PSR-UNI-S-1X2NO-1DO-24DC-..

Software-parameterizable safety relay for various safety equipment

Data sheet
112087_en_01

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1 Description

Intended Use

Safety relay for various safety equipment that can be parameterized via software. The safety relay is used to monitor 1- or 2-channel signal generators and to control actuators. When the sensor circuit is interrupted, the safety relay initiates the safe state. The safety relay interrupts circuits in a safety-related way.

Possible signal generators

- Emergency stop button
- Light grids
- Mechanical and contact-free safety door switches
- Sensors for synchronous activation monitoring
- Two-hand controls in accordance with ISO 13851 type IIIC
- 4-wire control strips or safety shut-off mats in accordance with EN ISO 13856-1

Contact switching type

- 2 sensor circuits
- 1 start input
- 2 2-channel enabling current paths
- 1 digital signal output

Control

- 1- or 2-channel
- Automatic or manual, monitored start

Achievable safety integrity

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061)

Additional features

- Can be parameterized via clipx ENGINEER device parameterization software
- Sensor circuits can be logically parameterized for the safety circuit
- Optionally adjustable switch-on or switch-off delay for the enabling current paths
- Optional pluggable screw or Push-in terminal blocks
- 22.5 mm housing width

Approvals

c UL us LISTED

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 with software parameterization, multifunctional, up to SIL 3, Cat. 4, PL e, 2 sensor circuits, 1-/2-channel operation, automatic/manual, monitored start, 1 x 2 enabling current paths, 1 signal output, U_S = 24 V DC, pluggable Push-in terminal block	PSR-UNI-S-1X2NO-1DO-24DC-PI	1501632	1
Safety relay with software parameterization, multifunctional, up to SIL 3, Cat. 4, PL e, 2 sensor circuits, 1-/2-channel operation, automatic/manual, monitored start, 1 x 2 enabling current paths, 1 signal output, U_S = 24 V DC, pluggable screw terminal block	PSR-UNI-S-1X2NO-1DO-24DC-SC	1501631	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
Parameterization software for Phoenix Contact devices. It includes online monitoring of current device process values, adjustment of device parameters, and logging of parameter changes. Windows installation version with online update. Software; application: Planning, Marking, Parameterization	CLIPX ENGINEER DEVICE PARAMETERIZATION	1371665	1

4 Technical data

Hardware/firmware version	
Hardware/firmware version (1501632)	≥ 00/100
Hardware/firmware version (1501631)	≥ 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 -20 % / +25 %
Rated control supply current I_S	typ. 53 mA (When sensor circuit and start circuit are controlled internally) typ. 38 mA (When sensor circuit and start circuit are controlled externally)
Power consumption at U_S	typ. 1.27 W
Inrush current	typ. 33 A (Δt = 25 µs at U_s)
Filter time	1 ms (logic)
Protective circuit	Serial protection against polarity reversal Suppressor diode

Device interface: Service interface	
Connection method	USB type C
Number of connections	1
Maximum cable length	3 m
Input voltage	5 V DC
Input current	< 20 mA
Inrush current	< 20 mA
Power consumption	max. 100 mW (typical)
Reverse polarity protection	yes (Serial)

Digital inputs: Logic (I1.1, I1.2, I2.1, I2.2)	
Number of inputs	4
Description of the input	safety-related IEC 61131-2 type 3
Input voltage range "0" signal	0 V DC ... 5 V DC
Input current range "0" signal	0 mA ... 1.5 mA
Input voltage range "1" signal	11 V DC ... 30 V DC
Inrush current	< 45 mA (typ. with U_S, Δt <50 µs)
Current consumption	3.5 mA (typ. with U_S)
Filter time	max. 3 ms (Test pulse width of low test pulses) min. 50 ms (Test pulse rate for low test pulse) < 1 ms (High test pulses at >100 ms test pulse rate possible)
Max. permissible overall conductor resistance	150 Ω
Concurrence	∞ (2-channel wiring), 5 s (non-equivalent wiring), 0.5 s (two-hand control, synchronous activation monitoring)
Limit frequency	min. 0 Hz max. 0.1 Hz
Protective circuit	Varistor

Digital inputs: Start circuit (S34)	
Number of inputs	1
Description of the input	non-safety-related IEC 61131-2 type 3
Input voltage range "0" signal	0 V DC ... 5 V DC
Input current range "0" signal	0 mA ... 1.5 mA
Input voltage range "1" signal	11 V DC ... 30 V DC
Inrush current	< 45 mA (typ. with U_S, Δt <50 µs)
Current consumption	< 3.5 mA (typ. with U_S)
Filter time	max. 3 ms (Test pulse width of low test pulses) min. 50 ms (Test pulse rate for low test pulse)
Max. permissible overall conductor resistance	150 Ω
Limit frequency	min. 0 Hz max. 0.1 Hz
Protective circuit	Varistor

Relay outputs: Enabling current paths (13/14, 23/24)	
Number of outputs	2
Output description	2 N/O contacts in series, safety-related, floating
Contact material	AgCuNi, +0.2 ... 0.4 µm Au
Switching voltage (see section “Relay data”)	min. 10 V AC/DC max. 250 V AC/DC
Limiting continuous current (see section “Relay data”)	6 A
Inrush current	min. 3 mA max. 6 A
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$	72 A^2 (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. 60 mW
Switching capacity	5 A (DC13) 3 A (AC15)
Output fuse	6 A gL/gG 4 A gL/gG (for low-demand applications)

Alarm outputs: M1	
Number of outputs	1
Output description	non-safety-related
Voltage	typ. (U_S - 2,5 V)
Current	max. 100 mA (observe derating)
Maximum inrush current	500 mA (Δt = 100 ms at U_s)
Ohmic load	min. 192 Ω (max. 100 mA)
Switching frequency	max. 0.1 Hz
Protective circuit	Reverse polarity protection Suppressor diode
Short-circuit protection	Yes
Discharging circuit	no

Clock outputs: T1, T2	
Number of outputs	2
Output description	non-safety-related
Voltage	typ. (U_S - 2,5 V)
Current	max. 100 mA
Maximum inrush current	500 mA (Δt = 100 ms at U_s)
Max. capacitive load	15 nF
Protective circuit	Reverse polarity protection Suppressor diode
Short-circuit protection	Yes
Discharging circuit	no

Times	
Typical starting time with U_s	1 s (when controlled via A1; ⚠ applicative control via A1/A2 is not permitted.) Applies to parameterization: switch-off delay or no delay. For switch-on delay, see section “Calculation of typical delay times”.
Typical response time at U_s	< 100 ms (Automatic/manual start) < 500 ms (Safety shut-off mat operation) Applies to parameterization: switch-off delay or no delay. For switch-on delay, see section “Calculation of typical delay times”.
Typical release time with U_s	< 25 ms (on demand via the sensor circuit) < 85 ms (Safety shut-off mat operation) < 25 ms (when requested via A1; ⚠ applicative deactivation via A1/A2 is not permitted.) Applies to parameterization: switch-on delay or no delay. For switch-off delay, see section “Calculation of typical delay times”.
Delay time range	0.1 s ... 300 s ± 3% (optionally parameterizable switch-on or switch-off delay, see section “Calculation of typical delay times”)
Restart time	< 1 s (Boot time)
Recovery time	500 ms (following demand of the safety function) > 100 ms (Availability time after activating the sensor circuit during manual start) > 500 ms (Availability time after activating the sensor circuits during manual start in safety shut-off mat operation)
Start pulse length	min. 500 ms (manual start)
General data	
Relay type	Electromechanical relay with force-guided contacts in accordance with IEC/EN 61810-3
Nominal operating mode	100% operating factor
Degree of protection	IP20
Min. degree of protection of inst. location	IP54
Mounting type	DIN rail mounting
Mounting position	vertical or horizontal
Assembly note	See derating curve
Type of housing	PA zinc yellow (RAL 1018)
Operating voltage display	1 x LED (green, yellow, red)
Status display	4 x LED (green, yellow, red)
Error indication	1 x LED (red)
Rated insulation voltage	250 V
Rated surge voltage/insulation	See “Insulation coordination”
Degree of pollution	2
Overvoltage category	II, III (See the section “Insulation coordination”)
Maximum power dissipation for nominal condition	5.55 W (at U_S = 30 V, I_L^2 = 72 A^2)
Note on power dissipation	See “Calculating the power dissipation”

Dimensions / weight	Push-in connection	Screw connection
W x H x D	22.5 x 107.9 x 111.7 mm	22.5 x 112.7 x 111.7 mm
Weight	220 g	220 g

Connection data	Push-in connection	Screw connection
Conductor cross-section rigid	0.2 mm² ... 2.5 mm²	0.2 mm² ... 2.5 mm²
Conductor cross-section flexible	0.2 mm² ... 2.5 mm²	0.2 mm² ... 2.5 mm²
Conductor cross-section AWG	24 ... 14	24 ... 12
Stripping length	10 mm	7 mm
Screw thread	-	M3
Tightening torque	-	0.5 Nm ... 0.6 Nm

Ambient conditions	
Ambient temperature (operation)	-25 °C ... 60 °C (observe derating)
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Max. permissible relative humidity (operation)	75 % (on average, 85% infrequently, non-condensing)
Max. permissible humidity (storage/transport)	75 % (on average, 85% infrequently, non-condensing)
Maximum altitude	≤ 2000 m (Above sea level)
Information on operating height	See the “Using PSR devices at altitudes greater than 2000 m above sea level” section
Shock	15g
Vibration (operation)	10 Hz ... 150 Hz, 2g

Approvals and manufacturer's declarations	
The latest documents can be found at:	www.phoenixcontact.com/product/1501632 www.phoenixcontact.com/product/1501631

Safety data	
Stop category according to IEC 60204	0 1 (with parameterized switch-off delay)

Safety parameters in accordance to IEC 61508 - high demand	
Equipment type	Type B
HFT	1
SIL	3
PFH_D	1.00×10^{-9} (5 A DC13; 3 A AC15; 8760 cycles/year)
Demand rate	< 12 Months
Proof test interval	240 Months
Mission time	240 Months

Safety parameters according to IEC 61508 - low demand	
Equipment type	Type B
HFT	1
SIL	3
PFD_{avg}	3.63×10^{-5}
Proof test interval	36 Months
Mission time	240 Months

Safety parameters according to EN ISO 13849-1	
Category	4 (5 A DC13; 3 A AC15; 8760 cycles/year)
Performance level	e
Mission time	240 Months
For applications in PL e, the required demand rate for the safety function is once per month.	

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

5 Interface type (ZVEI classification)

Digital inputs : Logic (I1.1, I1.2, I2.1, I2.2)				
Source/destination	**Interface type**	**Additional measure**	**Source/destination**	**Suitable interface type**
Destination	A	M	Source	A
Destination	C0	-	Source	C1, C2, C3

Interface type A - Destination			
Parameter	**min.**	**typ.**	**max.**
Input current I_i (in the ON-state)	1.8 mA	-	< 3.8 mA
Output voltage U_i	17.2 V	-	30 V
Input capacitance C_i	-	-	10 nF
Additional measure M	- T_G is T1 for Ix.1 - T_G is T2 for Ix.2		

Interface type C0 - Destination			
Parameter	**min.**	**typ.**	**max.**
Test pulse duration t_i	-	-	3 ms
Test pulse interval T	50 ms	-	-
Input resistance R	7 kΩ	-	-
Input capacitance C_L	-	-	15 nF
Inductance L_L	-	-	-
Additional measure M	-		

Digital inputs : Start circuit (S34)				
Source/destination	**Interface type**	**Additional measure**	**Source/destination**	**Suitable interface type**
Destination	A	-	Source	A
Destination	C0	-	Source	C1, C2, C3

Interface type A - Destination			
Parameter	**min.**	**typ.**	**max.**
Input current I_i (in the ON-state)	> 2 mA	-	< 3.8 mA
Output voltage U_i	17.2 V	-	30 V
Input capacitance C_i	-	-	10 nF
Additional measure M	-		

Interface type C0 - Destination			
Parameter	**min.**	**typ.**	**max.**
Test pulse duration t_i	-	-	3 ms
Test pulse interval T	50 ms	-	-
Input resistance R	7 kΩ	-	-
Input capacitance C_L	-	-	15 nF
Inductance L_L	-	-	-
Additional measure M	-		

Relay outputs : Enabling current paths (13/14, 23/24)				
Source/destination	**Interface type**	**Additional measure**	**Source/destination**	**Suitable interface type**
Source	A	M	Destination	A
Source	C0	M	Destination	-

Interface type A - Source			
Parameter	**min.**	**typ.**	**max.**
Switching current I_i	3 mA	-	6 A
Switching voltage U_i	10 V	-	250 V AC/DC
Internal resistance R_i (in the switched state)	50 mΩ	Load ≥ 100 mA/6 V ≤ 200 mΩ	-
Load capacitance C_L	-	-	-
Inductive load L_L	-	-	-
Electrical isolation	yes		
Additional measure M	- The outputs are not types in accordance with IEC 61131-2.		

Interface type C0 - Source			
Parameter	**min.**	**typ.**	**max.**
Test pulse duration t_i	-	-	-
Test pulse interval T	-	-	-
Nominal current I_N	-	-	6 A
Load capacitance C_L	-	-	-
Inductive load L_L	-	-	-
Additional measure M	- The outputs are not types in accordance with IEC 61131-2. - No test pulses are emitted at the output.		

Alarm outputs : M1				
Source/destination	**Interface type**	**Additional measure**	**Source/destination**	**Suitable interface type**
Source	C0	M	Destination	-

Interface type C0 - Source			
Parameter	**min.**	**typ.**	**max.**
Test pulse duration t_i	-	-	-
Test pulse interval T	-	-	-
Nominal current I_N	-	-	100 mA
Leakage current $I_{Leakage}$	-	-	-
Load capacitance C_L	-	-	-
Inductive load L_L	-	-	-
Additional measure M	- The outputs are not types in accordance with IEC 61131-2. - No test pulses are emitted at M1. - No monitoring of the output by the source		

6 Notes regarding documentation

6.1 Identification of warning notes

This symbol indicates hazards that could lead to personal injury.

There are three signal words indicating the severity of a potential injury.

DANGER Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

WARNING Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

CAUTION Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.

This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.

Here you will find additional information or detailed sources of information.

6.2 Validity

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

6.3 Target group

This data sheet is therefore aimed at:

– Qualified personnel who plan and design safety equipment for machines and systems and are familiar with regulations governing occupational safety and accident prevention.
– Qualified personnel who install and operate safety equipment in machines and systems.

Qualified personnel:

Qualified personnel are people who, because of their education, experience, and instruction and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized by those responsible for the safety of the system to carry out any required operations and who are able to recognize and avoid any possible dangers.

Requirements:

Knowledge of the following topics is required:

– Handling safety components
– Valid EMC regulations
– Valid regulations governing occupational safety and accident prevention

7 Safety regulations and installation notes

WARNING: Death, serious personal injury or damage to equipment

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

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

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.

Electrostatic discharge

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

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

Direct/indirect contact

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

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

Power supply units for 24 V supply

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

Startup, mounting, and modifications

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

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

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

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

Mismatching and polarity reversal of connections

- Take measures to prevent mismatching, polarity reversal, and manipulation of connections.

In operation

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

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

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

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

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

Inductive loads can lead to welded relay contacts.

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

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

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

EMC notes

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

The device is a Class A product.

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

Faulty devices

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

- Replace any defective devices.

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

– Repairs to the device

– Opening the housing

Replacing the device

- Dispose of the device in the following circumstances:

– At the end of its mission time

See “Technical data” section.

– At the end of its electrical service life

See section “Electrical service life”.

– In the event of a fault

7.1 Safety of machines or systems

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 function tests 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.

7.2 UL notes

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).

Fuse protection of the rated control circuit (A1)

– Install a fuse in accordance with UL 248, (JDYX2/8). The fuse shall be rated max. T 2.0 A and shall be installed in the 30 V DC power supply of the device to limit the available current. This fuse shall be installed by the installer.

7.3 Security in the network

NOTE: Network security jeopardized by unauthorized access

Connecting devices to a network entails the danger of unauthorized access to the network.

Observe the following safety notes:

- If possible, deactivate unused communication channels.
- Use secure passwords reflecting the complexity and service life recommended in the latest guidelines.
- Only allow authorized persons to access the device. Limit the number of authorized persons to the necessary minimum.
- Observe the IT and OT security requirements and the standards applicable to your application. Take the necessary protective measures. These may include, for example, virtual networks for remote maintenance access or a firewall.
- In security-critical applications, always use the device with an additional security appliance.
  Phoenix Contact offers security appliances in the mGuard product range. The mGuard routers connect various networks for the remote maintenance and protection of the local network and protect these networks against cyberattacks.
- You must take defense-in-depth strategies into consideration when planning networks.

Additional measures for protection against unauthorized network access can be found in the "INDUSTRIAL SECURITY" application note. The application note can be downloaded via the item (www.phoenixcontact.com/products).
German: AH DE INDUSTRIAL SECURITY, 107913
English: AH EN INDUSTRIAL SECURITY, 107913

If a security vulnerability exists for products, solutions, or services from Phoenix Contact, it will be published on the PSIRT (Product Security Incident Response Team) website:
www.phoenixcontact.com/psirt

8 Transport, storage, and unpacking

8.1 Transport

The device is delivered in cardboard packaging.

- Observe the instructions on how to handle the package indicated on the packaging.

Suitable transport packaging

- Only transport the device in its original packaging or in packaging suitable for transport.

Technical data and environmental conditions

- For transport, observe the humidity and air pressure specifications, and the temperature range.
  See Section "Technical data".

8.2 Storage

Suitable storage location

The storage location must meet the following requirements:

– Dry
– Protected against unauthorized access
– Protected against harmful environmental influences such as UV light

Technical data and environmental conditions

- For storage, observe the humidity and air pressure specifications, and the temperature range.
  See Section "Technical data".

8.3 Unpacking

The device is delivered in packaging together with a packing slip.

Observing the packing slip

- Read the entire packing slip carefully.
- Retain the packing slip.

Checking the delivery

- Check the delivery for damage and completeness.
- Submit any claims for transport damage immediately.

Scope of supply

Refer to the ordering data for the standard scope of supply for the product.
See Section "Ordering data".

9 Function description

For a tabular overview of the parameterizable functions of the device, see the appendix.

9.1 Parameterization

The safety relay is parameterized using the clipx ENGINEER device parameterization software.

The following functions are possible:

- 1-channel operation
- 2-channel operation without cross-circuit detection
- 2-channel operation with cross-circuit detection
- OSSD signal
- Safety mat operation
- 2-channel operation with synchronous activation monitoring
- Type IIIC two-hand control
- Non-equivalent operation
- Automatic start
- Manual, monitored start

See the “Parameterization” section.

Detailed step-by-step instructions for the parameterization can be found in the following document:

UM QS EN PSR-UNI-S clipX ENGINEER dp

The document can be downloaded at phoenixcontact.com/products.

9.2 Monitoring of the sensor circuits

The safety relay monitors two sensor circuits. The sensor circuits can be designed as 1-channel or 2-channel circuits.

See “Signal generator connection versions” section.

The sensor circuits (S1, S2) can be logically parameterized for the safety circuit (K1).

The following assignments are possible:

- S1 & S2 act on K1
- S1 acts on K1

The only logical links between sensor circuits and outputs that can be used are these available in the parameterization software.

Single-channel sensor circuit

The sensor circuit is not designed with redundancy.

The safety relay does not detect short and cross-circuits in the sensor circuit.

Two-channel sensor circuit

The connection of the 2-channel sensor circuit can be equivalent or non-equivalent.

With the corresponding wiring, the safety relay detects short and cross-circuits in the sensor circuit.

9.3 Safety circuit

The safety relay has a safety circuit that can be logically linked to the sensor circuits.

The safety circuit consists of two 2-channel enabling current paths, a start input, and a digital signal output.

See “Block diagram” section.

9.4 Startup behavior

The desired start behavior is selected via the parameterization in the software.

Optionally, a switch-on delay can be parameterized for the safety circuit.

See “Start and feedback circuit connection versions” section.

Automatic start

The safety circuit starts automatically after the corresponding sensor circuit has been closed.

If a switch-on delay is parameterized for the safety circuit, the start takes place only after the parameterized time has elapsed.

Manual, monitored start

With the sensor circuit closed, the safety circuit starts once the start circuit has been closed and opened again by pressing and releasing the reset button.

If a switch-on delay is parameterized for the safety circuit, the start takes place only after the parameterized time has elapsed.

A connected reset button is monitored.

9.5 Safe shutdown

Optionally, a switch-off delay can be parameterized for the safety circuit.

When at least one sensor circuit opens, the enabling current paths open according to the parameterization.

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

With switch-off delay: If the sensor circuit and the start circuit are reactivated within the delay time, the delay time is interrupted and the enabling current paths remain active.

9.6 Switch-on and switch-off delay (optional)

The delay time for the switch-on or switch-off delay can be parameterized in the software: 0.1 s ... 300 s (step size 100 ms).

Please refer to the section “Calculation of typical delay times”.

Switch-on delay

If a switch-on delay is parameterized, the enabling current paths close after the set delay time has elapsed.

Power off delay

With a parameterized switch-off delay, the safety relay module behaves according to stop category 1 in accordance with EN 60204-1. The corresponding enabling current paths open only after the set delay time has elapsed.

NOTE: Property damage due to immediate shutdown

The safety relay module ensures stop category 1 only during error-free operation. In the event that the supply voltage is lost or overvoltage, undervoltage, or an internal error occurs, the device behaves in accordance with stop category 0.

- Do **not** use the device for applications in which stop category 1 also has to be observed in the event of an error.

9.7 Signal output

The behavior of the signal output can be parameterized as follows:

– **Inverted:** When the safety circuit is open, the signal output switches **24 V**.
– **Not inverted:** When the safety circuit is open, the signal output switches **0 V**.

WARNING: Loss of safety function due to incorrect wiring

The signal output is non-safety-related.

- Do **not** use the signal output as a safety output.

9.8 Diagnostics

The safety relay indicates detected errors via the LEDs on the front.

See section “Diagnostics”.

10 Function and time diagrams

10.1 Notes on function and time diagrams

Key:

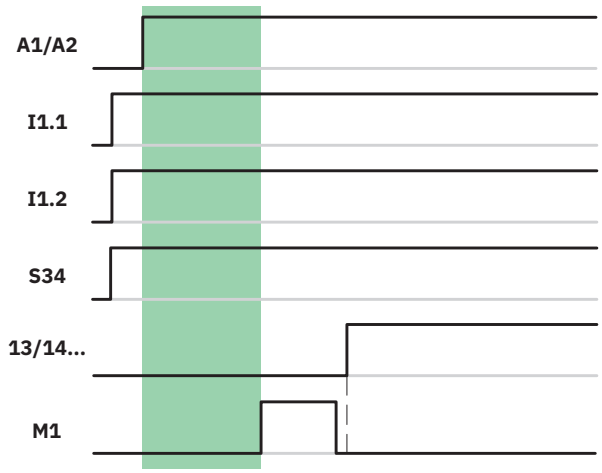
A1/A2	24 V DC power supply
T1, T2	Clock outputs
I1.1, I1.2	Sensor inputs
S34	Start circuit
13/14...	Undelayed enabling current paths
M1	Digital alarm output
Green area	Boot phase

10.2 Power-up, autostart

Parameterization:

- **Sensor circuit 1:**
  2-channel without cross-circuit detection
- **Start S34:** automatic
- **Delay K1:** none
- **Signal output M1:** inverted

Figure 1 Time diagram for power-up, automatic start

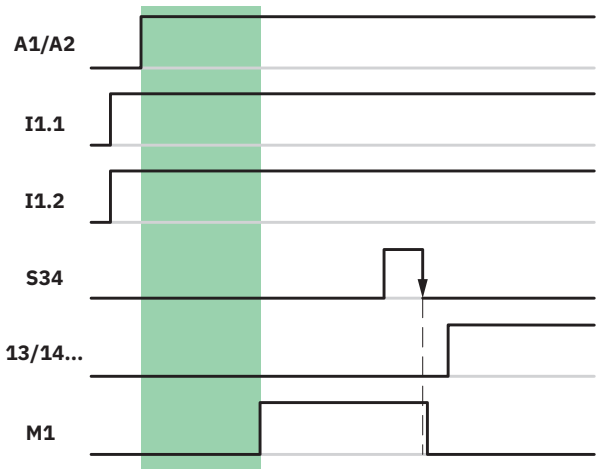


10.3 Power-up, manual start

Parameterization:

- **Sensor circuit 1:**
  2-channel without cross-circuit detection
- **Start S34:** manual, monitored
- **Delay K1:** none
- **Signal output M1:** inverted

Figure 2 Time diagram for power-up, manual start

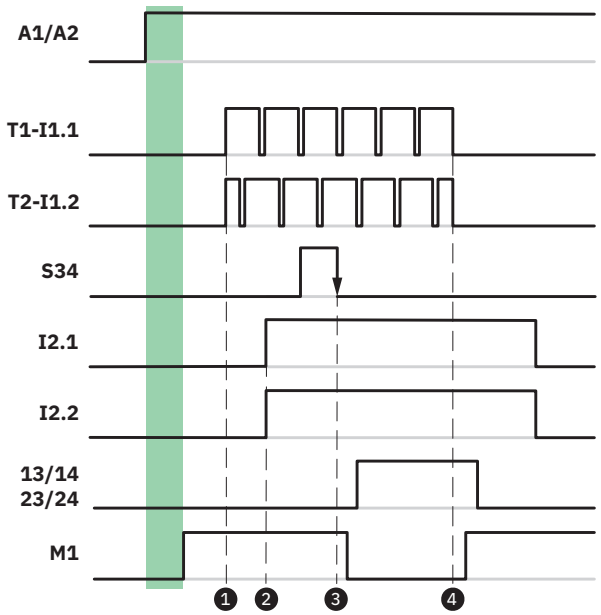


10.4 Emergency stop monitoring with manual start and safety door monitoring with autostart

Parameterization:

- **Sensor circuit 1:** 2-channel with cross-circuit detection
- **Sensor circuit 2:** 2-channel without cross-circuit detection
- **Start S34:** manual, monitored
- **Delay K1:** none
- **Signal output M1:** inverted
- **Logic:** S1 & S2 act on K1

Figure 3 Time diagram for emergency stop monitoring and safety door monitoring



1. Emergency stop is unlocked.
2. The safety door is closed.
3. The start button has been pressed and is now released. The signal output is deactivated. The enabling current paths close.
4. Emergency stop is actuated. The signal output is activated. The enabling current paths open.

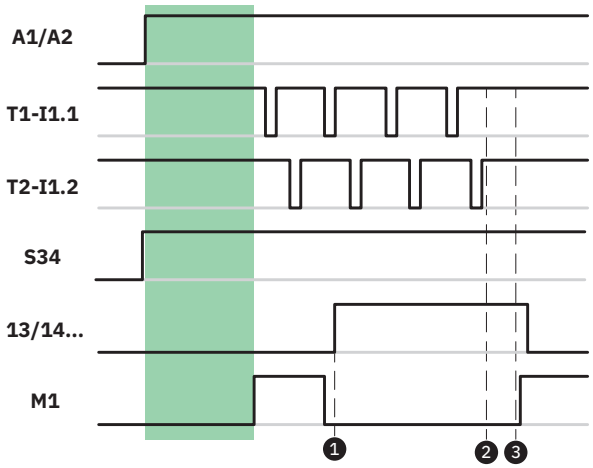
10.5 Safety shut-off mat monitoring

Parameterization:

- **Sensor circuit 1:** Safety mat sensor
- **Start S34:** automatic
- **Delay K1:** none
- **Signal output M1:** inverted

Note: The connection between clock outputs and inputs is hardwired.

Figure 4 Time diagram for safety shut-off mat monitoring



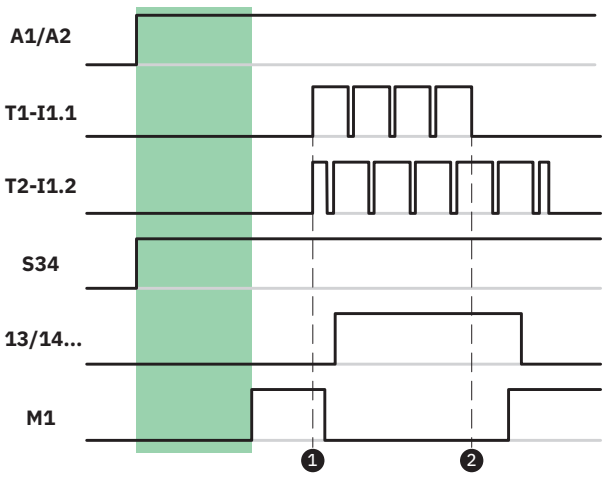
1. Nobody has stepped on the safety shut-off mat. Therefore, startup is possible. The signal output is deactivated. The enabling current paths close.
2. Somebody steps on the safety shut-off mat.
3. There are no more test pulses when somebody steps on the safety shut-off mat. The signal output is activated. The enabling current paths open.

10.6 Synchronous activation monitoring (e.g., THC type IIIA)

Parameterization:

- **Sensor circuit 1:**
  2-channel with synchronous activation monitoring
- **Start S34:** automatic
- **Delay K1:** none
- **Signal output M1:** inverted

Figure 5 Time diagram for synchronous activation monitoring



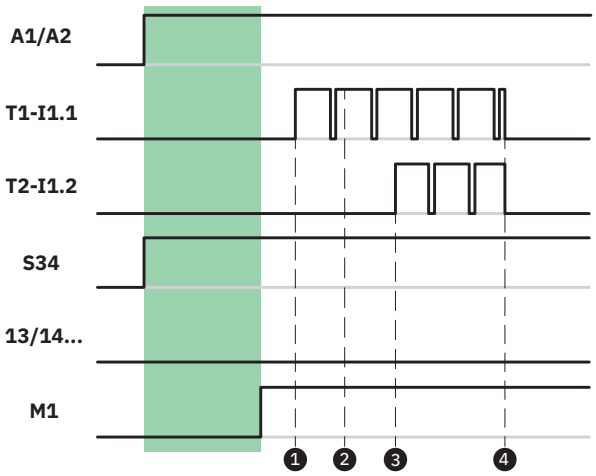
1. Channel 1 (I1.1) and channel 2 (I1.2) are switched on within the time Δt < 0.5 s. The signal output is deactivated. The enabling current paths close.
2. At least one channel is switched off. The signal output is activated. The enabling current paths open.

10.7 Error detection: Time violation error during synchronous activation monitoring (e.g., THC type IIIA)

Parameterization:

- **Sensor circuit 1:**
  2-channel with synchronous activation monitoring
- **Start S34:** automatic
- **Delay K1:** none
- **Signal output M1:** inverted

Figure 6 Time diagram for time violation error during synchronous activation monitoring



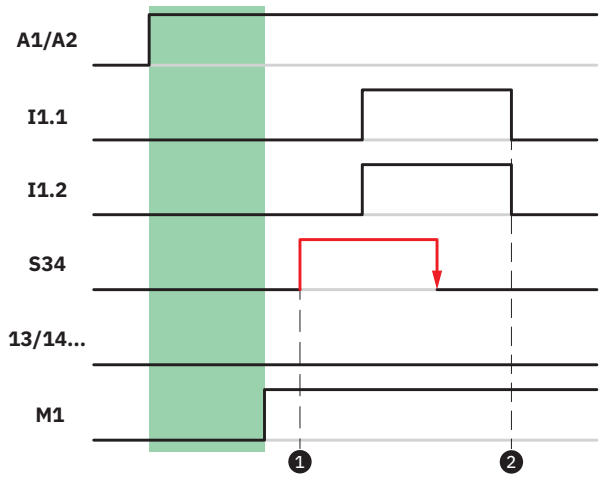
1. Channel 1 (I1.1) is switched on.
2. The time of 0.5 s is exceeded. The device indicates an error via the LEDs.
3. Channel 2 (I1.2) is switched on.
4. Both channels are switched off. The error is reset.

10.8 Error detection: Manual start error

Parameterization:

- **Sensor circuit 1:**
  2-channel without cross-circuit detection
- **Start S34:** manual, monitored
- **Delay K1:** none
- **Signal output M1:** inverted

Figure 7 Time diagram for manual start error



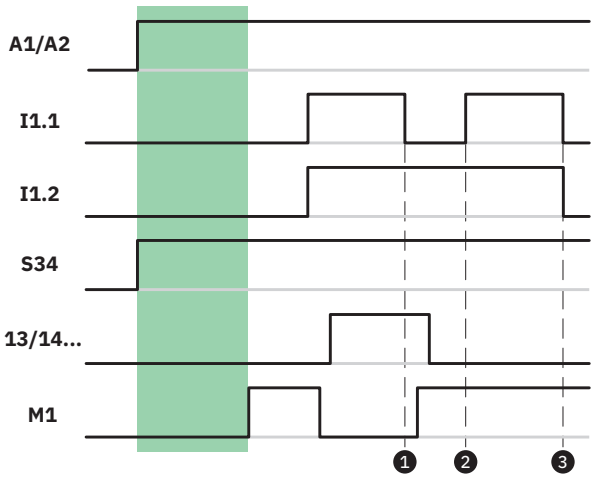
1. The device indicates the error via the LEDs.
2. The error is reset.

10.9 Error detection: Plausibility error

Parameterization:

- **Sensor circuit 1:**
  2-channel without cross-circuit detection
- **Start S34:** automatic
- **Delay K1:** none
- **Signal output M1:** inverted

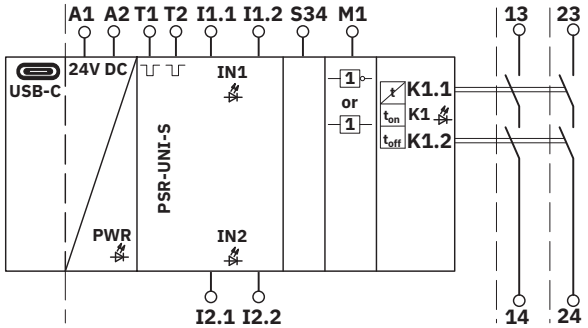
Figure 8 Time diagram for plausibility error



1. Channel 1 (I1.1) is switched off, channel 2 (I1.2) remains switched on.
2. Channel 1 (I1.1) is switched on again. The device indicates a plausibility error.
3. Channel 1 (I1.1) and channel 2 (I1.2) are switched off. The error is reset.

11 Block diagram

Figure 9 Block diagram



Key:

USB-C	USB type C interface
A1	24 V DC power supply
A2	0 V power supply
T1, T2	Clock outputs
I1.1	Input sensor circuit 1 (channel 1)
I1.2	Input sensor circuit 1 (channel 2)
I2.1	Input sensor circuit 2 (channel 1)
I2.2	Input sensor circuit 2 (channel 2)
S34	Start circuit
M1	Digital signal output, non-safety-related
K1 (K1.1/K1.2)	Safety circuit
13/14, 23/24	Enabling current paths

WARNING: Loss of electrical and functional safety

Different potentials can lead to a loss of electrical and functional safety.

- Use the same potential for supply, sensor inputs, start inputs, and signal outputs.

11.1 Insulation coordination

The following table shows the device-specific insulation values:

	A1/A2, logic	13/14	23/24	USB-C	Housing
A1/A2, logic	-	6 kV	6 kV	800 V	4 kV
13/14	-	-	4 kV	6 kV	4 kV
23/24	-	-	-	6 kV	4 kV
USB-C	-	-	-	-	-

Interpretation

The selection of the suitable insulation method (basic insulation or safe isolation) depends largely on the overvoltage category of the application.
The following table shows the dependencies between insulation method and overvoltage category:

Overvoltage category	Insulation type	
	Basic insulation	Safe isolation
II	2,5 kV	4 kV
III	4 kV	6 kV

Basic insulation

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

Reinforced insulation (e.g., thanks to greater air clearances and creepage distances between conductive paths) is designed for one overvoltage category higher than basic insulation. This means that SELV circuits of U ≤ 25 V AC or U ≤ 60 V DC and circuits with higher voltages can be mixed.

12 Derating

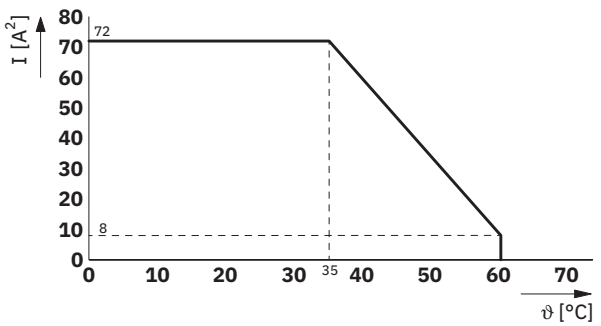
The temperature is measured at a 5 cm clearance below or to the side of the device.

12.1 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
- at U_S up to max. 30 V DC
- $I_{max}^2 = I_1^2 + I_2^2$
- $I_{max}^2 = 72\ A^2$

Figure 10 Derating curve - horizontal mounting position, without spacing



12.2 Vertical mounting position or mounting position with device front facing upwards

The derating curve applies for the following conditions:

- Mounting on a vertical DIN rail

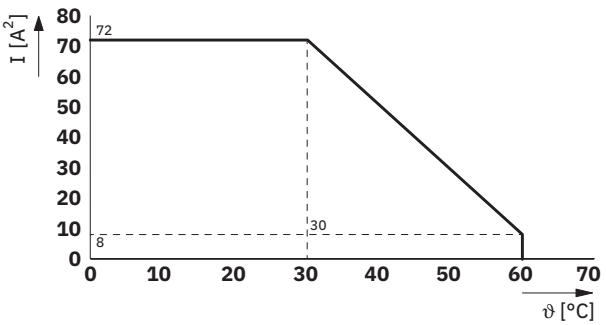
Or:

- Mounting on a horizontal DIN rail with the device front facing upwards (“upright mounting position”)

And:

- Devices mounted next to each other without spacing
- at U_S up to max. 30 V DC
- $I_{max}^2 = I_1^2 + I_2^2$
- $I_{max}^2 = 72\ A^2$

Figure 11 Derating curve - vertical or upright mounting position, without spacing



12.3 Examples

Example 1 for a **total current of 72 A²** with a distribution to **two N/O contacts**:

I_1 = 6 A, I_2 = 6 A

72 A² = (6 A)² + (6 A)²

Example 2 for a **total current of 8 A²** with a distribution to **two N/O contacts**:

I_1 = 2 A, I_2 = 2 A

8 A² = (2 A)² + (2 A)²

12.4 Derating of signal output

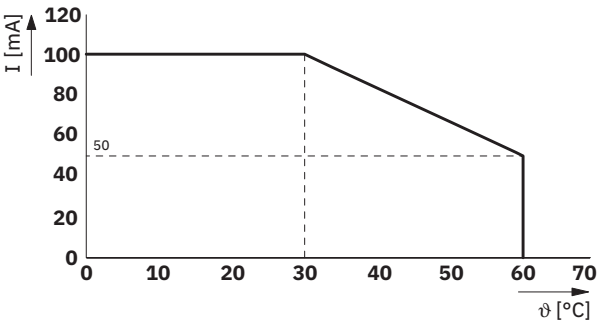
The derating of the signal output is dependent on parameterization.

12.4.1 Signal output, not inverted

The derating curve applies for the following conditions:

– at U_S up to max. 30 V DC
– $I_{max\ M1}$ = 100 mA
– Signal output **does not** switch inverted to the relay

Figure 12 Derating curve signal output, not inverted



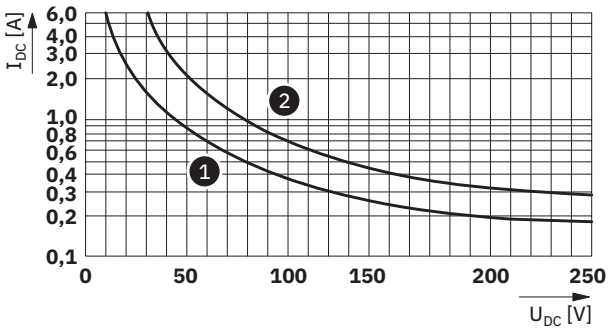
12.4.2 Signal output, inverted

If the signal output switches **inverted** to the relay, **no** derating is required up to 60°C.

13 Relay data

13.1 Load limit curve at DC load

Figure 13 Load limit curve - ohmic and inductive load

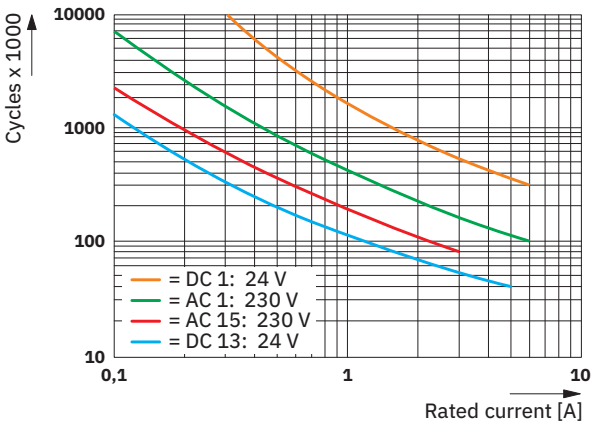


Key:

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

13.2 Electrical service life

Figure 14 Electrical service life, 1 N/O contact, switching frequency 0.1 Hz



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 about 190000 switching cycles.

WARNING: Loss of functional safety

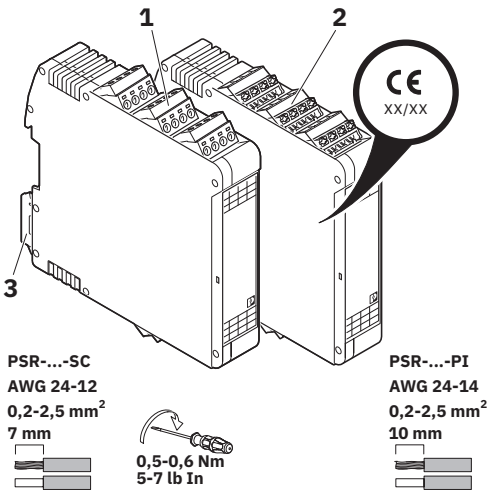
At the end of the electrical service life, there is an increased risk of loss of functional safety.

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

14 Operating and indication elements

14.1 Connection versions

Figure 15 Connection versions



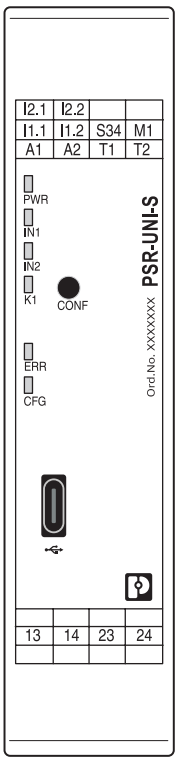
1 COMBICON plug-in screw terminal block
2 Pluggable COMBICON Push-in terminal block
3 Metal lock for fixing to DIN rail

See section "Optional terminal coding".

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

XX/XX = Calendar week / year

14.2 Connection assignment



I2.1	Input sensor circuit 2 (channel 1)
I2.2	Input sensor circuit 2 (channel 2)
I1.1	Input sensor circuit 1 (channel 1)
I1.2	Input sensor circuit 1 (channel 2)
S34	Start circuit
M1	Digital signal output, non-safety-related
A1	24 V DC power supply
A2	0 V power supply
T1	Clock output 24 V for I1.1 and I2.1
T2	Clock output 24 V for I1.2 and I2.2
CONF	Configuration button (press 2 s ... 5 s)
PWR	Power LED (red, yellow, green)
IN1	Status indicator for sensor circuit S1; LED (red, yellow, green)
IN2	Status indicator for sensor circuit S2; LED (red, yellow, green)
K1	Status indicator safety circuit; LED (red, yellow, green)
ERR	Error LED (red)
CFG	LED (red, yellow, green) for indicating the parameterization mode
13/14	Enabling current path
23/24	Enabling current path

14.3 Optional terminal coding

The device connection terminal blocks are **not** coded as standard.

The optional coding accessories can provide you with increased safety against connection mismatching and reverse polarity.
See section “Ordering data”.

If you do not use the coding accessories, ensure that alternative validation measures are taken.

Coding system

The terminal blocks can be coded by using coding sections and coding profiles.

Coding sections are plugged onto the terminal block header in the device housing.

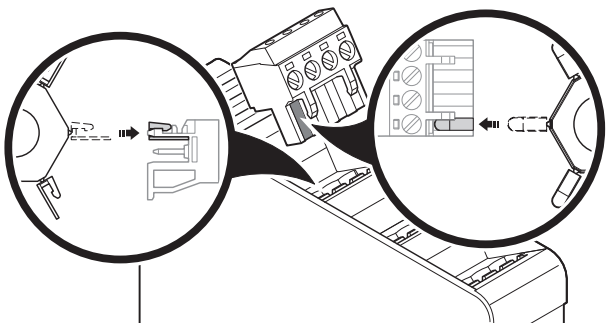
Coding profiles are plugged into the groove of the pluggable terminal block.

Various combinations can be used to create a coding system for the device terminal blocks.

Attaching coding elements

1. Push a coding section onto the terminal block header in the device housing.
   Remove the coding section from the coding star.
2. Push a coding profile into the groove of the terminal block.
   Remove the coding profile from the coding star.

Figure 16 Attach coding elements

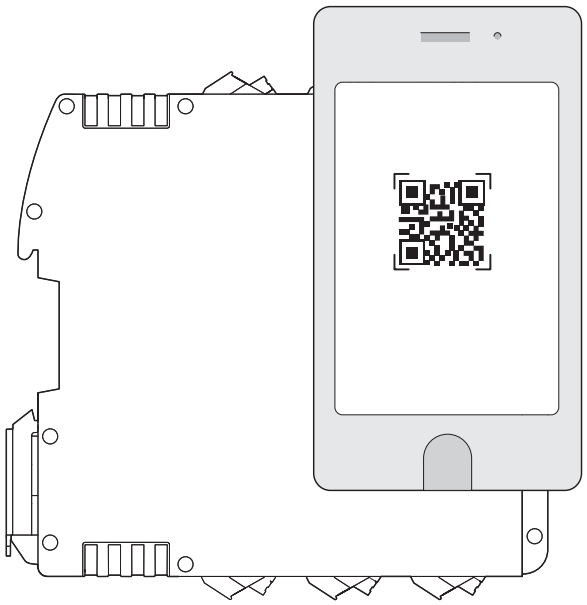


14.4 Digital nameplate

The digital nameplate provides the option of obtaining product-specific data related to a specific serial number.

If you scan the QR code (digital nameplate) on the device, you can, for example, retrieve documents on the production status as well as clearly identify the hardware and firmware status of the device at hand.

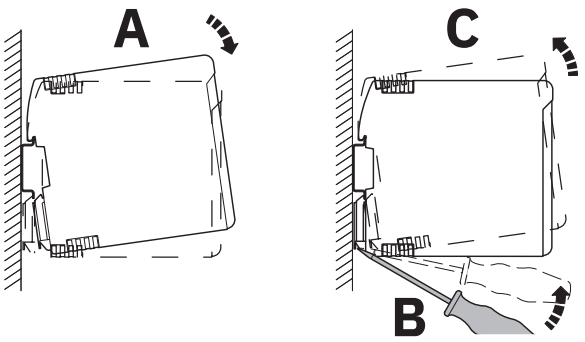
Figure 17 Scan QR code



15 Mounting and removing

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

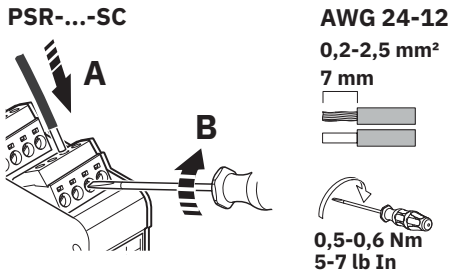
Figure 18 Mounting and removing



16 Wiring

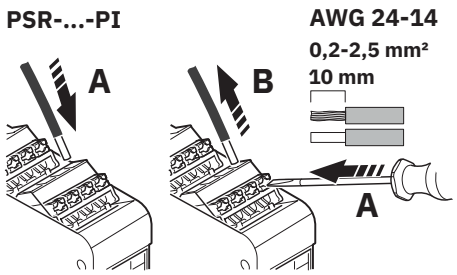
- Connect the cables to the connection terminal blocks using a screwdriver.

Figure 19 Connecting the cables for PSR-...-SC (screw terminal block)



- First open the springs using the pressure switch before connecting stranded conductors or disconnecting the cables for Push-in terminal blocks.

Figure 20 Connecting the cables for PSR-...-PI (Push-in terminal block)



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

Use the CRIMPFOX 6 crimping tool from Phoenix Contact.

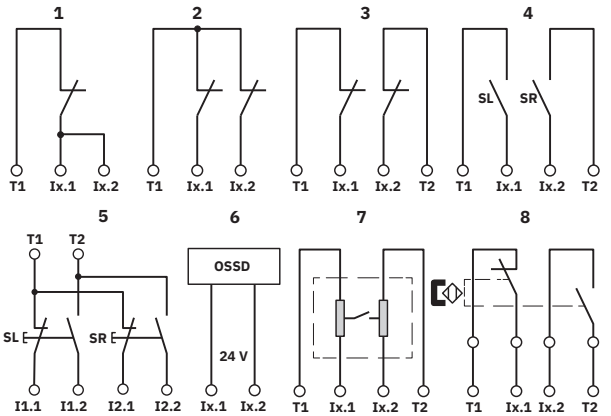
The tool enables the reliable processing of ferrules and easy removal of conductors with ferrules from the connection terminal blocks.

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

16.1 Signal generator connection versions

- Connect suitable signal generators to the corresponding sensor inputs and clock outputs.

Figure 21 Signal generator connection versions



1 1-channel connection

2 1- or 2-channel connection without cross-circuit detection

3 2-channel connection with cross-circuit detection

4 Two-hand controls in accordance with ISO 13851 type IIIA

5 Two-hand controls in accordance with ISO 13851 type IIIC

6 2-channel OSSD signal

7 2-channel connection for safety mat monitoring

8 2-channel, non-equivalent connection

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

16.2 Start and feedback circuit connection variants

Automatic start

- Bridge contacts T1/S34.

Manual, monitored start

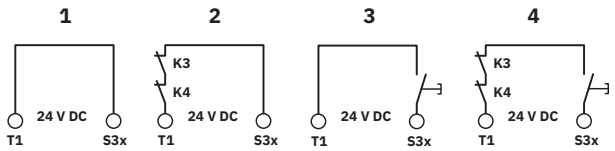
- Connect a reset button to contacts T1/S34.

A connected reset button is monitored.

Start and feedback circuit

- Place the relevant N/C contacts in path T1/S34 to monitor external contactors or extension devices with force-guided contacts.

Figure 22 Start and feedback circuit connection variants



1 Automatic start
2 Automatic start with monitored contact extension
3 Manual, monitored start
4 Manual, monitored start with monitored contact extension

K3/K4 Force-guided contactors

If you are using the two-hand control function, hard wire start input S34. Only use it for reading back actuators. Do not use a start button or similar.

17 Parameterization

17.1 Important information on parameterization

WARNING: Danger due to incorrect setting

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

- Validate the parameterization before starting up for the first time and every time a change is made.

WARNING: Risk of electric shock

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

In parameterization mode, the device is in a safe state.

Examples of applications with the corresponding parameterization can be found in the “Application examples” section.

For a tabular overview of the parameterizable functions of the device, see the appendix.

17.2 Delivery state

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

– Sensor circuit 1: 2-channel circuit with cross-circuit detection
– Sensor circuit 2: 2-channel circuit with cross-circuit detection
– Logic configuration: S1 & S2 act on K1
– Manual, monitored start
– No delay time
– Signal output switches to K1 inverted
– Password: psrunis

17.3 System requirements

Find out about the system requirements on the product page of the clipx ENGINEER device parameterization software at phoenixcontact.com/product/1371665.

17.4 Installing the parameterization software

The clipx ENGINEER device parameterization software can be downloaded from the download area of the PSR-UNI-S device used or from the address phoenixcontact.com/product/1371665.

Make sure you always use the latest software version.

Before connecting the safety relay module to the PC, you must install the parameterization software with the appropriate drivers for the safety relay module:

1. Download the software onto your PC.
2. Start the installation via the *.exe file.
3. Follow the instructions in the installation wizard.

17.5 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 in accordance with the specifications.
3. The power supply of the safety relay module (A1/A2) is switched on.
4. The selftest is completed without errors and the PWR LED is green.

Before starting parameterization, set the sensor circuits to the safe state.

17.6 Connecting the device to the PC

NOTE: Electrostatic discharge

Electrostatic discharge can damage or destroy components.

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

The interface is suitable for standard USB C cables.

The USB interface is **not** intended for permanent connection to a PC.

1. Open the parameterization software on your PC.
2. Use a suitable connecting cable to connect the safety relay module to the PC.

↪ When the USB connection is established, the device goes into the safe state and is ready for parameterization.

17.7 Editing device parameters

Detailed step-by-step instructions for the parameterization can be found in the following document:

UM QS EN PSR-UNI-S clipX ENGINEER dp

The document can be downloaded at phoenixcontact.com/products.

To parameterize the device, follow these steps:

1. Select the device in the parameterization software.
2. Set the input, logic, and output configuration parameters according to the application.
3. Transfer the parameters to the device by pressing the “Transfer” action field.
4. Enter the password that is stored on the device (delivery state: psrunis).

↪ A new window opens in the parameterization software, which compares the parameters in the software with the parameters on the device.

5. Compare these parameters and make sure that the selected parameters are suitable for your application.
6. Scroll to the end of the parameters and confirm the parameters.

NOTE: Non-identical parameters

If the confirmation button is grayed out (cannot be clicked), the parameters displayed in the software and on the device are **not** identical.

- Cancel the transfer and repeat the process.

After successful transfer:

7. Disconnect the USB connection.
8. Press the CONF button for **2 s ... 5 s**.

↪ The device applies the new parameters.

9. Validate the configured functions using the relevant startup.

See Section “Startup”.

Error message after parameterization

If errors are displayed after parameterization, proceed as follows:

1. Check that the correct sensor was connected.
2. If not, connect the correct sensor.

If there was previously an error in the sensor circuit:

1. Set the sensors to the safe state.
2. Perform a power-down reset.

17.8 LED display during parameterization

Key:

○ LED OFF
☀ LED flashing
● LED permanently on
... Any state

LED						Description
PWR	**IN1**	**IN2**	**K1**	**ERR**	**CFG**	
● green	○	○	○	○	☀ yellow	USB connection established; device is waiting for parameters; device is in the safe state
● green	○	○	○	○	☀ green/ yellow	The parameters received via USB have been confirmed in the software; USB connection (still) exists; device is in the safe state
● green	○	○	○	○	☀ green	USB connection has been disconnected; device is waiting for confirmation of the parameters by the user on the device (by pressing the CONF button)
● green	○	○	○	○	○	No USB connection
● green	○	○	○	○	☀ Red/ yellow	No valid data in the memory; USB connection established; device is waiting for parameters; device is in the safe state

17.9 Protection against manipulation

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

18 Startup

Startup includes checking the parameterized function.

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

PWR LED lights up.

- Continue with startup and checking in accordance with the corresponding table for the parameterized function.

WARNING: Loss of functional safety due to malfunction

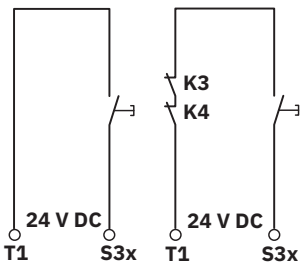
If executing startup does not result in the expected device response, this can lead to the loss of functional safety.

- Check that the parameterization of the input, logic, and output parameters is suitable for your desired application.
- Check that the wiring of the safety circuit is correct.
- If the response is still not as expected, replace the device.

18.1 Startup behavior

Manual, monitored start

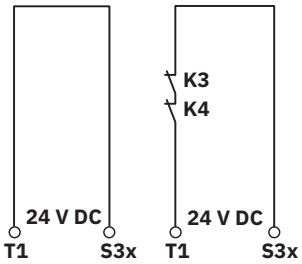
Figure 23 Manual, monitored start



Function	Procedure	Expected response of the device
Manual, monitored start	**Error detection, start process**	
	• Press and hold down the start button. • Close the sensor circuit.	The device enters the error state. - K1 LED lights up yellow. - ERR LED flashes red.
	• Open the sensor circuit. • Release the start button. • Wait for at least 1 s. • Close the sensor circuit. • Press and hold down the start button.	The device does not start up but does **not** enter the error state.
	• Release the start button.	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Open the sensor circuit.	The enabling current paths open.

Automatic start

Figure 24 Autostart

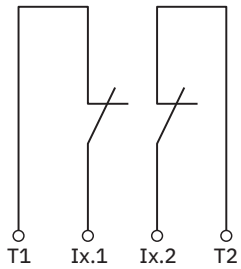


Function	Procedure	Expected response of the device
Autostart 2-channel without cross-circuit detection	**Start process**	
	If the automatic startup input is not wired directly: • Close the start circuit. • Close the sensor circuit.	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Open the sensor circuit.	The enabling current paths open.

18.2 Sensor circuits

Two-channel connection with cross-circuit detection

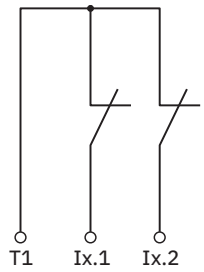
Figure 25 2-channel with cross-circuit detection



Function	Procedure	Expected response of the device
2-channel connection with cross-circuit detection	**Cross-circuit detection**	
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	• Bridge channel 1 and channel 2 of the sensor circuit.	The device enters the error state. The enabling current paths open. - INx LED lights up yellow. - ERR LED flashes red.
	• Remove the bridge between channel 1 and channel 2 of the sensor circuit.	The error state persists.
	• Open the sensor circuit.	The error state is canceled.

Two-channel connection without cross-circuit detection

Figure 26 2-channel without cross-circuit detection



Function	Procedure	Expected response of the device
2-channel connection without cross-circuit detection	**Start process**	
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Open the sensor circuit.	The enabling current paths open.
	Plausibility check	
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Open and close an input Ix.x.	The device enters the error state. The enabling current paths open. - INx LED lights up yellow. - ERR LED flashes red.
	• Open the sensor circuit.	The error state is canceled.

Single-channel connection without cross-circuit detection

Figure 27 1-channel without cross-circuit detection (version 1)

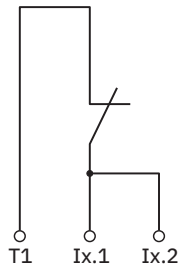
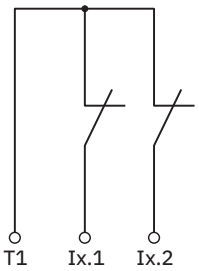


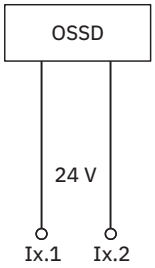
Figure 28 2 x 1-channel without cross-circuit detection (version 2)



Function	Procedure	Expected response of the device
1-channel connection without cross-circuit detection	**Start process**	
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Open channel 1 (Ix.1) of the sensor circuit.	The enabling current paths open.
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Open channel 2 (Ix.2) of the sensor circuit.	The enabling current paths open.

OSSD sensors

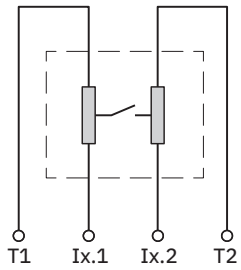
Figure 29 OSSD sensors



Function	Procedure	Expected response of the device
2-channel OSSD signal with external cross-circuit detection	**Start process**	
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Open the sensor circuit.	The enabling current paths open.
	Plausibility check	
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Open and close an input Ix.x.	The device enters the error state. The enabling current paths open. - INx LED lights up yellow. - ERR LED flashes red.
	• Open the sensor circuit.	The error state is canceled.

Safety mat sensor

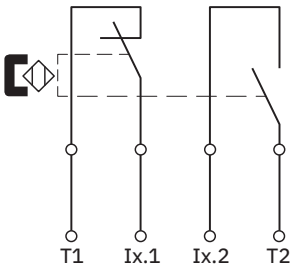
Figure 30 Safety shut-off mat sensor (T1, T2 required)



Function	Procedure	Expected response of the device
Safety mat	**Start process**	
	Initial situation: There is no one standing on the safety mat. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Step on the safety mat. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	• Step off the safety mat.	The enabling current paths open.

Non-equivalent sensor

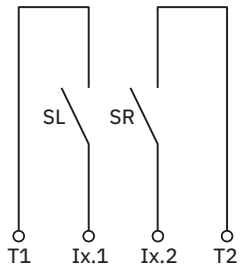
Figure 31 Non-equivalent sensor with cross-circuit detection



Function	Procedure	Expected response of the device
Non-equivalent sensor with cross-circuit detection (T1, T2)	**Start process**	
	• Close the sensor circuit. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	Executing the safety function	
	• Actuate the sensor circuit.	The enabling current paths open.
	Symmetry monitoring (symmetry error at Δt > 5 s)	
	• Open the channel Ix.2 of the sensor circuit. • Wait for > 5 s.	The device displays a symmetry error.
	• Close the channel Ix.2 of the sensor circuit.	The error state is canceled.

Dual-channel connection with synchronous activation monitoring

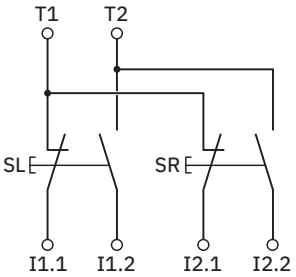
Figure 32 2-channel with synchronous activation monitoring (SL = actuator 1, SR = actuator 2)



Function	Procedure	Expected response of the device
2-channel with synchronous activation monitoring	**Time-based plausibility check (time violation error with Δt > 0.5 s)**	
	• Close actuator 1 and actuator 2 within < 0.5 s. • Press and release the start button (for manual start only).	The device starts up. The enabling current paths close.
	• Release one actuator.	The enabling current paths open.
	Time-based plausibility check (time violation error with Δt > 0.5 s)	
	• Close channel 1 of the sensor circuit.	The device does not start up and enters the error state after >0.5 s. - INx LED flashes yellow. - ERR LED is off.
	• Wait for 2 s. • Close channel 2 of the sensor circuit.	The error state persists.
	• Release both actuators.	The error state is canceled.

Type IIIC two-hand control

Figure 33 Type IIIC two-hand control with cross-circuit detection (SL = actuator 1, SR = actuator 2)



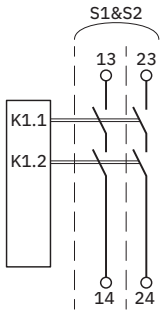
ⓘ The figure shows an actuated state.

Function	Procedure	Expected response of the device
Type IIIC two-hand control with cross-circuit detection (T1, T2)	**Time-based plausibility check (time violation error with Δt > 0.5 s)**	
	Requirement: The start input is hard-wired (autostart). • Close the actuator 1.	The device does not start up and enters the error state after > 0.5 s.
	• Wait for 2 s. • Close the actuator 2.	The device does not start up and enters the error state after > 0.5 s. - IN1 LED flashes yellow. - IN2 LED flashes yellow. - ERR LED is off.
	• Open the sensor circuits.	The error state is canceled.
	Cross-circuit detection	
	Requirement: The start input is hard-wired (autostart). • Close actuator 1 and actuator 2 within < 0.5 s.	The device starts up. The enabling current paths close.
	• Bridge channel 1 and channel 2 of one actuator.	The device enters the error state. **Cross-circuit, sensor circuit 1** - IN1 LED lights up yellow. - IN2 LED flashes yellow. - ERR LED flashes red. **Cross-circuit, sensor circuit 2** - IN1 LED flashes yellow. - IN2 LED lights up yellow. - ERR LED flashes red. **Cross-circuit, sensor circuit 1/2** - IN1 LED lights up yellow. - IN2 LED lights up yellow. - ERR LED flashes red.
	• Remove the bridge.	The error state persists.
	• Set both actuators to the safe state.	The error state is canceled.

18.3 Assignment of sensor circuits to the safety circuit

S1 & S2 act on K1

Figure 34 S1 & S2 act on K1

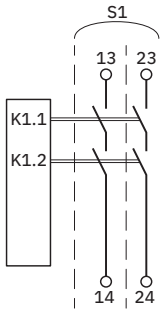


Function	Procedure	Expected response of the device
S1 & S2 act on K1 **(not** for THC type IIIC)	• Activate sensor circuit S1. • Press and release the start button (for manual start only).	The enabling current paths of K1 are open.
	• Deactivate sensor circuit S1 and activate sensor circuit S2. • Press and release the start button (for manual start only).	The enabling current paths of K1 are open.
	• Activate sensor circuit S1 and sensor circuit S2. • Press and release the start button (for manual start only).	The enabling current paths of K1 close.
	Executing the safety function	
	• Open the sensor circuit S1.	The enabling current paths of K1 open.
	• Activate sensor circuit S1. • Press and release the start button (for manual start only).	The enabling current paths of K1 close.
	Executing the safety function	
	• Open the sensor circuit S2.	The enabling current paths of K1 open.

Function	Procedure	Expected response of the device
S1 & S2 act on K1 (for THC type IIIC)	• Close actuator 1 and actuator 2 within < 0.5 s.	Autostart is executed. The enabling current paths of K1 close.
	• Release the actuator 1.	The enabling current paths of K1 open.

S1 acts on K1

Figure 35 S1 acts on K1



Function	Procedure	Expected response of the device
S1 acts on K1	• Activate sensor circuit S1. • Press and release the start button (for manual start only).	The enabling current paths of K1 close.
	Executing the safety function	
	• Open the sensor circuit S1.	The enabling current paths of K1 open.

18.4 Time delay

Function	Procedure	Expected response of the device
No delay time	• Close the sensor circuit. • Press and release the start button (for manual start only).	The associated enabling current paths close **without delay**.
	Executing the safety function	
	• Open the sensor circuit.	The associated enabling current paths open **without delay**.

Function	Procedure	Expected response of the device
Switch-on delay	• Close the sensor circuit. • Press and release the start button (for manual start only).	The associated enabling current paths close **with a delay**.
	• Measure the time until the enabling current paths are closed and compare it with the time set for the application.	-
	Executing the safety function	
	• Open the sensor circuit.	The associated enabling current paths open **without delay**.

Function	Procedure	Expected response of the device
Switch-off delay	• Close the sensor circuit. • Press and release the start button (for manual start only).	The associated enabling current paths close **without delay**.
	Executing the safety function	
	• Open the sensor circuit.	The associated enabling current paths open **with a delay**.
	• Measure the time until the enabling current paths are opened and compare it with the time set for the application.	-

19 Calculating the power dissipation

The total power dissipation of the safety relay module 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} = 1.25 W (at 19.2 V DC)
P_{Input} = 1.56 W (at 24 V DC)
P_{Input} = 1.95 W (at 30 V DC)

Contact power dissipation

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

Total power dissipation

$P_{Total} = P_{Input} + P_{Sensor\ inputs} + P_{Contact}$

When the sensor inputs are supplied via T1 and T2:

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

Key:

P	Power dissipation in mW
$\mathbf{I_L}$	Contact load current

20 Function test/proof test

To verify the device function, proceed as follows for each individual sensor circuit:

- Demand the safety function by actuating the corresponding safety equipment.
- Check whether the safety function was executed correctly by switching the device on again.
- For each mode setting, perform the corresponding startup including check.
  See the section “Startup”.

If the device does not switch on again, the proof test failed.

WARNING: Loss of functional safety due to malfunction

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

- Replace the device.

21 Calculation of typical delay times

21.1 Typical release time with parameterized switch-off delay

You can determine the typical release time of the enabling current path using the following formula:

$t_{response} = t_{delay\_off} + t_{logic\_off}$

Key:

$t_{response}$	Typical release time with U_S of the enabling current path with parameterized switch-off delay
t_{delay_off}	Parameterized switch-off delay time (0.1 s … 300 s ± 3%)
t_{logic_off}	Response time of the logic depending on the parameterized function ± Tolerance

Times and tolerances for t_{logic_off}

Function	t_{logic_off}	Tolerance
Control via Ix.1/Ix.2	20 ms	± 15 ms
Safety mat operation (S1 and/or S2)	50 ms	± 35 ms
Switch-off via A1 ⚠ Applicative deactivation via A1/A2 is not permitted.	When switching off via A1, the system switches off directly. See "Typical release time with U_S" in the technical data.	

Example:

Emergency stop monitoring (2-channel with cross-circuit detection) switches off an actuator with a parameterized switch-off delay of 500 ms.

t_{delay_off} = 500 ms ± 3 %

t_{logic_off} = 20 ms ± 15 ms

$t_{response\_min}$ =
(500 ms * 97%) + (20 ms - 15 ms) = 490 ms

$t_{response\_max}$ =
(500 ms * 103%) + (20 ms + 15 ms) = 550 ms

This results in a typical release time in the range of 490 ms ... 550 ms.

21.2 Typical response time with parameterized switch-on delay

You can determine the typical response time of the enabling current path using the following formula:

$t_{start} = t_{delay\_on} + t_{logic\_on}$

Key:

t_{start}	Typical response time with U_S of the enabling current path with parameterized switch-on delay
t_{delay_on}	Parameterized switch-on delay time (0.1 s … 300 s ± 3%)
t_{logic_on}	Response time of the logic depending on the parameterized function ± Tolerance

Times and tolerances for t_{logic_on}

Function	t_{logic_on}	Tolerance
Control via Ix.1/Ix.2 (manual start and autostart)	45 ms	± 25 ms
Safety mat operation (S1 or S2) in combination with another sensor (manual start and autostart)	184 ms	± 80 ms
Safety mat operation (S1 and S2) with parameterized logic S1 & S2 act on K1 (manual start and autostart)	395 ms	± 85 ms
Control via A1 with autostart ⚠ Applicative control via A1/A2 is not permitted.	965 ms	± 200 ms

Example:

Emergency stop monitoring (2-channel with cross-circuit detection) controls an actuator with a parameterized switch-on delay of 500 ms.

t_{delay_on} = 500 ms ± 3 %

t_{logic_on} = 45 ms ± 25 ms

t_{start_min} = (500 ms * 97%) + (45 ms - 25 ms) = 505 ms

t_{start_max} = (500 ms * 103%) + (45 ms + 25 ms) = 585 ms

This results in a typical response time in the range of 505 ms ... 585 ms.

22 Diagnostics

If the device is in parameterization mode, observe the **LED display during parameterization** in the “Parameterization” section.

Plausibility errors are deleted when the supply voltage is switched off (power down reset).

In the event of an error or fault that is not listed, please contact Phoenix Contact.

22.1 General states

Key:

○ LED OFF
☀ LED flashing
● LED permanently on
... Any state

LED						State	Notes
PWR	**IN1**	**IN2**	**K1**	**ERR**	**CFG**		
● green	...	...	...	○	○	Supply voltage present	Permitted range: 19.2 V DC ... 30 V DC
● green	● green	...	...	○	○	Sensor circuit 1 is active. Signals I1.1 and I1.2 are logically active.	Start is possible.
● green	...	● green	...	○	○	Sensor circuit 2 is active. Signals I2.1 and I2.2 are logically active.	Start is possible.
● green	● green	...	● green	○	○	Relay path K1.x has picked up. Enabling current paths 13/14 and 23/24 are closed.	-
● green	○	○	○	○	☀ yellow	The device is in parameterization mode. The USB connection is disconnected.	See table “LED display during parameterization”.

22.2 Error messages

Key:

- ○ LED OFF
- ✷ LED flashing
- ● LED permanently on
- ... Any state

LED						Error	Corrective
PWR	**IN1**	**IN2**	**K1**	**ERR**	**CFG**		
● red	...	...	...	○	○	**Supply voltage** outside the permissible range	Check the supply voltage. Make sure that the supply voltage is within the permissible range: 19.2 V DC ... 30 V DC
○	...	...	...	○	○	**PWR LED not active.** No supply voltage is present or the LED is defective.	Check the supply voltage.
● green	○	...	...	○	○	**IN1 LED not active.** Sensor circuit 1 is not closed or the LED is defective. Or clock assignment is incorrect in the case of safety mat operation: signals at I1.1 and I1.2 are assigned to the wrong clock.	Check the connections and signals to inputs I1.1 and I1.2. Check the clock assignment: T1 -> I1.1 T2 -> I1.2
● green	...	○	...	○	○	**IN2 LED not active.** Sensor circuit 2 is not closed or the LED is defective. Or clock assignment is incorrect in the case of safety mat operation: signals at I2.1 and I2.2 are assigned to the wrong clock.	Check the connections and signals to inputs I2.1 and I2.2. Check the clock assignment: T1 -> I2.1 T2 -> I2.2
● green	...	...	○	○	○	**K1 LED not active.** Enabling paths 13/14 and 23/24 may not be closed or the LED may be defective. The device may not start up correctly.	Deactivate and activate the sensor circuits. Perform startup.
● green	● yellow	...	...	✷ red	○	**Plausibility error** between I1.1 and I1.2 or **symmetry error** with non-equivalent wiring (both channels had the same logic state for Δt > 5 s)	Make sure that both channels have a zero crossing at the same time or are in the safe state. **Note:** With a combination of a non-equivalent sensor and safety mat, a power-down reset must be carried out to clear the error.
						Cross-circuit error between I1.1 and I1.2	Fix the cross-circuit error. Make sure that both channels have a zero crossing at the same time or are in the safe state.
						Signal missing at I1.1 or I1.2 for safety mat operation	Check the cables and connections of the sensor path. Restart the device.

LED						Error	Corrective
PWR	IN1	IN2	K1	ERR	CFG		
● green	...	● yellow	...	✷ red	○	**Plausibility error** between I2.1 and I2.2 or **symmetry error** with non-equivalent wiring (both channels had the same logic state for Δt > 5 s)	Make sure that both channels have a zero crossing at the same time or are in the safe state. **Note:** With a combination of a non-equivalent sensor and safety mat, a power-down reset must be carried out to clear the error.
						Cross-circuit error between I2.1 and I2.2	Fix the cross-circuit error. Make sure that both channels have a zero crossing at the same time or are in the safe state.
						Signal missing at I2.1 or I2.2 for safety mat operation	Check the cables and connections of the sensor path. Restart the device.
● green	● yellow	● yellow	...	✷ red	○	**Cross-circuit error** Both safety circuits are configured with cross-circuit detection and there is a cross-circuit between Ix.1 and Ix2.	Fix the cross-circuit error. Make sure that all channels have a zero crossing at the same time or are in the safe state.
● green	✷ yellow	...	...	○	○	**Time violation or plausibility error** for two-hand control at I1.1 and I1.2 (Δt > 0.5 s)	Make sure that both channels have a zero crossing at the same time and are closed within Δt < 0.5 s.
● green	...	✷ yellow	...	○	○	**Time violation or plausibility error** for two-hand control at I2.1 and I2.2 (Δt > 0.5 s)	Make sure that both channels have a zero crossing at the same time and are closed within Δt < 0.5 s.
● green	...	...	● yellow	✷ red	○	**Start error, manual start S34** The start circuit was closed before both sensor circuits I1.1 and I1.2 were closed.	Make sure that both channels and the startup input have a zero crossing at the same time or are in the safe state.
○	○	○	○	● red	○	Internal error	Please get in touch with Phoenix Contact.
						External error The power supply does not provide enough power and collapses under load.	Design the power supply unit to match the power output.
● green	○	○	○	○	✷ red	**Invalid parameterization**	Set a valid parameterization. See the “Parameterization” section.

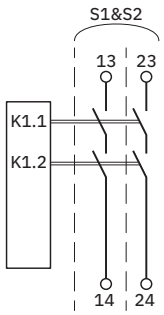
23 Application examples

23.1 Single-channel emergency stop and safety door monitoring

Parameterization:

- **Sensor circuit 1:** 1-channel
- **Sensor circuit 2:** 1-channel
- **Start S34:** automatic
- **Delay K1:** none
- **Logic:** S1 & S2 act on K1

Figure 36 Logic configuration



Application description:

- 1-channel emergency stop monitoring
- 1-channel safety door monitoring
- Automatic start
- Monitoring of external, force-guided contactors

Achievable safety integrity:

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

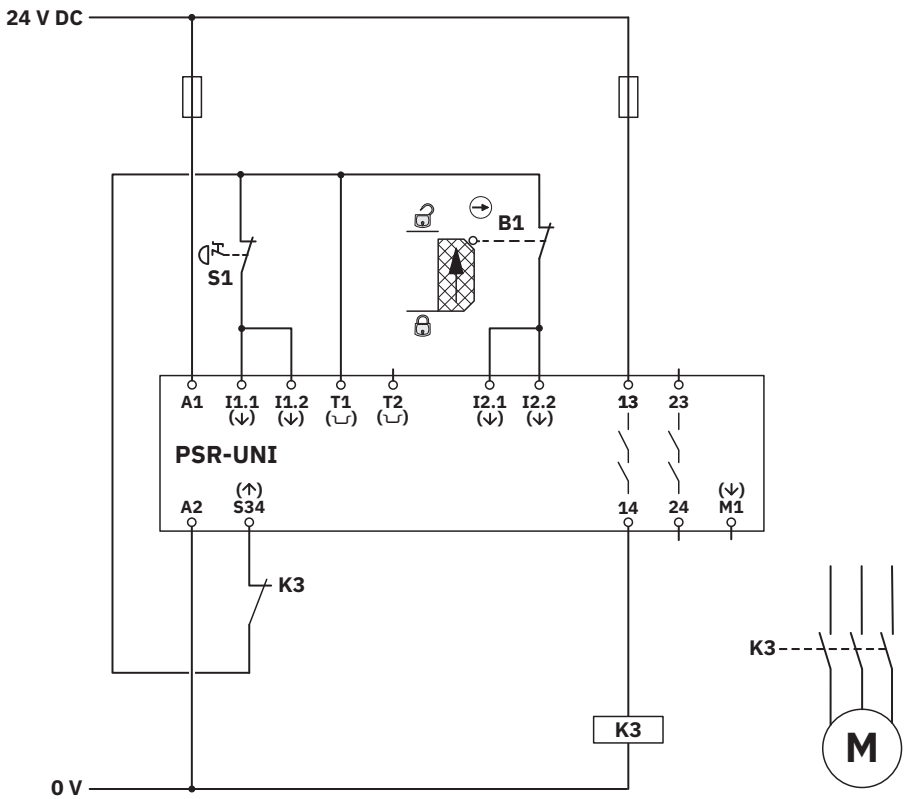
Notes:

WARNING: Loss of electrical and functional safety

Different potentials can lead to a loss of electrical and functional safety.

- Use the same potential for supply, sensor inputs, start inputs, and signal outputs.

Figure 37 1-channel emergency stop and safety door monitoring



Key:

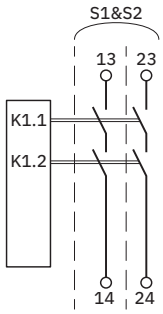
S1	Emergency stop button
B1	Mechanical safety door switch
K3	Force-guided contactor

23.2 Double magnetic switch monitoring - non-equivalent

Parameterization:

- **Sensor circuit 1:**
  Non-equivalent sensor with cross-circuit detection
- **Sensor circuit 2:**
  Non-equivalent sensor with cross-circuit detection
- **Start S34:** manual, monitored
- **Delay K1:** none
- **Logic:** S1 & S2 act on K1

Figure 38 Logic configuration



Application description:

- 2-channel, non-equivalent magnetic switch monitoring
- Manual, monitored start
- Monitoring of external, force-guided contactors

Achievable safety integrity:

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061), if cross-circuits in the control to the actuator can be ruled out

Notes:

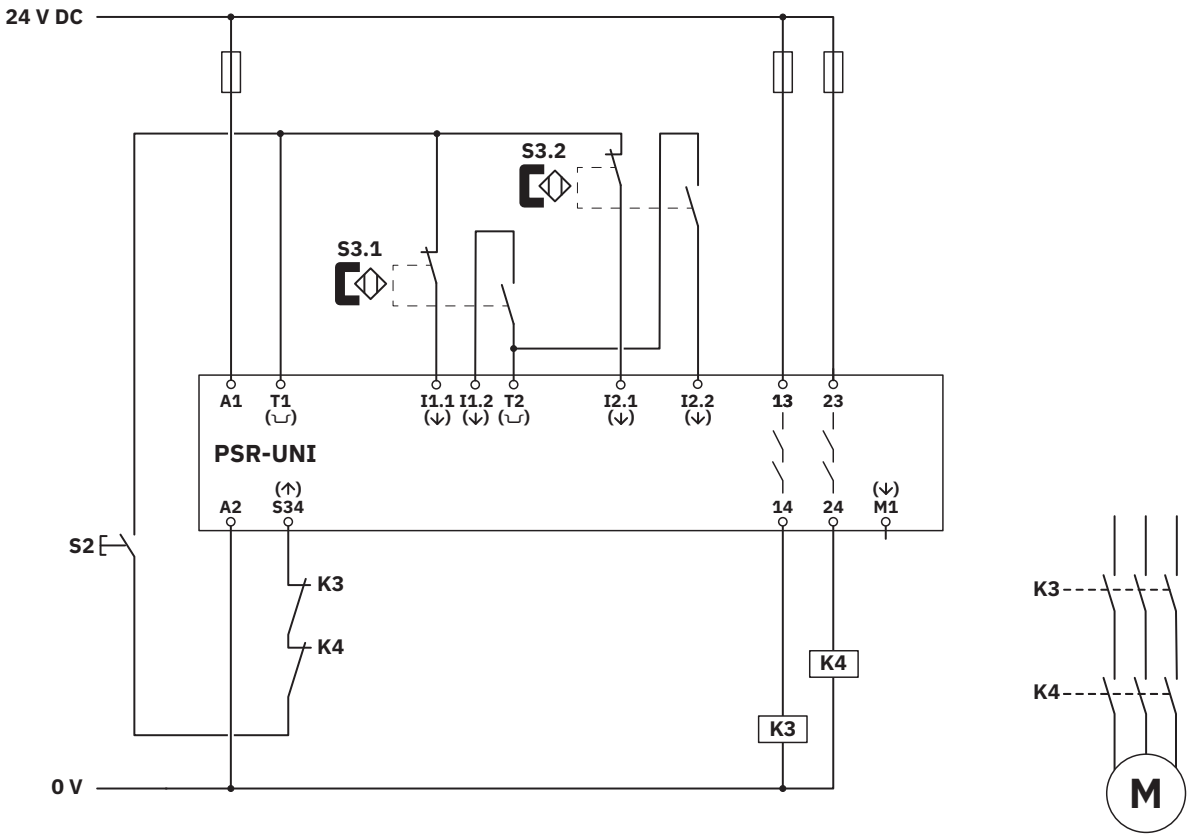
WARNING: Loss of electrical and functional safety

Different potentials can lead to a loss of electrical and functional safety.

- Use the same potential for supply, sensor inputs, start inputs, and signal outputs.

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

Figure 39 Double magnetic switch monitoring - antivalent



Key:

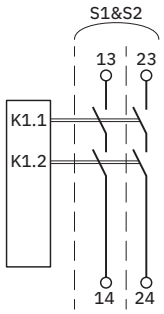
S2	Manual reset device
S3.1/S3.2	Magnetic switch
K3/K4	Force-guided contactors

23.3 Double magnetic switch monitoring - equivalent

Parameterization:

- **Sensor circuit 1:**
  2-channel with cross-circuit detection
- **Sensor circuit 2:**
  2-channel with cross-circuit detection
- **Start S34:** manual, monitored
- **Delay K1:** none
- **Logic:** S1 & S2 act on K1

Figure 40 Logic configuration



Application description:

- 2-channel, equivalent magnetic switch monitoring
- Manual, monitored start
- Monitoring of external, force-guided contactors

Achievable safety integrity:

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061), if cross-circuits in the control to the actuator can be ruled out

Notes:

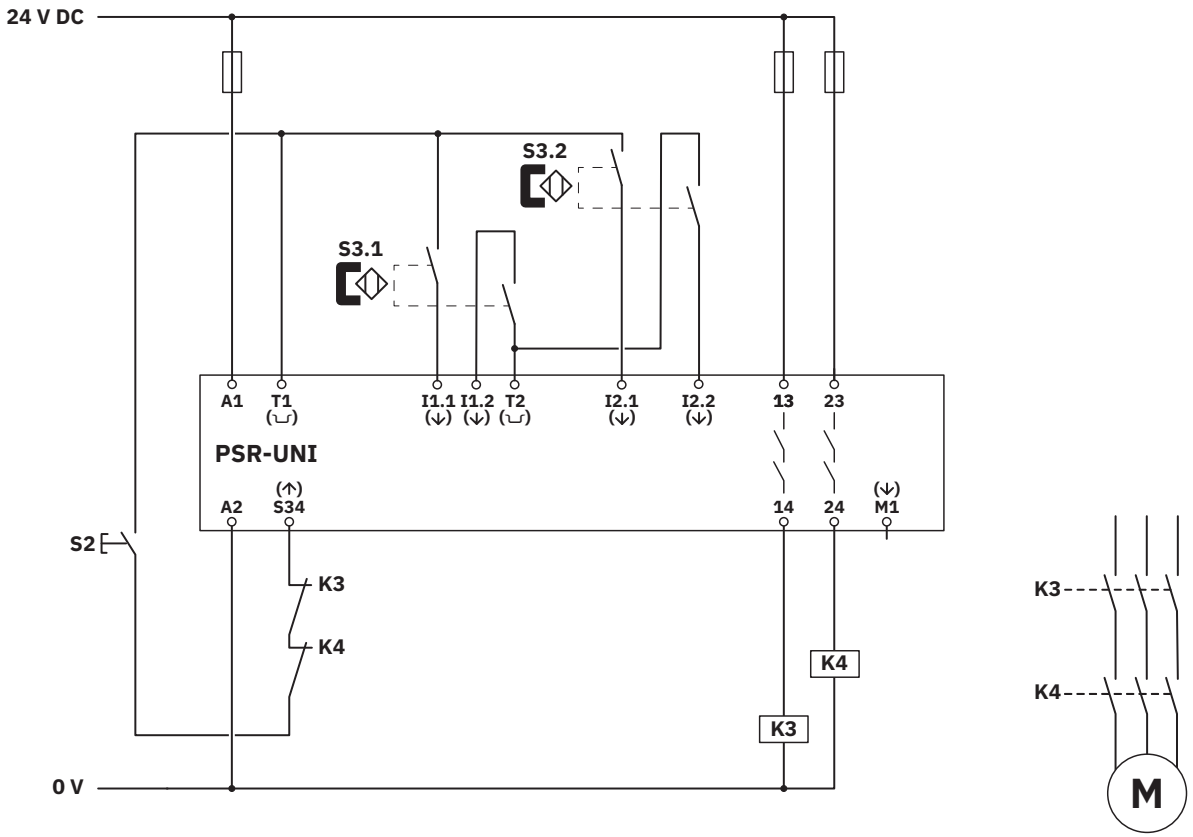
WARNING: Loss of electrical and functional safety

Different potentials can lead to a loss of electrical and functional safety.

- Use the same potential for supply, sensor inputs, start inputs, and signal outputs.

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

Figure 41 Double magnetic switch monitoring - equivalent



Key:

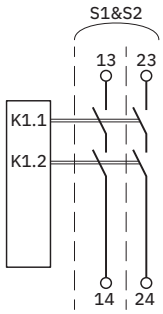
S2	Manual reset device
S3.1/S3.2	Magnetic switch
K3/K4	Force-guided contactors

23.4 Two-hand monitoring

Parameterization:

- **Sensor circuit 1:** THC type IIIC
- **Sensor circuit 2:** THC type IIIC
- **Start S34:** automatic
- **Delay K1:** none
- **Logic:** S1 & S2 act on K1

Figure 42 Logic configuration



Application description:

- Type IIIC two-hand control
- Synchronous activation monitoring < 0.5 s
- Automatic start
- Monitoring of external, force-guided contactors

Achievable safety integrity:

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061), if cross-circuits in the control to the actuator can be ruled out

Notes:

WARNING: Loss of electrical and functional safety

Different potentials can lead to a loss of electrical and functional safety.

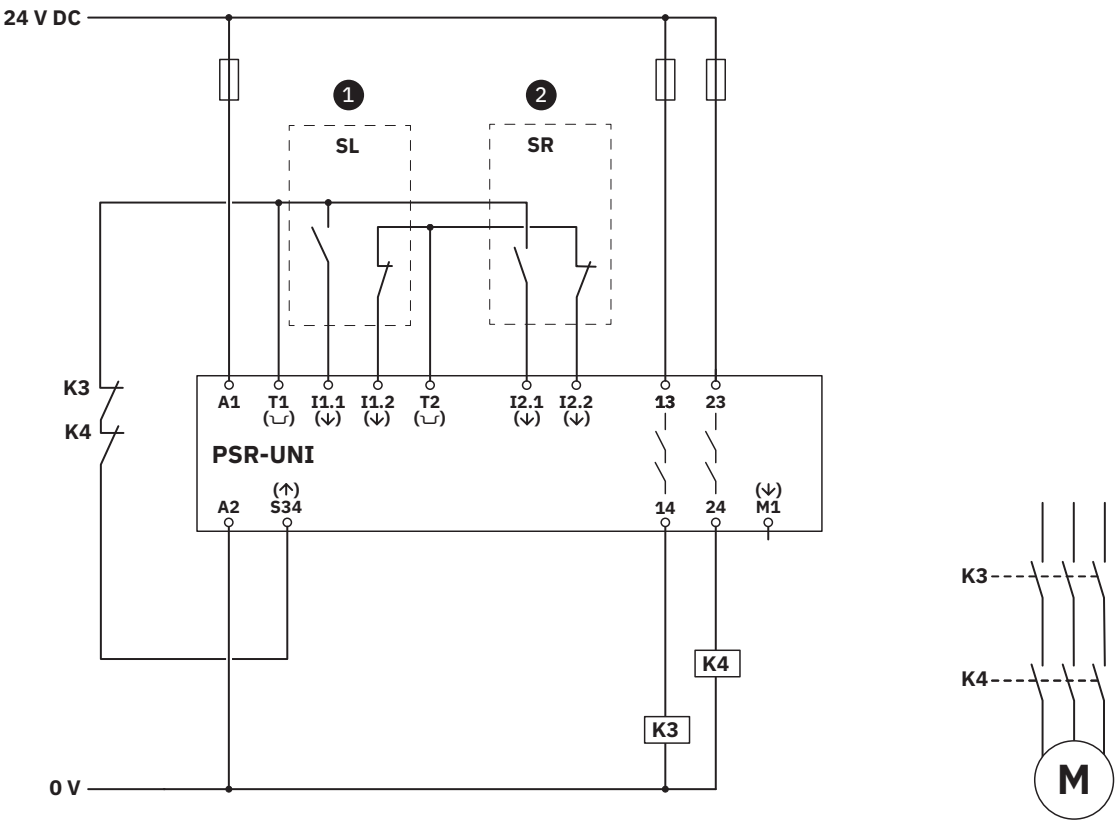
- Use the same potential for supply, sensor inputs, start inputs, and signal outputs.

If you are using the two-hand control function, hard wire start input S34. Only use it for reading back actuators. Do not use a start button or similar.

Observe the normative requirements and notes in accordance with ISO 13851.

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

Figure 43 Two-hand monitoring



Key:

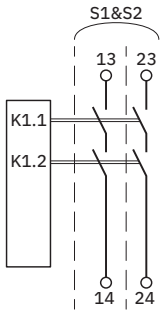
SL/SR	Two-hand buttons (left/right)
K3/K4	Force-guided contactors

23.5 Two-channel emergency stop and safety door monitoring

Parameterization:

- **Sensor circuit 1:**
  2-channel with cross-circuit detection
- **Sensor circuit 2:**
  2-channel with cross-circuit detection
- **Start S34:** manual, monitored
- **Delay K1:** none
- **Logic:** S1 & S2 act on K1

Figure 44 Logic configuration



Application description:

- 2-channel emergency stop monitoring
- 2-channel safety door monitoring
- Manual, monitored start
- Monitoring of external, force-guided contactors

Achievable safety integrity:

- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN IEC 62061), if cross-circuits in the control to the actuator can be ruled out

Notes:

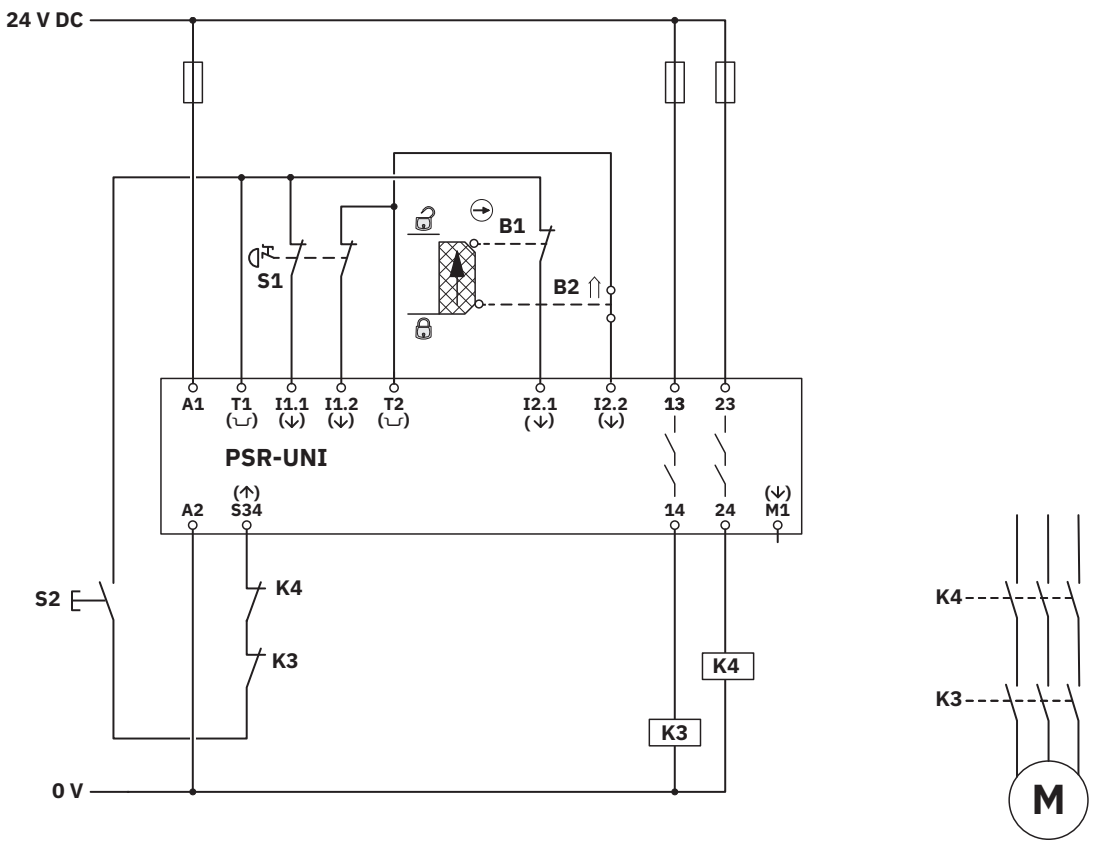
WARNING: Loss of electrical and functional safety

Different potentials can lead to a loss of electrical and functional safety.

- Use the same potential for supply, sensor inputs, start inputs, and signal outputs.

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

Figure 45 2-channel emergency stop and safety door monitoring



Key:

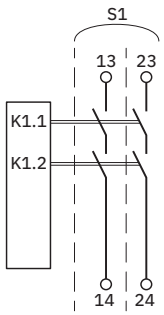
S1	Emergency stop button
S2	Manual reset device
B1/B2	Mechanical safety door switch
K3/K4	Force-guided contactors

23.6 Safety shut-off mat monitoring

Parameterization:

- **Sensor circuit 1:** Safety mat sensor
- **Start S34:** automatic
- **Delay K1:** Switch-on delay
- **Logic:** S1 acts on K1

Figure 46 Logic configuration



Application description:

- Switching strips or safety shut-off mats in accordance with EN ISO 13856-1 (short circuit principle)
- Automatic start
- Switch-on delay for the enabling current paths
- Monitoring of external, force-guided contactors

Achievable safety integrity:

- Suitable up to PL d (EN ISO 13849-1), SIL 2 (EN IEC 62061), if cross-circuits in the control to the actuator can be ruled out

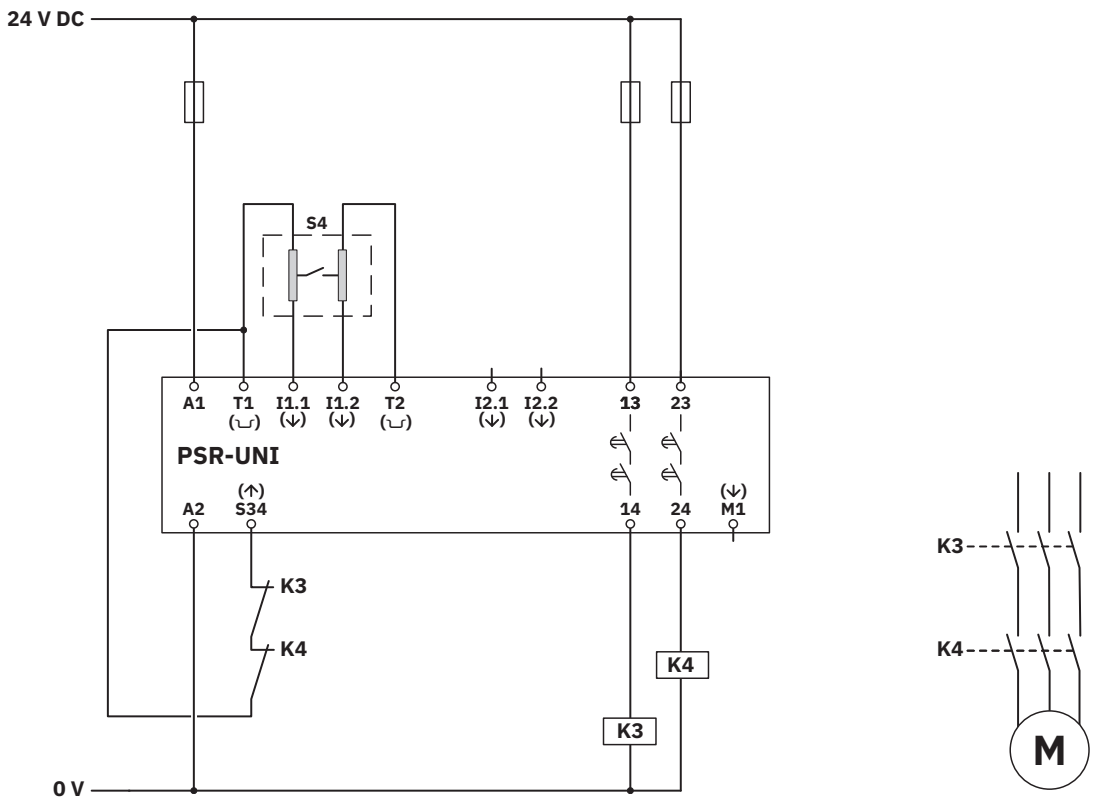
Notes:

WARNING: Danger caused by incorrectly implemented safety or overtravel distances

- Observe the requirements of EN ISO 13856-1 for determining the safety or overtravel distances.

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

Figure 47 Safety shut-off mat monitoring



Key:

S4	Safety mat
K3/K4	Force-guided contactors

24 Device replacement, device defect, and repair

24.1 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
– Parameterization

Observe the device type and version

The new device must meet the following requirements:

– Same device type
– Same or later version

24.2 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.

25 Maintenance, decommissioning, and disposal

25.1 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.

25.2 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.

26 Attachment

26.1 Tabular overview of the parameterizable functions

Parameter	Explanation
2-channel	The sensor channels must be connected to Ix.1 and Ix.2. Cross-circuit detection as a parameter is possible; for this, the sensor channels must be connected between T1/Ix.1 and T2/Ix.2. **Safe state:** Both inputs are open. **Error detection:** Plausibility error (if only one channel was switched)
1-channel	The sensor channel must be connected to Ix.1 and Ix.2 or, in the case of two 1-channel sensors, to Ix.1 and Ix.2 respectively. **Safe state:** One or both inputs or channels are open. **Note:** Channels Ix.1 and Ix.2 are logically AND-linked. For switch-on, both channels must be active. If one channel is switched off or changes to the safe state, the system is switched off.
OSSD	The sensor channels must be connected to Ix.1 and Ix.2. **Safe state:** Both inputs are open. **Error detection:** Plausibility error (if only one channel was switched)
Safety mat or 4-wire switching strips	Channels T1/Ix.1 and T2/Ix.2 must be hard-wired. It is **not** possible to combine this function with a function with cross-circuit detection as a parameter. **Safe state:** Channels T1/Ix.1 and T2/Ix.2 are connected. **Error detection:** Signal missing (connection T1/Ix.1 or T2/Ix.2 is not connected)
Non-equivalent	The sensor channels must be connected to Ix.1 and Ix.2. Cross-circuit detection as a parameter is possible; for this, the sensor channels must be connected between T1/Ix.1 and T2/Ix.2. **Safe state:** Ix.1 is open, and a signal is present on Ix.2. **Error detection:** Plausibility error (if only one channel was switched), Symmetry error $\Delta t > 5$ s (both channels have the same state for > 5 s)
2-channel with synchronous activation monitoring	The sensor channels must be connected to Ix.1 and Ix.2. Cross-circuit detection as a parameter is possible; for this, the sensor channels must be connected between T1/Ix.1 and T2/Ix.2. **Safe state:** Both inputs are open. **Error detection:** Plausibility error (if only one channel was switched), Time violation error $\Delta t > 0.5$ s (both channels were not activated within 0.5 s) **Note for THC type IIIA applications:** A THC type IIIA application is possible with this parameter. Observe the normative requirements and notes in accordance with ISO 13851.

Parameter	Explanation
THC Type IIIC (< 0.5 s)	This sensor application uses two 2-channel, non-equivalent actuators. Cross-circuit detection is active. Autostart is active. **Safe state:** I1.1 is open, and a signal is present on I1.2. I2.1 is open, and a signal is present on I2.2. **Error detection:** Plausibility error (if only one channel was switched), Symmetry error $\Delta t > 5$ s (both channels Ix.1/Ix.2 have the same state for > 5 s), Time violation error $\Delta t > 0.5$ s (both actuators were **not** activated within 0.5 s)
Cross-circuit detection **activated** (T1,T2)	The sensor channels must be connected between T1/Ix.1 and T2/Ix.2. Combination with a step mat is **not** possible if cross-circuit detection of a sensor is activated. **Error detection:** Cross-circuit between T1 and T2
Cross-circuit detection **deactivated**	The sensor channels can be connected from an external source to Ix.1 and Ix.2 or to T1/T2.
Automatic start	The start signal can be connected to S34 (Start K1) from an external source or from T1 or T2. Diagnostics of external actuators can be integrated into this circuit (see application examples). The start takes place when the sensor circuits become active. **Error detection:** External actuators (see application examples)
Manual, monitored start	The start signal can be connected to S34 (Start K1) from an external source or from T1 or T2. Diagnostics of external actuators can be integrated into this circuit (see application examples). The start takes place when the sensor circuits are active and the manual start button is pressed and released. **Error detection:** Jammed start button, Start actuation before sensor circuits are closed, External actuators (see application examples)
S1 & S2-K1	Sensor circuit 1 and sensor circuit 2 act on K1. **Safe state:** For K1: One channel of the sensor circuit 1 or sensor circuit 2 is in the safe state.
S1-K1	Sensor circuit 1 acts on K1. **Safe state:** For K1: One channel of the sensor circuit 1 is in the safe state.
No delay	In the event of demand of the safety function, the enabling current paths drop out without a delay. **Note:** Note the typical release time.
Switch-on delay	The selected relay switches on with a delay after activation of the sensor circuit and the start circuit. Adjustable delay time: 0.1 s ... 300 s (step size 100 ms). **Notes:** Observe the delay time range and formulas, and also the tolerance for the delay time range. See the section “Calculation of typical delay times”. Demand of the safety function interrupts the switch-on delay.

Parameter	Explanation
Switch-off delay	The selected relay switches off with a delay after demand of the safety function. Adjustable delay time: 0.1 s ... 300 s (step size 100 ms). **Note:** Observe the delay time range and formulas, and also the tolerance for the delay time range. See the section “Calculation of typical delay times”. If the sensor circuit and the start circuit are reactivated within the delay time, the delay time is interrupted and the relay remains active. If one of the following faults occurs during the switch-off delay, the safe state is assumed immediately (the relay is switched off): Loss of supply voltage, overvoltage, undervoltage, internal error, faulty parameter detection.
Signal output behavior	The signal output is assigned to the relay: M1 to K1 This output can send the status of the relay as a digital output signal, either **inverted** or **not inverted**.

26.2 Using PSR devices at altitudes > 2000 m amsl

The following section describes the special conditions for using PSR devices at altitudes > 2000 m amsl.
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 > 2000 m amsl
< 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 > 2000 m amsl
< 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 amsl	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

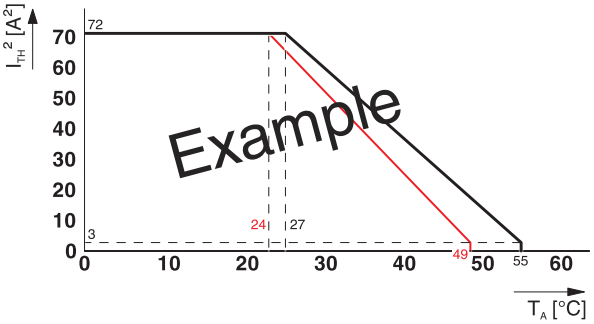
Example calculation for 3000 m

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 48 Example of a suspended derating curve (red)



26.3 Revision history

Version	Date	Contents
00	2026-03-18	First publication
01	2026-04-07	Error messages section: instruction added regarding remedy for plausibility errors/ symmetry errors