

PSR-...-24DC/MXF.../4X1/2X2/B

PL
EN ISO 13849

SILCL
IEC 62061



Multifunctional safety relay for emergency stop, safety door and light grid monitoring

Data sheet
105764_en_02

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1 Description

The multifunctional safety relay can be used in safety circuits according to EN 60204-1 and IEC 61508.

The safety relays may be implemented to monitor up to three different safety functions such as emergency stop and safety door locking.

Sensor circuit 1 switches safety circuit 1 on or off.

Sensor circuit 2 switches safety circuit 2 on or off.

Sensor circuit 0 is hierarchically and functionally overlaid above sensor circuits 1 and 2.

It can switch off both safety circuits independently of sensor circuits 1 and 2.

The safety circuits are controlled either with an automatic (S35 or S37) or manual start circuit (S34 or S36).

A reset button can be connected for each safety chain.

Using this module, circuits are interrupted in a safety-oriented manner.

Depending on the external wiring, up to category 4, PL e according to EN ISO 13849-1 or SILCL 3 according to EN 62061 can be achieved.

The safety relay is equipped with two by two enabling current paths that drop out without delay corresponding to stop category 0 according to EN 60204-1.

Features

- Emergency stop, safety door and light grid monitoring
- Suitable up to category 4, PL e (EN ISO 13849-1), SILCL 3 (EN 62061)
- Optional plug-in screw, spring cage or fixed push-in terminal blocks
- Single-channel or two-channel wiring with cross-circuit detection
- 2 x 2 enabling current paths
- 2 Signaling current paths



WARNING: Risk of electric shock

Observe the safety instructions 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".

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3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Multifunctional safety relay for emergency stop and safety doors up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in screw terminal block	PSR-SCP- 24DC/MXF1/4X1/2X2/B	2902725	1
Multifunctional safety relay for emergency stop and safety doors up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in spring-cage terminal block	PSR-SPP-24DC/MXF1/4X1/2X2/B	2902726	1
Multifunctional safety relay for emergency stop and safety doors up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, fixed push-in terminal blocks	PSR-PIP-24DC/MXF1/4X1/2X2/B	2903253	1
Multifunctional safety relay for emergency stop and safety doors up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in screw terminal block	PSR-SCP-24DC/MXF2/4X1/2X2/B	2903254	1
Multifunctional safety relay for emergency stop and safety doors up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in spring-cage terminal block	PSR-SPP-24DC/MXF2/4X1/2X2/B	2903255	1
Multifunctional safety relay for emergency stop and safety doors up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, fixed push-in terminal blocks	PSR-PIP-24DC/MXF2/4X1/2X2/B	2903256	1
Multifunctional safety relay for emergency stop, safety doors, and light grid up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in screw terminal block	PSR-SCP-24DC/MXF3/4X1/2X2/B	2903257	1
Multifunctional safety relay for emergency stop, safety doors, and light grid up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in spring-cage terminal block	PSR-SPP-24DC/MXF3/4X1/2X2/B	2903258	1
Multifunctional safety relay for emergency stop, safety doors, and light grid monitoring up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, fixed push-in terminal blocks	PSR-PIP-24DC/MXF3/4X1/2X2/B	2903259	1
Multifunctional safety relay for emergency stop, safety doors, and light grid up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in screw terminal block	PSR-SCP-24DC/MXF4/4X1/2X2/B	2903260	1
Multifunctional safety relay for emergency stop, safety doors, and light grid up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, plug-in spring-cage terminal block	PSR-SPP-24DC/MXF4/4X1/2X2/B	2903261	1
Multifunctional safety relay for emergency stop, safety doors, and light grid monitoring up to SIL 3, Cat. 4, PL e, automatically or manually monitored activation, 4 N/O contacts, 3 safety functions, 2 shutdown levels, fixed push-in terminal blocks	PSR-PIP-24DC/MXF4/4X1/2X2/B	2903262	1

4 Technical data

Input data	
Nominal input voltage U_N	24 V DC
Input voltage range (factor)	0.85 ... 1.1
Input voltage range "0"-signal	0 V DC ... 5 V DC (for safe off; applies to the sensor circuit 2 (I5/I6) of MXF3 and MXF4)
Typical input current	125 mA (with actuated relays) 55 mA (Two-channel 24 V/0 V + max. 200 mA control (message outputs 32/62) with non-actuated relays)
Current consumption	typ. 5 mA (I_{max}/I_x inputs) 20 mA (in electric torque)
Voltage at input/start and feedback circuit	24 V -15 %; +10 % (first channel: 24 V; second channel: 0 V)
Filter time	max. 1.5 ms (Test pulse duration; for all equivalent inputs) min. 7.5 ms (Test pulse rate; for all equivalent inputs)
Max. permissible overall conductor resistance (Input and reset circuit at U_N)	100 Ω
Typical response time	175 ms (monitored/manual start) 250 ms (automatic start)
Typical pick-up time	250 ms (when controlled via A1)
Typical release time	25 ms (when controlled via S11/I1,I3,I5 and S21/I2,I4,I6) 20 ms (when controlled via A1)
Recovery time	1 s (Availability time after activation of sensor circuit: 100ms)
Maximum switching frequency	0.5 Hz
Operating voltage display	1 x green LED
Status display	5 green LEDs
Indication	1 red LED
Protective circuit	Surge protection Suppressor diode
Output data	
Contact type	4 enabling current paths 2 semiconductor alarm outputs
Contact material	AgCuNi, +0,2 -0,4 μ m Au
Minimum switching voltage	10 V AC/DC
Maximum switching voltage	250 V AC/DC
Limiting continuous current	6 A (N/O contact) max. 100 mA (Alarm output (24 V DC))
Maximum inrush current	6 A
Inrush current, minimum	10 mA
Sq. Total current	72 A^2 ($I_{TH}^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2$) (see derating curve)
Interrupting rating (ohmic load) max.	1500 VA (250 V AC, $\tau = 0$ ms) 66 W (220 V DC, $\tau = 0$ ms) 66 W (110 V DC, $\tau = 0$ ms) 100 W (48 V DC, $\tau = 0$ ms) 144 W (24 V DC, $\tau = 0$ ms)
Maximum interrupting rating (inductive load)	48 W (24 V DC, $\tau = 40$ ms) 43 W (48 V DC, $\tau = 40$ ms)
Switching capacity min.	0.1 W
Switching capacity	
Mechanical service life	10×10^6 cycles
Switching capacity (360/h cycles)	5 A (0.1 Hz; DC13; 24 V)
Switching capacity (3600/h cycles)	3 A (AC15; 230 V)
Output fuse	6 A gL/gG NEOZED (N/O contact) 4 A gL/gG NEOZED (for low-demand applications)

General data	
Relay type	Electromechanical relay with forcibly guided contacts in accordance with EN 50205
Nominal operating mode	100% operating factor
Degree of protection	IP20
Min. degree of protection of inst. location	IP54
Mounting position	vertical or horizontal
Mounting type	DIN rail mounting
Air clearances and creepage distances between the power circuits	DIN EN 50178/VDE 0160
Rated insulation voltage	250 V AC
Rated surge voltage/insulation	4 kV/basic isolation (safe isolation, reinforced insulation and 6 kV between input circuit, enabling current paths and safety circuit 1 (13/14, 23/24) and safety circuit 2 (43/44, 53/54).)
Pollution degree	2
Overvoltage category	III

Dimensions	Screw connection	Spring-cage connection	Push-in connection
W x H x D	22.5 x 112.2 x 114.5 mm	22.5 x 117.4 x 114.5 mm	22.5 x 116.4 x 114.5 mm

Connection data	Screw connection	Spring-cage connection	Push-in connection
Conductor cross section, solid	0.2 mm ² ... 2.5 mm ²	0.2 mm ² ... 1.5 mm ²	0.2 mm ² ... 2.5 mm ²
Conductor cross section, flexible	0.2 mm ² ... 2.5 mm ²	0.2 mm ² ... 1.5 mm ²	0.2 mm ² ... 2.5 mm ²
Conductor cross section AWG/kcmil	24 ... 12	24 ... 16	24 ... 16
Stripping length	7 mm	8 mm	10 mm

Ambient conditions	
Ambient temperature (operation)	-20 °C ... 45 °C (see derating curve)
Ambient temperature (storage/transport)	-25 °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)

Conformance / approvals	
Approvals	

Safety data	
Stop category according to IEC 60204	0

Safety parameters for IEC 61508 - High demand	
SIL	3
PFH _d	1.93 x 10 ⁻¹⁰ (5 A DC13; 3 A AC15; 8760 cycles/year)
Demand rate	< 12 Months
Proof test interval	240 Months (Mission time)

Safety parameters for IEC 61508 - Low demand	
SIL	3
PFD _{avg}	1,45 x 10 ⁻⁴
Proof test interval	60 Months

Safety characteristic data according to EN ISO 13849	
Category	4
Performance level	e (5 A DC13; 3 A AC15; 8760 cycles/year)

5 Basic circuit diagram

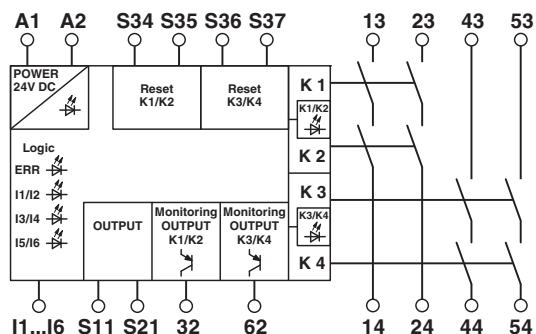


Figure 1 Block diagram

Key:

Designation	Explanation
A1/A2	Safety relay input voltage
I1	Sensor circuit 0, channel 1
I2	Sensor circuit 0, channel 2
I3	Sensor circuit 1, channel 1
I4	Sensor circuit 1, channel 2
I5	Sensor circuit 2, channel 1
I6	Sensorkreis 2, Kanal 2
13/14	Undelayed enabling current path 1 (safety circuit 1)
23/24	Undelayed enabling current path 2 (safety circuit 1)
43/44	Undelayed enabling current path 3 (safety circuit 2)
53/54	Undelayed enabling current path 4 (safety circuit 2)
32	Signaling current path (safety circuit 1)
62	Signaling current path (safety circuit 2)
S34	Manual start (safety circuit 1)
S35	Automatic start (safety circuit 1)
S36	Manual start (safety circuit 2)
S37	Automatic start (safety circuit 2)
S11	Output 24 V
S21	Output 0 V

6 Derating

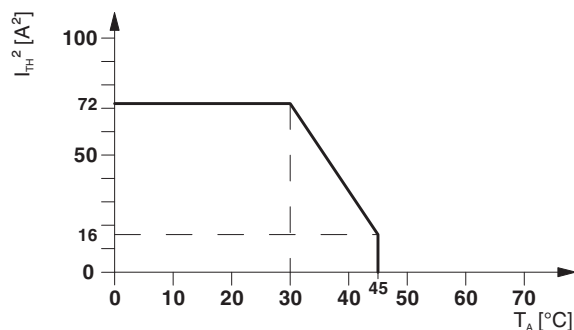


Figure 2 Derating curve - horizontal mounting position with connected modules

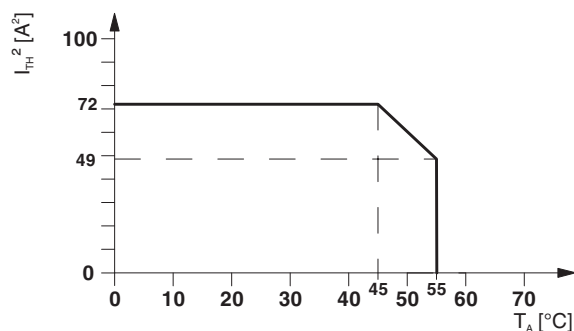


Figure 3 Derating curve - horizontal mounting position with 10 mm module spacing

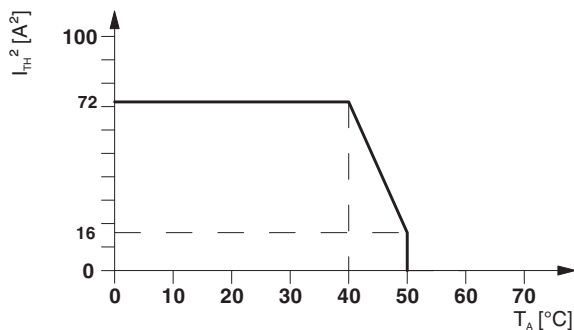


Figure 4 Derating curve - vertical mounting position with 10 mm module spacing

7 Safety notes



WARNING: Risk of electric shock

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

Before working on the switching device, disconnect the power.

Please observe the safety regulations of electrical engineering and industrial safety and liability associations!

Disregarding these safety regulations may result in death, serious personal injury or damage to equipment.

Startup, mounting, modifications, and upgrades should only be carried out by a skilled electrical engineer!



NOTE: Risk of damage to equipment due to noise emissions

When operating relay modules the operator must meet the requirements for noise emission for electrical and electronic equipment (EN 61000-6-4) on the contact side and, if required, take appropriate measures.



WARNING: Risk of automatic machine restart!

For emergency stop applications, the machine must be prevented from restarting automatically by a higher-level control system.

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



WARNING: Danger due to faulty devices!

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

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

Repairs to the device, especially if the housing must be opened, may only be carried out by the manufacturer or authorized persons. Otherwise the warranty is invalidated.



WARNING: Risk of electric shock

Circuit 1 (current paths 13-14 and 23-24) as well as circuit 2 (current paths 43-44 and 53-54) must only switch the same potential.



NOTE: Risk of damage to equipment due to incorrect installation

For reliable operation, the safety relay must be installed in housing protected from dust and humidity (IP54).

Carry out wiring according to the application. Refer to the "Application examples" section for this.

8 Operating and indication elements

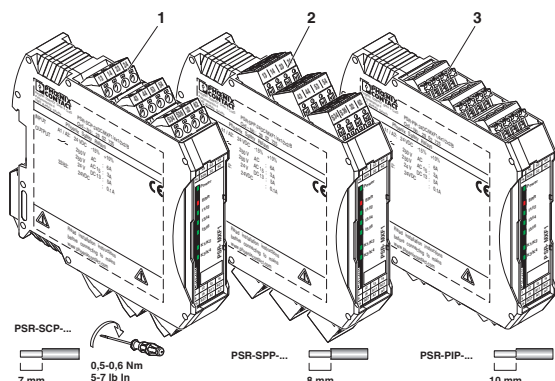


Figure 5 Connection versions

- 1 COMBICON plug-in screw terminal block
- 2 COMBICON plug-in spring-cage terminal block
- 3 Fixed FKDSO push-in connection

Pin assignment:

Figure	Designation	Explanation												
<table border="1" style="margin-left: 20px;"> <tr><td>13</td><td>14</td><td>23</td><td>24</td></tr> <tr><td>43</td><td>44</td><td>53</td><td>56</td></tr> <tr><td>S34</td><td>S36</td><td>32</td><td>62</td></tr> </table>	13	14	23	24	43	44	53	56	S34	S36	32	62	13, 14	Undelayed enabling current path 1 (safety circuit 1)
	13	14	23	24										
	43	44	53	56										
	S34	S36	32	62										
	23, 24	Undelayed enabling current path 2 (safety circuit 1)												
	43, 44	Undelayed enabling current path 3 (safety circuit 2)												
	53, 54	Undelayed enabling current path 4 (safety circuit 2)												
	S34	Manual start (safety circuit 1)												
	S36	Manual start (safety circuit 2)												
	32	Signaling current path (safety circuit 1)												
	62	Signaling current path (safety circuit 2)												
	Power	Power LED (green)												
	ERR	Error LED (red)												
	I1/I2	I1/I2 LED (green), status indicator sensor circuit 0												
	I3/I4	I3/I4 LED (green), status indicator sensor circuit 1												
	I5/I6	I5/I6 LED (green), status indicator sensor circuit 2												
	K1/K2	K1/K2 LED (green), status indicator sensor circuit 1												
	K3/K4	K3/K4 LED (green), status indicator sensor circuit 2												
	I1	Sensor circuit 0, channel 1												
	I2	Sensor circuit 0, channel 2												
	I3	Sensor circuit 1, channel 1												
	I4	Sensor circuit 1, channel 2												
	I5	Sensor circuit 2, channel 1												
	I6	Sensorkreis 2, Kanal 2												
	S11	Output 24 V												
	S21	Output 0 V												
	S35	Automatic start (safety circuit 1)												
	S37	Automatic start (safety circuit 2)												
	A1, A2	Safety relay input voltage												

The pin assignment applies to all PSR-...-24DC/MXF.../4X1/2X2/B.

9 Diagnostics

The following chapter describes the LED indicators for common situations, fault indications and error states as well as possible causes and remedies.

9.1 General states

PWR LED	I1/I2 LED	I3/I4 LED	I5/I6 LED	ERR LED	K1/K2 LED	K3/K4 LED	Notes	State
ON	OFF	OFF	OFF	OFF	OFF	OFF	Possible error see error messages	All relays are not activated. All sensor circuits are off.
ON	ON	ON	ON/OFF	OFF	OFF	ON/OFF	Safety circuit 2 with I1/I2 and I5/I6 and also K3/K4 may already be active.	Relays K1/K2 are ready to start and await reset/start command (S34 or S35)
ON	ON	ON/OFF	ON	OFF	ON/OFF	OFF	Safety circuit 1 with I1/I2 and I3/I4 and also K1/K2 may already be active.	Relays K3/K4 are ready to start and await reset/start command (S36 or S37)
ON	ON	ON	ON	OFF	ON	ON	-	All sensor circuits are active. All relays are picked up.

9.2 Error Messages

PWR LED	I1/I2 LED	I3/I4 LED	I5/I6 LED	ERR LED	K1/K2 LED	K3/K4 LED	Notes	Possible cause	Corrective
ON	OFF	OFF	OFF	OFF	OFF	OFF	The sensor circuits are actively controlled from S11/S21 but no input LEDs are lit up.	Internal cross-circuit monitoring is active. Possible cross circuit in a sensor circuit.	Power down Remove cross circuit Subsequent test of the safety function (function test).
ON	ON	ON	ON	OFF	OFF	ON/OFF	Sensor circuits are active, reset/start circuit (S34 or S35) is/was activated and safety circuit K1/K2 is not picking up.	External error: Reverse contact (external actuator) is open in the reset state. Internal error: Diagnostic contact is not correct, possibly welded N/O contact.	External error: Examination of the actuator. Internal error: Power Down, Reset with subsequent test of the safety function (function test). If the error occurs after the function test, please replace the device.
ON	ON	ON	ON	OFF	ON/OFF	OFF	Sensor circuits are active, reset/start circuit (S36 or S37) is/was activated and safety circuit K3/K4 is not picking up.	External error: Reverse contact (external actuator) is open in the reset state. Internal error: Diagnostic contact is not correct, possibly welded N/O contact.	External error: Examination of the actuator. Internal error: Power Down, Reset with subsequent test of the safety function (function test). If the error occurs after the function test, please replace the device.
OFF	OFF	OFF	OFF	OFF	OFF	OFF	Sensor circuits are active.	1. No supply voltage at A1/A 2. Over- or undervoltage at A1	Check the supply voltage.

9.3 Error state

Possible external error	Cause	Corrective
Plausibility error in one of the three sensor circuits (stuck-at at an input)	Switch failure (emergency stop etc.), cross circuit over the same signal	Remove the error in the sensor circuit. Subsequent test of the safety function (function test).
Error during manual reset S34;S36 (stuck-at at the input)	Switch failure, cross circuit over the same signal	Remove reset/start circuit error. Subsequent test of the safety function (function test).

Possible internal error	Cause	Corrective
Internal relay control failure	Component fault	Power down, subsequent test of the safety function (function test). If the error occurs after the function test, please replace the device.
Internal reset failure	Component fault	Power down, subsequent test of the safety function (function test). If the error occurs after the function test, please replace the device.

10 Application examples

For applications in PLe a demand rate of the safety function is required once a month.

10.1 MXF 1 - Dual channel emergency stop circuit with mechanical safety door switches

- Manual activation with connection at S34/S36
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061)

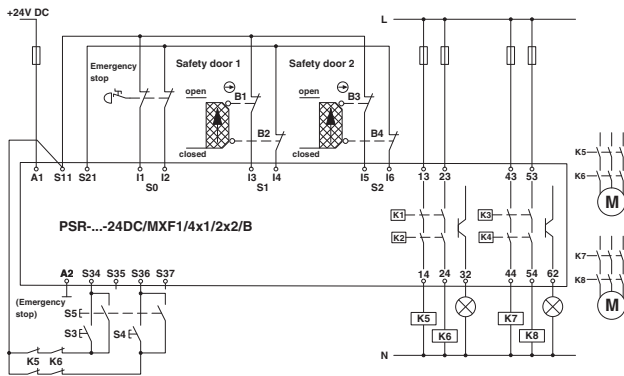


Figure 6 Emergency stop and safety door monitoring with cross-circuit detection

10.2 MXF 1 - Single channel emergency stop circuit with mechanical safety door switches

- Automatic activation with connection at S35 or S37
- Suitable up to category 1, PL c (EN ISO 13849-1), SIL 1 (EN 62061)

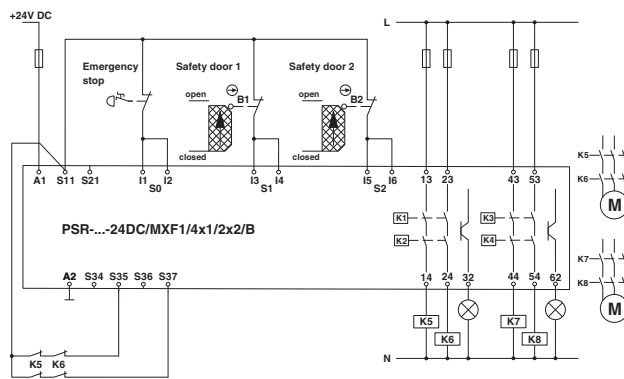


Figure 7 Emergency stop with mechanical safety door switches

10.3 MXF 1 - Dual channel emergency stop circuit with contact-free safety door switches

- Manual activation with connection at S34/S36
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061)
- Suitable switch types available on request



WARNING: Loss of functional safety!

Make sure that the signal generator (e.g., PLC output card or light grid) and the safety relay have the same ground potential.

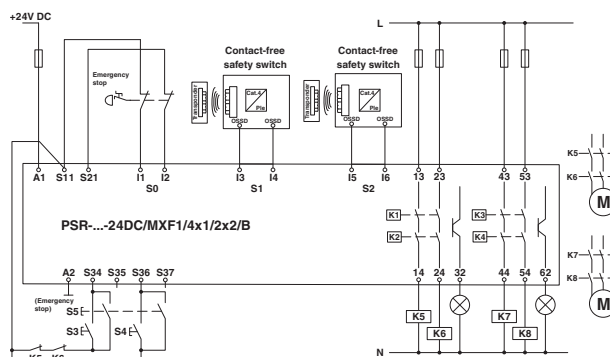


Figure 8 Emergency stop with contact-free safety door switches

10.4 MXF 2 - Dual channel emergency stop circuit with solenoid switches

- Manual activation with connection at S34/S36
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061)

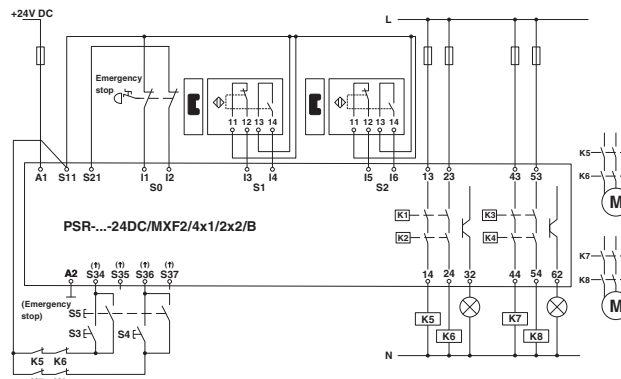


Figure 9 Emergency stop with solenoid switches

10.5 MXF 3 - Dual channel emergency stop circuit with mechanical safety door switches and light grid

- Manual activation with connection at S34/S36
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061)



WARNING: Loss of functional safety!
 Make sure that the signal generator (e.g., PLC output card or light grid) and the safety relay have the same ground potential.

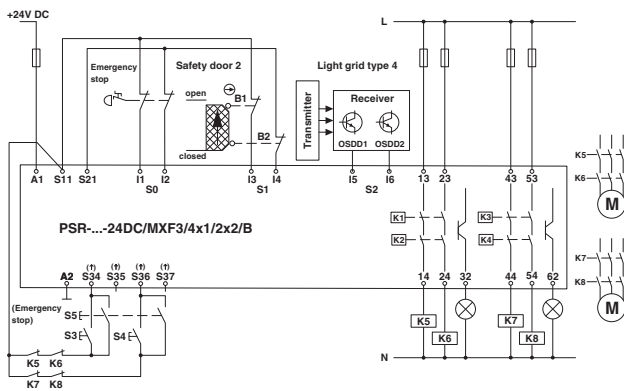


Figure 10 Emergency stop with mechanical safety door switches and light grid

10.6 MXF 3 - Dual channel emergency stop circuit with mechanical safety door switches

- Manual activation with connection at S34/S36
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061) for inputs I1/I2 and I3/I4
- Suitable up to category 3, PL d (EN ISO 13849-1), SIL 2 (EN 62061) for inputs I5/I6, if cross circuit can be eliminated

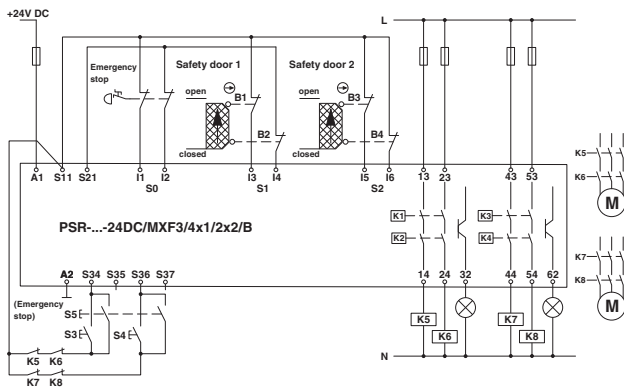


Figure 11 Emergency stop with mechanical safety door switches

10.7 MXF 4 - Dual channel emergency stop circuit with solenoid switches and light grid

- Manual activation with connection at S34/S36
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061)



WARNING: Loss of functional safety!
 Make sure that the signal generator (e.g., PLC output card or light grid) and the safety relay have the same ground potential.

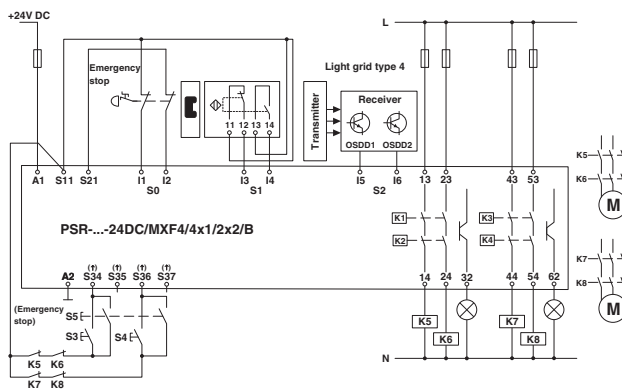


Figure 12 Emergency stop with solenoid switches and light grid

10.8 MXF 4 - Dual channel emergency stop circuit with mechanical safety door switches

- Manual activation with connection at S34/S36
- Suitable up to category 4, PL e (EN ISO 13849-1), SIL 3 (EN 62061) for inputs I1/I2 and I3/I4
- Suitable up to category 3, PL d (EN ISO 13849-1), SIL 2 (EN 62061) for inputs I5/I6, if cross circuit can be eliminated

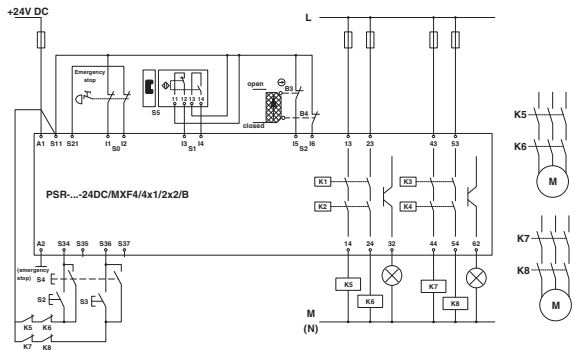


Figure 13 Emergency stop with safety door switches



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