PSR-...- 24DC/ESP4/2X1/1X2



Safety relay for emergency stop and safety door monitoring

Data sheet
100516_en_10

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1 Description

Intended Use

The safety relay is used to monitor 1-channel signal generators and to control actuators.

If the enable signal of the signal generator is not present at A1, the safety relay initiates the safe state.

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

Possible signal generators

- Emergency stop button
- Door locking mechanisms
- Failsafe controllers

Contact switching type

- 2 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

- 1-channel
- Automatic or manual start

A connected reset button is not monitored.

Achievable safety integrity

- Suitable for high- and low-demand applications up to SIL 3 (IEC 61508), SIL 3 (IEC 61511), Cat. 4 / PL e (EN ISO 13849), SIL 3 (EN 62061)

Additional features

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

Approvals

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 SIL 3 high-demand and low-demand applications, also approved in accordance with EN 50156, DNV, and EN ISO 13849, emergency stop and safety door monitoring, 1-channel, 2 enabling current paths, 1 signal contact, plug-in screw terminal blocks, width: 22.5 mm	PSR-SCP- 24DC/ESP4/2X1/1X2	2981020	1
Safety relay for SIL 3 high-demand and low-demand applications, also approved in accordance with EN 50156, DNV, and EN ISO 13849, emergency stop and safety door monitoring, 1-channel, 2 enabling current paths, 1 signal contact, width: 22.5 mm, pluggable Push-in terminal block	PSR-SPP- 24DC/ESP4/2X1/1X2	2981017	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

4 Technical data

Hardware/firmware version	
HW/FW	≥ 09/--
The technical data and safety characteristics are valid as of the specified HW/FW version.	

Digital inputs: Logic (A1)	
Number of inputs	1
Description of the input	safety-related
Input voltage range "1" signal	20.4 V ... 26.4 V
Inrush current	max. 1 A (typ. with U_S, Δt = < 10 ms)
Current consumption	65 mA (typ. with U_S)
Filter time	max. 3 ms (Test pulse width of low test pulses) min. 200 ms (Test pulse rate for low test pulse) No brightness test pulses / high test pulses permitted.
Max. permissible overall conductor resistance	50 Ω
Protective circuit	Suppressor diode

Digital inputs: Start circuit (Y2)	
Number of inputs	1
Description of the input	non-safety-related
Input voltage range "1" signal	20.4 V ... 26.4 V
Inrush current	< 14 mA (typ. with U_S at Y2, Δt - 10 ms)
Current consumption	0 mA (typ. with U_S at Y2)
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)	
Number of outputs	2
Output description	2 N/O contacts each in series, safety-related, floating
Contact material	$AgSnO_2$
Switching voltage (see section “Relay data”)	min. 10 V max. 250 V AC/DC
Limiting continuous current (see section “Relay data”)	6 A (Observe derating and load limit curve)
Inrush current	min. 10 mA max. 6 A
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$	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) 5 A (DC13)
Output fuse	10 A gL/gG 4 A gL/gG (for low-demand applications)

Relay outputs: Signaling current path (31/32)	
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 max. 250 V AC/DC
Limiting continuous current	6 A
Inrush current	min. 10 mA max. 6 A
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$	36 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	1.5 A (AC15) 2 A (DC13)
Output fuse	6 A gL/gG

Times	
Typical starting time with U_s	60 ms (At Us/on demand via A1)
Typical response time at U_s	typ. 60 ms (For U_s manual, monitored start) 60 ms (For U_s autostart)
Typical release time with U_s	typ. 20 ms (At Us/on demand via A1)
Restart time	< 1 s (Boot time)
Recovery time	≥ 1 s (following demand of the safety function)
Start pulse length	≥ 500 ms (manual start)

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	On horizontal and vertical DIN rail
Type of housing	PA zinc yellow (RAL 1018)
Operating voltage display	Green LED
Status display	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	16.12 W (At U_S = 26.4 V, I_L^2 = 72 A², $P_{Total\ max}$= 1.72 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

Conformance/Approvals	
CE	CE-compliant
The full EC Declaration of Conformity can be downloaded for the product at phoenixcontact.com/products.	
Approvals	

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
Systematic Capabiltiy (SC)	3
PFH_D	1.16×10^{-10}
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
Systematic Capabiltiy (SC)	3
PFD_{avg}	1.24×10^{-4}
Proof test interval	72 Months
Mission time	240 Months

Safety parameters according to EN ISO 13849-1	
Category	4
Performance level	e
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

5 Interface type (ZVEI classification)

Digital inputs : Logic (A1)				
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)	5 mA	-	1 A (Δt = < 10 ms)
Output voltage U_i	20.4 V	-	26.4 V
Input capacitance C_i	-	-	-
Additional measure M	- The inputs are not types in accordance with IEC 61131-2.		

Digital inputs : Start circuit (Y2)				
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)	0 mA (Y2)	-	14 mA (Δt - 10 ms)
Output voltage U_i	20 V	-	26.4 V
Input capacitance C_i	-	-	-
Additional measure M	- The inputs are not types in accordance with IEC 61131-2. - T_G is Y1 (24 V without cycle)		

Relay outputs : Enabling current paths 13/14, 23/24				
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/DC
Internal resistance R_i (in the switched state)	Load ≥ 1 A ≤ 200 mΩ	-	Load ≥ 10 mA ≤ 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. - No test pulses are emitted at the output.		

Relay outputs : Signaling current path 31/32				
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 ≤ 100 mΩ	-	Load ≥ 10 mA ≤ 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. - 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.

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 Single-channel wiring

The signal generator or the external enable signal of the failsafe controller is switched at A1.

9.2 Automatic start

The device starts automatically once it has received the enable signal of the signal generator or failsafe controller.

9.3 Manual start

When the enable signal is present, the device starts once the start circuit has been closed by pressing the reset button.

A connected reset button is not monitored.

9.4 Safe shutdown

Once the external enable signal has been deactivated, the enabling current paths open and the contacts enter the safe state.

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

The signaling current path closes.

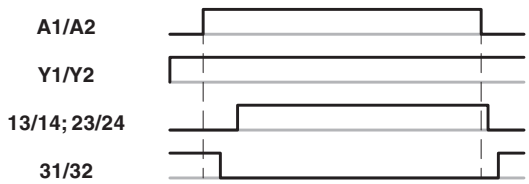
10 Function and time diagrams

Key:

A1/A2	Control voltage
Y1/Y2	Start and feedback circuit
13/14, 23/24	Enabling current path
31/32	Signaling current path

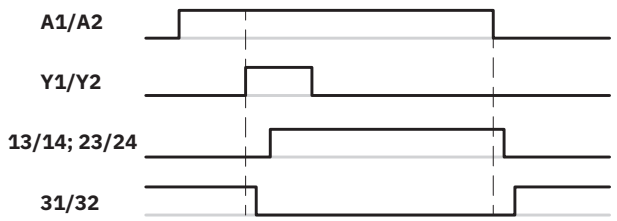
10.1 Time diagram for automatic start

Figure 1 Time diagram for automatic start



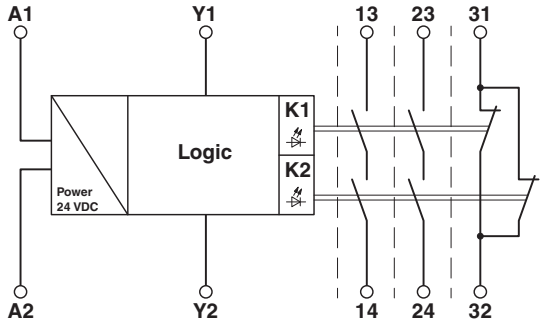
10.2 Time diagram for manual start

Figure 2 Time diagram for manual start



11 Block diagram

Figure 3 Block diagram



Key:

A1/A2	Control voltage
Y1/Y2	Start and feedback circuit
13/14	Undelayed enabling current paths
23/24	
31/32	Signaling current path, undelayed

11.1 Insulation coordination

	Housing	A1/A2, Y1/Y2	13/14	23/24	31/32
Housing	-	4 kV BI	4 kV BI	4 kV BI	4 kV BI
A1/A2, Y1/Y2	-	-	6 kV ST	6 kV ST	6 kV ST
13/14	-	-	-	6 kV ST	6 kV ST
23/24	-	-	-	-	6 kV ST
31/32	-	-	-	-	-

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

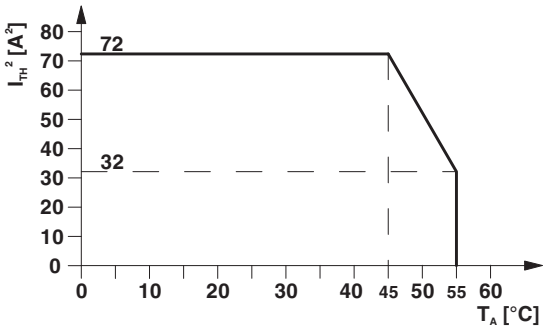
The temperature is measured at a 5 cm clearance below or to the side of the device.

12.1 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

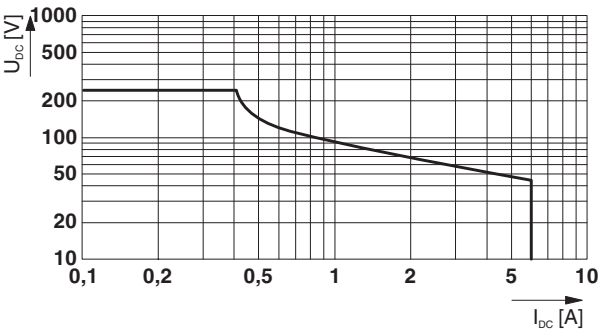
Figure 4 Derating curve - vertical or horizontal mounting position, without spacing



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

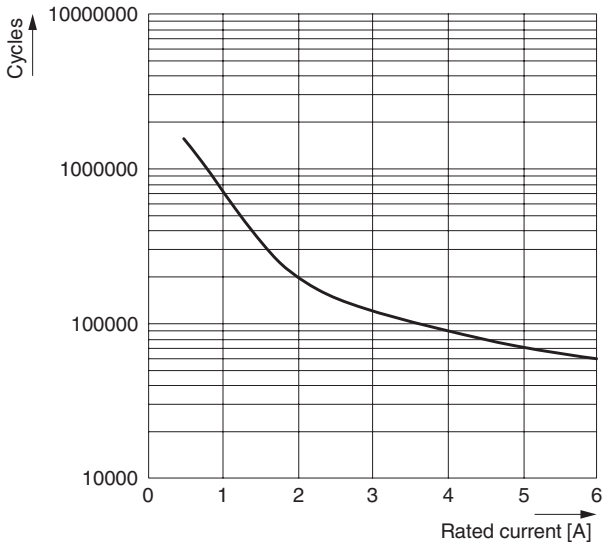


Figure 7 Number of switching cycles for AC-15

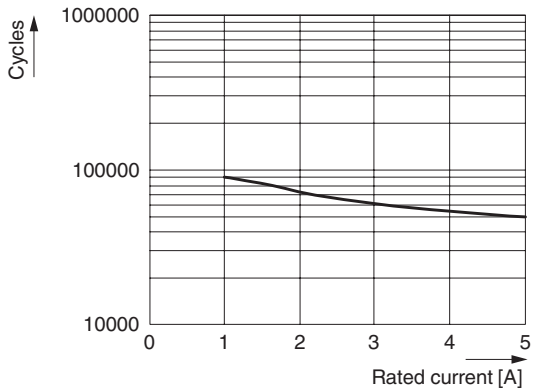


Figure 8 Number of switching cycles for DC-1

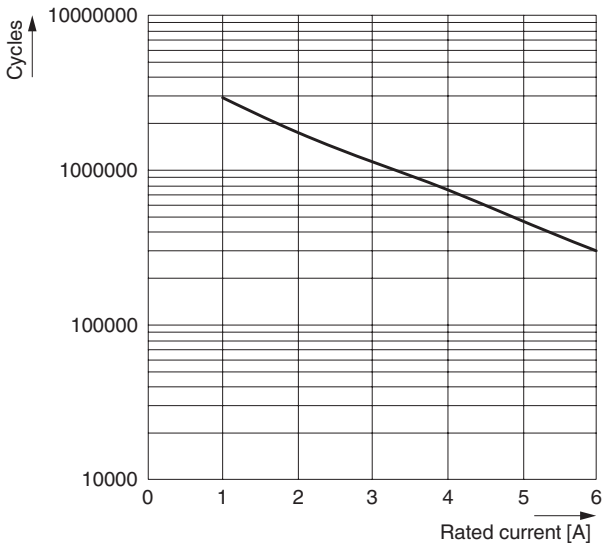
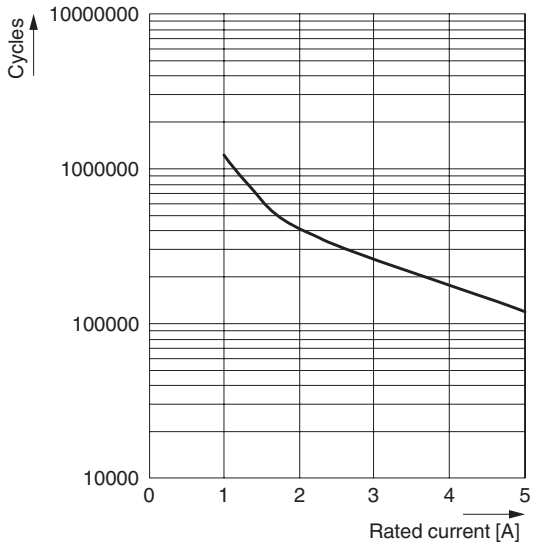


Figure 9 Number of switching cycles for DC-13



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

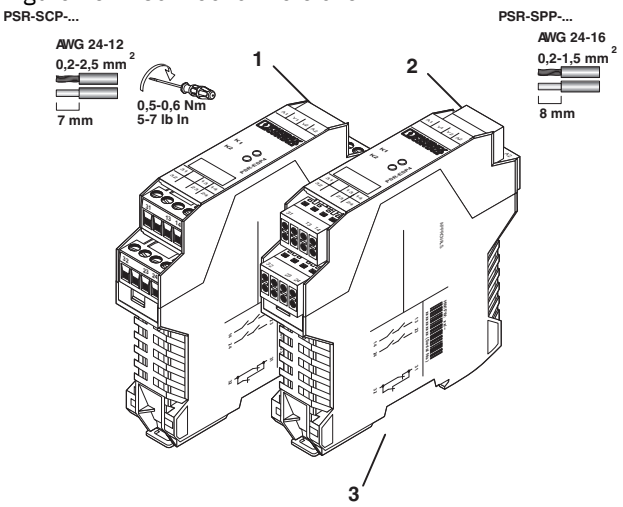
At the end of the electrical service life, there is an increased risk of loss of functional safety.

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

14 Operating and indication elements

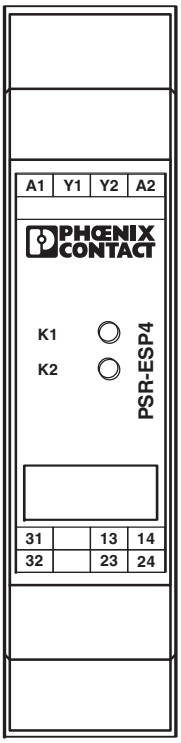
14.1 Connection versions

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

14.2 Connection assignment



A1/A2 Control voltage
Y1/Y2 Start and feedback circuit

K1 Status indicator safety circuit, LED (green)
K2 Status indicator safety circuit, LED (green)

31/32 Signaling current path, undelayed
13/14
23/24 Undelayed enabling current paths

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.

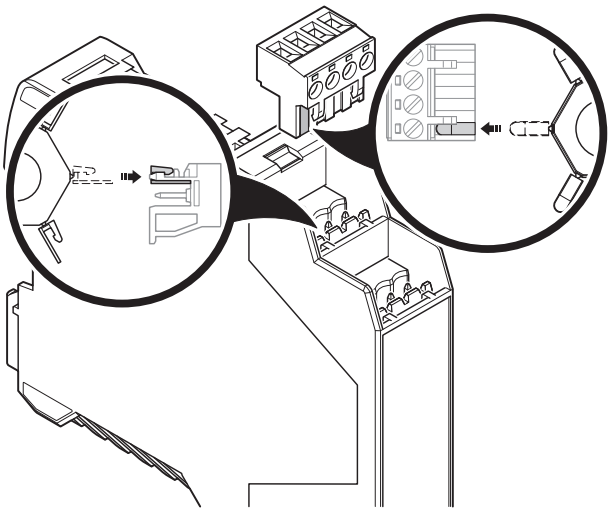
Coding profiles are plugged into the groove of the pluggable terminal block.

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.

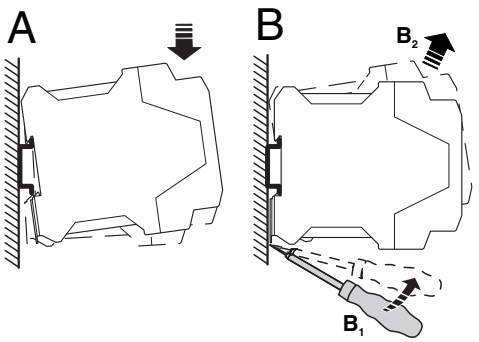
Figure 11 Attach coding elements



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

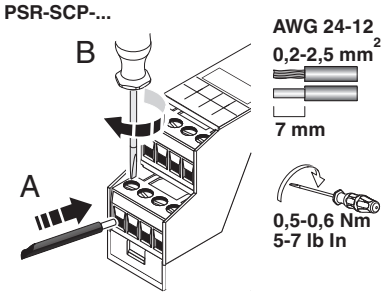
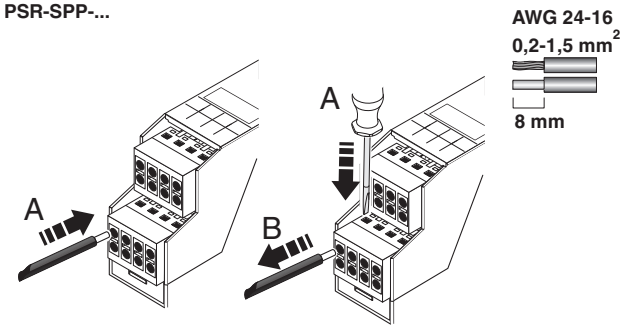


Figure 14 Connecting the cables for PSR-SPP-... (Push-in terminal block)



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

Use the CRIMPFOX 6 crimping tool from Phoenix Contact.

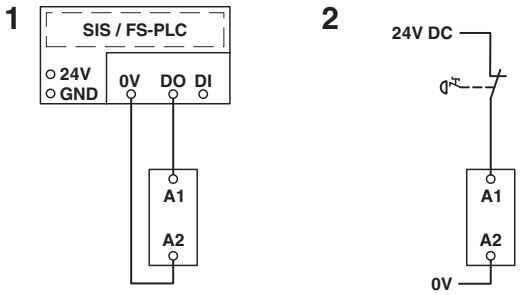
The tool enables the reliable processing of ferrules and easy removal of conductors with ferrules from the connection terminal blocks.

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 A1.

Figure 15 Signal generator connection versions



1 1-channel control via failsafe controller

2 1-channel connection

16.2 Start and feedback circuit connection variants

Automatic start

- Bridge contacts Y1/Y2.

Manual start

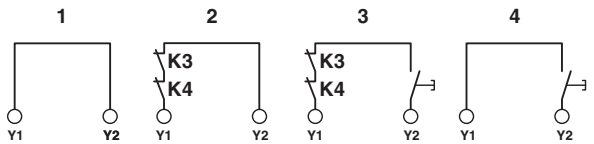
- Connect a reset button to contacts Y1/Y2.

A connected reset button is not monitored.

Start and feedback circuit

- Place the relevant N/C contacts in path Y1/Y2 to monitor external contactors or extension devices with force-guided contacts.

Figure 16 Start and feedback circuit connection variants



1 Automatic start

2 Automatic start with monitored contact extension

3 Manual start with monitored contact extension

4 Manual start

17 Startup

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

Automatic start

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

Signaling current path 31/32 opens.

The K1 and K2 LEDs light up.

Manual start

- Press the reset button.

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

Signaling current path 31/32 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

With the same load currents:

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

With different load currents:

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

Total power dissipation

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

therefore

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

or

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

Key:

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

19 Proof test

To verify the device function, proceed as follows:

1. Deactivate the device.
2. Restart the device.
3. Check whether the K1 and K2 LEDs light up.

If the K1 and K2 LEDs light up, both safety circuits have been started correctly.

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

20.1 General states

Key:

○ LED OFF
● LED ON

LED		State	Notes
K1	K2		
○	○	No relays are activated. The start circuit is inactive.	Possible error see error messages
●	●	All relays are picked up.	-

20.2 Error messages

Key:

○ LED OFF
● LED ON

LED		Possible cause	Corrective
K1	K2		
○	○	No voltage or undervoltage at A1/A2.	Check the control voltage.
		Short circuit between A1 and A2.	Switch off the control voltage and rectify the short circuit. Then perform a function test.
		External error: the readback contact (external actuator) is open in the reset circuit. Internal error: diagnostics active.	External error: Examination of the actuator. Internal error: Power Down, Reset with subsequent test of the safety function (function test). If the error occurs after the function test, please replace the device.
○	●	Internal error. Diagnostics active.	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 High-demand application with failsafe controller

Application description:

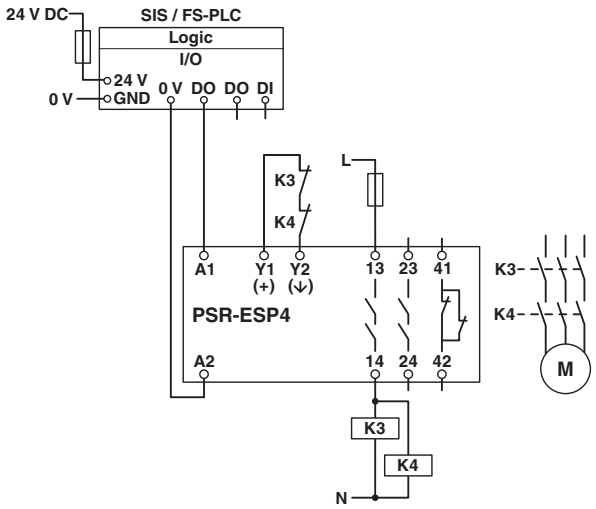
- Automatic start
- It is assumed that errors in the cable installation have been eliminated
- Monitoring of external, force-guided contactors
- The digital output (DO) of the failsafe controller satisfies the requirements in accordance with the required safety integrity

Achievable safety integrity:

- Suitable for high-demand applications up to SIL 3 (IEC 61508, IEC 61511), Cat. 4 / PL e (EN ISO 13849), SIL 3 (EN IEC 62061)

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

Figure 17 High-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K3/K4	Force-guided contactors

21.2 Low-demand application with failsafe controller

Application description:

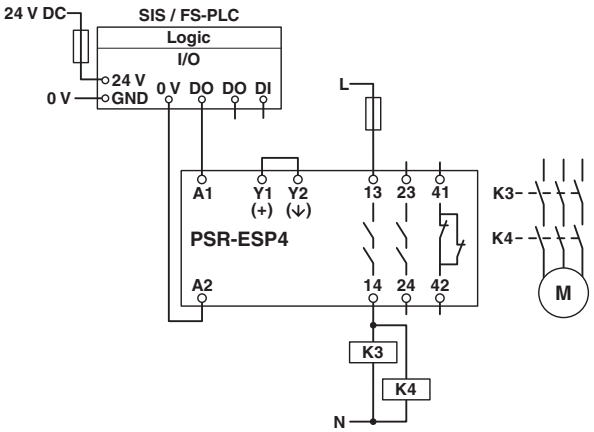
- Automatic start
- It is assumed that errors in the cable installation have been eliminated
- The digital output (DO) of the failsafe controller satisfies the requirements in accordance with the required safety integrity

Achievable safety integrity:

- Suitable for low-demand applications up to SIL 3 (IEC 61508, IEC 61511)

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

Figure 18 Low-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K3/K4	Force-guided contactors

21.3 Single-channel emergency stop monitoring

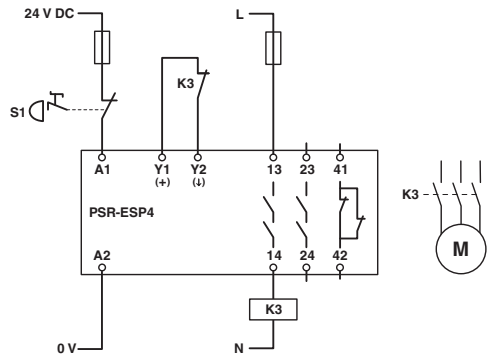
Application description:

- Automatic start
- Monitoring of external contactor
- The emergency stop button satisfies the requirements in accordance with the required safety integrity

Achievable safety integrity:

- Suitable for high-demand applications up to SIL 1 (IEC 61508, IEC 61511), Cat. 1 / PL c (EN ISO 13849), SIL 1 (EN IEC 62061)

Figure 19 1-channel emergency stop monitoring/auto-start



Key:

S1	Emergency stop button
K3	Contactor

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

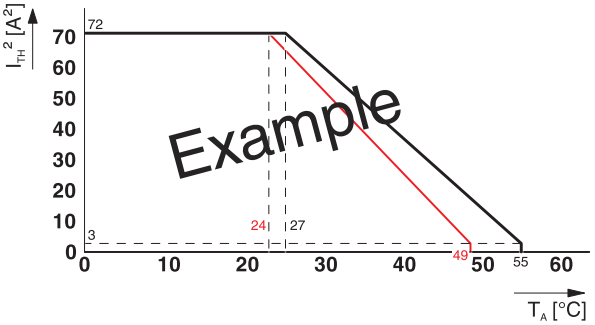
Example calculation for 3000 m

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 20 Example of a suspended derating curve (red)



24.2 Revision history

Version	Date	Contents
06	2019-03-08	New edition of the data sheet
07	2020-11-06	Chap. Technical data: Maximum interrupting rating (inductive load) removed, note on output fuse added; Chap. Safety regulations and installation notes: note on inductive loads changed; Chap. Load limit curve: figure changed; Chap. Application examples: EN 50156 for example 1 and 3 added
08	2023-06-30	Page 1 new structure. Technical data: new structure, HW/FW, digital inputs, start pulse duration and HFT added, supply changed to DC, suppressor diode protective circuit, inrush current and switching capacity, response time changed, HFT added. New sections added: Interface type (ZVEI classification), Notes on documentation, Transport, storage and unpacking, Functional description, Functional and timing diagrams, Insulation coordination, Load limit curve, Electrical service life, Optional terminal coding, Mounting and removal, Wiring, Commissioning, Calculation of power dissipation, Function test/proof test, Device replacement, Device defect and repair, Maintenance, Decommissioning and disposal, Appendix. Revised sections: Safety regulations and installation instructions, Derating, Operating and indication elements, Diagnostics, Application examples.
09	2023-11-06	Technical data section, enabling current paths: switching capacity changed to 5 A (DC13)
10	2025-06-02	Approvals changed, accessories added to order data, technical data updated; Safety regulations and installation notes section updated; Heading added in Relay data section; Electrical service life section edited; note added to Wiring section