

PSR-...-24UC/URM4/5X1/2X2/B



Safety relay for contact extension

Data sheet
100517_en_03

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1 Description

Intended Use

The safety relay is used as a contact extension for safety relays for the emergency stop and safety door monitoring.

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

Possible signal generators

- Safety relays

Contact type

- 5 undelayed enabling current paths
- 1 undelayed confirmation current path
- 1 undelayed enabling current path

The enabling current paths, the confirmation current path, and the signaling current path drop out without delay according to stop category 0 (EN 60204-1).

Control

- Single or two channel
- Automatic start

Achievable safety integrity

- Suitable up to category 4, PL e (EN ISO 13849-1), SILCL 3 (EN 62061) in conjunction with an appropriate evaluation device

Additional features

- Option of screw or spring-cage terminal blocks for plug-in
- 22.5 mm housing width

Approvals



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.net/products.



This document is valid for the products listed in the "Ordering data".

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	Order No.	Pcs./Pkt.
Single or two-channel contact extension, 5 N/O contacts, 1 N/C contact, 1 confirmation current path, plug-in screw terminal blocks, width: 22.5 mm	PSR-SCP- 24UC/URM4/5X1/2X2/B	2981033	1
Single or two-channel contact extension, 5 N/O contacts, 1 N/C contact, 1 confirmation current path, plug-in spring-cage terminal block, width: 22.5 mm	PSR-SPP- 24UC/URM4/5X1/2X2/B	2981046	1
Documentation	Type	Order No.	Pcs./Pkt.
User manual, English, for applications for PSR safety relay	UM EN SAFETY RELAY APPLICATION	2888712	1

4 Technical data

Hardware/firmware version	
HW/FW	≥ 05/--
The technical data and safety characteristics are valid as of the specified HW/FW version.	
Input data	
Rated control circuit supply voltage U_s	24 V AC/DC -15 % / +10 %
Rated control supply current I_s	typ. 81 mA AC typ. 71 mA DC
Typical inrush current	175 mA ($\Delta t = 5$ ms at U_s)
Power consumption at U_s	typ. 1.94 W (AC) typ. 1.7 W (DC)
Filter time	2 ms (at A1 in the event of voltage dips at U_s)
Typical starting time with U_s	< 20 ms (when controlled via A1)
Typical release time with U_s	< 20 ms (when controlled via A1)
Recovery time	< 1 s
Maximum switching frequency	1 Hz
Operating voltage display	1 x green LED
Protective circuit	Surge protection Varistor
Output data	
Contact type	5 enabling current paths 1 confirmation current path 1 signaling current path
Contact material	AgSnO ₂
Minimum switching voltage	5 V AC/DC
Maximum switching voltage	250 V AC/DC (Observe the load curve)
Limiting continuous current	6 A (N/O contact, pay attention to the derating) 6 A (N/C contact)
Maximum inrush current	20 A ($\Delta t \leq 100$ ms)
Inrush current, minimum	10 mA
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + \dots + I_N^2$	72 A ² (observe derating)
Interrupting rating (ohmic load) max.	144 W (24 V DC, $\tau = 0$ ms) 288 W (48 V DC, $\tau = 0$ ms) 110 W (110 V DC, $\tau = 0$ ms) 88 W (220 V DC, $\tau = 0$ ms) 1500 VA (250 V AC, $\tau = 0$ ms)

Output data

Maximum interrupting rating (inductive load)	42 W (24 V DC, $\tau = 40$ ms) 42 W (48 V DC, $\tau = 40$ ms) 42 W (110 V DC, $\tau = 40$ ms) 42 W (220 V DC, $\tau = 40$ ms)
Switching capacity min.	50 mW
Mechanical service life	10×10^6 cycles
Switching capacity (360/h cycles)	4 A (24 V DC) 4 A (230 V AC)
Switching capacity (3600/h cycles)	2.5 A (24 V (DC13)) 3 A (230 V (AC15))
Output fuse	10 A gL/gG (N/O contact) 6 A gL/gG (N/C contact)

General data

Relay type	Electromechanical relay with forcibly guided contacts in accordance with EN 50205
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 instructions	See derating curve
Type of housing	PBT yellow
Air clearances and creepage distances between the power circuits	according to DIN EN 50178/VDE 0160
Rated insulation voltage	250 V AC
Rated surge voltage/insulation	Basic insulation 4 kV: between all current paths and housing
Degree of pollution	Safe insulation, reinforced insulation 6 kV: between A1/A2, 11/12, 23/24, 71/72 and 33/34, 43/44, 53/54, 63/64
Overvoltage category	2

Dimensions

	Screw connection	Spring-cage 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	Spring-cage connection
Conductor cross section, solid	0.2 mm ² ... 2.5 mm ²	0.2 mm ² ... 1.5 mm ²
Conductor cross section, flexible	0.2 mm ² ... 2.5 mm ²	0.2 mm ² ... 1.5 mm ²
Conductor cross section AWG/kcmil	24 ... 12	24 ... 16
Stripping length	7 mm	8 mm
Screw thread	M3	

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	max. 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

Conformance / approvals

Conformance CE-compliant

The full EC Declaration of Conformity can be downloaded for the product at phoenixcontact.net/products.

Approvals

**Safety data**

Stop category according to IEC 60204 0

Safety parameters for IEC 61508 - High demand

SIL 3 (In conjunction with suitable evaluating device)

PFH_D 1.02 x 10⁻¹⁰

Demand rate < 12 Months

Proof test interval 240 Months

Duration of use 240 Months

The specifications apply assuming the following calculation basis

B_{10D} 230000 (At 3 A AC15)d_{op} 365.25 Daysh_{op} 24 ht_{Cycle} 3600 s**Safety parameters for IEC 61508 - Low demand**

SIL 3 (In conjunction with suitable evaluating device)

PFD_{avg} 1.50 x 10⁻⁴

Proof test interval 84 Months

Duration of use 240 Months

Safety characteristic data according to EN ISO 13849

Category 4 (In conjunction with suitable evaluating device)

Performance level e (In conjunction with suitable evaluating device)

Duration of use 240 Months

For applications in PL e, the required demand rate for the safety function is once per month.

Calculation basis

B_{10D} 230000 (At 3 A AC15)d_{op} 365.25 Daysh_{op} 24 ht_{Cycle} 3600 s**Safety parameters for EN 62061**

SILCL 3 (In conjunction with suitable evaluating device)

5 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.

General

- Observe the safety regulations of electrical engineering and industrial safety and liability associations.

Disregarding these safety regulations may result in death, serious personal injury or damage to equipment.

- Only use power supply units with safe isolation and SELV/PELV according to EN 50178/VDE 0160.

Startup, mounting, and modifications

Startup, mounting, modifications, and upgrades may only be carried out by an electrically skilled person.

- Before working on the device, disconnect the power.
- 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).

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.

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.

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.

Surge voltages can destroy the device.

- Make sure that the output voltage of the voltage supply does not exceed 37 V even in the event of error.

Faulty devices

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

- In the event of an error, replace the device.

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

- Repairs to the device
- Opening the housing

Taking out of service and disposal

- Dispose of the device in accordance with environmental regulations.
- Make sure that the device can never be reused.

6 Function description

6.1 Contact extension

The device provides additional output contacts for safe shutdown for a suitable basic device.

6.2 Single-channel or two-channel wiring

The external enable signal of the basic device is connected to A1.

The external enable signal of the basic device can also be optionally connected to A2.

6.3 Automatic start

The device starts automatically once it has received the external enable signal of the basic device.

6.4 Safe shutdown

Once the external enable signal of the basic device has been deactivated, the enabling current paths open without delay.

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

The confirmation current path and signaling current path close.

7 Function and time diagrams

7.1 Time diagram for automatic start

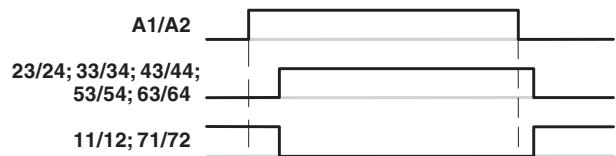


Figure 1 Time diagram for automatic start

Key:

A1/A2	Control
23/24 ... 63/64	Undelayed enabling current paths
11/12, 71/72	(Confirmation) signaling current paths

8 Basic circuit diagram

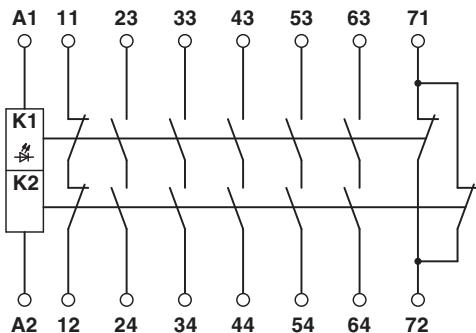


Figure 2 Block diagram

Key:

A1	24 V AC/DC control
A2	0 V control
11/12	Confirmation current path, undelayed
23/24 ... 63/64	Undelayed enabling current paths
71/72	Signaling current path, undelayed

10 Load curve

10.1 Ohmic load

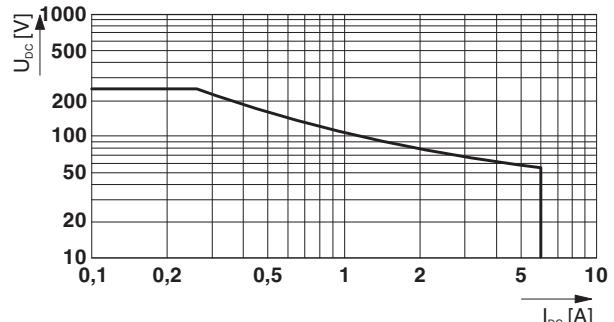


Figure 4 Relay load curve - ohmic load

9 Derating

9.1 Vertical or horizontal mounting position

The derating curve applies for the following conditions:

- Mounting on a vertical or horizontal DIN rail
- Devices mounted next to each other without spacing

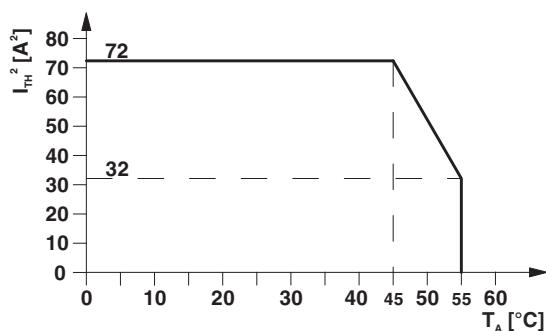


Figure 3 Derating curve - vertical or horizontal mounting position, without spacing

11 Operating and indication elements

11.1 Connection versions

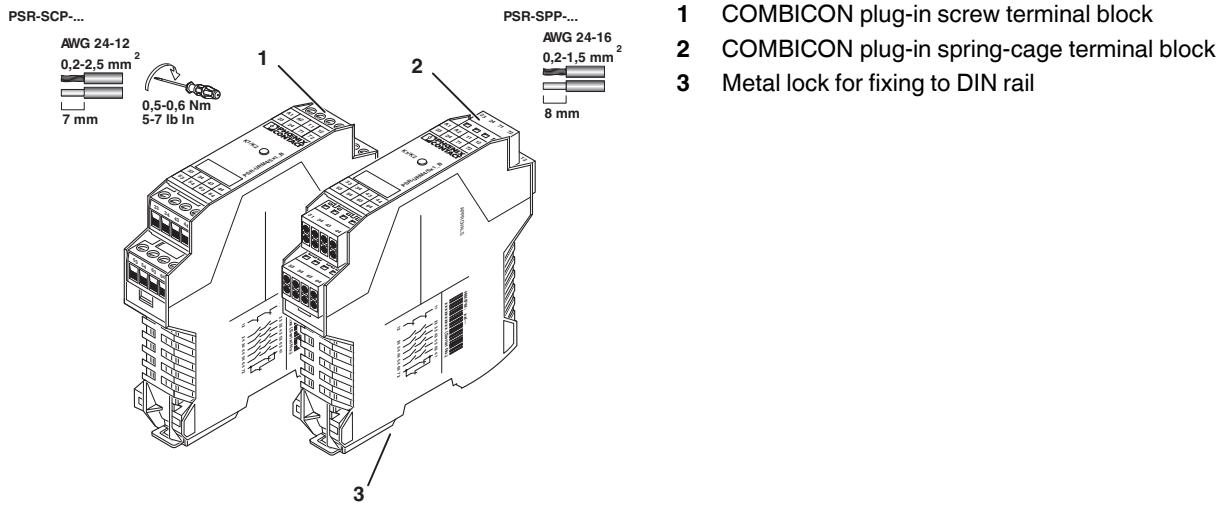
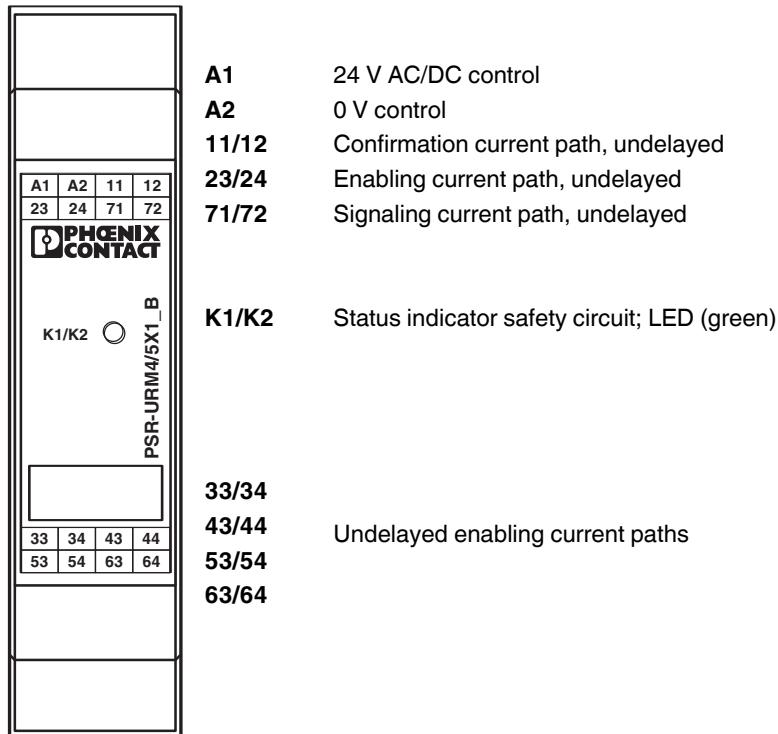


Figure 5 Connection versions

11.2 Connection assignment



12 Mounting and removing

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

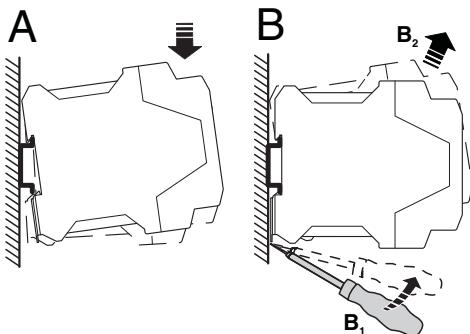


Figure 6 Mounting and removing

13 Wiring

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

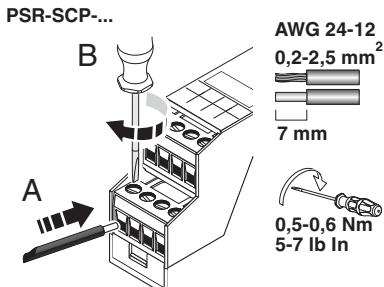


Figure 7 Connecting the cables for PSR-SCP-... (Screw terminal block)

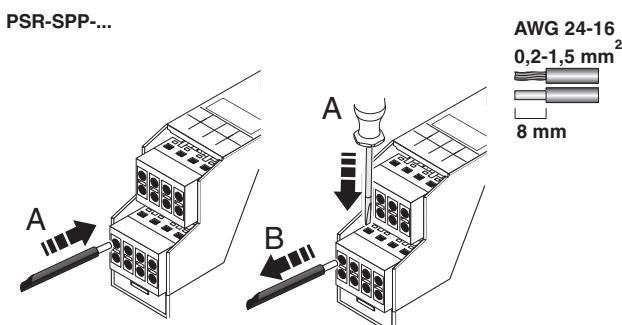


Figure 8 Connecting the cables for PSR-SPP-... (Spring-cage terminal block)



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



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

13.1 Basic device connection

- Connect the basic device to A1.
- Install confirmation current path 11/12 in the feedback circuit of the basic device.

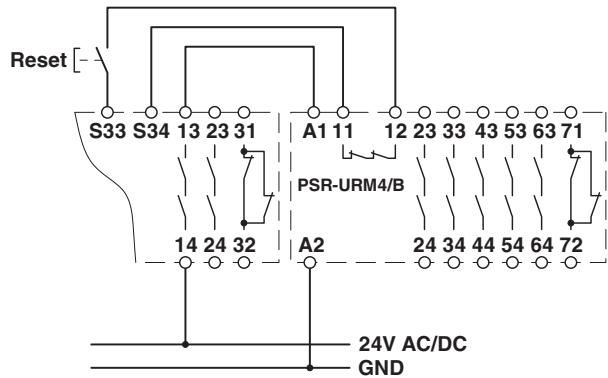


Figure 9 Single-channel connection with integration of the confirmation current path

- Place the relevant N/C contact in the path from 11/12 to the basic device to monitor external contactors or extension devices with force-guided contacts.

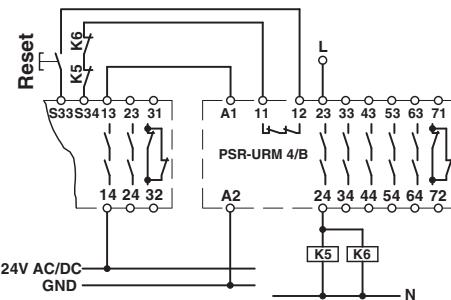


Figure 10 Single-channel connection with integration of the confirmation current path and externally monitored contacts



For two-channel operation, also connect the basic device via A2.

14 Startup

- Provide the external enable signal (24 V AC/DC) at terminal block A1.

The K1/K2 LED lights up.

The enabling current paths 23/24, 33/34, 43/44, 53/54, and 63/64 close.

Confirmation current path 11/12 and signaling current path 71/72 open.

15 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

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

Contact power dissipation

With the same load currents:

$$P_{\text{Contact}} = n \cdot I_L^2 \cdot 200 \text{ m}\Omega$$

With different load currents:

$$P_{\text{Contact}} = (I_{L1}^2 + I_{L2}^2 + \dots + I_{Ln}^2) \cdot 200 \text{ m}\Omega$$

Total power dissipation

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

therefore

$$P_{\text{Total}} = U_B^2 / (U_S/I_S) + n \cdot I_L^2 \cdot 200 \text{ m}\Omega$$

or

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

Key:

- P** Power dissipation in mW
- U_B** Applied operating voltage
- U_S** Rated control circuit supply voltage
- I_S** Rated control supply current
- n** Number of enabling current paths used
- I_L** Contact load current

16 Diagnostics

For the diagnostic description, please refer to the application manual for PSR safety relays.

Function test/proof test



Use the function test to test the safety function. To do this, request the safety function once via the basic device by pressing the emergency stop button, for example. Check whether the safety function is executed correctly by then switching the basic device and thereby also the contact extension on again.

17 Application examples

17.1 Two-channel emergency stop monitoring with contact extension

- Manual, monitored start
- Monitoring of external contactors
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061), if cross-circuits can be ruled out in the control for contact extension



Cross-circuits in the cable installation can be excluded if the safety relay and the contact extension are located in the same electrical installation space.

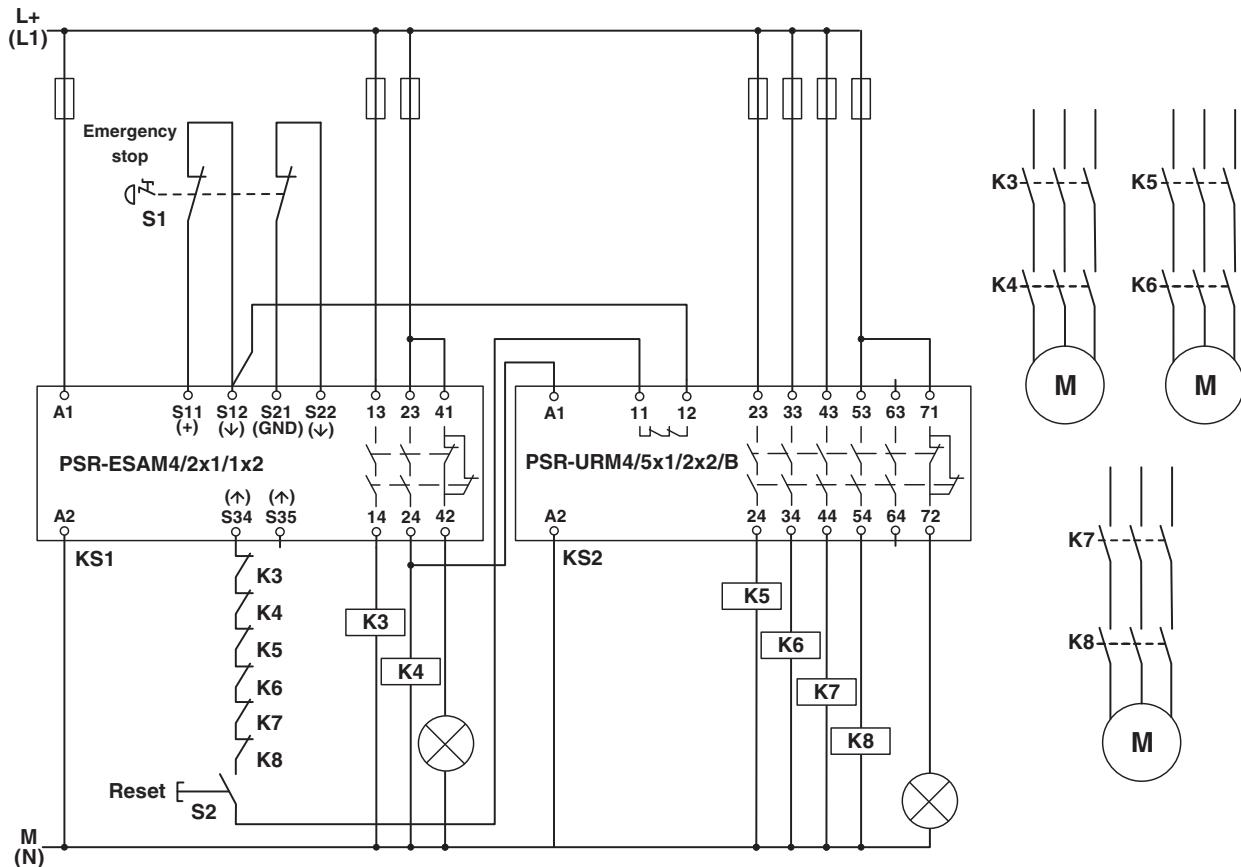


Figure 11 Two-channel emergency stop monitoring with contact extension

Key:

S1 Emergency stop button

K3 ... K8 Contactors

18 Attachment

18.1 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 **greater than 2000 m above sea level up to max. 4500 m above sea level** 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.

$$27 \text{ }^{\circ}\text{C} \bullet 0.906 \approx 24 \text{ }^{\circ}\text{C}$$

$$55 \text{ }^{\circ}\text{C} \bullet 0.906 \approx 49 \text{ }^{\circ}\text{C}$$

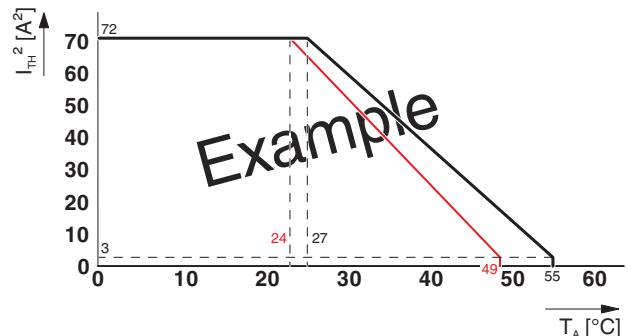


Figure 12 Example of a suspended derating curve (red)

18.2 Revision history

Version	Date	Contents
03	2016-02-03	New edition of the data sheet