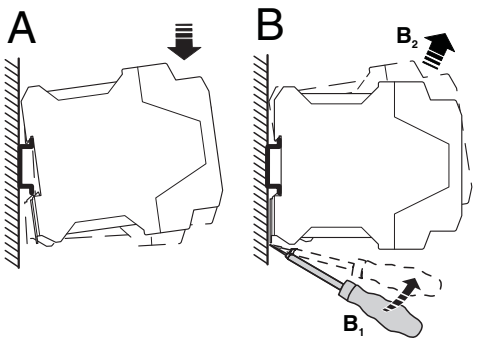
Figure 11 Attach coding elements



## 15 Mounting and removing

- Mount the device on a 35 mm DIN rail in accordance with EN 60715.
- To remove the device, use a screwdriver to release the snap-on foot.

Figure 12 Mounting and removing



# 16 Wiring

- Connect the cables to the connection terminal blocks using a screwdriver.

Figure 13 Connection of the cables

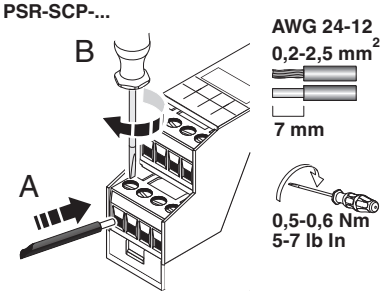
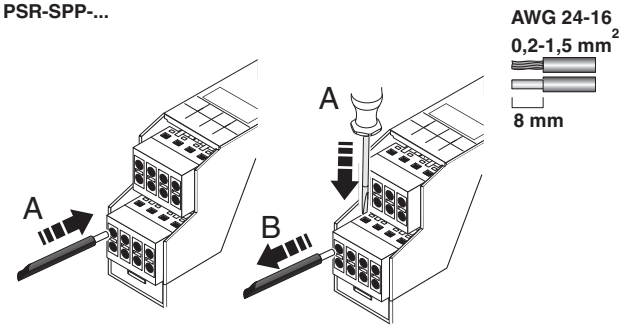



Figure 14 Connecting the cables for PSR-SPP-... (Push-in terminal block)




It is recommended that ferrules are used to connect stranded cables.

Use the CRIMPFOX 6 crimping tool from Phoenix Contact.

The tool enables the reliable processing of ferrules and easy removal of conductors with ferrules from the connection terminal blocks.

For compliance with UL approval, use copper wire that is approved up to 60°C/75°C.

## 16.1 Signal generator connection versions

- Connect suitable signal generators to S12/S22.

Figure 15 2-channel with cross-circuit detection

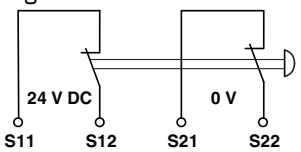
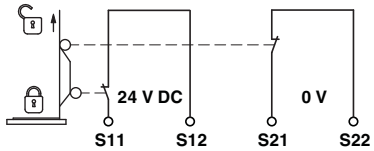


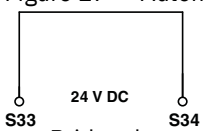

Figure 16 2-channel safety door circuit. 2 N/C contacts.




## 16.2 Start and feedback circuit connection variants

### Automatic start

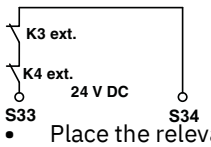
Figure 17 Automatic activation




- Bridge the contacts S33/S34.

### Start and feedback circuit

Figure 18 Automatic activation with monitored contact extension




- Place the relevant N/C contact in path S33/S34 to monitor external contactors or extension devices with force-guided contacts.

**K3/K4** Force-guided contactors

## 17 Startup

- Apply the rated control circuit supply voltage (24 V DC) at terminal blocks A1/A2.

The Power LED lights up.

- Close contacts S11/S12 and S21/S22.

↪ The IN 1/2 LED lights up.

See “Signal generator connection versions” section.

**Automatic start**

The enabling current paths 13/14, 23/24 and 33/34 close.

Signaling current path 41/42 opens.

The K1 and K2 LEDs light up.

## 18 Calculating the power dissipation

The total power dissipation of the safety relay is based on the input power dissipation and the contact power dissipation for the same and for different load currents.

**Input power dissipation**

$P_{Input} = U_B^2 / (U_S/I_S)$

**Contact power dissipation**

$P_{Contact} = (I_{L1}^2 + I_{L2}^2 + ... + I_{Ln}^2) \bullet 200\ m\Omega$

**Total power dissipation**

$P_{Total} = P_{Input} + P_{Contact}$

$P_{Total} = U_B^2 / (U_S/I_S) + (I_{L1}^2 + I_{L2}^2 + ... + I_{Ln}^2) \bullet 200\ m\Omega$

**Key:**

| | |
|---|---|
| **P** | Power dissipation in mW |
| **$U_B$** | Applied operating voltage |
| **$U_S$** | Rated control circuit supply voltage |
| **$I_S$** | Rated control supply current |
| **$I_L$** | Contact load current |

## 19 Function test/proof test

To verify the device function, proceed as follows:

- Demand the safety function by actuating the corresponding safety equipment.
- Check whether the safety function was executed correctly by switching the device on again.

If the device does not switch on again, the proof test failed.

**WARNING: Loss of functional safety due to malfunction**

If the proof test contains errors, the device no longer functions correctly.

- Replace the device.

# 20 Diagnostics

Plausibility errors are deleted when the supply voltage is switched off (power down reset).

In the event of an error or fault that is not listed, please contact Phoenix Contact.

## 20.1 General states

**Key:**

○ LED OFF
● LED ON

| LED | | | | State | Notes |
|---|---|---|---|---|---|
| Power | IN 1/2 | K1 | K2 | | |
| ● | ○ | ○ | ○ | No relays are activated. The sensor circuit is inactive. | - |
| | | | | Only channel 1 or channel 2 of the sensor circuit is active. | - |
| ● | ● | ○ | ○ | The sensor circuit is active. Relays K1 and K2 are ready to start and await reset/start command (S34). | Possible error see error messages |
| ● | ● | ● | ● | The sensor circuit is active. All relays are picked up. | - |

## 20.2 Error messages

**Key:**

○ LED OFF
● LED ON

| LED | | | | State | Possible cause | Corrective |
|---|---|---|---|---|---|---|
| Power | IN 1/2 | K1 | K2 | | | |
| ○ | ○ | ○ | ○ | The sensor circuit is actively controlled, but no input LEDs are lit up. | Possible cross-circuit in sensor circuit S11/S12 and S21/S22. | Switch off the operating voltage and rectify the cross-circuit. Then perform a function test. |
| | | | | The sensor circuits are active. | No supply voltage or undervoltage at A1/A2. | Check the supply voltage. |
| ● | ● | ○ | ○ | The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up. | External error: the readback contact (external actuator) is open in the reset circuit.<br>Internal error:<br>1. The diagnostic contact is not working correctly.<br>2. An N/O contact is welded. | External error: check the actuator.<br>Internal error: perform a power down reset with subsequent function test. **If the error occurs again after the function test, replace the device.** |
| ● | ● | ○ | ● | The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up. | Possible short circuit in the sensor circuit between S21 and S22. | Switch off the operating voltage and remove the short circuit. Then perform a function test. |
| | | | | The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1) is not picking up. | External error: both channels of the sensor circuit were not opened or requested.<br>Internal error: diagnostics active. | External error: check whether the second channel opens when the sensor is requested.<br>Internal error: perform a power down reset with subsequent function test. **If the error occurs again after the function test, replace the device.** |
| ● | ● | ● | ○ | The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up. | Possible short circuit in the sensor circuit between S11 and S12. | Switch off the operating voltage and remove the short circuit. Then perform a function test. |
| | | | | The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K2) is not picking up. | External error: both channels of the sensor circuit were not opened or requested.<br>Internal error: diagnostics active. | External error: check whether the second channel opens when the sensor is requested.<br>Internal error: perform a power down reset with subsequent function test. **If the error occurs again after the function test, replace the device.** |

# 21 Application examples

## 21.1 Two-channel emergency stop monitoring

**Application description:**

- Automatic start
- Cross circuiting detection
- Monitoring of external, force-guided contactors

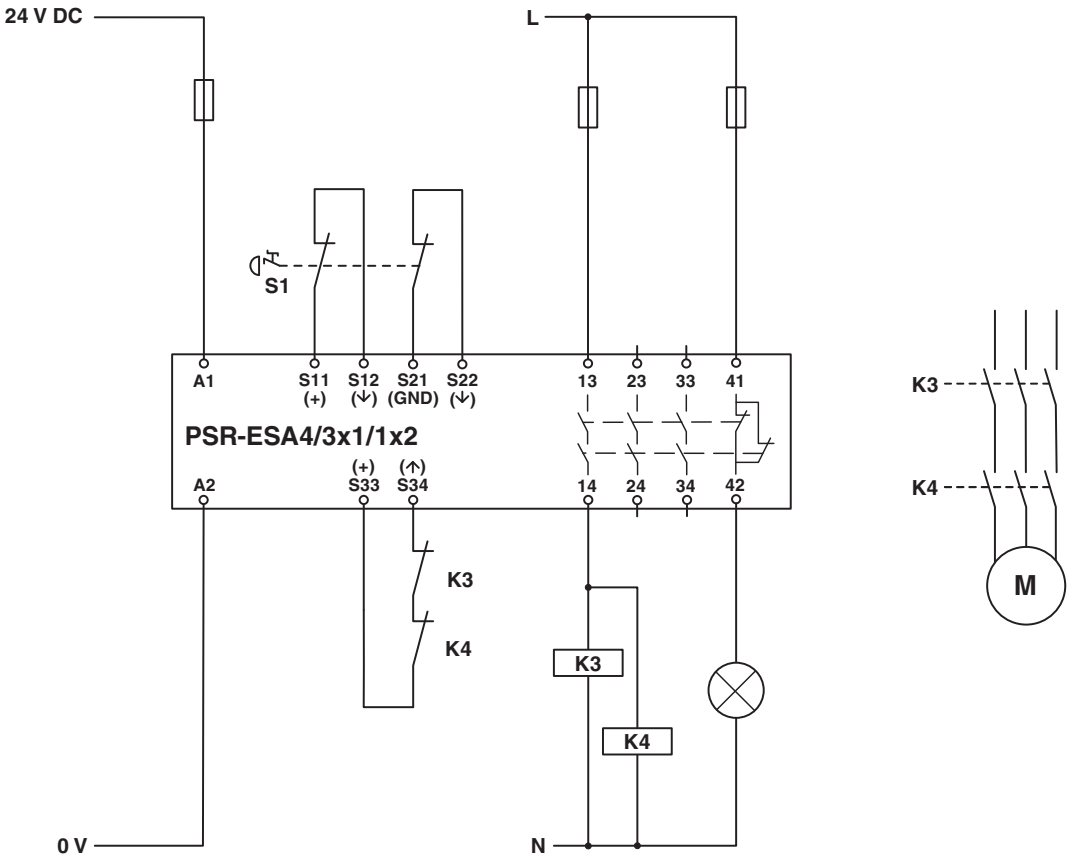
**Notes:**

Cross-circuits in the cable installation can be ruled out in the same electrical installation space or through mechanically protected cable installation.

**Achievable safety integrity:**

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061)

Figure 19 2-channel emergency stop monitoring




**Key:**

| | |
|---|---|
| **S1** | Emergency stop button |
| **K3/K4** | Force-guided contactors |

### 21.2 Two-channel safety door monitoring

**Application description:**

- Automatic start
- Cross circuiting detection
- Monitoring of external, force-guided contactors

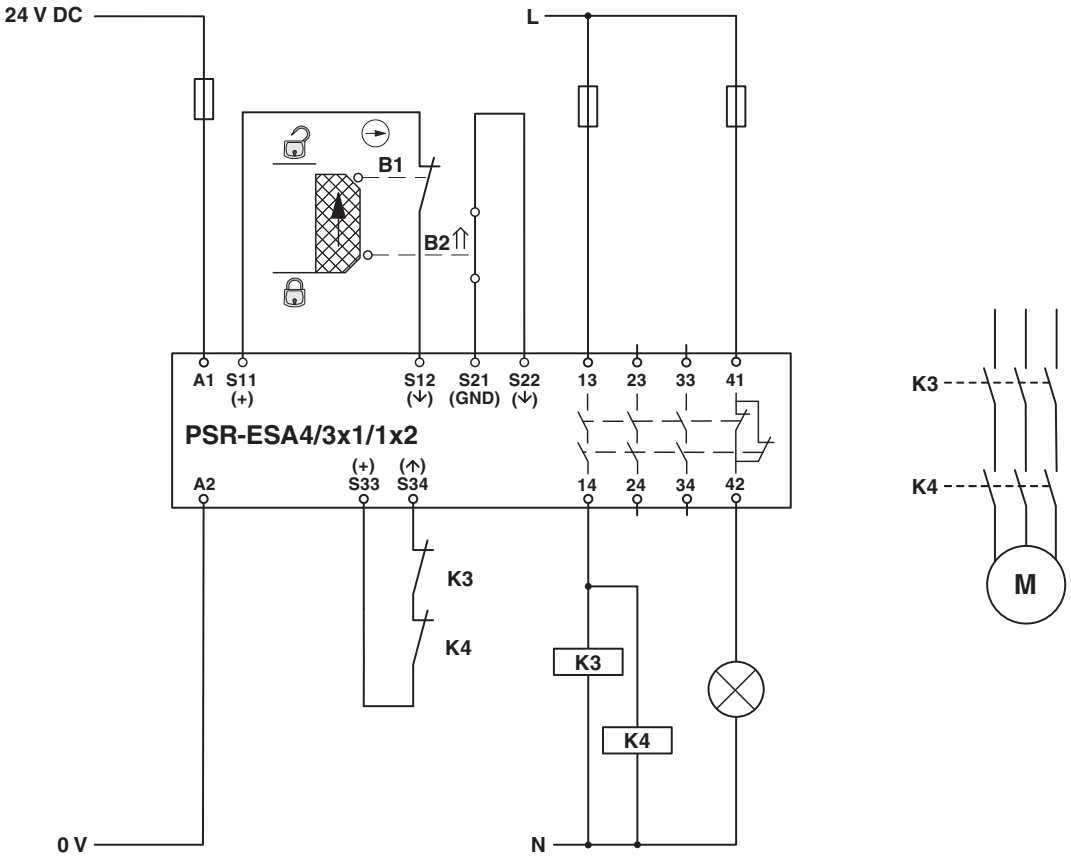
**Notes:**

Cross-circuits in the cable installation can be ruled out in the same electrical installation space or through mechanically protected cable installation.

**Achievable safety integrity:**

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061)

Figure 20 2-channel safety door monitoring




**Key:**

| | |
|---|---|
| **B1/B2** | Mechanical safety door switches |
| **K3/K4** | Force-guided contactors |

# 22 Device replacement, device defect, and repair

## 22.1 Device replacement

The device can be replaced, if necessary.

If you need to replace the device, proceed as described in the following section:

– Mounting and removal
– Wiring

**Observe the device type and version**

The new device must meet the following requirements:

– Same device type
– Same or later version

## 22.2 Device defect and repair

**Do not open the housing**

Repairs may only be carried out by Phoenix Contact. Do not open the housing. If the housing is opened, the function of the device can no longer be ensured.

**Faulty devices**

- Please contact Phoenix Contact.

# 23 Maintenance, decommissioning, and disposal

## 23.1 Maintenance

The device requires no maintenance during the permissible mission time. Refer to the technical data for the mission time of the device.

If necessary, carry out proof tests within the specified proof test interval.

See “Technical data” section.

Depending on the application and connected I/O devices, you should test the function of the I/O devices and the safety chain regularly.

Observe the relevant manufacturer specifications for carrying out maintenance on connected I/O devices.

## 23.2 Decommissioning and disposal

Carry out decommissioning according to the requirements of the machine or system manufacturer.

When decommissioning the system or parts of the system, ensure the following for the devices used.

**The device continues to be used only as intended:**

- Observe the storage and transport requirements.

See “Transport, storage, and unpacking” section.

**The device is not used any more:**

The symbol with the crossed-out trash can indicates that this item must be collected and disposed of separately from other waste.
Phoenix Contact or public collection sites will take the item back for free disposal. For information on the available disposal options, visit www.phoenixcontact.com.

**Packaging disposal**

- Dispose of packaging materials that are no longer needed (cardboard packaging, paper, bubble wrap sheets, pillow bags, etc.) with household waste in accordance with the currently applicable national regulations.

# 24 Attachment

## 24.1 Using PSR devices at altitudes greater than 2000 m above sea level

The following section describes the special conditions for using PSR devices at altitudes greater than 2000 m above sea level.
Observe the relevant device-specific data (technical data, derating, etc.) according to the product documentation for the individual device.

Using the device at altitudes **> 2000 m amsl up to max. 4500 m amsl** is possible under the following conditions:

1. Limit the rated control circuit supply voltage ($U_S$) in accordance with the table below. Observe the technical data for the device.

| $U_S$ according to the technical data for the device | $U_S$ when used at altitudes greater than 2000 m above sea level |
|---|---|
| < 150 V AC/DC | $U_S$ according to the technical data for the device still valid |
| > 150 V AC/DC | Limited to max. 150 V AC/DC |

2. Limit the maximum switching voltage in accordance with the table below. Observe the technical data for the device.

| Max. switching voltage according to the technical data for the device | Max. switching voltage when used at altitudes greater than 2000 m above sea level |
|---|---|
| < 150 V AC/DC | Max. switching voltage according to the technical data for the device still valid |
| > 150 V AC/DC | Limited to max. 150 V AC/DC |

3. Reduce the maximum ambient temperature for operation by the corresponding factor in accordance with the table below.
4. If derating is specified, offset all the points of the derating curve by the corresponding factor in accordance with the table below.

| Altitude above sea level | Temperature derating factor |
|---|---|
| 2000 m | 1 |
| 2500 m | 0.953 |
| 3000 m | 0.906 |
| 3500 m | 0.859 |
| 4000 m | 0.813 |
| 4500 m | 0.766 |

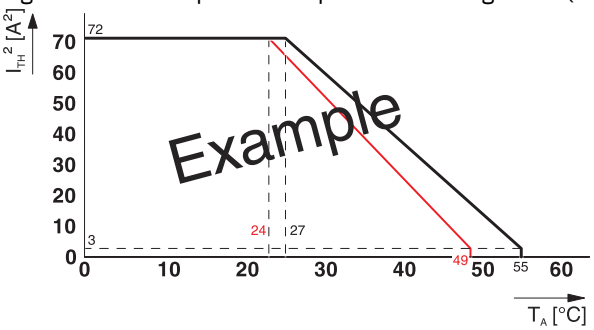
**Example calculation for 3000 m**

The following calculation and the illustrated derating curve are provided as examples.
Perform the actual calculation and offset the derating curve for the device used according to the technical data and the “Derating” section.

27 °C • 0.906 ≈ 24 °C

55 °C • 0.906 ≈ 49 °C

Figure 21 Example of a suspended derating curve (red)



## 24.2 Revision history

| Version | Date | Contents |
|---|---|---|
| 04 | 2022-05-02 | Safety regulations and installation notes section revised.<br>Technical data adapted, AC content removed;<br>Derating curve changed;<br>Diagnostics section revised. Applications section revised.<br>New sections added: Notes on documentation, Electrical service life, Transport, storage, and unpacking, Terminal block coding, Function test / proof test, Device replacement, device defects, and repairs, Maintenance, decommissioning, and disposal. |
| 05 | 2023-05-08 | Ordering data section has been extended to include set items. Technical data section is restructured. Functional and timing diagrams section: Enabling current path, delayed has been corrected to **not** delayed.<br>Interface type (ZVEI classification) section has been added. |
| 06 | 2025-05-14 | Approvals changed, accessories added to order data, technical data updated;<br>Safety regulations and installation notes section updated;<br>Heading added in Relay data section; Electrical service life section edited; note added to Wiring section |
| 07 | 2026-04-15 | Technical data section: approvals and manufacturer’s declarations updated; Safety regulations and installation notes section: reference to SAFETY NOTES FOR INSTALLATION AND MOUNTING added |