PSR-PC21

SIL coupling relay

Data sheet
109207_en_03

 2024-11-11

1 Description

Intended Use

The SIL coupling relay is used to adjust the power and for electrical isolation in high- and low-demand applications. The coupling relay safely interrupts circuits. The category 3 device is designed for installation in zone 2 potentially explosive areas.

Possible signal generators

– Failsafe controllers

Contact switching type

– 2 undelayed enabling current paths
– 2 confirmation current paths without delay

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

Control

– 1- or 2-channel
– Automatic start
– Independent control of the relay channels possible

The enabling current paths can be controlled individually by independently controlling the relay channels.

Achievable safety integrity

– Suitable for high-demand applications up to SIL 3 (IEC 61508), SIL 3 (IEC 61511), Cat. 4 / PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061)

Additional features

– Easy proof test according to IEC 61508 due to forcibly guided signal contact
– Integrated test pulse filter.
– Optional pluggable screw or Push-in terminal blocks
– 12.5 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.

2 Table of contents

3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Coupling relay for SIL 3 high and low-demand applications, coupled digital output signals to the I/O, 2 independently controllable enabling current paths, 2 confirmation current paths, safe state off applications, test pulse filter, pluggable screw terminal block	PSR-PC21-2NO-2NC-24DC-SC	1086945	1
Coupling relay for SIL 3 high and low-demand applications, coupled digital output signals to the I/O, 2 independently controllable enabling current paths, 2 confirmation current paths, safe state off applications, test pulse filter, pluggable Push-in terminal block	PSR-PC21-2NO-2NC-24DC-SP	1086946	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	≥ 00/--
The technical data and safety characteristics are valid as of the specified HW/FW version.	
Control inputs: A1/A2, A3/A4	
Rated control circuit supply voltage U_S	24 V DC -20 % / +25 %
Rated control circuit supply voltage U_S	19.2 V DC ... 30 V DC
Rated control supply current I_S per channel (configurable)	typ. 15 mA typ. 25 mA typ. 40 mA typ. 46 mA
Power consumption at U_S per channel (configurable)	typ. 360 mW typ. 600 mW typ. 960 mW typ. 1.1 W
Input voltage range "0" signal	0 V DC ... 5 V DC
Input current range "0" signal	0 mA ... 2 mA
Inrush current per channel (configurable)	typ. 200 mA (Δt = 10 µs at U_s) typ. 300 mA (Δt = 10 µs at U_s)
Filter time	2 ms (in the event of voltage dips at U_s)
Protective circuit	Serial protection against polarity reversal, 38.6 V suppressor diode
Relay outputs: Enabling current paths (13/14, 33/34)	
Number of outputs	2
Output description	2 N/O contacts parallel, without delay, safety-related, floating
Contact material	$AgSnO_2$
Switching voltage (see section “Relay data”)	min. 12 V DC max. 250 V AC/DC
Limiting continuous current (see section “Relay data”)	6 A (High demand) 4 A (Low demand)
Inrush current	min. 3 mA max. 6 A
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$	72 A^2 (High-demand, observe derating) 32 A^2 (Low-demand, observe derating)
Switching capacity	min. 60 mW
Switching frequency	max. 0.1 Hz
Service life electrical	See section “Electrical service life”
Mechanical service life	10x 10^6 cycles
Switching capacity in accordance with IEC 60947-5-1	4 A (24 V (DC13)) 4 A (250 V (AC15), low demand) 2 A (250 V (AC15), high demand)
Output fuse	6 A gL/gG 4 A gL/gG (for low-demand applications)

Relay outputs: Confirmation current paths (21/22, 41/42)	
Number of outputs	2
Output description	2 N/C contacts parallel, without delay, safety-related, floating
Contact material	AgCuNi, + Au
Switching voltage	min. 5 V DC max. 30 V DC
Limiting continuous current	100 mA
Inrush current	min. 1 mA max. 100 mA
Switching capacity	min. 20 mW
Mechanical service life	10x 10^6 cycles
Output fuse	150 mA Fast-blow

Times	
Typical starting time with U_s	< 70 ms (when controlled via A1 or A3 at U_S)
Typical release time with U_s	< 30 ms (when controlled via A1 or A3 at U_S)
Recovery time	500 ms

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	Polyamide zinc yellow (RAL 1018)
Status display	2 x LED (green)
Air clearances and creepage distances between the power circuits	according to EN 61010-1, EN 60947-1, EN 60079-7, EN 60079-15
Rated insulation voltage	250 V AC
Rated surge voltage/insulation	See “Insulation coordination”
Degree of pollution	2
Overvoltage category	III
Maximum power dissipation for nominal condition	7.05 W (S1, S2, S3, S4 = ON, 2-channel load, U_B = 30 V, U_S = 24 V, I_S = 2*46 mA, I_L^2 = 36 A, $R_{contact}$ = 0.05 Ω)
Note on power dissipation	See “Calculating the power dissipation”

Dimensions	Screw connection	Push-in connection
W x H x D	12.5 x 112.2 x 114.5 mm	12.5 x 116.6 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	0.6 Nm	-

Ambient conditions	
Ambient temperature (operation)	-40 °C … 70 °C (observe derating)
Ambient temperature (storage/transport)	-40 °C … 85 °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 complete EU declaration of conformity is available on the Internet at phoenixcontact.com/products.	
Approvals	
IECEx (IECEx ULD 19.0023X)	Ex ec nC IIC T4 Gc
ATEX (DEMKO 19 ATEX 2240X)	II 3G Ex ec nC IIC T4 Gc
UL, USA/Canada (E140324)	cULus
UL Ex, USA / Canada (E360692)	Class I, Zone 2, AEx ec nC IIC T4 / Ex ec nC IIC Gc T4 X Class I, Div. 2, Groups A, B, C, D, T4
CCC / China-Ex (2022122304115696)	Ex ec nC IIC T4 Gc
Environmental simulation test (ISA-S71.04)	G3

Safety data	
Stop category according to IEC 60204	0

Safety parameters in accordance with IEC 61508 - high demand		
	IEC 61508 – High-demand for 2-channel wiring (1oo2 structure)	**IEC 61508 – High-demand for 1-channel wiring (1oo1 structure)**
Equipment type	Type A	Type A
HFT	1	0
SIL	3	2
Systematic Capabiltiy (SC)	3	3
PFH_D	1.00×10^{-9}	1.00×10^{-8}
Demand rate	< 12 Months	< 12 Months
Proof test interval	240 Months	240 Months
Mission time	240 Months	240 Months
Calculation basis	4 A DC13; 2 A AC15 (application examp. 1), 4 A AC15 (application examp. 2); 8760 switching cycles/year	4 A DC13; 2 A AC15 (application examp. 3); 8760 switching cycles/year
Note	For use in high-demand applications, the diagnostics function must be implemented via the confirmation current path.	For use in high-demand applications, the diagnostics function must be implemented via the confirmation current path.

SIL examination as a 1oo1 structure alternative illustration		
Equipment type	Type A	Type A
HFT	0	0
SIL	3	2
Systematic Capabiltiy (SC)	3	3
SFF	99 %	99 %
λSD	0 FIT	0 FIT
λSU	2497.76 FIT	918.43 FIT
λDD	3.63 FIT	379.5 FIT
λDU	0.07 FIT	3.83 FIT
λTotal	2501.46 FIT	1301.77 FIT
MTBF	45.18 Years	85.72 Years
PFH_D	7.33×10^{-11}	3.83×10^{-9}

Safety technology parameters according to IEC 61508 - low demand		
	IEC 61508 – Low-demand for 2-channel wiring (1oo2 structure)	**IEC 61508 – Low-demand for 1-channel wiring (1oo1 structure)**
Equipment type	Type A	Type A
HFT	1	0
SIL	3	2
Systematic Capability	3	3
PFD_{avg}	1.36×10^{-4}	$1{,}61 \times 10^{-3}$
Proof test interval	72 Months	21 Months
Mission time	240 Months	240 Months

SIL examination as a 1oo1 structure alternative illustration		
Equipment type	Type A	Type A
HFT	0	0
SIL	3	2
Systematic Capability	3	3
SFF	99 %	84 %
λSD	0 FIT	0 FIT
λSU	3010.53 FIT	1228.58 FIT
λDD	0 FIT	0 FIT
λDU	4.26 FIT	210.24 FIT
λTotal	3014.79 FIT	1438.82 FIT
MTBF	37.49 Years	79.14 Years
PFD_{avg} (for T1 = 1 year)	1.87×10^{-5} (for proof test interval = 1 year)	9.91×10^{-4} (for proof test interval = 1 year)

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. For use in high-demand applications, the diagnostic function must be implemented via the confirmation current path.	
Calculation basis	4 A DC13; 2 A AC15 (application examp. 1), 4 A AC15 (application examp. 2); 8760 switching cycles/year

Safety parameters in accordance with EN IEC 62061	
SIL	3
For applications in SIL 3 the required demand rate for the safety function is once per month.	

Safety parameters for EN 50156-2	
SIL	3 (Reference IEC 61508)

5 Notes regarding documentation

5.1 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.

5.2 Validity

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

5.3 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

6 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

The device contains components that can be damaged or destroyed by electrostatic discharge.

- When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

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.

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).

Error removal within the process safety time

When an error is detected by the higher-level controller, it is assumed that the safety function can no longer be performed.

The error must be removed within 72 hours or within the process safety time if required by the application.

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

6.1 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.

6.2 Installation in potentially explosive area

WARNING: Explosion hazard when used in potentially explosive areas

Please make sure that the following notes and instructions are observed.

- The category 3 device is designed for installation in zone 2 potentially explosive areas. It satisfies the requirements of the following standards. Comprehensive details are to be found in the EU Declaration of Conformity which is enclosed and also available on our website in the latest version:

  EN/IEC 60079-0, EN/IEC 60079-7, EN/IEC 60079-15
- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described.
- When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations, must be observed. The safety-relevant data is listed in this document.
- Observe the specified conditions for use in potentially explosive areas! Also observe the requirements of EN/IEC 60079-14.
- It is not permissible to open or modify the device. Do not repair the device yourself but replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from violation.
- Do not subject the device to mechanical and/or thermal loads that exceed the specified limits.
- The device must be stopped and immediately removed from the Ex area if it is damaged or was subject to an impermissible load or stored incorrectly or if it malfunctions.
- **Nominal switching voltages greater than 60 V SELV/PELV and simultaneous load currents greater than 2 A are only permitted for low-demand applications.**
- **When load contacts 13/14 are connected in series with 33/34, the electrical service life is 20000 switching cycles.Replace the device in good time before the end of the electrical service life.**

6.3 Special conditions

- Install the device in such a way that a degree of protection of at least IP54 is achieved in accordance with EN/IEC 60529.
  To this end, a suitable, approved housing that meets the requirements of EN/IEC 60079-0, GB/T 3836.1 must be used.
- Only devices that are designed for operation in Ex zone 2 and are suitable for the conditions at the installation location may be connected to circuits in zone 2.
- In potentially explosive areas, only connect and disconnect cables and plug-in connections (e.g., connector, SD card, DIN rail connector) when the power is disconnected.
- For safe operation, lockable plug-in connections (e.g., connector, SD card, DIN rail connector) must be fully inserted and have a functional interlock (e.g., locking clip, screw connection).
- Insert the interlock. Repair any damaged plug-in connections immediately.
- Only connect one cable to each terminal point.
- Use the device in an environment that does not exceed pollution degree 2 in accordance with EN/IEC 60664-1, GB/T 16935.1.
- Use transient protection so that short-term surge voltages do not exceed 119 V.

6.4 Ambient temperature in potentially explosive area

- Observe the derating curves.
- Observe the special temperature conditions according to the rating plate.

Figure 1 Rating plate (laser printing)

Input	A1-A2	24V DC, 46mA	A3-A4	24V DC, 46mA
Output	13/14 NO-contact	21/22 NC-contact	33/34 NO-contact	41/42 NC-contact
	250V AC, 2A Resistive 24V DC, 6A Resistive B300 , R300	24V DC 100mA Resistive	250V AC, 2A Resistive 24V DC, 6A Resistive B300 , R300	24V DC 100mA Resistive
Ambient Temperature	-40 °C to 65 °C (see Note 1 in fig. 4 in Operating Manual)		-40 °C to 65 °C	

Note 1:
Horizontal mounting NO and NC at 65 °C Ambient Temperature with 10 mm spacings between devices.
Vertical mounting NO and NC at 55 °C Ambient Temperature with 10 mm spacings between devices.
Vertical mounting NO and NC at 45 °C Ambient Temperature without spacings between devices.
Horizontal mounting NO and NC at 45 °C Ambient Temperature without spacings between devices.

6.5 Installation in areas with a danger of dust explosions

WARNING: Explosion hazard

The device is not designed for use in atmospheres with a danger of dust explosions.

7 UL notes

7.1 UL Ordinary Location

– Only use copper connecting cables providing the permitted temperature range (60°C/75°C).
– Tighten the screws on the screw terminal blocks with 5 ... 7 lb in (0.5 ... 0.6 Nm).

7.2 UL Hazardous Location

– This device must be installed in an area that is no longer classified as pollution degree 2 in accordance with IEC 60664-1.
– WARNING - Do not disconnect the terminal blocks when energized!
– Device must be mounted in a **tool only accessible** enclosure certified for use in Class I, Zone 2, Groups IIC and rated IP54 in accordance with IEC 60529 when used in Class I, Zone 2 environment.
– A surge protection device must be provided outside of the device that is set to a level that does not exceed 140 % of the nominal voltage at the power supply connections of the device.

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 Independent control of the relay channels

The enabling current paths can be controlled individually by independently controlling the relay channels.

The control via A1/A2 affects the enabling current path 13/14 and the associated confirmation current path 21/22.

The control via A3/A4 affects the enabling current path 33/43 and the associated confirmation current path 41/42.

See “Block diagram” section.

9.2 One or two-channel activation

For both relay channels, 1- or 2-channel control is possible.

With 1-channel control, the external enable signal of the failsafe controller is switched at A1 or at A3.

For 2-channel control, the external enable signal of the failsafe controller is additionally switched via a negative switching output at A2 or A4.

See “Signal generator connection versions” section.

9.3 Automatic start

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

9.4 Safe shutdown

Safe shutdown is performed per relay channel independently of each other respectively.

After deactivating the external enable signal of the failsafe controller for the respective relay channel, the enabling current path of this relay channel opens.

When the enabling current path is open, the relay channel is in the safe state.

The confirmation current path of the relay channel closes.

See section “Independent control of the relay channels”.

Use both relay channels to achieve the maximum possible safety integrity.

9.5 Proof-Test

The proof test required by standards can be carried out in two ways:

1. Continuity test for the confirmation current path
2. Evaluation of the failsafe controller via readback of the confirmation current path

See section “Proof test”.

See section “Feedback circuit connection versions”.

If several devices are used, the N/C contacts of the confirmation current paths can be connected in series.

9.6 Test pulse filter

By filtering the control controller test pulses, premature failure of the forcibly guided safety relay is prevented.

9.7 Configuration of the current consumption

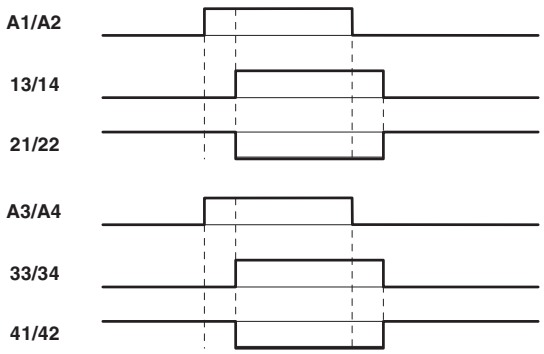
Set the current consumption via the DIP switches on the front of the device. The configuration of the current consumption ensures compatibility for safe control.

See section “Configuration”.

10 Function and time diagrams

10.1 Time diagram for automatic start

Figure 2 Time diagram for automatic start

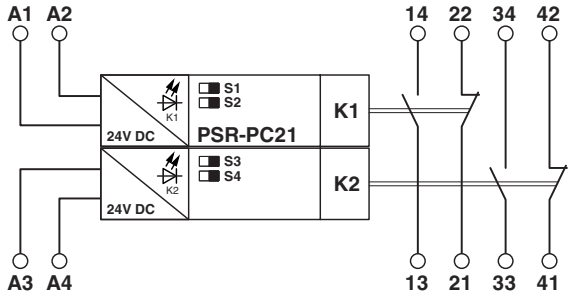


Key:

A1/A2	Channel 1	Control
13/14		Enabling current path, undelayed
21/22		Confirmation current path, undelayed
A3/A4	Channel 2	Control
33/34		Enabling current path, undelayed
41/42		Confirmation current path, undelayed

11 Block diagram

Figure 3 Block diagram



Key:

A1	Channel 1	24 V DC control
A2		0 V control
13/14		Enabling current path (non-delayed, floating)
21/22		Confirmation current path (non-delayed, floating)
A3	Channel 2	24 V DC control
A4		0 V control
33/34		Enabling current path (non-delayed, floating)
41/42		Confirmation current path (non-delayed, floating)
K1/K2	Channel 1/Channel 2	
S1/S2	DIP switches for channel 1	
S3/S4	DIP switches for channel 2	

11.1 Insulation coordination

	A1/A2, 21/22	A3/A4, 41/42	13/14	33/34	Housing
A1/A2, 21/22	-	500 V	6.4 kV ST	6.4 kV ST	4 kV BI
A3/A4, 41/42	500 V	-	6.4 kV ST	6.4 kV ST	4 kV BI
13/14	6.4 kV ST	6.4 kV ST	-	6.4 kV ST	4 kV BI
33/34	6.4 kV ST	6.4 kV ST	6.4 kV ST	-	4 kV BI
Housing	4 kV BI	4 kV BI	4 kV BI	4 kV BI	-

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 ≤ 25 V AC or U ≤ 60 V DC and circuits with higher voltages can be mixed.

12 Derating

NOTE: Temperature behavior depends on the configuration

The configuration of the current consumption affects the temperature behavior of the device.

- Observe the respective derating curves.

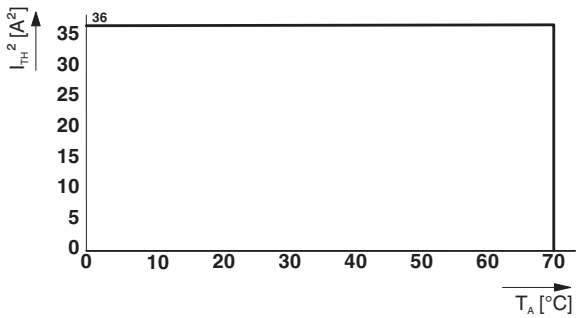
The temperature is measured at a 5 cm clearance below or to the side of the device.

12.1 Horizontal mounting position with spacing

The derating curve applies for the following conditions:

– Mounting on a horizontal DIN rail
– Devices mounted next to each other with ≥ 10 mm spacing
– Mode switch: S1, S2, S3, S4 = ON
– at U_S up to max. 30 V DC

Figure 4 Derating curve - horizontal mounting position with 10 mm spacing

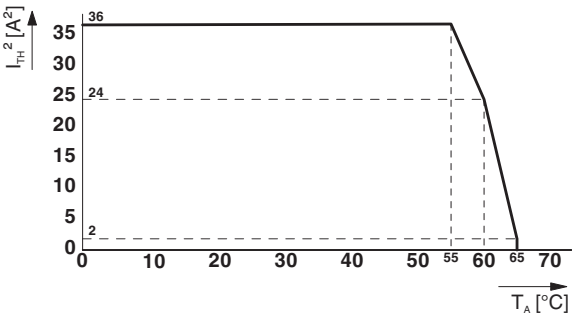


12.2 Vertical mounting position with spacing

The derating curve applies for the following conditions:

– Mounting on a vertical DIN rail
– Devices mounted next to each other with ≥ 10 mm spacing
– Mode switch: S1, S2, S3, S4 = ON
– at U_S up to max. 30 V DC

Figure 5 Derating curve - vertical mounting position with 10 mm spacing

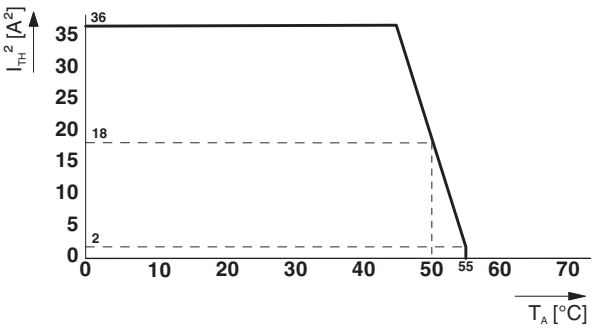


12.3 Horizontal mounting position without spacing

The derating curve applies for the following conditions:

– Mounting on a horizontal DIN rail
– Devices mounted next to each other without spacing
– Mode switch: S1, S2, S3, S4 = ON
– at U_S up to max. 30 V DC

Figure 6 Derating curve - horizontal mounting position, without spacing

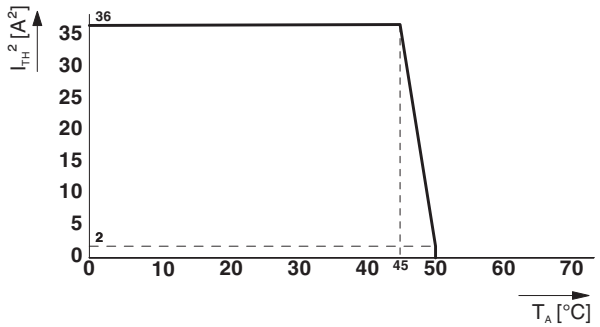


12.4 Vertical mounting position without spacing

The derating curve applies for the following conditions:

– Mounting on a vertical DIN rail
– Devices mounted next to each other without spacing
– Mode switch: S1, S2, S3, S4 = ON
– at U_S up to max. 30 V DC

Figure 7 Derating curve - vertical mounting position, without spacing

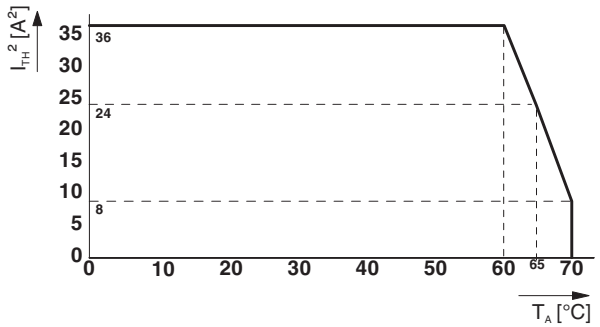


12.5 Vertical or horizontal mounting position without spacing

The derating curve applies for the following conditions:

– Mounting on a vertical or horizontal DIN rail
– Devices mounted next to each other without spacing
– Mode switch: S1, S3 = ON or S1, S2, S3, S4 = OFF
– at U_S up to max. 30 V DC

Figure 8 Derating curve - vertical or horizontal mounting position, without spacing



13 Relay data

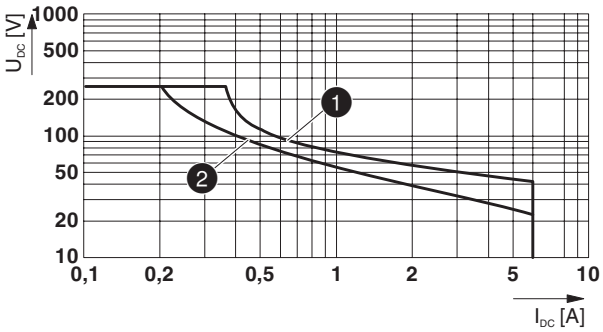
13.1 Maximum switching values for AC load

– 2 A, maximum, to 250 V AC, maximum, for high-demand applications and one N/O contact
– 6 A, maximum, to 60 V AC, maximum, for one N/O contact
– 4 A, maximum, to 250 V AC, maximum, for low-demand applications and one N/O contact
– 6 A, maximum, to 250 V AC, maximum, for two N/O contacts in series

13.2 Load limit curve at DC load

Ohmic and inductive load

Figure 9 Load limit curve - ohmic and inductive load

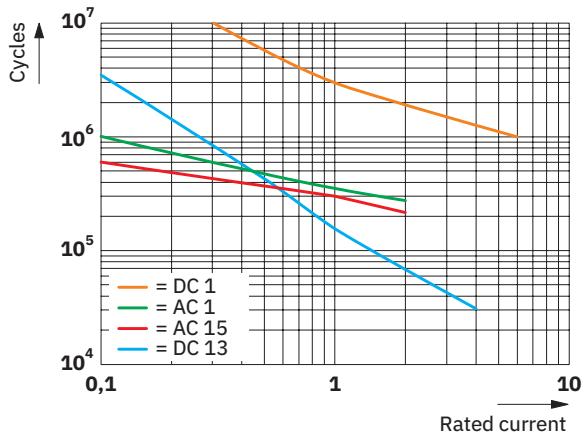


Key:

❶	Ohmic load	L/R = 0 ms
❷	Inductive load	L/R = 40 ms

13.3 Electrical service life

Figure 10 Electrical service life for high-demand applications



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 300000 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.

WARNING: Explosion hazard when used in potentially explosive areas

Nominal switching voltages greater than 60 V SELV/PELV and simultaneous load currents greater than 2 A are only permitted for low-demand applications.

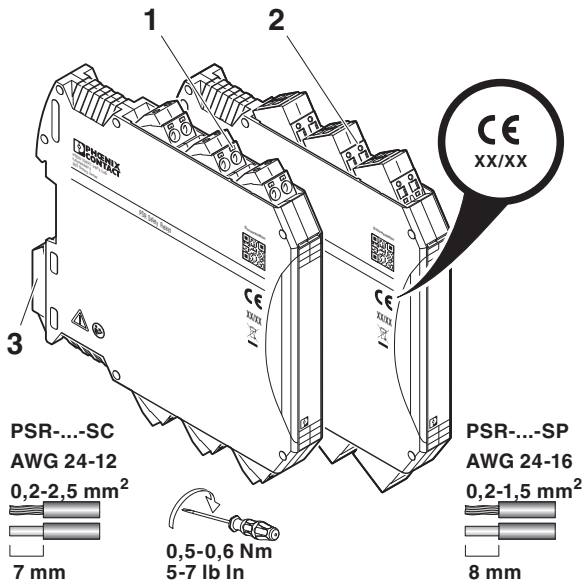
When load contacts 13/14 are connected in series with 33/34, the electrical service life is 20000 switching cycles.

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

14 Operating and indication elements

14.1 Connection versions

Figure 11 Connection versions



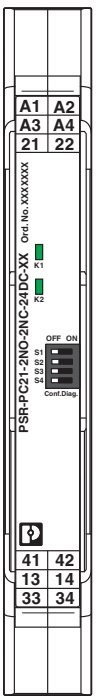
1 COMBICON plug-in screw terminal block
2 Pluggable COMBICON Push-in terminal block
3 Metal lock for fixing to DIN rail

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	24 V DC control (channel 1)
A2	0 V control (channel 1)
A3	24 V DC control (channel 2)
A4	0 V control (channel 2)
21/22	Confirmation current path, non-delayed, floating (channel 1)
K1	LED (green): Lights up when control voltage is applied at A1/A2, load current path 13/14 closed
K2	LED (green): Lights up when control voltage is applied at A3/A4, load current path 33/34 closed
S1/S3	DIP switches for the configuration of the current consumption (channel 1)
S2/S4	DIP switches for the configuration of the current consumption (channel 2)
41/42	Confirmation current path, non-delayed, floating (channel 2)
13/14	Enabling current path, non-delayed, floating (channel 1)
33/34	Enabling current path, non-delayed, floating (channel 2)

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.

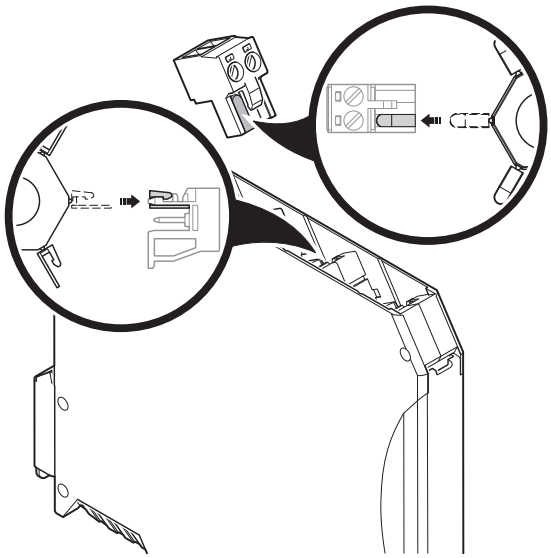
Coding profiles are plugged into the groove of the pluggable terminal block.

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.

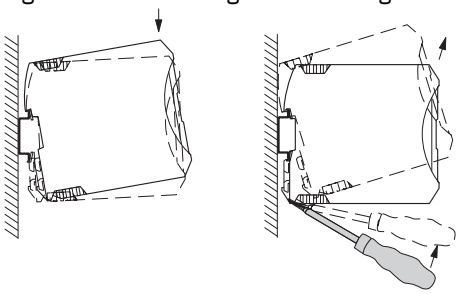
Figure 12 Attach coding elements



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 13 Mounting and removing



16 Wiring

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

Figure 14 Connecting the cables for PSR-...-SC (screw terminal block)

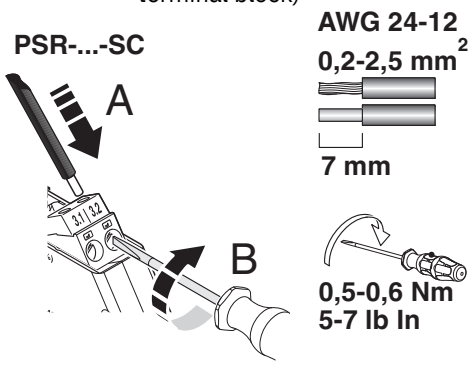
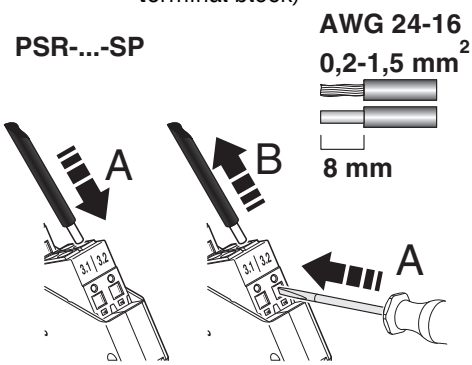


Figure 15 Connecting the cables for PSR-...-SP (Push-in terminal block)



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.

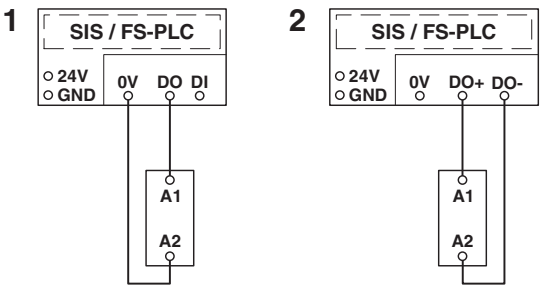
For compliance with UL approval, use copper wire that is approved up to 60°C/75°C.

16.1 Signal generator connection versions

- Connect suitable signal generators to A1/A2 or to A3/4.

Example for channel 1

Figure 16 Signal generator connection versions channel 1



1 1-channel control via failsafe controller
2 2-channel control via failsafe controller

For channel 2, the connection versions to A3/A4 apply accordingly.

If control is 1-channel via a PLC, the digital output of the PLC must satisfy the requirements in accordance with the required safety integrity.

16.2 Feedback circuit connection versions

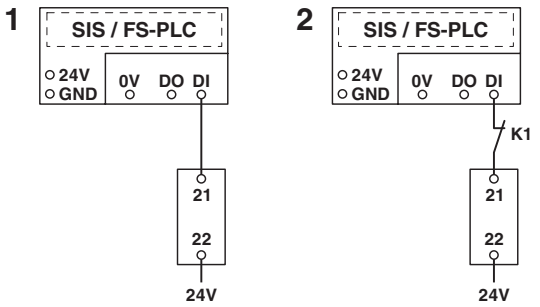
To achieve Cat. 4 / SIL 3 for high-demand applications, a diagnostics function via the confirmation current path is necessary.

To carry out the diagnostic function via the confirmation current path, proceed as follows:

- Read the confirmation current path back to one of the digital inputs of the failsafe controller.
- Place the relevant N/C contacts in the confirmation current path to the digital input of the failsafe controller to monitor external contactors or extension devices with force-guided contacts.

Example for channel 1

Figure 17 Feedback circuit connection versions channel 1



1 Confirmation current path without monitored contact extension

2 Confirmation current path with monitored contact extension

For channel 2, the connection versions for confirmation current path 41/42 apply accordingly.

The confirmation current paths of channel 1 and channel 2 can be connected in series.

17 Configuration

Set the current consumption via the DIP switches on the front of the device. The configuration of the current consumption ensures compatibility for safe control.

NOTE: Temperature behavior depends on the configuration

The configuration of the current consumption affects the temperature behavior of the device.

- Observe the respective derating curves.

17.1 Applying the configuration

NOTE: Damage

Adjusting the DIP switches when the device is switched on may damage the device.

- Only adjust the DIP switches when the device is switched off.

1. Remove power from the unit.
2. Configure each channel in accordance with the following table.

The DIP switches are assigned to the relay channels:

– **S1/S2:** Configuration for channel 1

– **S3/S4:** Configuration for channel 2

S1 or S3	S2 or S4	I_S	I_{In}	P_S
OFF	OFF	15 mA	200 mA	360 mW
ON	OFF	25 mA	200 mA	600 mW
OFF	ON	40 mA	300 mA	960 mW
ON	ON	46 mA	300 mA	1.1 W

Key:

I_S Rated control supply current per channel

I_{In} Inrush current per channel (Δt = 10 µs)

P_S Power consumption at U_S per channel

17.2 Protection against manipulation

Operate the device in a locked control cabinet to protect the configuration against tampering.

18 Startup

Channel 1

- Provide the external enable signal of the failsafe controller (24 V DC) at terminal blocks A1/A2.

K1 LED lights up.

Enabling current path 13/14 closes.

Confirmation current path 21/22 opens.

Channel 2

- Provide the external enable signal of the failsafe controller (24 V DC) at terminals A3/A4.

The K2 LED lights up.

Enabling current path 33/34 closes.

Confirmation current path 41/42 opens.

19 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

$P_{Contact} = (I_{L1}^2 + I_{L2}^2 + ... + I_{Ln}^2) \bullet 50\ m\Omega$

Total power dissipation

$P_{Total} = U_B^2 / (U_S/I_S) + (I_{L1}^2 + I_{L2}^2 + ... + I_{Ln}^2) \bullet 50\ m\Omega$

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

20 Proof test

To verify the device function, proceed according to one of the following diagnostic options.

Carry out a proof test for each of the relay channels individually.

WARNING: Loss of functional safety due to malfunction

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

- Replace the device.

20.1 Continuity test on confirmation current path

1. Deactivate A1.
2. Perform a continuity test for the confirmation current path (21/22).

Expectation: Continuity can be measured.

20.2 Evaluation of the failsafe controller via readback of the confirmation current path

1. Deactivate A1.
2. Read the confirmation current path back into one of the digital inputs of the failsafe controller.

Expectation: The failsafe controller receives a 24 V signal via the confirmation current path.

Carry out the proof test for channel 2 as described above. To do so, use the corresponding connections of channel 2.

20.3 Proof test evaluation

Terminal point			State	Proof test
21/41	22	42		
24 V	24 V	24 V	A1 and A3 are **not** activated. A diagnostic supply voltage is present at terminals 21/41. The diagnostic supply voltage applied can be measured at terminals 22/42.	Proof test passed.
24 V	0 V	24 V	A1 and A3 are **not** activated. A diagnostic supply voltage is present at terminals 21/41. The diagnostic supply voltage applied is **not** measurable at terminal 22.	Proof test **not** passed.
24 V	24 V	0 V	A1 and A3 are **not** activated. A diagnostic supply voltage is present at terminals 21/41. The diagnostic supply voltage applied is **not** measurable at terminal 42.	Proof test **not** passed.

21 Application examples

21.1 High-demand applications

WARNING: Loss of functional safety due to infiltration of process safety time

If the evaluation of the confirmation current path is not performed in high-demand applications within the process safety time, this may lead to a loss of functional safety.

- Ensure that the evaluation of the confirmation current path is performed in high-demand applications within the process safety time.

Requirements on the safe controller

If the safe controller detects an error in the evaluation of the confirmation current paths or at the control inputs, both channels must be disconnected by the safe controller.

21.1.1 High-demand application 1

Application description:

The application example illustrates the safe, 2-channel disconnection of a load in high-demand mode.

Assumptions, information, and marginal conditions:

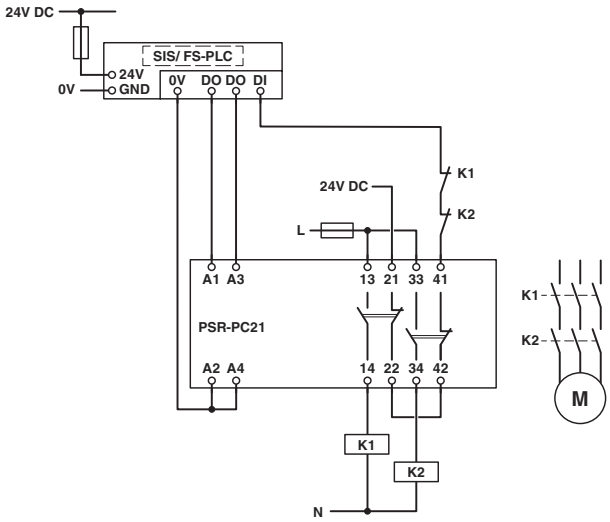
- It is assumed that errors in the cable installation have been eliminated; see EN ISO 13849-2 Tab. D.4
- Evaluation of the confirmation current path in the safe controller
- The digital output (DO) of the failsafe controller satisfies the requirements in accordance with the required safety integrity
- Fuse rating enabling current paths: max. 6 A

Achievable safety integrity:

- Suitable for high-demand applications up to SIL 3 (IEC 61508), SIL 3 (IEC 61511), Cat. 4 / PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061)
- For applications in PL e/SIL 3, the required demand rate for the safety function is once per month.

Cross-circuits in the cable installation can be excluded if the failsafe PLC, safety relay, and external contactors K1 and K2 are located in the same electrical installation space.

Figure 18 High-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K1/K2	Force-guided contactors

21.1.2 High-demand application 2

Application description:

The application example illustrates the safe, 2-channel disconnection of a load in high-demand mode.

Assumptions, information, and marginal conditions:

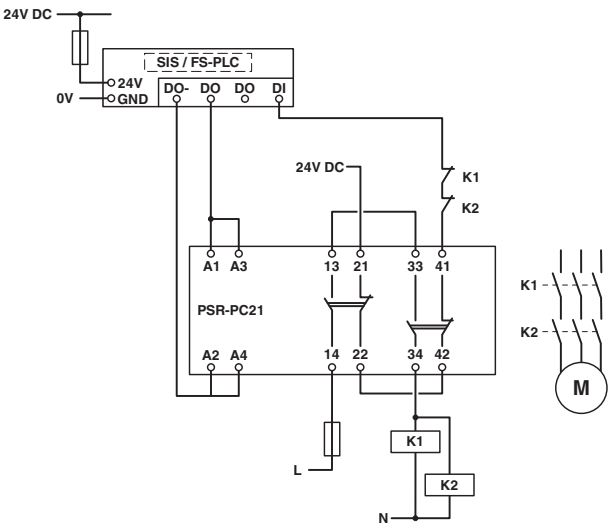
- It is assumed that errors in the cable installation have been eliminated; see EN ISO 13849-2 Tab. D.4
- Evaluation of the confirmation current path in the safe controller
- The digital output (DO) of the failsafe controller satisfies the requirements in accordance with the required safety integrity
- Fuse rating enabling current paths: max. 6 A

Achievable safety integrity:

- Suitable for high-demand applications up to SIL 3 (IEC 61508), SIL 3 (IEC 61511), Cat. 4 / PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061)
- For applications in PL e/SIL 3, the required demand rate for the safety function is once per month.

Cross-circuits in the cable installation can be excluded if the failsafe PLC, safety relay, and external contactors K1 and K2 are located in the same electrical installation space.

Figure 19 High-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K1/K2	Force-guided contactors

21.1.3 High-demand application 3

Application description:

The application example illustrates the safe disconnection of a 1-channel load in high-demand mode.

Assumptions, information, and marginal conditions:

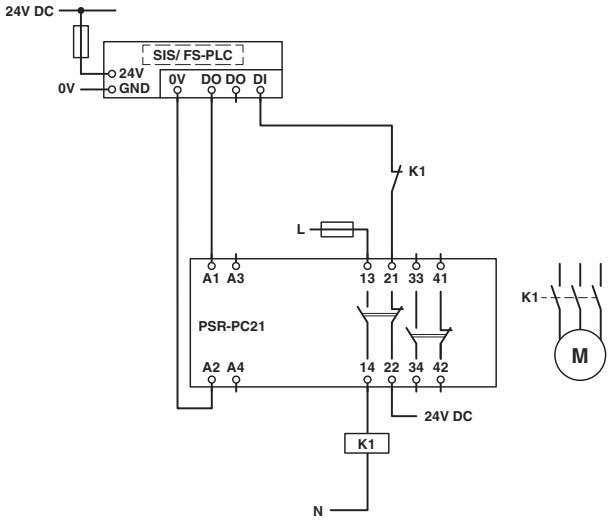
- It is assumed that errors in the cable installation have been eliminated; see EN ISO 13849-2 Tab. D.4
- Evaluation of the confirmation current path in the safe controller. If the safe controller detects an error in the evaluation of the confirmation current path or at the control inputs, the safe state must be initiated by another piece of safety equipment via the safe controller.
- The digital output (DO) of the failsafe controller satisfies the requirements in accordance with the required safety integrity
- Fuse rating enabling current path: max. 6 A

Achievable safety integrity:

- Suitable for high-demand applications up to SIL 2 (IEC 61508), Cat. 1 / PL c (EN ISO 13849-1), SIL 2 (EN IEC 62061)

Cross-circuits in the cable installation can be excluded if the failsafe PLC, the safety relay, and the external K1 contactor are located in the same electrical installation space.

Figure 20 High-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K1	Force-guided contactor

21.2 Low-demand applications

The confirmation current path is not absolutely necessary for low-demand applications. However, readback is recommended so a potential error in the switching operation can be read into the controller. In any case, verify proper function with regular proof tests.

21.2.1 Low-demand application 1

Application description:

The application example illustrates the safe, 2-channel disconnection of a load in low-demand mode.

Assumptions, information, and marginal conditions:

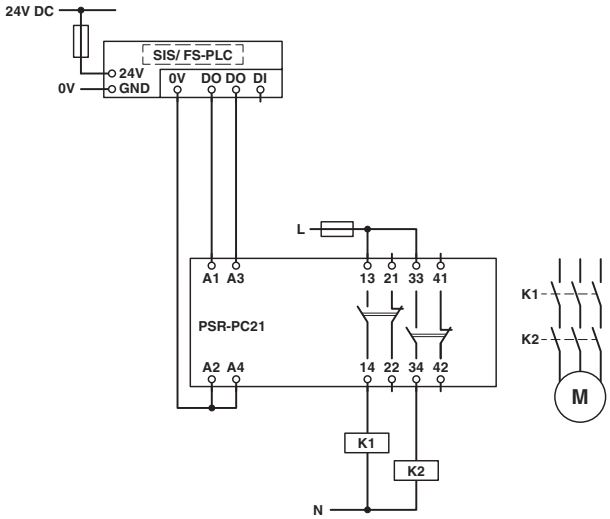
- It is assumed that errors in the cable installation have been eliminated
- The digital output (DO) of the failsafe controller satisfies the requirements in accordance with the required safety integrity
- Fuse rating enabling current paths: max. 4 A

Achievable safety integrity:

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

Cross-circuits in the cable installation can be excluded if the failsafe PLC, safety relay, and external contactors K1 and K2 are located in the same electrical installation space.

Figure 21 Low-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K1/K2	Force-guided contactors

21.2.2 Low-demand application 2

Application description:

The application example illustrates the safe, 2-channel disconnection of a load in low-demand mode.

Assumptions, information, and marginal conditions:

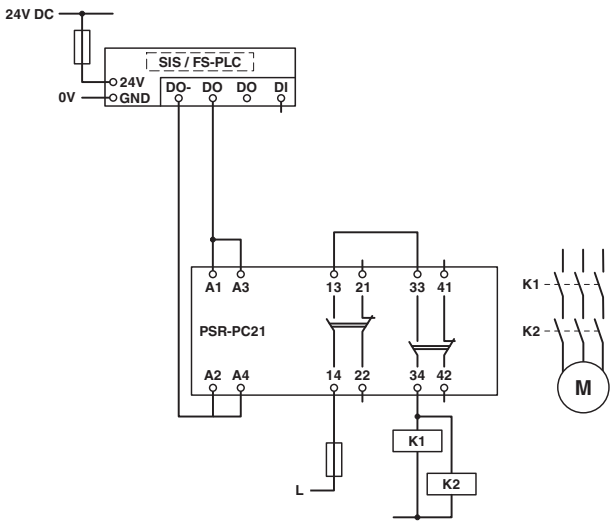
– It is assumed that errors in the cable installation have been eliminated
– The digital output (DO/DO-) of the failsafe controller satisfies the requirements in accordance with the required safety integrity
– Fuse rating enabling current paths: max. 4 A

Achievable safety integrity:

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

Cross-circuits in the cable installation can be excluded if the failsafe PLC, safety relay, and external contactors K1 and K2 are located in the same electrical installation space.

Figure 22 Low-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K1/K2	Force-guided contactors

21.2.3 Low-demand application 3

Application description:

The application example illustrates the safe disconnection of a 1-channel load in low-demand mode.

Assumptions, information, and marginal conditions:

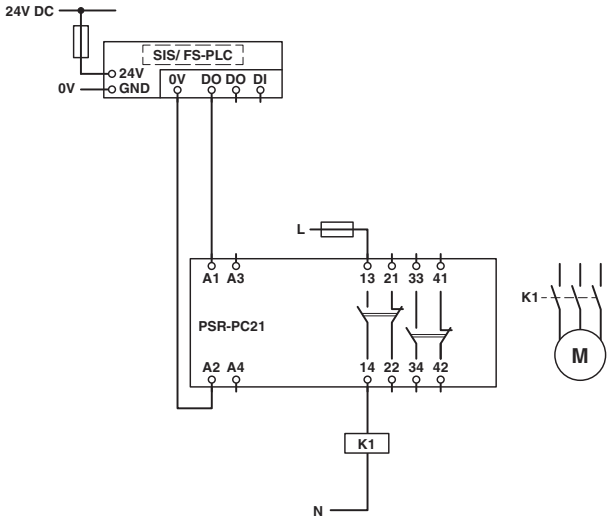
- It is assumed that errors in the cable installation have been eliminated
- The digital output (DO) of the failsafe controller satisfies the requirements in accordance with the required safety integrity
- The power contactor is protected by a suitable fuse
- Fuse rating enabling current path: max. 4 A

Achievable safety integrity:

- Suitable for low-demand applications up to SIL 2 (IEC 61508), SIL 2 (IEC 61511)

Cross-circuits in the cable installation can be excluded if the failsafe PLC, the safety relay, and the external K1 contactor are located in the same electrical installation space.

Figure 23 Low-demand application with failsafe controller



Key:

SIS / **FS-PLC**	Safety Instrumented System / failsafe controller
DI	Digital input
DO	Digital output
K1	Force-guided 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 **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

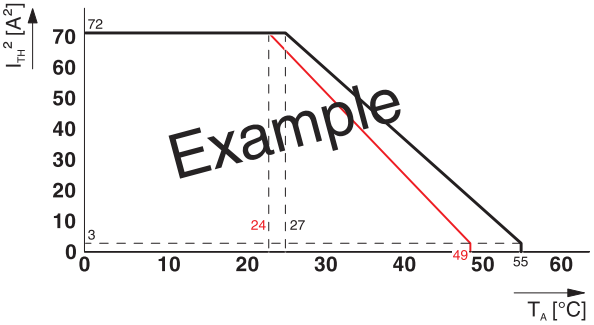
Example calculation for 3000 m

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 °C • 0.906 ≈ 24 °C

55 °C • 0.906 ≈ 49 °C

Figure 24 Example of a suspended derating curve (red)



24.2 Revision history

Version	Date	Contents
00	2020-04-09	First publication
01	2020-05-05	ATEX report numbers adjusted
02	2020-09-07	Figure in Sect. “Ambient temperature in Ex area” changed; Note 3 in Sect. “UL hazardous location” changed
03	2024-11-06	Designation of standard EN IEC 62061 updated; SILCL changed to SIL; EAC logo removed; accessories added to ordering data; changes in "Technical data" section: Relay outputs: References to "Relay data" section added, switching frequency changed, electrical service life added, switching capacity according to IEC 60947-5-1 changed; CCC / China-Ex approval data added; calculation basis for safety characteristics changed, systematic capability (SC) added; notes in “Safety regulations and installation notes” section edited; “Specific terms and conditions of use for ATEX/IECEx” section eliminated; harmonized sections “Installation in potentially explosive areas” and “Special conditions” added; Fig. 1 rating plate changed; “Relay data” section including “Electrical service life” added