PSR-PC52

SIL 3 coupling relay for safety-related switch on

Data sheet
108158_en_03

 2025-02-24

1 Description

Intended Use

The SIL coupling relay is used for power adaptation and electrical isolation in safe state On applications.

The coupling relay safely switches on circuits.

The category 3 device is designed for installation in zone 2 potentially explosive areas.

Possible signal generators

– Failsafe controllers

Contact switching type

– 1 undelayed enabling current path
– 1 non-delayed signaling current path

Control

– 1- or 2-channel
– Automatic start

Achievable safety integrity

– Suitable for low-demand applications up to SIL 3 in accordance with IEC 61508, IEC 61511, and EN 50156

Additional features

– Earth leakage monitoring
– Configurable Off and On state diagnostics
  – Load monitoring for wire break and short circuit
  – Monitoring of the load supply voltage and diagnostic supply voltage
– Diagnostic messages
  – Error message via ERR LED
  – Active error feedback via A1 at DO (only in the Off state)
  – Error acknowledgment via the signaling current path
– Integrated DCS test pulse filter
– Controller-specific Termination Carrier available on request
– Optional pluggable screw or Push-in terminal blocks
– 17.5 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 electrical isolation and power adaptation for SIL 3 F&G applications, low demand, load diagnostics in the Off and On state for wire break and short circuit, 1 enabling current path, test pulse filter, plug-in screw terminal block, width: 17.5 mm	PSR-PC52-1NO-1NC-24DC-SC	1017062	1
Coupling relay for electrical isolation and power adaptation for SIL 3 F&G applications, low demand, load diagnostics in the Off and On state for wire break and short circuit, 1 enabling current path, test pulse filter, plug-in Push-in terminal block, width: 17.5 mm	PSR-PC52-1NO-1NC-24DC-SP	1017064	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	
Rated control circuit supply voltage U_S	24 V DC -15 % / +10 %
Rated control supply current I_S	typ. 75 mA
Power consumption at U_S	typ. 2 W (at U_S/U_D; On state)
Inrush current	max. 100 mA
Filter time	2 ms (at A1-A2 in the event of voltage dips at U_s) max. 2 ms (at A1-A2; low test pulse width) ≥ 100 ms (at A1-A2; low test pulse rate) max. 17 ms (at A1-A2; high test pulse width) ≥ 800 ms (at A1-A2; high test pulse rate)
Protective circuit	Surge protection, 36 V suppressor diode
	Reverse polarity protection

Diagnostic supply voltage: 24V/0V	
Diagnostic supply voltage U_D	24 V DC -20 % / +25 %
Input current at U_D	35 mA (at U_D = 24 V) 45 mA (at U_D = 19 V) 25 mA (at U_D = 30 V)
Inrush current at U_D	1.5 A (Δt < 10 µs)
Power consumption	typ. 0.9 W (at U_D; Off state)
Protective circuit	Surge protection, 33 V suppressor diode
	Reverse polarity protection

Digital inputs: Test points for proof test (T1, T2, T3)	
Number of inputs	3
Inrush current	typ. 200 mA
Current consumption	typ. 20 mA (Input TP1) typ. 20 mA (Input TP2) typ. 30 mA (Input TP3)
Protective circuit	Surge protection 36 V suppressor diode

Relay outputs: Enabling current path (L-LO-NI-N / L'-LO'-NI'-N')	
Number of outputs	1 (undelayed)
Output description	safety-related N/O contacts
Contact material	AgNi, gold-flashed, Ag alloy
Switching voltage (see section “Relay data”)	min. 16 V AC/DC max. 250 V AC max. 125 V DC
Limiting continuous current (see section “Relay data”)	3 A (Observe derating, load type, and on-load voltage)
Inrush current	min. 50 mA max. 5 A ($\Delta t \leq 1$ s)
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$	9 A^2 (observe derating)
Switching capacity	min. 1 W
Switching frequency	max. 0.5 Hz
Mechanical service life	approx. 5x 10^7 cycles

Relay outputs: Signaling current path (21/22)	
Number of outputs	1 (without delay, floating)
Output description	non-safety-related N/C contact
Switching voltage range (Observe the load curve)	5 V DC ... 30 V DC 5 V AC ... 28.8 V AC
Switching current	max. 100 mA
Inrush current	≤ 800 mA ($\Delta t \leq 100$ ms)
Contact resistance	typ. 6 Ω (closed) ≥ 1 MΩ (open)
Short-circuit protection	no
Protective circuit	Surge protection 42 V suppressor diode

Times	
Typical starting time with U_s	typ. 100 ms (when controlled via A1-A2)
Typical release time with U_s	typ. 30 ms (when controlled via A1-A2)
Recovery time	1 s (when controlled via A1-A2) 3 s (Availability time for diagnostics after U_D is applied)

General data	
Relay type	Electromechanical relay
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	Frianyl A63 RV0 zinc yellow (RAL 1018)
Operating voltage display	1 x LED (yellow)
Status display	1 x LED (green)
Error indication	1 x LED (red)
Air clearances and creepage distances between the power circuits	according to EN 60664-1
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	3.8 W (ati U_B = 26.4 V DC, U_{BD} = 26.4 V DC, I_L = 3 A)
Note on power dissipation	See “Calculating the power dissipation”

Dimensions	Screw connection	Push-in connection
W x H x D	17.5 x 112.2 x 114.5 mm	17.5 x 117.4 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	-

Ambient conditions	
Ambient temperature (operation)	-25 °C … 60 °C (observe derating)
Ambient temperature (storage/transport)	-40 °C … 65 °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, 11 ms
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 parameters according to IEC 61508 - low demand	
Equipment type	Type A
HFT	2
SIL	3
Systematic Capabiltiy (SC)	3
PFD_{avg}	1.49×10^{-4} (< 15% of the overall SIL)
Proof test interval	72 Months
Mission time	240 Months

SIL examination as a 1oo1 structure alternative illustration	
Calculation basis	Application example 1
Equipment type	Type A
HFT	0
SIL	3
Systematic Capabiltiy (SC)	3
Safe Failure Fraction (SFF)	99.68 %
λSD	0 FIT
λSU	1831.13 FIT
λDD	3.66 FIT
λDU	5.72 FIT
λTotal	1840.51 FIT
MTBF	66.98 Years
PFD_{avg}	2.5×10^{-5} (for proof test interval = 1 year)

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

4.1 Notes regarding documentation

4.2 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.

4.3 Validity

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

4.4 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

5 Safety regulations and installation notes

WARNING: Death, serious personal injury or damage to equipment

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

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

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.

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.

– In the event of a fault

5.1 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.

5.2 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.

5.3 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.

5.4 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	24 V DC, 75 mA		
Input 24 V-0 V	24 V DC, 35 mA		
Output	NO-contact		NC-contact
	250 V AC / 24 V DC 3 A, Resistive B300, R300	250 V AC / 24 V DC 1 A, Resistive B300, R300	24 V DC 100 mA Resistive
Ambient Temperature	-25 °C to 50 °C	-25 °C to 60 °C	

5.5 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.

6 UL notes

6.1 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).

6.2 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.

7 Transport, storage, and unpacking

7.1 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”.

7.2 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”.

7.3 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”.

8 Function description

8.1 One or two-channel activation

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

The external enable signal of the failsafe controller can also be switched at A2 as an option.

8.2 Compatibility

Apply the diagnostic supply voltage in order to be able to establish compatibility with the failsafe controller and to use device-internal diagnostics.

When using active error feedback via A1, check compatibility with the secure system used.

8.3 Automatic start

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

8.4 Safe switch-on (safe state On)

When the enable signal of the failsafe controller is switched on, the enabling current path closes.

When the enabling current path is closed, the device is in the safe state.

8.5 Diagnostics and error messages

The device offers the option of Off state monitoring and On state monitoring.

For a detailed evaluation of all diagnostics and error messages, refer to the “Diagnostics” section.

8.5.1 Off state diagnostics

When **switched off**, the device monitors the following states:

– Wire break and short circuit of the load
– Presence of the load supply voltage
– Presence of the diagnostic supply voltage

When lit, the green DGN LED indicates the presence of the diagnostic supply voltage and therefore the activation of the diagnostic functions.

The device reports a potential error as follows:

– Error message via ERR LED
– Active error acknowledgment via A1
– Error acknowledgment via the signaling current path

The diagnostic threshold values for load monitoring can be configured.

See Section "Configuration".

8.5.2 On state diagnostics

When **switched on**, the device monitors the following states:

– Minimum value for the load current
– Presence of the load supply voltage
– Presence of the diagnostic supply voltage

When lit, the green DGN LED indicates the presence of the diagnostic supply voltage and therefore the activation of the diagnostic functions.

The device reports a potential error as follows:

– Error message via ERR LED
– Error acknowledgment via the signaling current path

The diagnostic threshold values for load monitoring can be configured.

See Section "Configuration".

8.5.3 Active error acknowledgment via A1

In the Off state

When **switched off**, the device reports a potential error to the respective digital output of the failsafe controller via A1.

For active error acknowledgment, line load monitoring is required from the failsafe controller.

If an error occurs within the device, the device simulates an error that the safety controller detects when line load monitoring is switched on.

This diagnostic procedure is only possible with compatible controllers.

8.5.4 Readback of the signaling current path

In the Off and On state

The device reports a potential error to the controller via the floating signaling current path.

8.6 Proof-Test

The Proof test checks the individual relay channels and device diagnostics to ensure proper functioning.

Perform the proof test using the test points intended for this purpose.

You can find information on executing and evaluating the proof test under the special sections “Proof test” and “Diagnostics”.

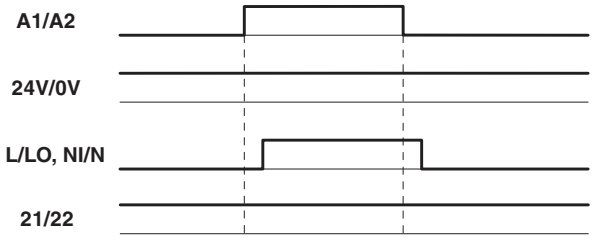
8.7 Test pulse filter

By filtering the controller test pulses, premature failure of the safety relays is prevented.

9 Function and time diagrams

9.1 Time diagram for automatic start

Figure 2 Time diagram for automatic start

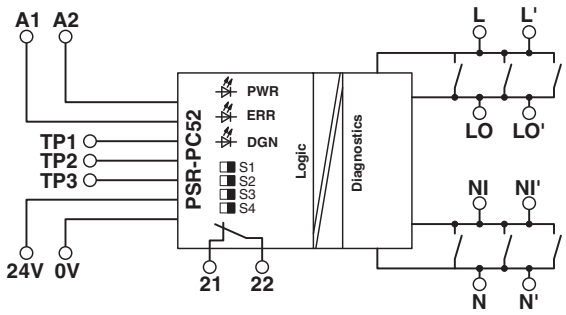


Key:

A1/A2	Control
24V/0V	Diagnostic supply voltage
L/LO, NI/N	Enabling current path
21/22	Signaling current path

10 Block diagram

Figure 3 Block diagram



Key:

A1	24 V DC control
A2	0 V control
24V	Diagnostic supply voltage
0V	Reference ground of the diagnostic supply voltage (0 V)
21/22	Signaling current path (floating)
TP1/TP2/ TP3	Test point for proof test

L/L'	On-load voltage input	Enabling current path
N/N'	0 V	
LO/LO'	Load input	
NI/NI'	Load output	

Contacts L', N', LO', NI' are **not** suitable for through wiring.
These contacts may only be used for optional redundant wiring.

10.1 Insulation coordination

	A1/A2, 24V/0V, 21/22, TP1/TP2/TP3	L,L´ / LO,LO´, NI,NI´ / N,N´	Housing
A1/A2, 24V/0V, 21/22, TP1/TP2/TP3	-	6 kV ST	4 kV BI
L,L´ / LO,LO´, NI,NI´ / N,N´	-	-	4 kV BI
Housing	-	-	-

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.

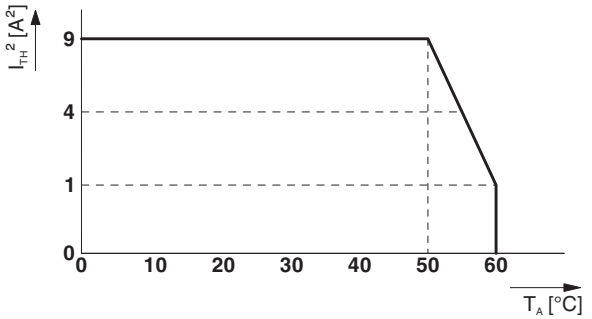
11 Derating

11.1 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

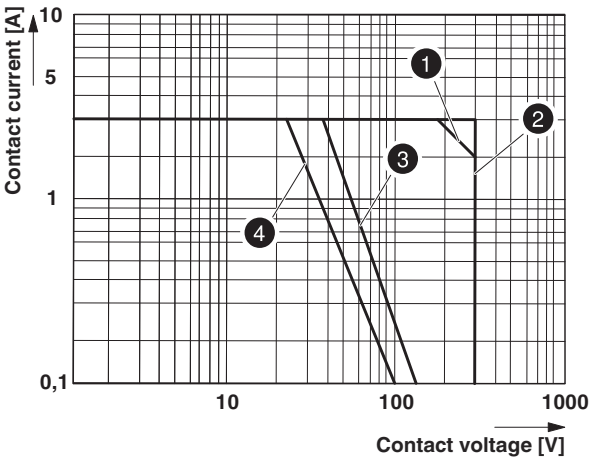


If the devices are mounted with ≥ 9 mm spacing between one another, no derating is required **up to 60°C**.

12 Relay data

12.1 Load limit curve

Figure 5 Relay load curve



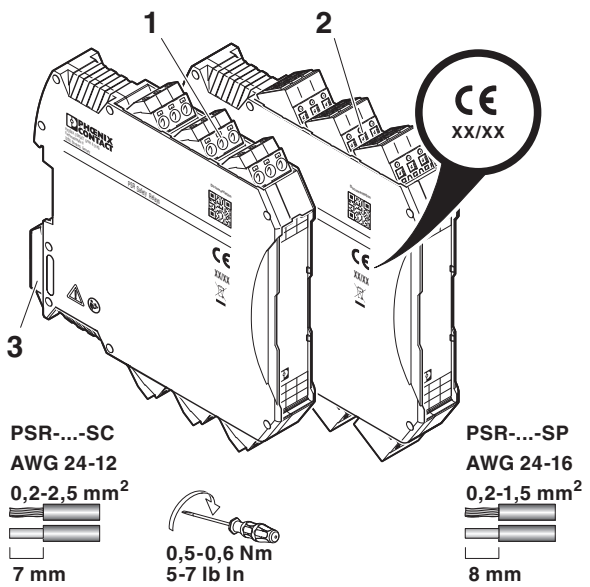
Key:

1. AC inductive load cos φ = 0.4
2. AC resistive load
3. DC resistive load
4. DC inductive load L/R = 7 ms

13 Operating and indication elements

13.1 Connection versions

Figure 6 Connection versions



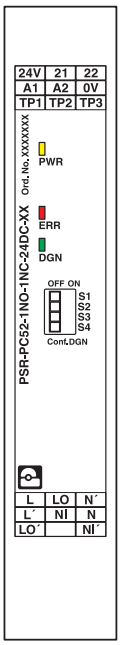
1 COMBICON plug-in screw terminal block
2 Pluggable COMBICON Push-in terminal block
3 Metal lock for fixing to DIN rail

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

13.2 Connection assignment



24V	24 V DC diagnostic supply voltage
21/22	Signaling current path (floating)
A1	24 V DC control
A2	0 V control
0V	Reference ground of the diagnostic supply voltage (0 V)
TP1/TP2/TP3	Test point for proof test
PWR	LED status indicator, yellow - contacts on the load side are closed
ERR	LED status indicator, red - error
DGN	LED status indicator, green - diagnostics are active
S1 ... S4	DIP switches for configuring load monitoring

L/L'	On-load voltage input	Enabling current path
N/N'	0 V	
LO/LO'	Load input	
NI/NI'	Load output	

Contacts L', N', LO', NI' are **not** suitable for through wiring.
These contacts may only be used for optional redundant wiring.

13.3 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.

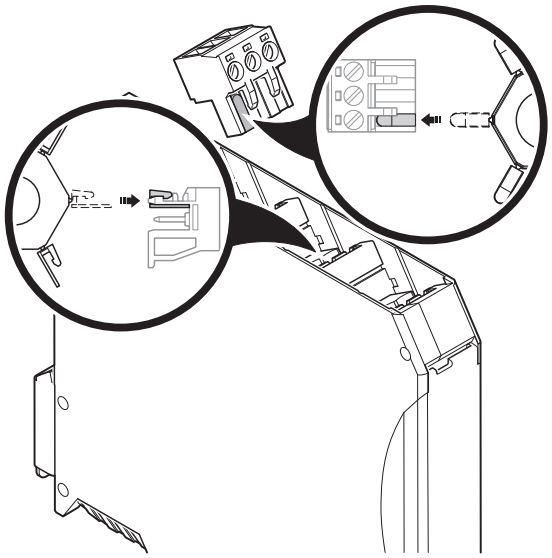
Coding profiles are plugged into the groove of the pluggable terminal block.

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.

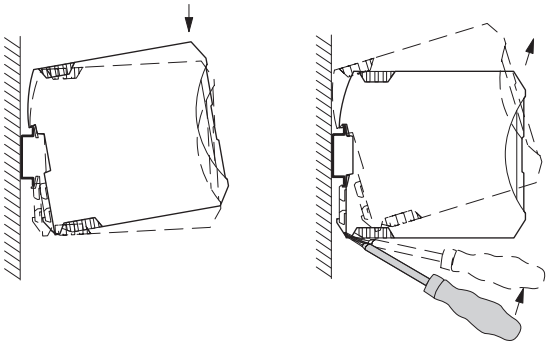
Figure 7 Attach coding elements



14 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 8 Mounting and removing



15 Wiring

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

Figure 9 Connecting the cables for PSR-...-SC (screw terminal block)

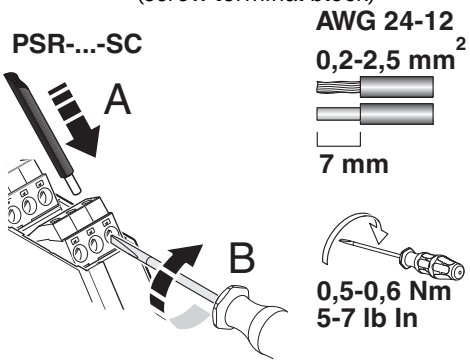
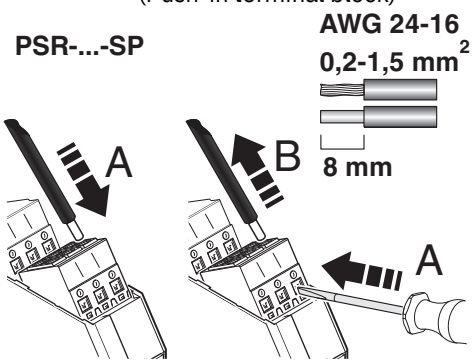


Figure 10 Connecting the cables for PSR-...-SP (Push-in terminal block)



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

Use the CRIMPFOX 6 crimping tool from Phoenix Contact.

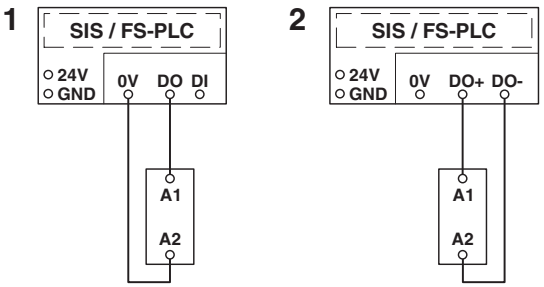
The tool enables the reliable processing of ferrules and easy removal of conductors with ferrules from the connection terminal blocks.

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

15.1 Signal generator connection versions

- Connect suitable signal generators to A1/A2.

Figure 11 Signal generator connection versions



1 1-channel control via failsafe controller

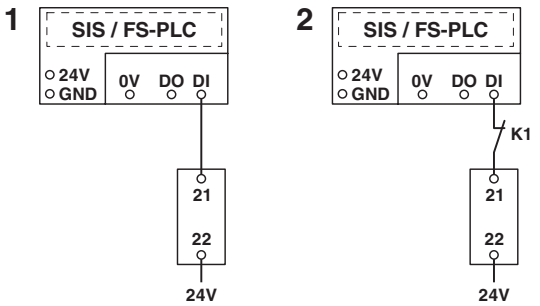
2 2-channel control via failsafe controller

15.2 Feedback circuit connection versions

To implement the optional diagnostic function via the signaling current path, proceed as follows:

- Read signaling current path 21/22 back to one of the digital inputs of the failsafe controller.
- Place the relevant N/C contact in the path from 21/22 to the digital input of the failsafe controller to monitor external contactors or extension devices with force-guided contacts.

Figure 12 Feedback circuit connection versions



1 Signaling current path without monitored contact extension

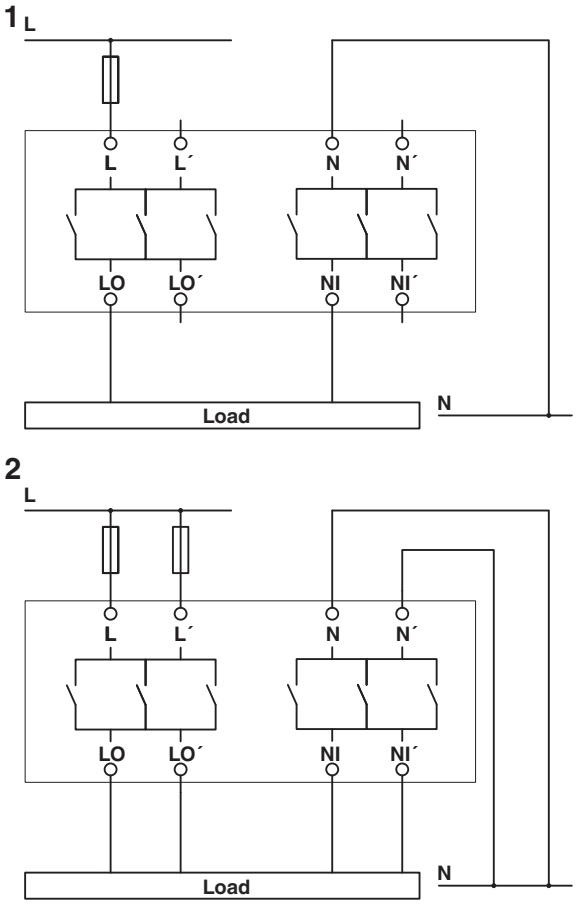
2 Signaling current path with monitored contact extension

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

15.3 Connection versions for enabling current path

- Connect the supply voltage of the load to terminal blocks L/N.
- Connect the load to terminal blocks LO/NI.
- **Optional:** for redundant wiring of the enabling current path, also connect terminal blocks L', N', LO', NI' accordingly.

Figure 13 Connection versions for enabling current path



1 Simple wiring of the enabling current path

2 Redundant wiring of the enabling current path

Contacts L', N', LO', NI' are **not** suitable for through wiring.
These contacts may only be used for optional redundant wiring.

16 Configuration

16.1 Delivery state

Before being configured and started up for the first time, the device is in the following state:

- Switch S1 = OFF
- Switch S2 = OFF
- Switch S3 = OFF
- Switch S4 = OFF

16.2 General information on configuration

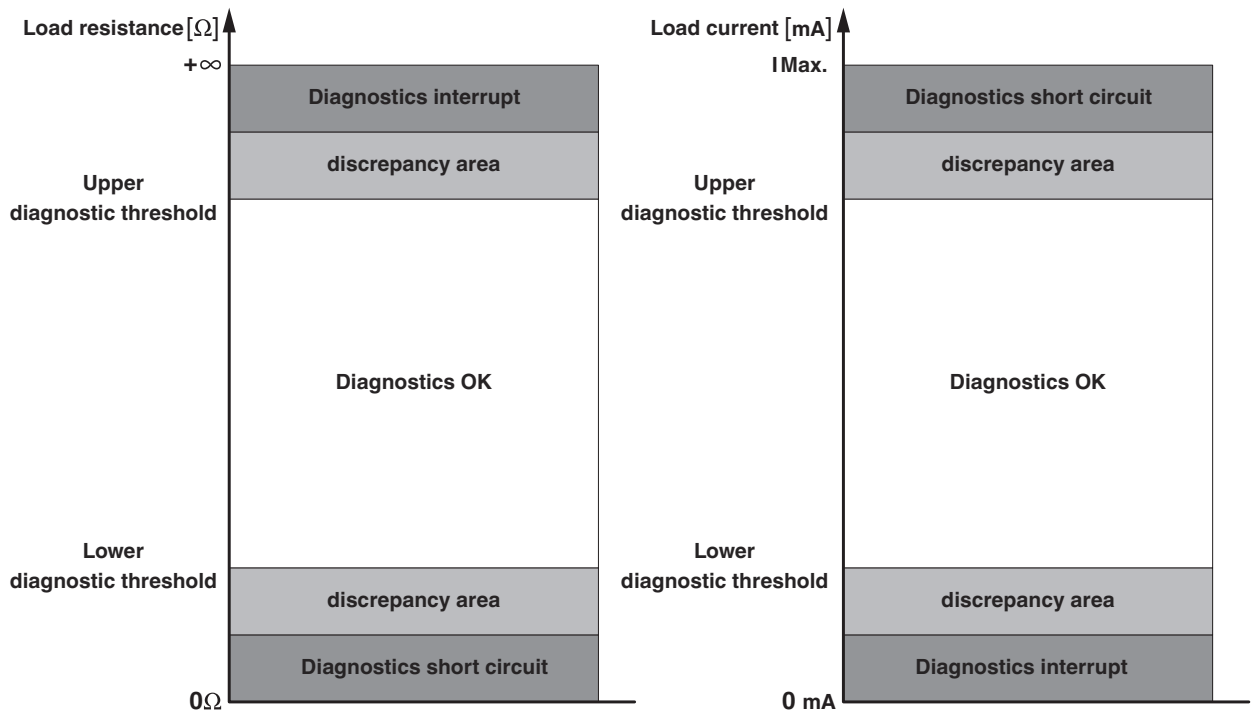
The following diagnostic threshold values for load monitoring can be configured:

- Lower limit for load monitoring for **short-circuit** diagnostics in the Off state
- Upper limit of load monitoring for **wire-break** diagnosis in the Off state
- Lower limit for the presence of the load current in the On state (❸)

In order to establish the compatibility with the failsafe controller and use device-internal diagnostics, apply the diagnostic supply voltage.

When lit, the green DGN LED indicates the presence of the diagnostic supply voltage and therefore the activation of the diagnostic functions.

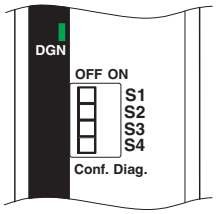
Figure 14 Diagnostic thresholds



16.3 Applying the configuration

Configure the device using the 4-way DIP switch on the front of the device.

Figure 15 DIP switches



Refer to the configuration tables below for the settings.

WARNING: Loss of safe diagnostics!

Observe the relevant discrepancy areas for safe diagnostics.

16.3.1 Lower limit for load monitoring

- Set the lower limit for load monitoring via DIP switches **S1** and **S2** in accordance with the table below.

DIP switch position		Lower limit for load	Discrepancy area	Typical at 25 °C
S1	S2			
0	0	70 Ω	64 Ω ... 70 Ω	66.5 Ω
1	0	20 Ω	17 Ω ... 20 Ω	18.2 Ω
0	1	10 Ω	8 Ω ... 10 Ω	8.8 Ω
1	1	7 Ω	5 Ω ... 7 Ω	6 Ω

16.3.2 Upper limit for load monitoring

- Set the upper limit for load monitoring via DIP switch **S3** in accordance with the table below.

DIP switch position	Upper limit for load	Discrepancy area	Typical at 25 °C
S3			
0	250 kΩ	250 kΩ ... 300 kΩ	280 kΩ
1	20 kΩ	20 kΩ ... 24 kΩ	22,6 kΩ

16.3.3 Lower limit for load current

- Set the lower limit for the load current via DIP switch **S4** in accordance with the table below.

AC/DC on-load voltage	DIP switch position	Lower limit for load current	Discrepancy area	Typical at 25 °C
	S4			
AC (50/60 Hz)	0	100 mA	70 mA ... 100 mA	86 mA
AC (50/60 Hz)	1	50 mA	30 mA ... 50 mA	38 mA
DC	0	100 mA	70 mA ... 100 mA	88 mA
DC	1	50 mA	30 mA ... 50 mA	37 mA

16.3.4 Upper limit for load current

The upper limit for the load current is **not** configurable. However, a discrepancy area also applies for the diagnostic threshold.

Make sure the upper limit for the load current and the relevant discrepancy area are in accordance with the table below.

AC/DC on-load voltage	Upper limit for load current	Discrepancy area	Typical at 25 °C
AC (50/60 Hz)	3.25 A	3.05 A ... 3.8 A	3.25 A
DC	3.25 A	3.05 A ... 3.8 A	3.41 A

16.4 Validating the configuration

WARNING: Danger due to incorrect setting

An incorrect configuration can result in dangerous machine or system states.

- Check the configuration before starting up for the first time.
- Perform a full function and diagnostic test during startup.

16.5 Protection against manipulation

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

17 Startup

- Apply the diagnostic supply voltage (24 V DC) to terminal blocks 24V/0V.

DGN LED lights up.

The diagnostic supply voltage makes the failsafe controller compatible and allows the use of the device-internal diagnostics.

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

PWR LED lights up.

The contacts of enabling current path L/LO, N/NI and L'/LO', N'/NI' close.

Signaling current path 21/22 closes.

18 Calculating the power dissipation

The total power dissipation is based on the input power dissipation, the power dissipation of the diagnostic supply, and the contact power dissipation.

Input power dissipation

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

Power dissipation of diagnostic supply

$P_{Diagnostics} = U_{BD}^2 / (U_D/I_D)$

Contact power dissipation

$P_{Contact} = (I_{L1}^2 + I_{L2}^2 + ... + I_{Ln}^2) \bullet 91\ m\Omega$

Total power dissipation

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

$P_{Total} = U_B^2 / (U_S/I_S) + U_{BD}^2 / (U_D/I_D) + (I_{L1}^2 + I_{L2}^2 + ... + I_{Ln}^2) \bullet 91\ m\Omega$

Key:

P	Power dissipation in mW
U_B	Applied operating voltage
U_S	Rated control circuit supply voltage
I_S	Rated control supply current
U_{BD}	Applied operating voltage for diagnostics
U_D	Diagnostic supply voltage
I_D	Current consumption of diagnostics
I_L	Contact load current

19 Proof test

To verify the device function, proceed as follows.

WARNING: Loss of functional safety due to malfunction

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

- Replace the device.

CAUTION: The enabling contacts are closed during the Proof test!

19.1 Testing of relay channels

1. Deactivate A1.
2. Apply 24 V DC to TP1 (in relation to A2).
3. Check whether the load is switched on.
   Or:
   Perform a continuity test of the contacts in the following order: L to LO and N to NI

Expectation (proof test passed):

– The load switches on.
– Continuity can be measured.

Possible error (proof test not passed):

– The load does **not** switch on.
– Continuity **cannot** be measured.

4. Remove the voltage applied to TP1.
5. Repeat steps 2 to 4 for TP2 and TP3.

If all the tests have been completed without errors:

6. Re-establish the original wiring.
7. Check switchability by the controller.

19.2 Testing diagnostics

Perform the following steps to check all the diagnostics for the device.

Between each individual step, make sure that the diagnostic message you are using is active.

19.2.1 In the Off state

(Enabling current path active)

1. Simulate a wire break of the load by interrupting the wiring between terminal blocks LO and NI.
2. Re-establish the original wiring.
3. Simulate a short circuit of the load by bridging contacts LO to NI.
4. Re-establish the original wiring.
5. Simulate a wire break of the load supply voltage by interrupting the wiring at terminal blocks L or N.
6. Re-establish the original wiring.

Expectation (proof test passed):

– The red ERR-LED lights up.
– Signaling current path 21/22 is **open**.
– Active error acknowledgment is **active**.

Possible error (proof test not passed):

– The red ERR LED does **not** light up.
– The signaling current path 21/22 is **closed**.
– Active error acknowledgment via A1 is **not** active.

19.2.2 In the On state

(Enabling current path closed)

1. Simulate a wire break of the load by interrupting the wiring between terminal blocks LO and NI.
2. Re-establish the original wiring.

Expectation (proof test passed):

– The red ERR-LED lights up.
– Signaling current path 21/22 is **open**.

Possible error (proof test not passed):

– The red ERR LED does **not** light up.
– The signaling current path 21/22 is **closed**.

20 Diagnostics

ERR-LED	DGN-LED	21/22	Error acknowledgment A1*)	State	Error	No.
OFF	OFF	0 V	Active	On/Off state	**Diagnostic supply voltage too low/interrupted** at contacts 24V/0V (U_D < 4 V DC)	01
ON	ON	0 V	Active	Off state	**Short circuit of the load** between contacts LO/LO' and NI/NI' (configured lower limit for load monitoring taken into consideration)	02
					Interruption of the load between contacts LO/LO' and NI/NI' (configured upper limit for load monitoring taken into consideration)	03
					Load supply voltage too low between contacts L/L' and N/N' (U_L < 12 V AC/DC ±5 V)	04
ON	ON	0 V	Inactive	On state	**Load supply voltage interrupted** between contacts L/L' and N/N' - Interruption of U_L at contact L/L' - Interruption of U_L at contact N/N'	05
					Load current < configured lower limit for the load current, e.g., in the following cases: - Interruption of the load between contacts LO/LO' and NI/NI' - Interruption of U_L at contact L/L' - Interruption of U_L at contact N/N'	06
					Load current too high (I_L > 3.6 A AC/DC), e.g., in the following case: - Short circuit of the load between contacts LO/LO' and NI/NI'	07
OFF	ON	24 V	Inactive	On/Off state	**Interruption of the control line at** A1/A2 (line load monitoring required by the failsafe controller)	08

*) This diagnostic procedure is only possible with compatible controllers.

21 Application examples

21.1 Low-demand application with failsafe controller

Application description:

The application example illustrates the safe switch-on of a load (e.g., signaling device) in low-demand operation. The safe coupling relay is controlled via a single channel using a failsafe controller. The device starts automatically.

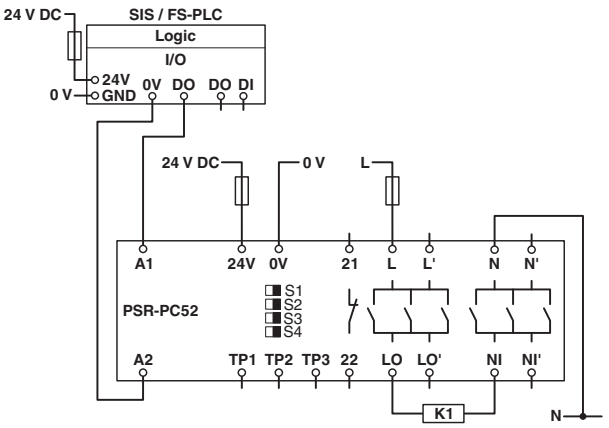
Assumptions, information, and marginal conditions:

- It is assumed that errors in the cable installation have been eliminated
- The failsafe controller is compatible with active error acknowledgment via A1.
- The digital output (DO) of the failsafe controller meets SIL 3 requirements in accordance with IEC 61508.
- Line load monitoring at the DO of the failsafe controller is active in the Off state.
- The diagnostic coverage (DC) of the digital output is ≥ 90 %.
- The configuration is set and validated according to the application.

Achievable safety integrity:

- Suitable for low-demand applications up to SIL 3 in accordance with IEC 61508, IEC 61511, and EN 50156

Figure 16 Low-demand application with failsafe controller



Key:

SIS / FS-PLC	Safety Instrumented System / failsafe controller
DC	Diagnostic Coverage according to IEC 61508 (line/load diagnostics at DO)
DI	Digital input
DO	Digital output
K1	Load

Device data converted into a 1oo1 structure	
Active error acknowledgment via A1	
Device type	Type A
HFT	0
SIL	3
SFF	99.68 %
λ_{SD}	0 FIT
λ_{SU}	1831.13 FIT
λ_{DD}	3.66 FIT
λ_{DU}	5.72 FIT
λ_{Total}	1840.51 FIT
MTBF	66.98 years
PFD_{avg}	2.5×10^{-5} (for T1 = 1 year)

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

If the failsafe controller is not compatible with active error acknowledgment via A1, use the diagnostics via signaling current path 21/22.

21.2 Application with earth leakage monitoring

For an application example with earth leakage monitoring, please contact Phoenix Contact.

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

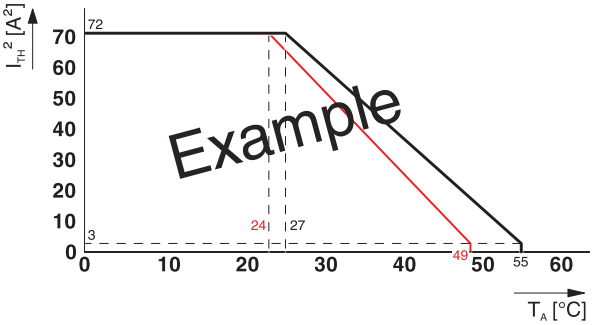
Example calculation for 3000 m

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 17 Example of a suspended derating curve (red)



24.2 Revision history

Version	Date	Contents
00	2017-10-10	First publication
01	2022-03-31	ATEX / IECEx approval data added, HW/FW version increased, coding accessories and “Optional terminal block coding” section included, structure of the technical data (supply) modified, specifications for conductor cross-sections with ferrules included, “Safety regulations and installation notes” and “Diagnostics” sections revised and new subsections added, device design in figures modified, other new sections: “Notes on documentation”, “Transport, storage, and unpacking”, “Device replacement, device defects, and repairs”, “Maintenance, decommissioning, and disposal”
02	2022-09-02	Description: Diagnostic messages: (only in the Off state) added. Technical data: Safety parameters for IEC 61508: Systematic Capability (SC) added. Standard for air clearances and creepage distances changed. Diagnostics: No. 5 - No. 7 error feedback changed to inactive.
03	2025-02-24	Section “Description” updated; technical data updated; approval data updated; Section “Safety regulations and installation notes” updated; Section “Specific terms and conditions of use for ATEX/IECEx” removed; harmonized Sections “Installation in potentially explosive areas” and “Special conditions” added; figure of front in Section “Connection assignment” updated