Valid: up to HW/FW 01/110

PSR-MC73

Safety relay for emergency stop, safety door, and light grid monitoring with adjustable off delay or on delay

Data sheet
108859_en_02

1 Description

Intended Use

The safety relay is used for emergency stop, safety door, and light grid monitoring.

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
- Door locking mechanisms
- Light grids

Contact type

- 3 undelayed enabling current paths
- 2 delayed enabling current paths
- 1 digital signal output

The undelayed enabling current paths drop out in accordance with the stop category 0 of EN 60204-1.

With the appropriate configuration, the delayed enabling current paths drop out in accordance with the stop category 1 of EN 60204-1.

When the enabling current paths are open, the signal output is active.

Control

- Single or two channel
- Automatic or manual, monitored start

Achievable safety integrity

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

Additional features

- Adjustable off delay or on delay
- Retrigger function for delay time
- Optional pluggable screw or Push-in terminal blocks
- 22.5 mm housing width

Approvals

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.net/products.

This document is valid for the products listed in the “Ordering data”.

This document meets the same requirements as the original operating instructions with respect to the contents.

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Safety relay for emergency stop, safety doors, light grids up to SIL 3, Cat. 4, PL e, 1- or 2-channel operation, cross-circuit detection, can be retriggered, off-/on delay of 0.2 s to 300 s, 5 enabling current paths, U_S = 24 V DC, plug-in screw terminal block	PSR-MC73-5NO-1DO-24DC-SC	1015533	1
Safety relay for emergency stop, safety doors, light grids up to SIL 3, Cat. 4, PL e, 1- or 2-channel operation, cross-circuit detection, can be retriggered, off-/on delay of 0.2 s to 300 s, 5 enabling current paths, U_S = 24 V DC, plug-in Push-in terminal block	PSR-MC73-5NO-1DO-24DC-SP	1015526	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 mm^2 ... 6.0 mm^2, lateral entry, trapezoidal crimp	CRIMPFOX 6	1212034	1

4 Technical data

Hardware/firmware version	
HW/FW	≥ 01/110
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 circuit supply voltage U_S	19.2 V DC ... 30 V DC
Rated control supply current I_S	typ. 80 mA
Power consumption at U_S	typ. 1.92 W
Inrush current	typ. 28 A (Δt = 30 µs at U_s)
Filter time	1 ms (For the logic. At A1 in the event of voltage dips at U_s)
Protective circuit	Serial protection against polarity reversal, Suppressor diode
Digital inputs: Sensor circuit S12, S22	
Number of inputs	2
Description of the input	safety-related sensor inputs
Input voltage range "0" signal	0 V DC ... 5 V DC
Input current range "0" signal	0 mA ... 2 mA
Input voltage range "1" signal	11 V DC ... 30 V DC
Inrush current	< 11 mA (typically with U_S)
Current consumption	< 4.5 mA (typically with U_S)
Filter time	max. 3 ms (Test pulse width of low test pulses) min. 21 ms (Test pulse rate for low test pulse)
Max. permissible overall conductor resistance	150 Ω
Concurrence	∞
Limit frequency	min. 0 Hz max. 1 Hz
Protective circuit	Varistor
Digital inputs: Start circuit S34	
Number of inputs	1
Description of the input	non-safety-related
Input voltage range "0" signal	0 V DC ... 5 V DC
Input current range "0" signal	0 mA ... 2 mA
Input voltage range "1" signal	11 V DC ... 30 V DC
Inrush current	< 8.6 mA (typically with U_S)
Current consumption	< 3.2 mA (typically with U_S)
Filter time	max. 1 ms (Test pulse width of low test pulses) min. 21 ms (Test pulse rate for low test pulse)
Max. permissible overall conductor resistance	150 Ω
Limit frequency	min. 0 Hz max. 1 Hz
Protective circuit	Varistor

Relay outputs: Enabling current paths 13/14, 23/24/34, 47/48/58	
Number of outputs	3 (undelayed: 13/14, 23/24/34) 2 (delayed: 47/48/58)
Output description	2 N/O contacts each in series, safety-related, floating
Contact material	AgCuNi +0.2 µm ... 0.4 µm Au / $AgSnO_2$ +0.2 µm Au
Switching voltage	min. 12 V AC/DC max. 250 V AC/DC (Observe the load curve)
Limiting continuous current	6 A
Inrush current	min. 5 mA max. 6 A
Sq. Total current $I_{TH}^2 = I_1^2 + I_2^2 + ... + I_N^2$	108 A^2 (observe derating)
Switching capacity	min. 60 mW
Switching frequency	0.5 Hz (depending on the set delay time)
Mechanical service life	10x 10^6 cycles
Switching capacity according to IEC 60947-5-1	4 A (24 V (DC13)) 3 A (230 V (AC 15))
Output fuse	6 A gL/gG 4 A gL/gG (for low-demand applications)

Alarm outputs: M1	
Number of outputs	1
Output description	PNP non-safety-related
Voltage	approx. 23 V DC (U_S - 1 V)
Current	max. 100 mA
Maximum inrush current	500 mA (Δt = 10 ms at U_s)
Protective circuit	Suppressor diode
Short-circuit protection	Yes

Clock outputs: S11, S21	
Number of outputs	2
Output description	PNP non-safety-related
Voltage	corresponds to U_S
Current	max. 100 mA
Maximum inrush current	500 mA (Δt = 10 ms at U_s)
Max. permissible overall conductor resistance	150 Ω
Protective circuit	Suppressor diode
Short-circuit protection	Yes

Times	
Typical starting time with U_S	500 ms (with U_S when controlled via A1)
Typical response time at U_S	< 50 ms (automatic start) < 50 ms (manual, monitored start)
Typical release time with U_S	< 25 ms (when controlled via S12 and S22 (only for undelayed contacts)) < 10 ms (when controlled via A1; applicative deactivation via A1/A2 is not permitted)
Delay time range	0.2 s ... 300 s ±5 % (can be set for 47/48/58)
Restart time	< 1 s (Boot time)
Recovery time	500 ms (following demand of the safety function)

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 instructions	See derating curve
Type of housing	Polyamide yellow
Status display	5 x bi-color LED
Air clearances and creepage distances between the power circuits	according to EN 60664-1
Rated insulation voltage	250 V AC
Rated surge voltage/insulation	See section “Insulation coordination”
Degree of pollution	2
Overvoltage category	III
Maximum power dissipation for nominal condition	8.1 W (At U_S = 30 V, I_L^2 = 108 A^2)
Note on power dissipation	See “Calculating the power dissipation”

Dimensions	Screw connection	Push-in connection
W x H x D	22.5 x 112.2 x 114.5 mm	22.5 x 117.5 x 114.5 mm

Connection data	Screw connection	Push-in connection
Conductor cross section solid	0.2 mm² ... 2.5 mm²	0.2 mm² ... 1.5 mm²
Conductor cross section flexible	0.2 mm² ... 2.5 mm²	0.2 mm² ... 1.5 mm²
Conductor cross-section AWG	24 ... 12	24 ... 16
Conductor cross section flexible, with ferrule without plastic sleeve		0.25 mm² ... 1.5 mm² (only together with CRIMPFOX 6)
Conductor cross section flexible, with ferrule with plastic sleeve		0.25 mm² ... 1.5 mm² (only together with CRIMPFOX 6)
Stripping length	7 mm	8 mm
Screw thread	M3	
Torque	0.5 Nm ... 0.6 Nm	

Ambient conditions	
Ambient temperature (operation)	-35 °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	10g (operation), 15g (transport)
Vibration (operation)	10 Hz ... 150 Hz, 2g

Conformance/Approvals	
CE	CE-compliant
Approvals	

Safety data	
Stop category according to IEC 60204	0 (Undelayed contacts) 1 (delayed contacts)

Safety parameters in accordance with IEC 61508 - high demand	
IEC 61508 - High demand	
Equipment type	Type B
HFT	1
SIL	3
PFH_D	$1{,}00 \times 10^{-9}$ (4 A DC13; 3 A AC15; 8760 switching cycles/year)
Demand rate	< 12 Months
Proof test interval	240 Months
Duration of use	240 Months

Safety technology parameters according to IEC 61508 - low demand	
IEC 61508 - Low demand	
Equipment type	Type B
HFT	1
SIL	3
PFD_{avg}	5.03×10^{-5}
Proof test interval	36 Months
Duration of use	240 Months

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

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

5 Notes regarding documentation

5.1 Identification of warning notes

This symbol indicates hazards that could lead to personal injury.

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

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

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

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

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

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

5.2 Validity

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

5.3 Target group

This data sheet is therefore aimed at:

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

Qualified personnel:

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

Requirements:

Knowledge of the following topics is required:

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

6 Safety regulations and installation notes

WARNING: Death, serious personal injury or damage to equipment

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

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

Direct/indirect contact

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

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

Power supply units for 24 V supply

- Only use power supply units with safe isolation and SELV/PELV.
- Protect the 24 V area with a suitable external fuse.
- Make sure that the power supply unit is able to supply **four times** the nominal current of the external fuse, to ensure that it trips in the event of an error.

Startup, mounting, and modifications

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

- Before working on the device, disconnect the power.
- 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.

The device only ensures stop category 1 during error-free operation. In the event that the supply voltage is lost or an internal error occurs, the device behaves according to 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.

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).

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

6.1 Safety of machines or systems

Draw up and implement a safety concept

The machine or system manufacturer and the operator are responsible for the safety of the machine or system and the application in which the machine or system is used. In order to use the device described in this document, you must have drawn up an appropriate safety concept for your machine or system. This includes a risk assessment in accordance with the directives and standards specified in the EC Declaration of Conformity, as well as other standards.

Risk assessment, validation and function test

- Before using the device, perform a risk assessment on the machine or system.
- Validate your entire safety system.
- Carry out a new validation every time you make a safety-related modification.
- Perform a function test on a regular basis.

Achievable safety integrity

The functional safety is ensured for the device as a single component. However, this does not guarantee functional safety for the entire machine or system. In order to be able to achieve the desired safety level for the entire machine or system, define the safety requirements for the machine or system as well as how to implement them from both a technological and an organizational perspective.

7 Transport, storage, and unpacking

7.1 Transport

The device is delivered in cardboard packaging.

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

Suitable transport packaging

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

Technical data and environmental conditions

- For transport, observe the specifications regarding the temperature range, humidity, and air pressure.

See “Technical data” section.

7.2 Storage

Suitable storage location

The storage location must meet the following requirements:

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

Technical data and environmental conditions

- For storage, observe the specifications regarding the temperature range, humidity, and air pressure.

See “Technical data” section.

7.3 Unpacking

The device is delivered in packaging together with a packing slip that provides installation instructions.

Observing the packing slip

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

Checking the delivery

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

Scope of supply

Refer to the ordering data for the standard scope of supply for the product.

See “Ordering data” section.

8 Function description

8.1 Single-channel sensor circuit

The sensor circuit is not designed with redundancy.

Cross-circuit detection is not possible.

8.2 Two-channel sensor circuit

The sensor circuit is designed with redundancy.

The following variants are possible:

– 2-channel with cross-circuit detection

See “Signal generator connection versions” section.

8.3 Automatic start

The device starts automatically after the sensor circuit has been closed.

8.4 Manual, monitored start

When the sensor circuit is closed, the device starts once the start circuit has been closed and opened again by pressing and releasing the reset button.

A connected reset button is monitored.

See “Start and feedback circuit connection versions” section.

See section “Function and time diagrams”.

8.5 Safe shutdown

When the sensor circuit is opened, the enabling current paths 13/14 and 23/24/34 open without delay. The enabling current paths 47/48/58 open in accordance with the configuration.

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

Signal output M1 is active.

See “Off delay” section and “On delay” section.

8.6 Cross-circuit monitoring

Cross-circuit monitoring should be activated or deactivated via the DIP switch on the device.

When cross-circuit monitoring is activated, the safety relay detects short circuits and cross-circuits in the sensor circuit.

Inputs S12, S22 expect clock signals of assigned clock outputs S11, S21.

WARNING: Reduced safety integrity when cross-circuit detection is deactivated

When cross-circuit detection is deactivated, some errors are no longer detected by the device. The achievable safety integrity is reduced to max. PL d (EN ISO 13849-1), SIL 2 (EN 62061), if no additional measures are taken for error detection and fault avoidance.

- Take additional measures for error detection and fault avoidance in order to achieve higher safety integrity.

Deactivate cross-circuit detection for the single-channel connection of sensors and when using light grids or safe controllers.

8.7 Off delay

The off delay is configured via the DIP switch on the device.

The delay time of 0.2 s to 300 s is set in increments via the DIP switch on the device.

If off-delay is configured, the enabling current paths 47/48/58 drop out after the set delay time has elapsed (stop category 1).

If the safety function has been demanded, the delay time can be reset using the retrigger function. The delay time is restarted by the retrigger signal.

8.8 On delay

The on delay is configured via the DIP switch on the device.

The delay time of 0.2 s to 300 s is set in increments via the DIP switch on the device.

If on-delay is configured, the enabling current paths 47/48/58 close after the set delay time has elapsed.

If the safety function has been demanded, the delay time can be reset using the retrigger function. The delay time is restarted by the retrigger signal.

The on delay function is only permitted in combination with the activated retrigger function.

8.9 Retrigger function

The retrigger function should be activated or deactivated via the DIP switch on the device.

If the safety function has been demanded, the retrigger signal resets the delay time. The delay time is restarted.

The retrigger signal is triggered depending on the selected startup behavior of the device.

Trigger the retrigger signal on an automatic start:

- Close the sensor circuit (e.g., release the emergency stop button) while the delay time is running.

Trigger the retrigger signal on a manual, monitored start:

- Close the sensor circuit (e.g., release the emergency stop button) while the delay time is running.
- Press the reset button and release it again while the delay time is running.

WARNING: No diagnostics for delayed enabling current path

The retrigger function means that the function of the internal relay of the delayed enabling current paths (47/48/58) cannot be diagnosed while the delay time is running.

- Carry out a risk evaluation.

NOTE: Retrigger function blocked when monitoring external contacts

The retrigger function for the off delay is blocked when external contact monitoring is integrated in start circuit S11/S34 or S21/S34.

9 Function and time diagrams

9.1 Notes on function and time diagrams

Key:

A1/A2	Power supply
S12	Input sensor circuit (channel 1)
S22	Input sensor circuit (channel 2)
S34	Feedback circuit
13/14, 23/24/34	Undelayed enabling current paths
47/48/58	Enabling current path, delayed
M1	Signal output (PNP), not safety-related

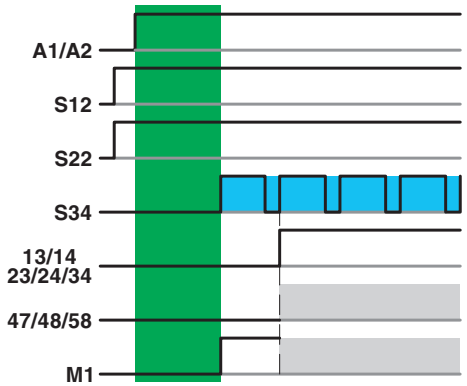
Meaning of the color markings:

= Boot phase
= Clock of S21
= Behavior depends on the configuration/delay time
= (ERR) error

9.2 Startup behavior on power up

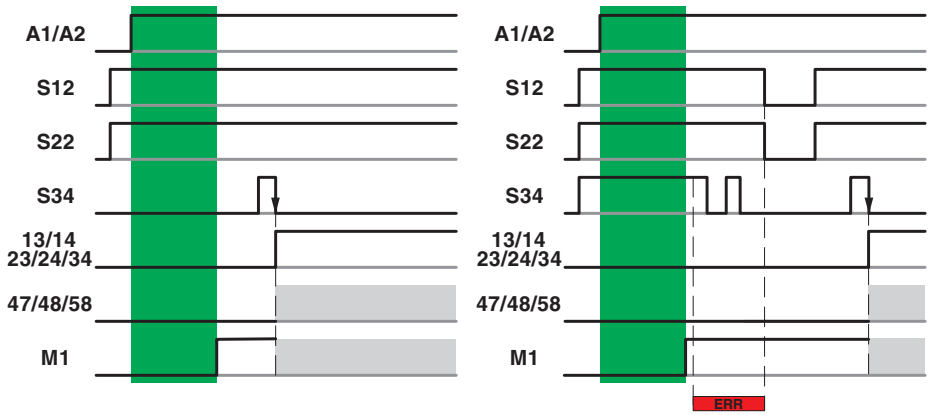
9.2.1 Automatic start

Figure 1 Time diagram for power-up, automatic start



9.2.2 Manual start

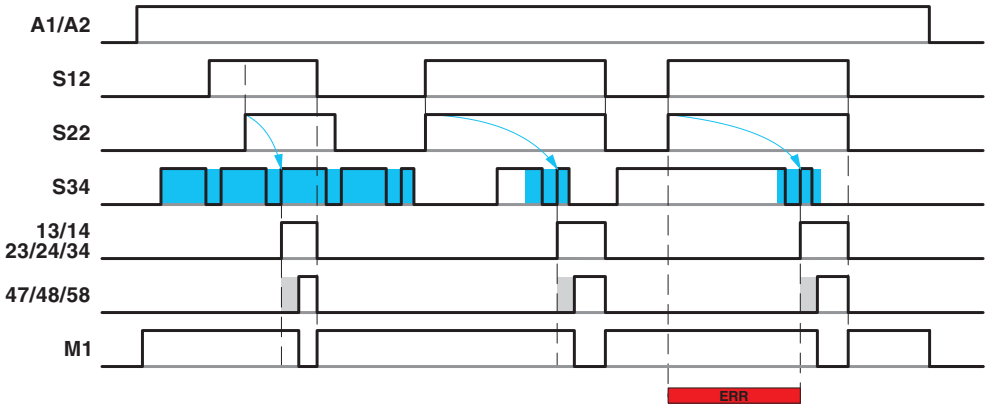
Figure 2 Time diagram for power-up, manual start



9.3 On delay

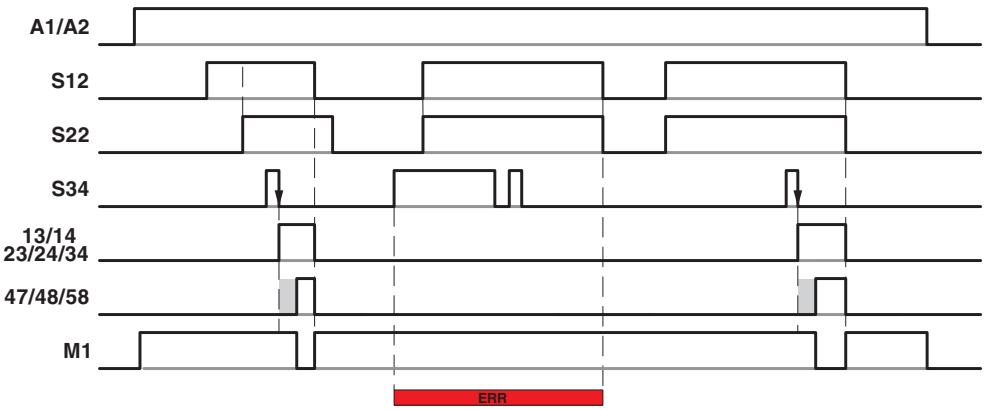
9.3.1 Automatic start

Figure 3 Time diagram for on delay, automatic start



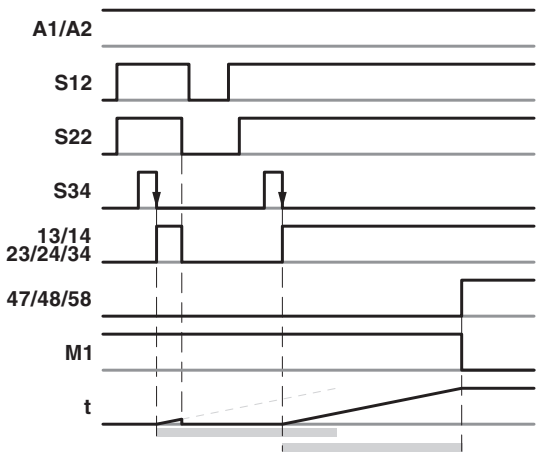
9.3.2 Manual start

Figure 4 Time diagram for on delay, manual start



9.3.3 Manual start with retrigger function

Figure 5 Time diagram for on delay, manual start, can be re-triggered

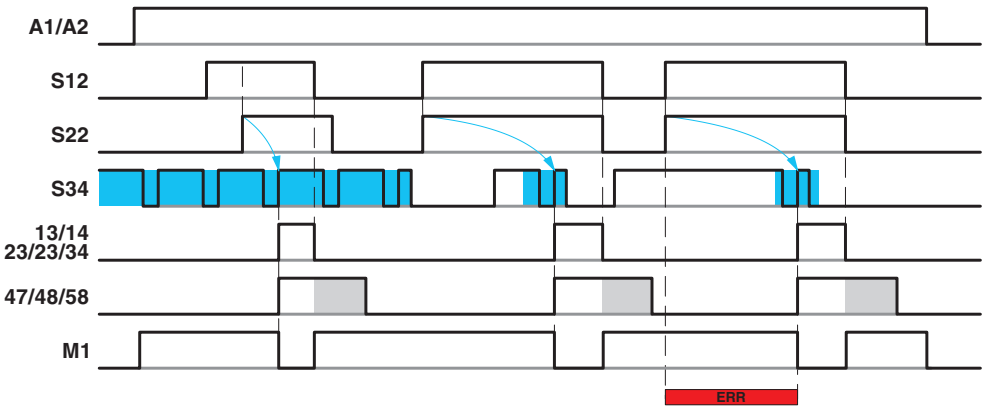


The behavior for automatic start is identical. The start conditions at S34 differ. See “Configuration” section.

9.4 Off delay

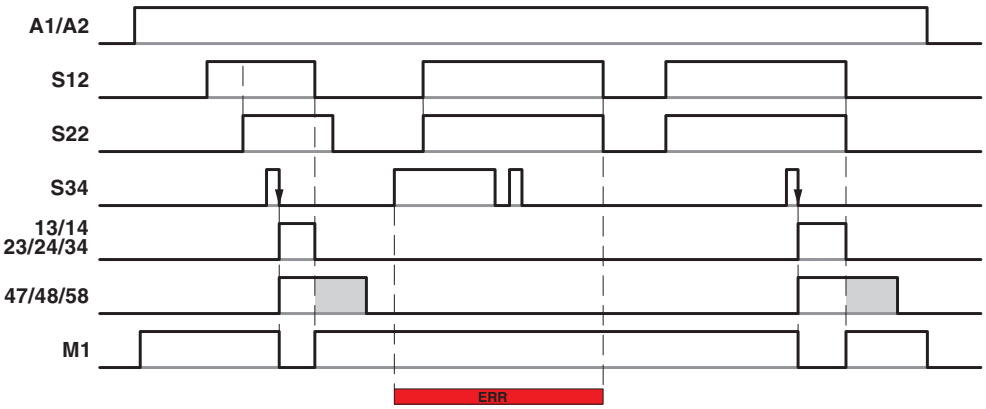
9.4.1 Automatic start

Figure 6 Time diagram for off delay, automatic start



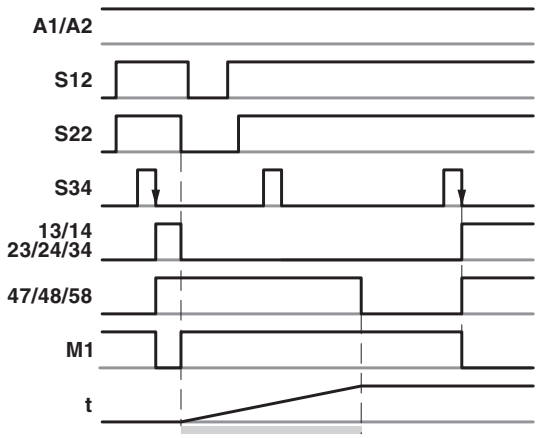
9.4.2 Manual start

Figure 7 Time diagram for off delay, manual start



9.4.3 Manual start without retrigger function

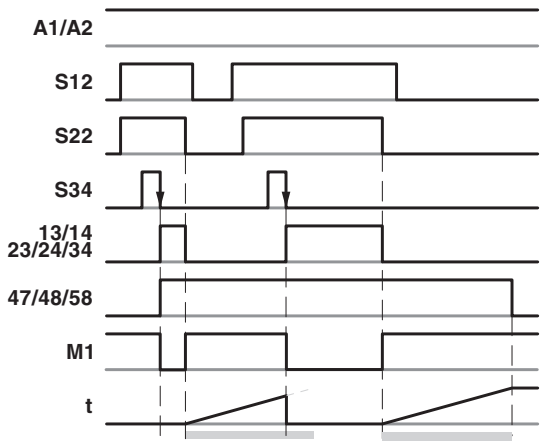
Figure 8 Time diagram for off delay, manual start, cannot be re-triggered



The behavior for automatic start is identical. The start conditions at S34 differ. See “Configuration” section.

9.4.4 Manual start with retrigger function

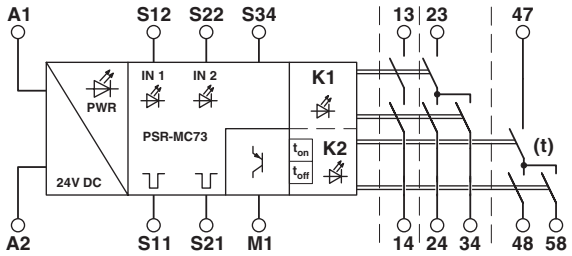
Figure 9 Time diagram for off delay, manual start, can be re-triggered



The behavior for automatic start is identical. The start conditions at S34 differ. See “Configuration” section.

10 Block diagram

Figure 10 Block diagram



Key:

A1	24 V DC power supply
A2	0 V power supply
S12	Input sensor circuit (channel 1)
S11	Clock output 24 V for sensor input S12
S22	Input sensor circuit (channel 2)
S21	Clock output 24 V for sensor input S22
S34	Start and feedback circuit
M1	Signal output (PNP), not safety-related
13/14 **23/24/34**	Undelayed enabling current paths
47/48/58	Delayed enabling current paths

10.1 Insulation coordination

	A1/A2, logic	13/14	23/24/34	47/48/58	Housing
A1/A2, logic	-	6 kV ST	6 kV ST	6 kV ST	4 kV BI
13/14	-	-	6 kV ST	6 kV ST	4 kV BI
23/24/34	-	-	-	6 kV ST	4 kV BI
47/48/58	-	-	-	-	4 kV BI
Housing	-	-	-	-	-

Key:

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

Basic insulation

(rated surge voltage of 4 kV)

A mixture of SELV and PELV is strictly prohibited. Only switch 250 V AC at one of the enable contacts if the adjacent contact/enabling current path carries the same potential.

Safe isolation/reinforced insulation

(rated surge voltage of 6 kV)

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

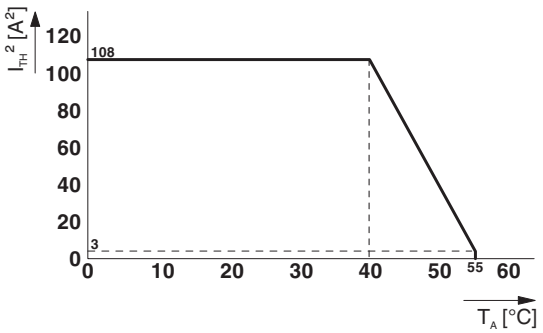
11 Derating

11.1 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
- $I_{max}^2 = I_1^2 + I_2^2 + I_3^2$

Figure 11 Derating curve - horizontal mounting position, without spacing



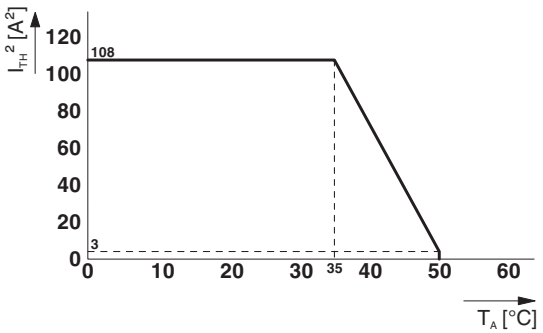
If the devices are mounted in the **horizontal** mounting position with a clearance of ≥10 mm between one another, derating is not required **up to 60°C**.

11.2 Vertical mounting position

The derating curve applies for the following conditions:

- Mounting on a vertical DIN rail
- Devices mounted next to each other without spacing
- at U_S up to max. 30 V DC
- $I_{max}^2 = I_1^2 + I_2^2 + I_3^2$

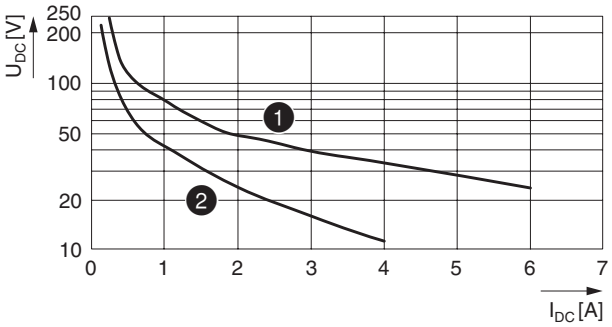
Figure 12 Derating curve - vertical mounting position, without spacing



12 Load limit curve

12.1 Ohmic and inductive load

Figure 13 Load limit curve - ohmic and inductive load

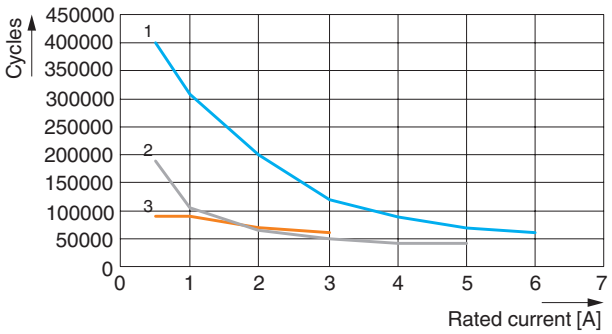


Key:

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

13 Electrical service life

Figure 14 Electrical service life

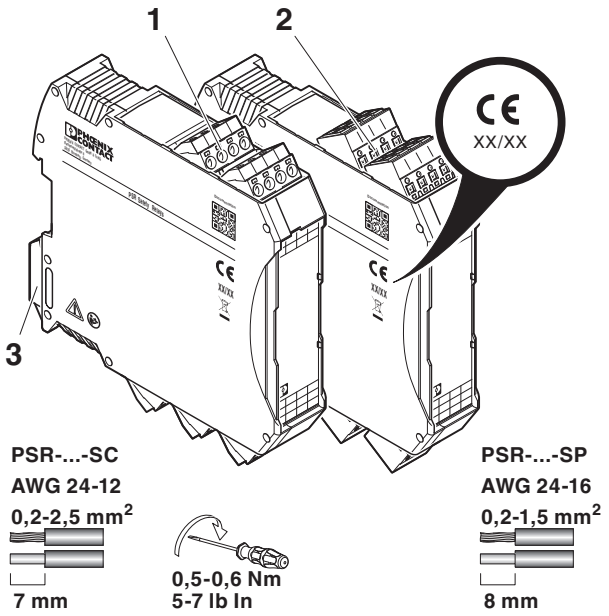


1 Number of switching cycles for AC-1
2 Number of switching cycles for DC-13
3 Number of switching cycles for AC-15

14 Operating and indication elements

14.1 Connection versions

Figure 15 Connection versions

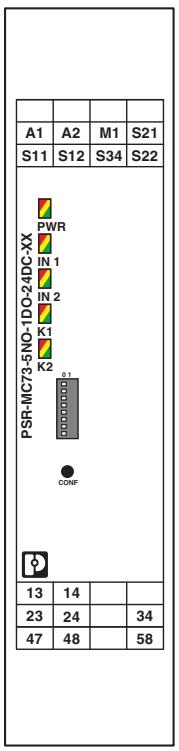


1 COMBICON plug-in screw terminal block
2 Pluggable COMBICON Push-in terminal block
3 Metal lock for fixing to DIN rail

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



A1	24 V DC power supply
A2	0 V power supply
M1	Signal output (PNP), not safety-related
S21	Clock output 24 V for sensor input S22
S11	Clock output 24 V for sensor input S12
S12	Input sensor circuit (channel 1)
S34	Start and feedback circuit
S22	Input sensor circuit (channel 2)
PWR	Power LED (red, yellow, green)
IN 1	Status indicator sensor circuit; LED (red, yellow, green)
IN 2	Status indicator sensor circuit; LED (red, yellow, green)
K1	Status indicator safety circuit; LED (red, yellow, green)
K2	Status indicator safety circuit; LED (red, yellow, green)
CONF	CONF button for confirming/displaying the configuration
DIP switch	8-way switch for configuration of: Delay time (DP1 to 5) Off delay or on delay (DP6) Retrigger function activated/deactivated (DP7) Cross-circuit monitoring activated/deactivated (DP8)
13/14 **23/24/34**	Undelayed enabling current paths
47/48/58	Delayed enabling current paths

14.3 Optional terminal coding

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

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

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

Coding system

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

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

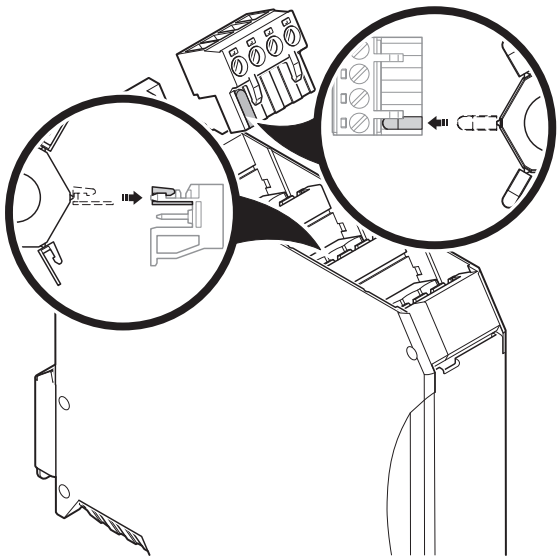
Coding profiles are plugged into the groove of the pluggable terminal block.

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

Attaching coding elements

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

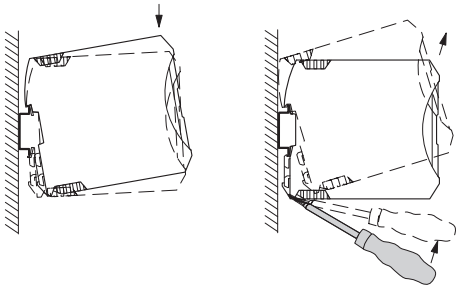
Figure 16 Attach coding elements



15 Mounting and removing

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

Figure 17 Mounting and removing



16 Wiring

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

Figure 18 Connecting the cables for PSR-...-SC (screw terminal block)

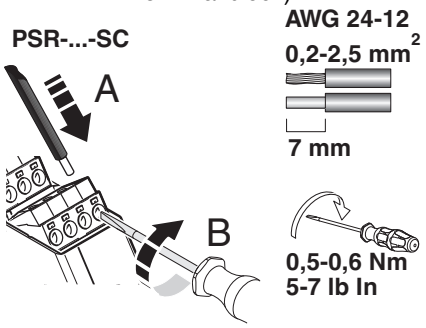
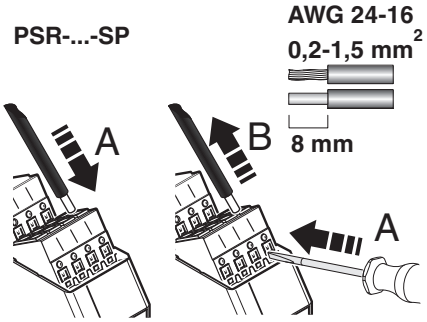


Figure 19 Connecting the cables for PSR-...-SP (Push-in terminal block)



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

Use the CRIMPFOX 6 crimping tool from PHOENIX CONTACT.

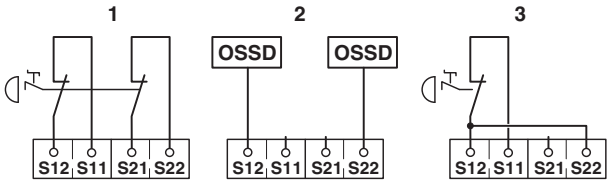
The tool enables the reliable processing of ferrules and easy removal of conductors with ferrules from the connection terminal blocks.

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

16.1 Signal generator connection versions

- Connect suitable signal generators to S11/S12 and S21/S22.

Figure 20 Signal generator connection versions



1 Two-channel connection

2 Two-channel OSSD signal

3 Single-channel connection

If control is single-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

The startup behavior selected due to the corresponding wiring must be confirmed during configuration.
See “Configuration” section.

Automatic start

- Bridge the contacts S21/S34.

Manual, monitored start

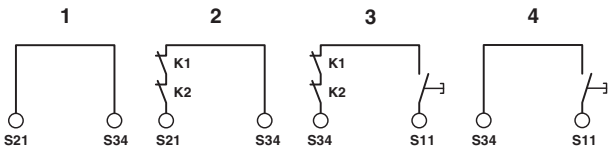
- Connect a reset button to S11/S34.

A connected reset button is monitored.

Start and feedback circuit

- Place the relevant N/C contact in path S21/S34 or S11/S34 to monitor external contactors or extension devices with force-guided contacts.

Figure 21 Start and feedback circuit connection variants



1 Automatic start

2 Automatic start with monitored contact extension

3 Manual, monitored start with monitored contact extension

4 Manual, monitored start

K1/K2 Force-guided contactors

17 Configuration

17.1 Delivery state

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

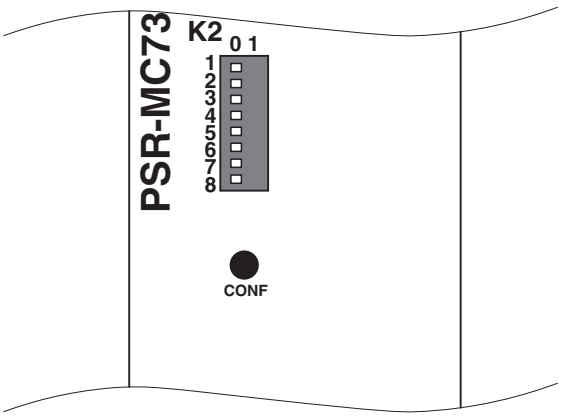
– Off delay activated
– Set delay time: 0.2 s
– Retrigger function deactivated
– Cross-circuit detection activated

17.2 General information on configuration

Configuration is performed using the 8-way DIP switch and CONF button on the front of the safety relay.

By briefly pressing the CONF button, the safety relay indicates the delay time that is currently set via the LEDs on the front of the device.

Figure 22 CONF button and DIP switch



The device functions to be configured should be assigned to the individual DIP switch poles (DPs) as follows.

DP	Function
1 ... 5	Delay time (in increments from 0.2 s ... 300 s)
6	Off delay or on delay
7	Retrigger function activated/deactivated
8	Cross-circuit monitoring activated/deactivated

17.3 Displaying the currently set delay time

- Press the CONF button for **< 2 s.**

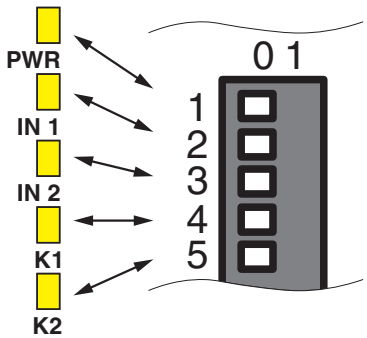
The five LEDs on the front of the device **light up yellow** for around 3 s to indicate the configuration of DIP switch poles DP1 to DP5 that is currently stored in the memory.

LED OFF	=	Position 0
LED on	=	Position 1

See “Configuration table”.

The assignment of the LEDs to the DIP switch poles shown in the figure applies.

Figure 23 Assignment of LEDs and DIP switch poles



17.4 Applying the configuration

WARNING: Risk of automatic restart

If the safety relay is operated with automatic start, once configuration is completed the device starts up automatically when the sensor circuit is closed.

- Remember this when completing configuration.

1. Press the CONF button for **at least 3 s** to enter configuration mode.

The safety relay enters the safe state whereby the enabling current paths open.

If an off-delay is configured for the delayed enabling current paths (47/48/58), the paths only open once the selected delay time has elapsed.

Flashing yellow LEDs indicate the delay time that is currently set.

2. Apply the setting for the desired delay time via DIP switch poles **DP1 to DP5** (see “Configuration table”).

The new delay time setting is immediately played back via flashing yellow LEDs for verification.

WARNING: Danger due to incorrect setting.

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

- If the LED display does not correspond to the switch position, repeat the process or replace the device.

3. Apply the setting for off delay/on delay functions, retrigger function, and cross-circuit monitoring via DIP switch poles **DP6 to DP8** (see “Configuration table”).
4. Confirm the configuration by double-clicking on the CONF button.

By confirming the configuration, you are also applying the wired startup behavior for the device.

Automatic start is only configured if the signal from S21 to S34 is present during confirmation of the configuration.

In all other cases, the device is configured with manual, monitored start.

The configuration is stored and the safety relay switches to the operating mode. The enabling current paths close according to the selected startup behavior (automatic or manual, monitored start).

WARNING: Danger due to incorrect setting.

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

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

17.5 Protection against manipulation

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

17.6 Configuration table

For the exact switch position for the desired configuration, refer to the following table.

Function		DIP switch pole							
		DP1	DP2	DP3	DP4	DP5	DP6	DP7	DP8
Delay time	Reserved	0	0	0	0	0	x	x	x
	0.2 s	0	0	0	0	1	x	x	x
	0.4 s	0	0	0	1	0	x	x	x
	0.5 s	0	0	0	1	1	x	x	x
	0.6 s	0	0	1	0	0	x	x	x
	0.8 s	0	0	1	0	1	x	x	x
	1 s	0	0	1	1	0	x	x	x
	1.2 s	0	0	1	1	1	x	x	x
	1.5 s	0	1	0	0	0	x	x	x
	1.6 s	0	1	0	0	1	x	x	x
	2.4 s	0	1	0	1	0	x	x	x
	2.5 s	0	1	0	1	1	x	x	x
	3 s	0	1	1	0	0	x	x	x
	3.2 s	0	1	1	0	1	x	x	x
	4 s	0	1	1	1	0	x	x	x
	4.8 s	0	1	1	1	1	x	x	x
	5 s	1	0	0	0	0	x	x	x
	6.4 s	1	0	0	0	1	x	x	x
	8 s	1	0	0	1	0	x	x	x
	10 s	1	0	0	1	1	x	x	x
	12.8 s	1	0	1	0	0	x	x	x
	19.2 s	1	0	1	0	1	x	x	x
	25 s	1	0	1	1	0	x	x	x
	30 s	1	0	1	1	1	x	x	x
	32 s	1	1	0	0	0	x	x	x
	38 s	1	1	0	0	1	x	x	x
	50 s	1	1	0	1	0	x	x	x
	100 s	1	1	0	1	1	x	x	x
	150 s	1	1	1	0	0	x	x	x
	200 s	1	1	1	0	1	x	x	x
	250 s	1	1	1	1	0	x	x	x
	300 s	1	1	1	1	1	x	x	x
Off delay		x	x	x	x	x	0	x	x
On delay (*)		x	x	x	x	x	1	x	x
Retrigger function deactivated		x	x	x	x	x	x	0	x
Retrigger function activated		x	x	x	x	x	x	1	x
Cross-circuit monitoring activated		x	x	x	x	x	x	x	0
Cross-circuit monitoring deactivated		x	x	x	x	x	x	x	1

x = DIP switch pole not relevant for the respective function

(*) The on delay function is only permitted in combination with the activated retrigger function.

18 Startup

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

PWR LED lights up.

- Close sensor circuit.

The IN 1 and IN 2 LEDs light up.

See “Signal generator connection versions” section.

Automatic start

The enabling current paths close.

The K1 and K2 LEDs light up.

Signal output M1 is not active.

If an on delay is configured for the delayed enabling current paths (47/48/58), the paths only close once the selected delay time has elapsed.

Manual, monitored start

- Press the reset button.

The enabling current paths close.

The K1 and K2 LEDs light up.

Signal output M1 is not active.

If an on delay is configured for the delayed enabling current paths (47/48/58), the paths only close once the selected delay time has elapsed.

19 Calculating the power dissipation

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

Input power dissipation for U_S = 24 V DC

P_{Input} = 1.92 W

Output power dissipation for I = 100 mA

P_{Output} = 0.31 W

Contact power dissipation

$P_{Contact} = (I_{L13/14}^2 + I_{L23/24/34}^2 + I_{L47/48/58}^2) * 50\ m\Omega$

Total power dissipation

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

therefore

$P_{Total} = 2.23\ W + P_{Contact}$

therefore

$P_{Total} = 2.23\ W + (I_{L13/14}^2 + I_{L23/24/34}^2 + I_{L47/48/58}^2) \bullet 50\ m\Omega$

Key:

P	Power dissipation in mW
U_S	Rated control circuit supply voltage
I	Current at clock and signal outputs
I_L	Contact load current

20 Function test/proof test

To verify the device function, proceed as follows:

- Demand the safety function by actuating the corresponding safety equipment.
- Check whether the safety function was executed correctly by switching the device on again.

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 Diagnostics

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.

Signal output M1 - not safety-related

Signal output M1 transmits non-safety-related status information. Feedback of signal output M1 to external basic devices for reasons of functional safety is therefore not required.

21.1 General states

Key:

○ LED OFF
◐ LED is permanently **green**
☼ LED is flashing **green slowly**

LED					State	Notes
PWR	IN1	IN2	K1	K2		
◐	○	○	○	○	No relays are activated. The sensor circuit is inactive.	-
◐	○	○	○	◐	Configuration: off delay Relay K2 remains picked up until the set delay time has elapsed.	Sensor circuit was opened during operation.
◐	◐	◐	○	◐	Configuration: off delay, manual start Relay K2 remains picked up until the set delay time has elapsed.	Sensor circuit was opened and closed again during operation.
◐	◐	◐	◐	○	Configuration: on delay Relay K2 remains open until the set delay time has elapsed.	-
◐	◐	◐	○	☼	Relay K2 remains picked up until the set delay time has elapsed.	The CONF button was pressed for > 3 s during operation. After the set delay time has elapsed, the device automatically switches to configuration mode.
◐	◐	◐	○	○	Relays K1/K2 are ready to start and await reset/start command (S34).	Possible error see error messages
◐	◐	◐	◐	◐	All sensor circuits are active. All relays are picked up.	-

21.2 Error messages

Key:

○ LED OFF
◐ LED is permanently **green**
◑ LED is permanently **red**
☼ LED is flashing **red slowly**

LED					State	Possible cause	Corrective
PWR	IN1	IN2	K1	K2			
◐	◐	◐	○	○	The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up.	External error: readback contact (external actuator) is open in the reset circuit.	Switch off the operating voltage and check the actuator. Then perform a function test.
◑	○	○	○	○	-	Internal error	Perform a power down reset with subsequent function test. **If the error occurs again after the function test, replace the device.**
☼	○	○	○	○	-	The operating voltage is outside the permissible range.	Check the operating voltage. Make sure that the operating voltage is in the permissible range.
☼	◑	◑	○	○	The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up.	Cross-circuit detection active. Possible cross-circuit in the sensor circuit (S12/S22).	Switch off the operating voltage and rectify the cross-circuit. Then perform a function test.
☼	◑	○ / ◐	○	○		Cross-circuit detection active. Possible cross-circuit in the sensor circuit (S12).	
☼	○ / ◐	◑	○	○		Cross-circuit detection active. Possible cross-circuit in the sensor circuit (S22).	
☼	◑	◑	○	○		Implausible signal change at the inputs (S12/S22), e.g., due to defective signal generator.	Remove the error. Then perform a function test.

LED					State	Possible cause	Corrective
PWR	IN1	IN2	K1	K2			
☼	○ / ◐	○ / ◐	◑	◑	For automatic start: The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up.	Short circuit between 24 V and S34.	Switch off the operating voltage and remove the error. Then perform a function test.
					For manual start: The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up.	Short circuit between 24 V and S34, before the sensor circuit is closed.	
☼	◑	◑	◑	◑	For automatic start: The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up.	Short circuit between 24 V and S34 **and** implausible signal change at the inputs (S12/S22), e.g., due to defective signal generator.	
					For manual start: The sensor circuit is active. The reset/start circuit (S34) is/was activated. The safety circuit (K1 and K2) is not picking up.	Short circuit between 24 V and S34, before the sensor circuit is closed **and** implausible signal change at the inputs (S12/S22), e.g., due to defective signal generator.	
◐	☼	☼	○	◐	Configuration: off delay without retrigger function, automatic start Relay K2 remains picked up until the set delay time has elapsed.	Sensor circuit was opened and closed again during operation.	Wait the set delay time. The device then starts automatically.
					Configuration: off delay without retrigger function, manual start Relay K2 remains picked up until the set delay time has elapsed.	Sensor circuit was opened and closed again during operation and the manual start was performed.	Wait the set delay time. The device can then be activated again via a manual start.

21.3 Error messages regarding configuration

21.3.1 DIP switch moved

The safety relay detects if the 8-pos. DIP switch is moved during operation.

Consequently the device enters the safe state and indicates via LED combinations which DIP switch pole (DP1 to D8) has moved.

If an off-delay is configured for the delayed enabling current paths (47/48/58), the paths only open once the selected delay time has elapsed.

The table below applies in the event that a single DIP switch pole has moved. If multiple DIP switch poles moved at the same time, the following applies:

DP1 ... DP5: All moved DPs are indicated simultaneously.

DP6 ... DP8: The moved DPs are indicated according to their priority. Only the higher order DP is indicated (DP8 > DP7 > DP6).

Key:

○ LED OFF

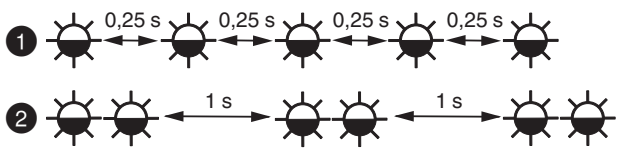
◒ LED is permanently **yellow**

☼ LED flashes **yellow**

LED					Moved DIP switch pole	Corrective
PWR	IN1	IN2	K1	K2		
☼ ❷	○	○	○	○	DP1	Correct the switch position. Perform a power down reset with subsequent function test or apply the new configuration in configuration mode (see “Applying the configuration” section).
○	☼ ❷	○	○	○	DP2	
○	○	☼ ❷	○	○	DP3	
○	○	○	☼ ❷	○	DP4	
○	○	○	○	☼ ❷	DP5	
☼ ❶	◒	○	○	○	DP6	
☼ ❶	○	◒	○	○	DP7	
☼ ❶	○	○	◒	○	DP8	

Note the different blink behavior, see ❶ or ❷ in the table and figure.

Figure 24 LED blink behavior



21.4 Invalid configuration frame

If a reserved or invalid configuration is selected during the configuration process, all LEDs flash yellow.

- Correct the configuration.

22 Application examples

22.1 Emergency stop monitoring/automatic start

Application description:

- Two-channel emergency stop monitoring
- 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 62061), if cross-circuits in the control to the actuator can be ruled out

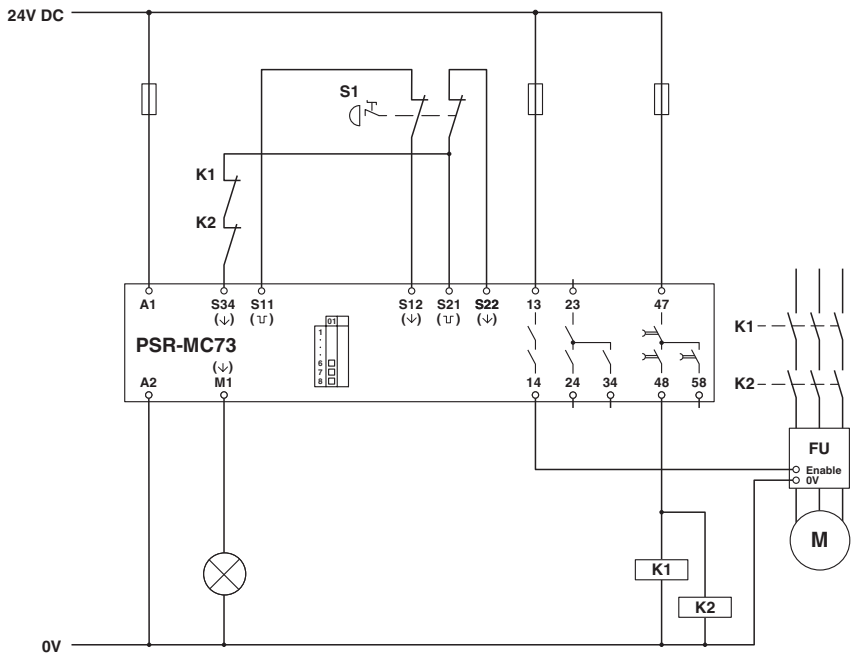
Cross-circuits in the cable installation can be excluded if the safety relay and external contactors K1 and K2 are located in the same electrical installation space.

WARNING: Loss of functional safety in the event of errors in the FU.

The quick stop function of the frequency inverter is purely functional. It is not suitable for safety-related use. If an error occurs in the frequency inverter at the same time that the emergency stop control device is actuated, the quickest possible stop may not occur or the delay may be shorter.

The solution described is widely used and can be viewed as state of the art.

Figure 25 Emergency stop monitoring/automatic start



DIP switch setting	
DP1 ... DP5	According to the desired delay time (see “Configuration table”)
DP6	0
DP7	0
DP8	0

Key:

S1	Emergency stop button
K1/K2	Force-guided contactors
FU	Frequency inverter

22.2 Emergency stop monitoring/manual, monitored start

Application description:

- Two-channel emergency stop 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 62061), if cross-circuits in the control to the actuator can be ruled out

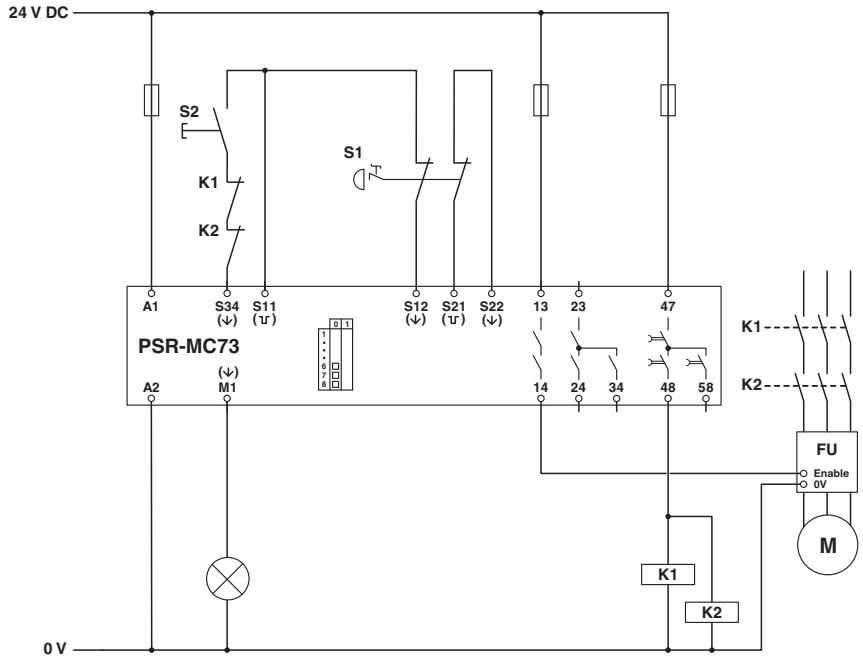
Cross-circuits in the cable installation can be excluded if the safety relay and external contactors K1 and K2 are located in the same electrical installation space.

WARNING: Loss of functional safety in the event of errors in the FU.

The quick stop function of the frequency inverter is purely functional. It is not suitable for safety-related use. If an error occurs in the frequency inverter at the same time that the emergency stop control device is actuated, the quickest possible stop may not occur or the delay may be shorter.

The solution described is widely used and can be viewed as state of the art.

Figure 26 Emergency stop monitoring/manual, monitored start



DIP switch setting	
DP1 ... DP5	According to the desired delay time (see “Configuration table”)
DP6	0
DP7	0
DP8	0

Key:

S1	Emergency stop button
S2	Manual reset device
K1/K2	Force-guided contactors
FU	Frequency inverter

22.3 Single-channel emergency stop monitoring/ manual, monitored start

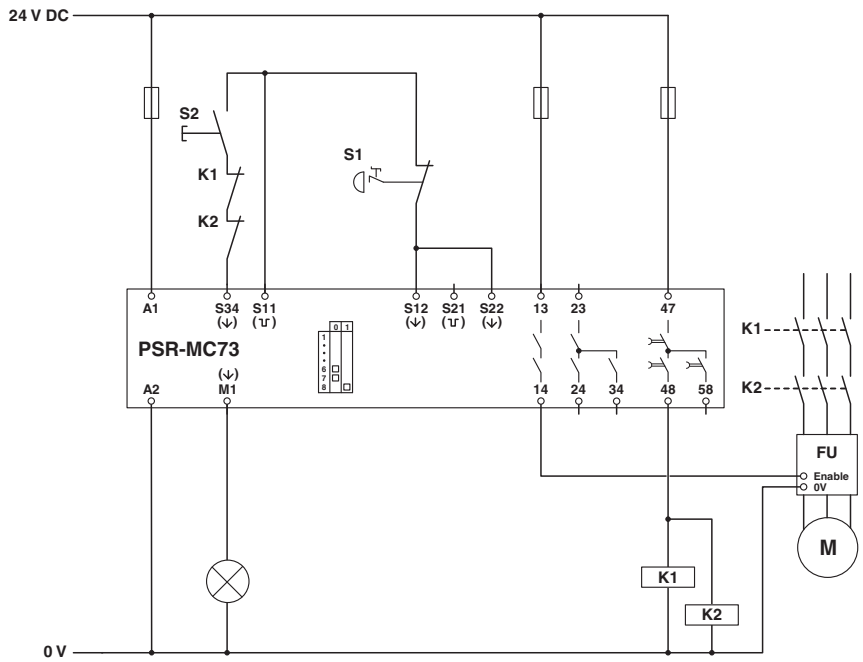
Application description:

- Single-channel emergency stop monitoring
- Manual, monitored start
- Monitoring of external contactors (optional)

Achievable safety integrity:

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

Figure 27 Single-channel emergency stop monitoring/manual, monitored start



DIP switch setting	
DP1 ... DP5	According to the desired delay time (see “Configuration table”)
DP6	0
DP7	0
DP8	1

Key:

S1	Emergency stop button
S2	Manual reset device
K1	Contactor
FU	Frequency inverter

22.4 Light grid monitoring/manual, monitored start

Application description:

- Two-channel light grid 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 62061), if cross-circuits in the control to the actuator can be ruled out

Notes:

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

WARNING: Loss of functional safety

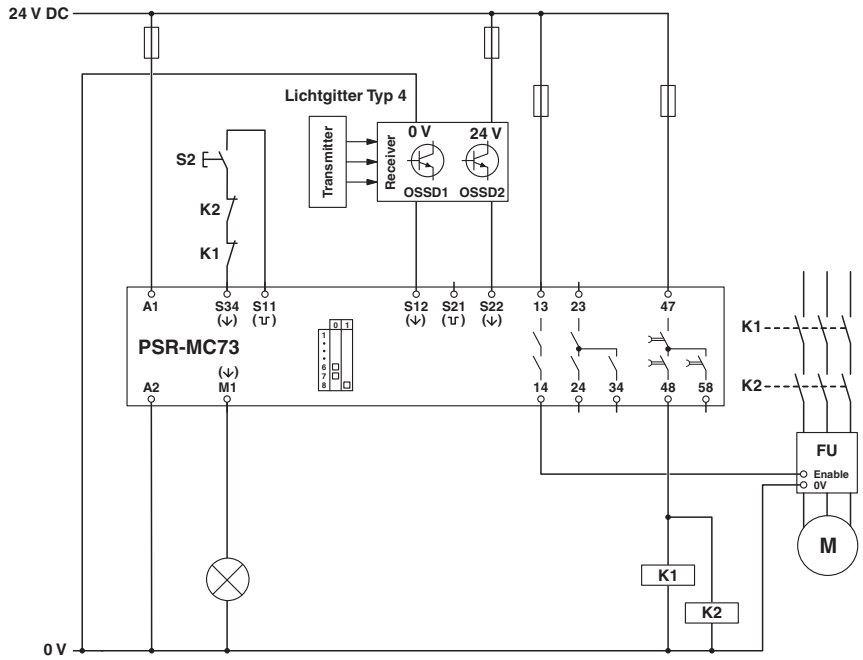
Make sure that the signal generator and the safety relay have the same ground potential.

WARNING: Loss of functional safety in the event of errors in the FU.

The quick stop function of the frequency inverter is purely functional. It is not suitable for safety-related use. If an error occurs in the frequency inverter at the same time that the emergency stop control device is actuated, the quickest possible stop may not occur or the delay may be shorter.

The solution described is widely used and can be viewed as state of the art.

Figure 28 Light grid monitoring/manual, monitored start



DIP switch setting	
DP1 ... DP5	According to the desired delay time (see “Configuration table”)
DP6	0
DP7	0
DP8	1

Key:

S2	Manual reset device
K1/K2	Force-guided contactors
FU	Frequency inverter

22.5 Non-contact safety door switch monitoring / manual, monitored start

Application description:

- Two-channel safety door 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 62061), if cross-circuits in the control to the actuator can be ruled out

Notes:

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

WARNING: Loss of functional safety

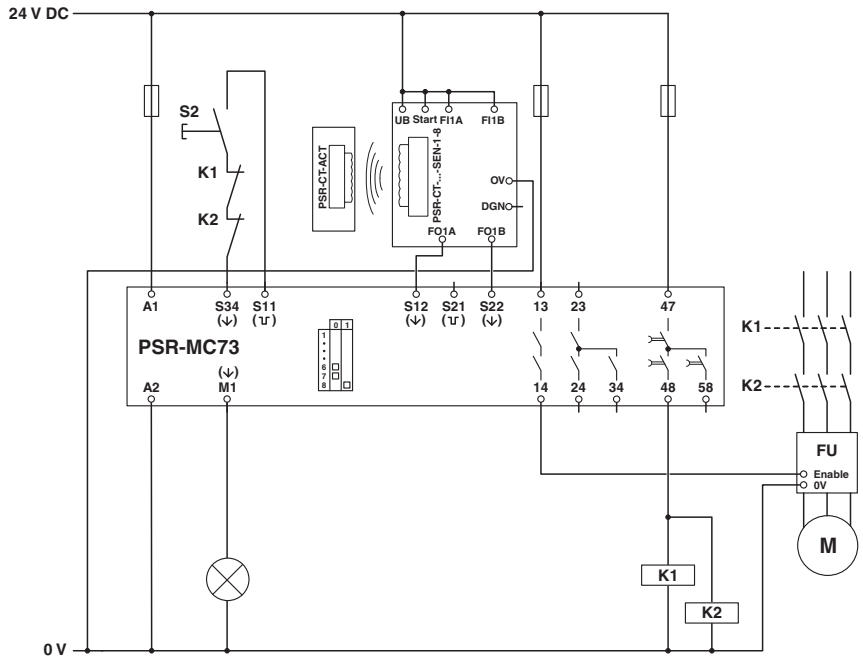
Make sure that the signal generator and the safety relay have the same ground potential.

WARNING: Loss of functional safety in the event of errors in the FU.

The quick stop function of the frequency inverter is purely functional. It is not suitable for safety-related use. If an error occurs in the frequency inverter at the same time that the emergency stop control device is actuated, the quickest possible stop may not occur or the delay may be shorter.

The solution described is widely used and can be viewed as state of the art.

Figure 29 Non-contact safety door monitoring / manual, monitored start



DIP switch setting	
DP1 ... DP5	According to the desired delay time (see “Configuration table”)
DP6	0
DP7	0
DP8	1

Key:

S2	Manual reset device
K1/K2	Force-guided contactors
FU	Frequency inverter

23 Device replacement, device defect, and repair

23.1 Device replacement

The device can be replaced, if necessary.

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

– Mounting and removal
– Wiring

Observe the device type and version

The new device must meet the following requirements:

– Same device type
– Same or later version

23.2 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.

24 Maintenance, decommissioning, and disposal

24.1 Maintenance

The device requires no maintenance during the permissible duration of use. Refer to the technical data for the duration of use 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.

24.2 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 device contains valuable recyclable materials, which should be utilized.

Device disposal

- Do not dispose of the device with household waste; it should instead be disposed of in accordance with the currently applicable national regulations.

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.

25 Attachment

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

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

Using the device at altitudes **greater than 2000 m above sea level up to max. 4500 m above sea level** is possible under the following conditions:

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

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

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

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

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

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

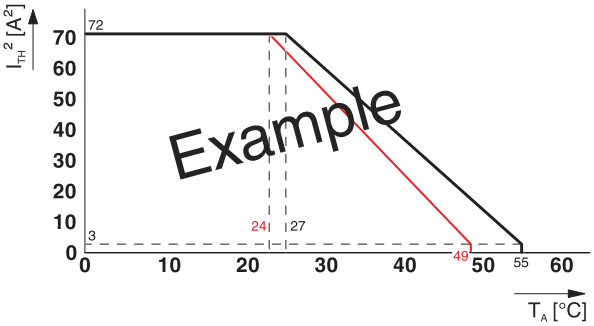
Example calculation for 3000 m

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

27 °C • 0.906 ≈ 24 °C

55 °C • 0.906 ≈ 49 °C

Figure 30 Example of a suspended derating curve (red)



25.2 Revision history

Version	Date	Contents
00	2019-03-28	First publication
01	2019-04-05	Accessories, information, and section on terminal coding added
02	2022-05-03	COMPLETE line change. Technical data, block diagram, insulation coordination, and load limit curve updated. “Electrical service life” section added. Application drawing for emergency stop monitoring / autostart changed.