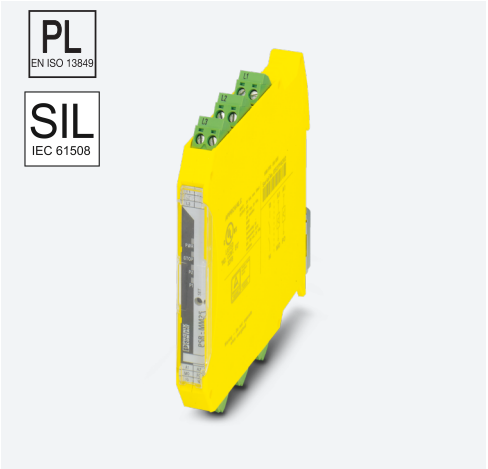
PSR-MM25

Safety relay module for zero-speed monitoring



Data sheet
106670_en_08

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1 Description

Intended Use

The safety relay module is used for machine zero-speed monitoring without sensors.

Zero-speed is detected by evaluating the voltage induced by the motor winding (e.m.f.).

The switching device interrupts circuits in a safety-related way.

Possible drive systems

- Single-phase AC motors
- Three-phase AC motors
- DC motors
- Speed-regulated motors on frequency inverters

Contact switching type

- 1 safe enabling current path
- 2 digital alarm outputs

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

The standard, digital signal outputs are used to transmit the status to a higher-level controller.

Functional properties

- 2-channel evaluation
- Automatic start

Achievable safety integrity

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

Additional features

- No additional sensors required
- Adjustable switching threshold
- Adjustable switch-on delay
- 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.

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Safety relay module for sensor-free zero-speed monitoring for 3- and 1-phase motors up to SIL 3, Cat. 3, PL e, 2-channel evaluation of the residual voltage of AC, three-phase, and DC motors, plug-in screw terminal block, width: 12.5 mm	PSR-MM25-1NO-2DO-24DC-SC	2702355	1
Safety relay module for sensor-free zero-speed monitoring for 3- and 1-phase motors up to SIL 3, Cat. 3, PL e, 2-channel evaluation of the residual voltage of AC, three-phase, and DC motors, plug-in Push-in terminal block, width: 12.5 mm	PSR-MM25-1NO-2DO-24DC-SP	2702356	1

Accessories	Type	Item no.	Pcs./Pkt.
Ring cable lug, blue, 1.5 … 2.5 mm², M4	C-RCI 2,5/M4	3240023	100
Ring cable lug, blue, 1.5 … 2.5 mm², M6	C-RCI 2,5/M6	3240025	50
Ring cable lug, blue, 1.5 … 2.5 mm², M8	C-RCI 2,5/M8	3240026	50
Ring cable lug, non-insulated, 1.1 … 2.5 mm², M3,5	C-RC 2,5/M3,5 DIN	3240077	100
Ring cable lug, non-insulated, 1.1 … 2.5 mm², M5	C-RC 2,5/M5 DIN	3240079	100
Ring cable lug, non-insulated, 1.1 … 2.5 mm², M6	C-RC 2,5/M6 DIN	3240080	100
Ring cable lug, non-insulated, 1.1 … 2.5 mm², M8	C-RC 2,5/M8 DIN	3240081	100
Ring cable lug, non-insulated, 1.1 … 2.5 mm², M10	C-RC 2,5/M10 DIN	3240082	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	
Hardware/firmware version (2702355)	≥ 00/100
Hardware/firmware version (2702356)	≥ 00/100

The technical data and safety characteristics are valid as of the specified HW/FW version.

Supply: A1/A2	
Rated control circuit supply voltage U_S	24 V DC -15 % / +10 %
Rated control circuit supply voltage U_S	20.4 V DC ... 26.4 V DC
Rated control supply current I_S	typ. 50 mA
Power consumption at U_S	typ. 1.2 W
Inrush current	5.6 A (Δt = 400 µs at U_s)
Filter time	1 ms (at A1 in the event of voltage dips at U_s)
Protective circuit	Surge protection Suppressor diode Reverse polarity protection

Measuring inputs: L1, L2, L3	
Number of inputs	3
Current consumption	max. 0.35 mA
Voltage input signal	max. 690 V AC/DC
Limit frequency	max. 3 kHz (At voltages > 2 V_{RMS})

Relay outputs: Enabling current path (13/14)	
Number of outputs	1 (undelayed)
Output description	safety-related N/O contacts
Contact material	$AgSnO_2$
Switching voltage (see section “Relay data”)	min. 24 V AC/DC max. 250 V AC/DC
Limiting continuous current (see section “Relay data”)	5 A
Inrush current	min. 3 mA max. 5 A
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$	25 A^2 (observe derating)
Switching frequency	max. 0.1 Hz
Service life electrical	See section “Electrical service life”
Mechanical service life	10x 10^6 cycles
Switching power	min. 72 mW
Switching capacity	5 A (AC15) 4 A (DC13)
Output fuse	5 A gL/gG

Alarm outputs: M0, F0	
Number of outputs	2 (digital, PNP)
Voltage	23 V DC (U_S - 1 V)
Current	max. 100 mA
Maximum inrush current	500 mA
Short-circuit protection	Yes

Times	
Typical starting time with U_s	< 1 s
Response time	typ. 20 ms (at 50 Hz input frequency)
Delay time range	0.5 s ... 20 s ±1 % (K1, K2 can be parameterized)

General data	
Nominal operating mode	100% operating factor
Degree of protection	IP20
Min. degree of protection of inst. location	IP54
Mounting type	DIN rail mounting
Mounting position	vertical or horizontal
Assembly note	See derating curve
Type of housing	PA zinc yellow (RAL 1018)
Status display	4 x LED Bi-Colour
Rated insulation voltage	250 V AC
Rated surge voltage/insulation	See “Insulation coordination”
Degree of pollution	2
Overvoltage category	III

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	0.2 mm² ... 2.5 mm²	0.25 mm² ... 1.5 mm² (only together with CRIMPFOX 6)
Conductor cross-section flexible, with ferrule with plastic sleeve	0.2 mm² ... 2.5 mm²	0.25 mm² ... 1.5 mm² (only together with CRIMPFOX 6)
Stripping length	7 mm	8 mm
Screw thread	M3	
Tightening torque	0.5 Nm ... 0.6 Nm	

Ambient conditions	
Ambient temperature (operation)	-20 °C ... 55 °C (observe derating)
Ambient temperature (storage/transport)	-40 °C ... 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	max. 2000 m (Above sea level)
Shock	15g
Vibration (operation)	10 Hz ... 150 Hz, amplitude 0.15 mm, 2g

Conformance/Approvals

Content of the EU Declaration of Conformity:
The product conforms with the most important requirements of the following directive(s) and their modification directives:
- 2006/42/EC Machinery Directive
- 2014/30/EU Electromagnetic Compatibility Directive (EMC)

The full EU Declaration of Conformity can be downloaded from the product page at www.phoenixcontact.com/products.

The latest approvals can be downloaded from the product page at www.phoenixcontact.com/products.

Safety data	
Stop category according to IEC 60204	0

Safety parameters in accordance to IEC 61508 - high demand	
IEC 61508 - High demand	
Equipment type	Type B
HFT	1
SIL	3 (4 A DC13; 5 A AC15; 17520 switching cycles/year)
PFH_D	5.79×10^{-8} (4 A DC13; 5 A AC15; 17520 switching cycles/year)
Demand rate	< 12 Months
Proof test interval	240 Months
Mission time	240 Months

Safety parameters according to EN ISO 13849-1	
Category	3
Performance level	e (4 A DC13; 5 A AC15; 17520 switching cycles/year)

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

Safety parameters according to EN IEC 62061	
SIL	3

For applications in SIL 3 the required demand rate for the safety function is once per month.

5 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.

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

Direct/indirect contact

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

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

Power supply units for 24 V supply

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

Startup, mounting, and modifications

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

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

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

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

In operation

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

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

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

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

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

Inductive loads can lead to welded relay contacts.

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

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

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

EMC notes

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

The device is a Class A product.

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

Faulty devices

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

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

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

– Repairs to the device
– Opening the housing

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.

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.

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 Two-channel evaluation

The 2-channel evaluation unit of the safety relay module measures the residual voltage generated by the motor winding (measurement inputs L1, L2, L3) and evaluates it based on the switching threshold set for zero-speed.

8.2 Switching Threshold

The switching threshold, which can be set in 15 levels, consists of a lower value (switch-on threshold U_{on}) and an upper value (switch-off threshold U_{off}) for every increment.

If the set switch-on threshold is undershot, the enabling current path (13/14) of the safety relay module closes after the set delay time (t_d) has elapsed.

If the measured residual voltage rises above the set switch-off threshold due to the motor switching on or moving, the enabling current path (13/14) opens without delay.

8.3 Switch-on delay

The switch-on delay is set in 15 levels (min. 0.5 s, max. 20 s) and takes effect when the parameterized switch-on threshold for zero-speed is undershot.

See “Function and time diagrams”.
See “Parameterization”.

8.4 Safety function

If the zero-speed safety relay detects a movement or error, the enabling current path opens and the device enters the safe state (path 13/14 open).

A safety function, such as unlocking or locking guard locking, can be executed via the enabling current path.

8.5 Error detection

Monitoring for internal and external errors is performed during operation. As soon as an error is detected, the device enters the safe state.

See “Error messages”.

8.6 Operation on frequency inverters

Operation on adjustable speed electrical power drive systems (frequency inverters) is possible when the following provisions are observed.

WARNING: Standard operation

Safe operation cannot be ensured at excessively high output frequencies.

- Make sure that the 32 kHz output frequency of the drive (PWM) is not exceeded.

NOTE: Electromagnetic interference

Using shielded measuring lines is one possible way of countering electromagnetic interference.

- Observe the EMC installation measures of the frequency inverter manufacturer.

The safety relay module detects zero-speed only when a control inhibit is disabled/there is no position control.

8.7 Use of DC brakes

Note the following device behavior:

If braking is by means of a DC brake, the safety relay module diagnoses a wire-break error during DC supply (PWR LED lights up orange).

After switching off the braking voltage at standstill and after the set switch-on delay has elapsed, the error state is automatically reset and the device is ready for operation (PWR LED lights up green).

See “Function and time diagrams”.

8.8 Operation on DC motors

Zero-speed monitoring of DC motors is possible with the safety relay module, provided a residual voltage is generated when run down.

Connection is the same as for single-phase AC motors.

Note the following device behavior:

The PWR LED lights up orange throughout DC operation. After switching off the DC motor voltage, zero-speed detection, and after the set switch-on delay has elapsed, the PWR LED lights up green.

8.9 Operation on synchronous or servo motors

WARNING: Loss of functional safety

For synchronous or servo motor connections/applications, the switching threshold must be between 1 and 7.

See “Parameterization”.

If the setting for synchronous or servo motors is between 8 and 15, motor standstill may be detected too early or incorrectly under certain circumstances.

8.10 Operation on motors with star-delta or pole changeover

Operation on motors with star-delta or pole changeover is possible when the following measures are observed.

- Make sure that measurement inputs L1, L2, and L3 are always directly connected to the monitored drive and that the connection is not interrupted when the motor is shut down, e.g., by switch contacts.

In the absence of a permanent connection between the measurement inputs and the monitored drive, the safety relay module diagnoses a wire break and enters the safe state.

Option 1:

In the case of star-delta changeover, a permanent connection can be achieved between the measurement inputs and motor windings, for example, by enabling the star contactor at standstill.

Option 2:

Alternatively, a permanent connection can be achieved whereby the safety relay module between two phases is directly connected to one of the motor windings.

Proceed as follows:

- Bridge measuring lines L1 and L3 at the safety relay module.
- Connect bridged measuring lines L1/L3 to a motor winding.
- Connect measuring line L2 to the other end of the same motor winding.

WARNING: Loss of functional safety

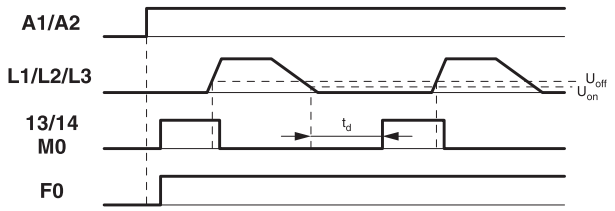
When you switch to option 2, your safety evaluation is no longer valid.

- Perform another safety evaluation for the connection to just one motor winding.
- Also refer to the notes for the “Downtime monitoring 1-phase motor” application example.

9 Function and time diagrams

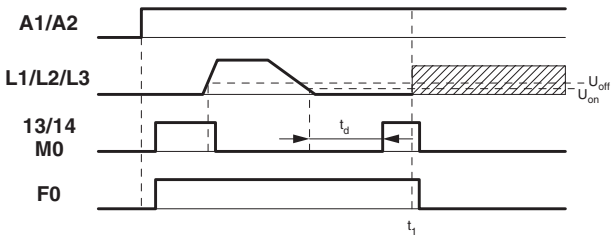
9.1 Normal operation

Figure 1 Time diagram, normal operation



9.2 Fault

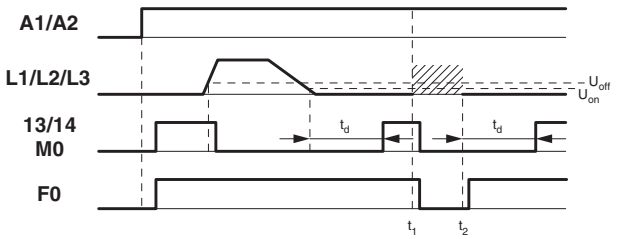
Figure 2 Time diagram, error



9.3 Wire-break error

In the event of a wire-break error, the device starts automatically once the error has been rectified.

Figure 3 Timing diagram for wire-break error

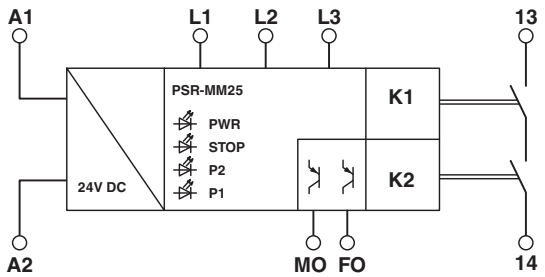


Key:

t_d	Switch-on delay (t_d)
U_{off}	Switch-off threshold (U_{off}) *
U_{on}	Switch-on threshold (U_{on}) *
t_1	Time of the error
t_2	Error removed

10 Block diagram

Figure 4 Block diagram



Key:

A1	+24 V power supply
A2	0 V power supply
L1, L2, L3	Measuring inputs
MO	Signal output (PNP)
FO	Error message output (PNP)
13/14	Enabling current path

Make sure that measurement inputs L1 - L3 are permanently connected to the motor windings.

Digital signal outputs MO and FO are **not** safe. These outputs should only be used to transmit the status.

10.1 Insulation coordination

	A1/A2, logic	13/14	L1/L2/L3	Housing
A1/A2, logic	-	6 kV ST	8 kV ST	4 kV BI
13/14	-	-	8 kV ST	4 kV BI
L1/L2/L3	-	-	-	4 kV BI

Key:

BI	Basic insulation
ST	Safe isolation
Logic	Sensor and start circuits, signal output

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/8 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

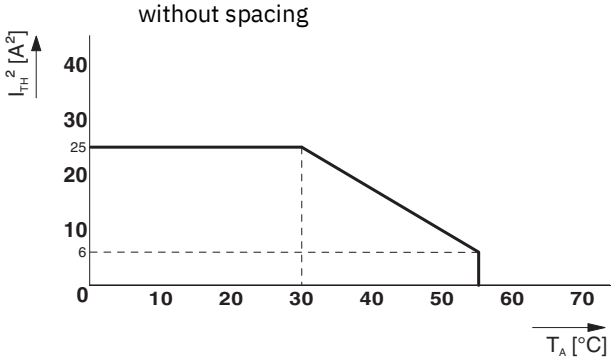
The temperature is measured at a 5 cm clearance below or to the side of the device.

11.1 Horizontal mounting position

The derating curve applies for the following conditions:

– Mounting on a horizontal DIN rail
– Devices mounted next to each other without spacing

Figure 5 Derating curve - horizontal mounting position, without spacing

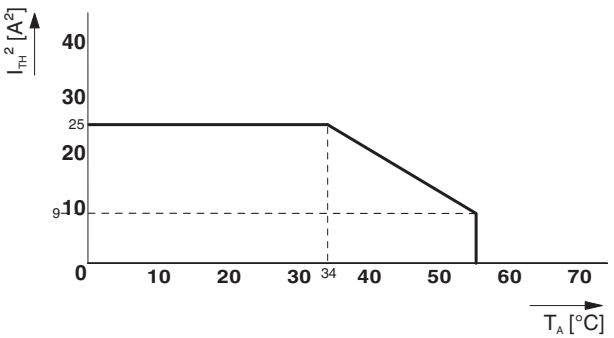


11.2 Vertical mounting position

The derating curve applies for the following conditions:

– Mounting on a vertical DIN rail
– Devices mounted next to each other without spacing

Figure 6 Derating curve - vertical mounting position, without spacing

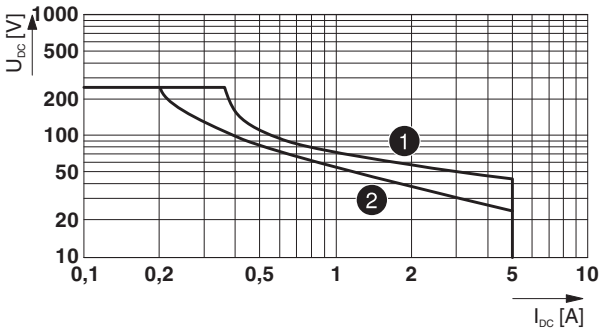


12 Relay data

12.1 Load limit curve at DC load

Ohmic and inductive load

Figure 7 Load limit curve - ohmic and inductive load

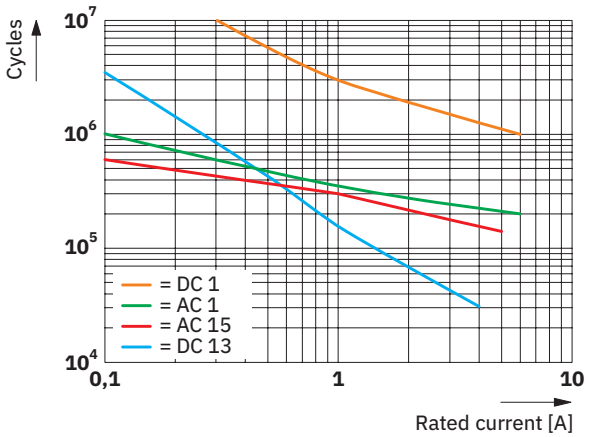


Key:

1	Ohmic load	L/R = 0 ms
2	Inductive load	L/R = 40 ms

12.2 Electrical service life

Figure 8 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

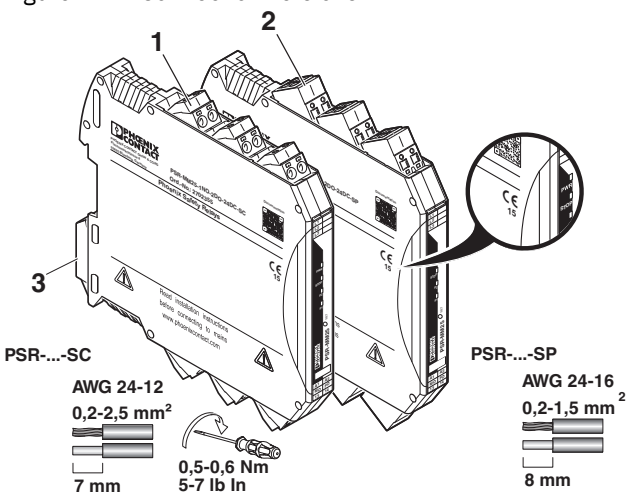
At the end of the electrical service life, there is an increased risk of loss of functional safety.

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

13 Operating and indication elements

13.1 Connection versions

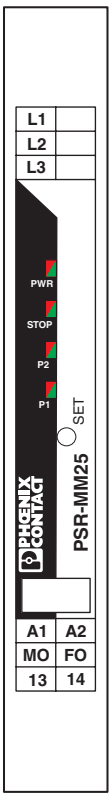
Figure 9 Connection versions



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

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

13.2 Connection assignment

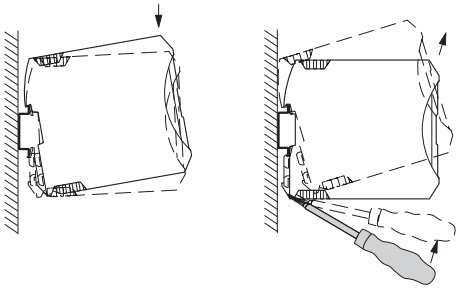


L1, L2, L3	Measuring inputs
PWR	Power LED (red, green)
STOP	LED (red, green) - status of the safety function
P2	LEDs (red, green) - parameterization
P1	
SET	SET button for parameterization
A1	+24 V power supply
A2	0 V power supply
MO	Signal output (PNP)
FO	Error message output (PNP)
13/14	Enabling current path

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 10 Mounting and removing



15 Wiring

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

Figure 11 Connecting the cables for PSR-...-SC (screw terminal block)

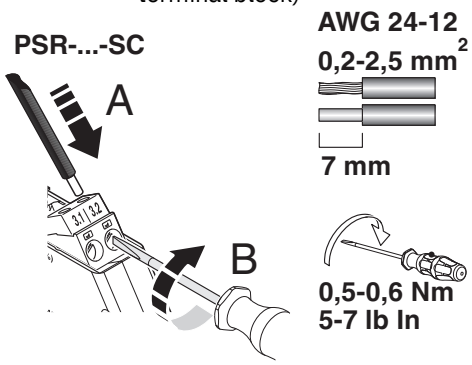
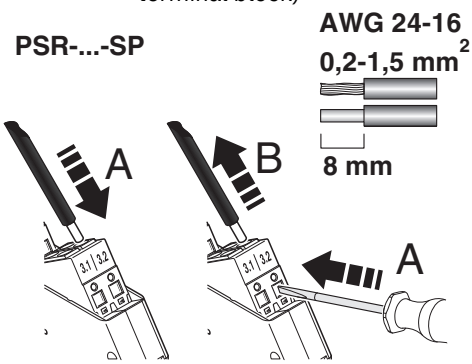


Figure 12 Connecting the cables for PSR-...-SP (Push-in terminal block)



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 Arrangement of the measuring lines

Observe the provisions of EN 60204-1 regarding the options and conditions for the connection of the safety relay module to the motor phases as well as for the arrangement of overcurrent protection equipment.

The conditions that must be met include the following:

– The conductor cross-section of the measuring lines must be at least 1.5 mm².
– A parallel load on the measuring lines to the safety relay module is not permitted.
– The measuring lines should be installed so that the possibility of a cross-circuit or short circuit is reduced, e.g., the lines are protected by a cable duct or they are only installed inside the same mounting frame.
– If the conductor cross-section is reduced, the section of the conductor that runs between the point where the current carrying capacity is reduced and the safety relay module must not be longer than 3 m.

15.2 Cabling aids

Suitable connectors for directly connecting the measurement inputs to the motor terminal board of the drive can be found at www.phoenixcontact.com/products.
A selection of insulated and uninsulated connectors can be found in the “Ordering data” section.

Observe the applicable installation instructions of the motor manufacturer.

16 Startup

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

A selftest is performed.

Following successful completion of the selftest, the device is ready for operation when the PWR LED lights up green.

If a valid parameterization is already present on the device, the STOP LED also lights up green.

17 Parameterization

17.1 Important information on parameterization

WARNING: Risk of electric shock

Use a VDE-insulated screwdriver in accordance with EN 60900 to press the SET button.

WARNING: Danger due to unexpected movement

The switching threshold and switch-on delay must be set correctly in order to ensure safe operation; this responsibility lies with the user.

- With the settings you make, you must make sure that the movement cannot present any danger.
- Specify the correct setting based on appropriate tests under worst-case conditions.
- Document the values set.

A new parameter setting is **not** saved if the operating voltage is interrupted during setup mode or if the SET button is not pressed for 20 s. The old parameter setting remains active.

When setup mode is active, the safety function and error monitoring are active in the background.

17.2 Preparation

Make sure the following preparations are made for parameterization:

1. No one is present in the danger zone for the machine.
2. The safety relay module is connected according to the specifications and the measurement inputs (L1, L2, L3) are constantly connected to the monitored motor.
3. The monitored motor is at standstill.
4. The power supply of the safety relay module (A1/A2) is switched on.
5. The selftest is completed without errors and the PWR LED is green.

17.3 Displaying the currently set switching threshold

1. Press the SET button for around **3 s** until all the LEDs are flashing **red**.
2. Release the button. The LEDs flash according to the set parameter level.

You are now in setup mode. Briefly press the SET button again to adjust the parameter level.

3. Press the SET button for around **2 s** to save the set parameter level and exit setup mode.

17.4 Displaying the currently set switch-on delay

1. Press the SET button for around **6 s** until all the LEDs are flashing **green**.
2. Release the button. The LEDs flash according to the set parameter level.

You are now in setup mode. Briefly press the SET button again to adjust the parameter level.

3. Press the SET button for around **2 s** to save the set parameter level and exit setup mode.

17.5 Setting the switching threshold

The switching threshold should be set in 15 predefined parameter levels using the SET button on the device (see table).

The required switching threshold depends on the residual voltage generated on motor run down and is adapted to the monitored motor by means of the different parameter levels.

1. Press the SET button for around **3 s** until all the LEDs are flashing **red**.
2. Release the button. The LEDs flash according to the set parameter level.
3. Make sure that a low parameter level is set for the switching threshold (default upon delivery: 80 mV).
4. Change the parameter level by briefly pressing the SET button. Each press of the button sets the next level up.
5. If the STOP LED does not light up green after the set switch-on delay has elapsed, incrementally increase the switching threshold (parameter level 1 ... 2 ... 3 ...) until the STOP LED lights up green.
6. Press the SET button for around **2 s** to save the set parameter level and exit setup mode.

Parameter level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
PWR-LED	○	○	○	○	○	○	○	✹ red	✹ red	✹ red	✹ red	✹ red	✹ red	✹ red	✹ red
STOP-LED	○	○	○	✹ red	✹ red	✹ red	✹ red	○	○	○	○	✹ red	✹ red	✹ red	✹ red
P2-LED	○	✹ red	✹ red	○	○	✹ red	✹ red	○	○	✹ red	✹ red	○	○	✹ red	✹ red
P1-LED	✹ red	○	✹ red	○	✹ red	○	✹ red	○	✹ red	○	✹ red	○	✹ red	○	✹ red
Switch-on threshold (U_{on}) *	50 mV	55 mV	60 mV	65 mV	70 mV	75 mV	80 mV	200 mV	230 mV	250 mV	300 mV	350 mV	400 mV	460 mV	500 mV
Switch-off threshold (U_{off}) *	120 mV	120 mV	120 mV	120 mV	120 mV	120 mV	120 mV	1000 mV	1000 mV	1000 mV	1000 mV	1000 mV	1000 mV	1000 mV	1000 mV

*) Peak-to-peak voltage

Key:

✹ = LED flashing

○ = LED OFF

See “Function and time diagrams”.

WARNING: Loss of functional safety

For synchronous or servo motor connections/applications, the switching threshold must be between 1 and 7.

If the setting for synchronous or servo motors is between 8 and 15, motor standstill may be detected too early or incorrectly under certain circumstances.

17.6 Set switch-on delay

After the parameterized switching threshold is undershot, the switch-on delay is applied for the enabling current path in order to implement an additional waiting time for motors that gradually coast to an actual standstill.

The minimum value to be set is 0.5 s. Switch-on can be delayed by a maximum of 20 s.

The switch-on delay should be set in 15 predefined parameter levels using the SET button on the device (see table).

1. Switch the motor on.

The STOP LED goes out, the enabling current path (13/14) and the signal output (MO) switch off.

2. Switch the motor off.

The switch-on delay is active, the STOP LED flashes green (default upon delivery: 1 s).

3. Determine the time the motor actually needs to run down.
4. Press the SET button for around **6 s** until all the LEDs are flashing **green**.
5. Release the button. The LEDs flash according to the set parameter level.
6. Select the desired parameter level by briefly pressing the SET button. Each press of the button sets the next level up.
7. Press the SET button for around **2 s** to save the set parameter level and exit setup mode.

When the motor has run down, the STOP LED lights up green (standstill) and both the enabling current path (13/14) and the signal output (MO) are active.

If the motor has not come to a standstill after the set switch-on delay has elapsed, optimize the settings for switching threshold and switch-on delay.

WARNING: Danger due to incorrect setting

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

- Check the parameterization before starting up for the first time.

Parameter level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PWR-LED	○	○	○	○	○	○	○	✷ green	✷ green	✷ green	✷ green	✷ green	✷ green	✷ green	✷ green
STOP-LED	○	○	○	✷ green	✷ green	✷ green	✷ green	○	○	○	○	✷ green	✷ green	✷ green	✷ green
P2-LED	○	✷ green	✷ green	○	○	✷ green	✷ green	○	○	✷ green	✷ green	○	○	✷ green	✷ green
P1-LED	✷ green	○	✷ green	○	✷ green	○	✷ green	○	✷ green	○	✷ green	○	✷ green	○	✷ green
Switch-on delay (t_d)	0.5 s	1 s	2 s	3 s	4 s	5 s	6 s	7 s	8 s	10 s	12 s	14 s	16 s	18 s	20 s

Key:

✷ = LED flashing

○ = LED OFF

See “Function and time diagrams”.

18 Calculating the power dissipation

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

Input power dissipation

$P_{Input} = U_B \bullet I_S$

Contact power dissipation

$P_{Contact} = I_L^2 \bullet 50\ m\Omega$

Total power dissipation

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

therefore

$P_{Total} = U_B \bullet I_S + I_L^2 \bullet 50\ m\Omega$

Key:

P	Power dissipation in mW
$\mathbf{U_B}$	Applied operating voltage
$\mathbf{I_S}$	Rated control supply current
$\mathbf{I_L}$	Contact load current

19 Function test/proof test

Use the function test to check the safety function. To do this, request the safety function once by allowing the monitored motor to start up. The outputs of the device switch off. Then allow the motor to run down. Once the motor has reached a standstill and after the set delay time has elapsed, the outputs switch on.

See “Startup”.

WARNING: Loss of functional safety due to malfunction

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

- Replace the device.

20 Diagnostics

The following section describes the LED indicators for general states and error messages as well as the possible status of the digital signal outputs.

20.1 General states

Key:

○ LED OFF
● LED ON
✷ LED flashing

PWR-LED	STOP-LED	State	
● green	● green	Standstill	The device is ready for operation after completing a selftest without errors or after a switch-on delay has elapsed. The enabling current path is closed.
● green	○	Movement	A movement has been detected. The enabling current path is open (safe state).
		Standstill	The device enters the safe state even though the motor is at a standstill. Remedy: ensure that there are no residual voltages (induced voltages or drives that are in position control). Parameterize the switching threshold during the startup phase (see “Setting the switching threshold”).
● green	✷ green	Motor runs down	The set switching threshold has already been undershot and the set switch-on delay is running. The enabling current path is open for the duration of the switch-on delay (safe state).

20.2 Status of the signal outputs

The device and operating status can be transmitted to a higher-level controller via the digital signal outputs.

MO	FO	Device	Motor
24 V	24 V	OK	Standstill
0 V	24 V	OK	Movement
0 V	0 V	Not OK	No influence

20.3 Error messages

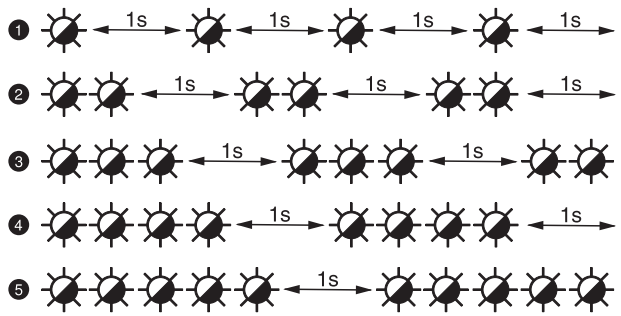
○ LED OFF
● LED ON
☀ LED flashing

The flashing red PWR LED indicates an error state.

Refer to the figure for the detailed blink behavior of the red PWR LED in the event of different error causes.

See ❶ - ❺ in the table and figure.

Figure 13 Blink behavior of the PWR LED (red)



PWR-LED		STOP-LED	State	Possible cause	Corrective
☀ red	❶❸❺	○	Internal error	-	1. Ensure that there is no external error. 2. Acknowledge the internal error by switching the device off and then on again. **If the error still occurs, replace the device.**
☀ red	❷	○	External error	Impermissible operating voltage / operating voltage outside the tolerance range	Check the operating voltage and control the operating voltage so that it is within the permissible range.
☀ red	❹	○	External error	Single-channel signal at the measuring lines (simultaneity failure)	Check the connection of the device for cross or short circuit.
			No error	Sustained signal difference (simultaneity failure) > 10 s due to gradual motor run down	Connect the motor lines between two phases directly to one of the motor windings. To do this, connect L1 and L3 (bridged) to one end of a winding and L2 to the other end of the same motor winding (see “Operation on motors with star-delta or pole changeover”).
● orange	-	○	External error	Wire break on the measuring lines	Check the connection of the device for cross or short circuit.
			No error	Operation on DC motors or DC brakes	No action required. The error message will be reset automatically after DC shutdown.

21 Application examples

21.1 Zero-speed monitoring 1-phase motor

Application description:

- 1-phase motor
- Interlocking device with guard locking
- PSR-MM25: zero-speed monitoring, control/release of guard locking
- PSR-MC30: safety door monitoring
- Error prevention required:
  - on mechanical parts of guard locking
  - for cross-circuits in the control for guard locking

Achievable safety integrity:

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

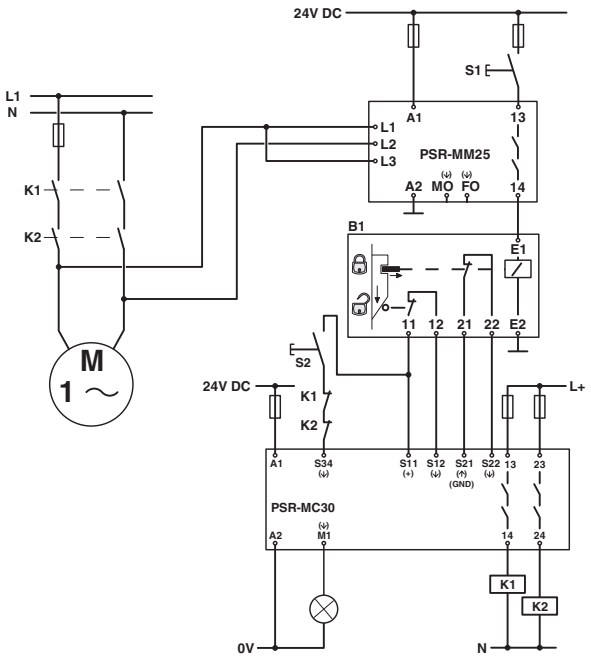
Key:

S1	Unlock button (release of guard locking)
S2	Manual reset device
E1/E2	Guard locking
B1	Interlocking device
K1 ... **K4**	Force-guided contactors

Notes:

If fault exclusion is required to reach the necessary safety integrity, implement this in accordance with EN ISO 13849-2, Annex D.

Figure 14 Zero-speed monitoring 1-phase motor



If motor faults (e.g., interturn fault) are taken into consideration and appropriate measures are taken, the following alternative safety ratings are possible for the application.

Alternative safety rating and measure:

- Higher-level motor protection as test equipment for early detection of a motor fault (suitable overcurrent and overtemperature protection)
- Suitable up to category 2, PL d (EN ISO 13849-1), SIL 2 (EN IEC 62061)

Alternative safety rating and measure:

- A motor fault is taken into consideration by preventatively reducing the switch-on threshold (U_{on}) or increasing the switch-on delay (t_d) depending on the risk assessment
- Suitable up to category 3, PL d (EN ISO 13849-1), SIL 2 (EN IEC 62061)

Alternative safety rating and measure:

- Prevention of motor faults which lead to a reduction in the inductance and therefore reduce the residual voltage
- Suitable up to category 3, PL d (EN ISO 13849-1), SIL 2 (EN IEC 62061)

21.2 Zero-speed monitoring 3-phase motor

Application description:

- 3-phase motor
- Interlocking device with guard locking
- PSR-MM25: zero-speed monitoring, control/release of guard locking
- PSR-MC30: safety door monitoring
- Error prevention required:
  - on mechanical parts of guard locking
  - for cross-circuits in the control for guard locking

Achievable safety integrity:

- Suitable up to category 3, PL d (EN ISO 13849-1), SIL 2 (EN IEC 62061)

Key:

S1	Unlock button (release of guard locking)
S2	Manual reset device
E1/E2	Guard locking
B1	Interlocking device
K1 ... **K4**	Force-guided contactors

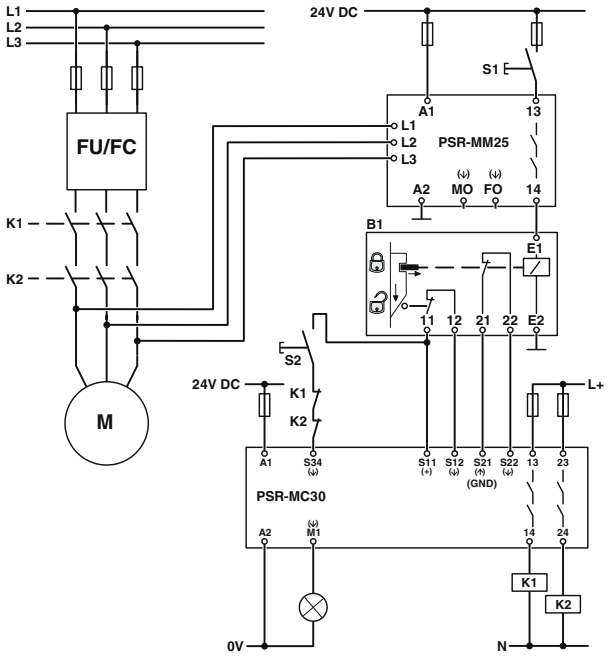
Notes:

If fault exclusion is required to reach the specified safety integrity, implement this in accordance with EN ISO 13849-2, Annex D.

Make sure that measurement inputs L1 - L3 are permanently connected to the motor windings.

See “Operation on motors with star-delta or pole changeover”.

Figure 15 Zero-speed monitoring 3-phase motor



22 Device replacement, device defect, and repair

22.1 Device replacement

The device can be replaced, if necessary.

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

– Mounting and removal
– Wiring

Observe the device type and version

The new device must meet the following requirements:

– Same device type
– Same or later version

22.2 Device defect and repair

Do not open the housing

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

Faulty devices

- Please contact Phoenix Contact.

23 Maintenance, decommissioning, and disposal

23.1 Maintenance

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

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

See “Technical data” section.

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

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

23.2 Decommissioning and disposal

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

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

The device continues to be used only as intended:

- Observe the storage and transport requirements.

See “Transport, storage, and unpacking” section.

The device is not used any more:

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

Packaging disposal

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

24 Attachment

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

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

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

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

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

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

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

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

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

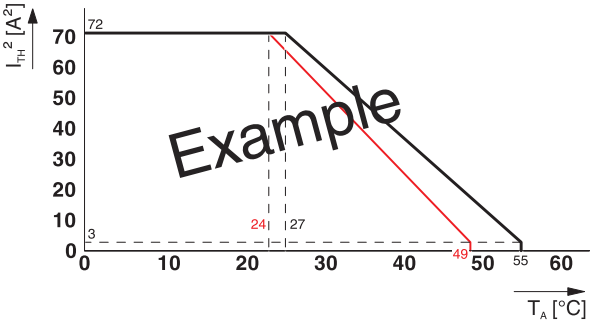
Example calculation for 3000 m

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

27 °C • 0.906 ≈ 24 °C

55 °C • 0.906 ≈ 49 °C

Figure 16 Example of a suspended derating curve (red)



24.2 Revision history

Version	Date	Contents
00	2015-12-11	First publication, internal
01	2016-02-16	First publication
02	2016-03-18	Application example 17.2 modified
03	2016-04-21	Application example 17.1 modified
04	2016-06-03	Safety note added in Section 6.9; safety note in Section 15.1 revised; alternative safety ratings added for application example 17.1
05	2017-09-15	Technical data: Values for rated insulation voltage and rated surge voltage / insulation amended; safety notes for 24 V supply amended
06	2021-09-24	Safety note added in Section 8.9 and 17.5. Circuit diagram changed in 19.2. New sections: “Notes on documentation”, “Transport, storage, and unpacking”, “Device replacement, device defects, and repairs”, “Maintenance, decommissioning, and disposal”, “Appendix/Using PSR devices at altitudes greater than 2000 m above sea level”
07	2024-10-30	New section: Relay data; revised sections: Technical data (enabling current paths: switching frequency, electrical service life, switching capacity), Safety regulations and installation notes
08	2025-10-29	Section "Technical data": Air clearance and creepage distance attribute removed; "Safety regulations and installation notes" section: Reference to safety notes for installation and mounting inserted in other languages