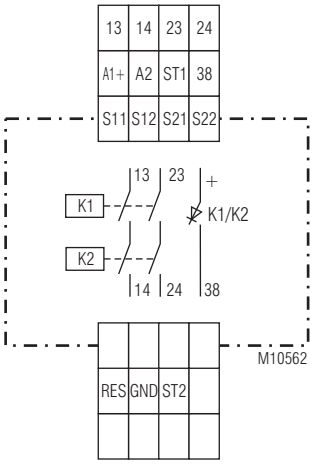
SAFEMASTER C
Multifunctional Safety Module
UG 6980

0269011

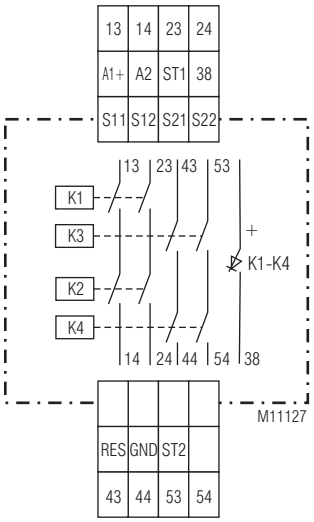
Product Description

The multifunctional safety module UG 6980 provides protection of men and machines by enabling and disabling a safety circuit. It is used together with e-stop buttons, safety gates, light curtains with self testing (type 4) to IEC/EN 61496-1, 2-hand buttons on presses for metal processing and productions machines with dangerous closing movements (type III C to EN 574) and safety mats, edges and tape switches. Simply select 1 out of 5 safety functions on rotary switches - ready. This reduces divers types of safety modules in stock and simplifies your disposition.

Circuit Diagram



UG 6980.02



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Connection Terminals

Terminal designation	Signal designation
A1 +	DC 24 V
A2	0 V
13, 14, 23, 24, 43, 44, 53, 54	Forcibly guided NO contacts for release circuit
38	Semiconductor monitoring output
GND	Reference potential for Semiconductor monitoring output
S11, S21	control output
S12, S22, ST1, ST2, RES	control input

Your Advantage

- **Adjustable safety functions:**
  - E-Stop
  - Safety gate
  - Two-hand control
  - Safety mat / Safety edge
  - Exclusive or contacts
  - Light curtain
- Manual or auto start
- Only one device, different safety functions

Features

- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1: 2008**
  - **SIL Claimed Level (SIL CL) 3 to IEC/EN 62061**
  - **Safety Integrity Level (SIL) 3 to IEC/EN 61508 and IEC/EN 61511**
- Acc. to EN 50156-1 for furnaces
- Line fault detection on On-button:
- Manual restart or automatic restart
- With or without cross fault monitoring
- 2-channel
- Forcibly guided output contacts
- Output: max. 4 NO instantaneous semiconductor monitoring output
- LED indicator for operation, delay contects and failure
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width: 22.5 mm

Approvals and Markings

CE · TÜVRheinland CERTIFIED · Functional Safety Type Approved · www.tuv.com ID 0600000000 · c UL us LISTED · Canada / USA

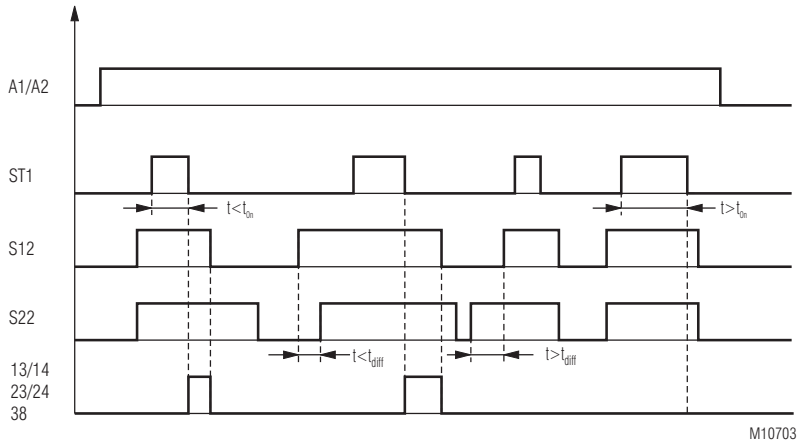
Application

For enable and interrupt a safety circuit in a safe way. It can be used to protect people and machines in applications with e-stop buttons, safety gates, light curtains with selftesting (Type 4) acc. to IEC/EN 61 496-1, 2-hand controls for presses as well as other production machinery with dangerous closing action (Type III C to EN 574) and for safety mats, safety edges and tape switches with a max. switching current of 15 mA.

Indicators

green LED ON:	on, when supply connected
red LED ERR:	on, at internal error flashes at external error
green LED K1/K2 (.02) e.g. K1-K4 (.04):	on, when relay K1 and K2 (.02) energized, e.g. when relay K1, K2, K3 and K4 (.04) energized flashes during time delay

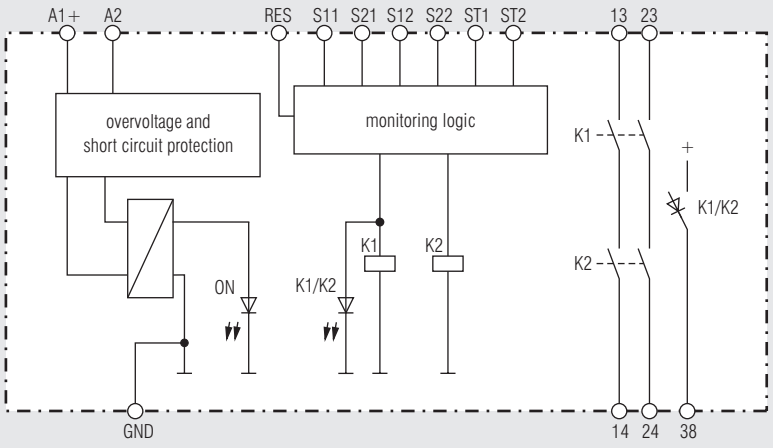
Function Diagram



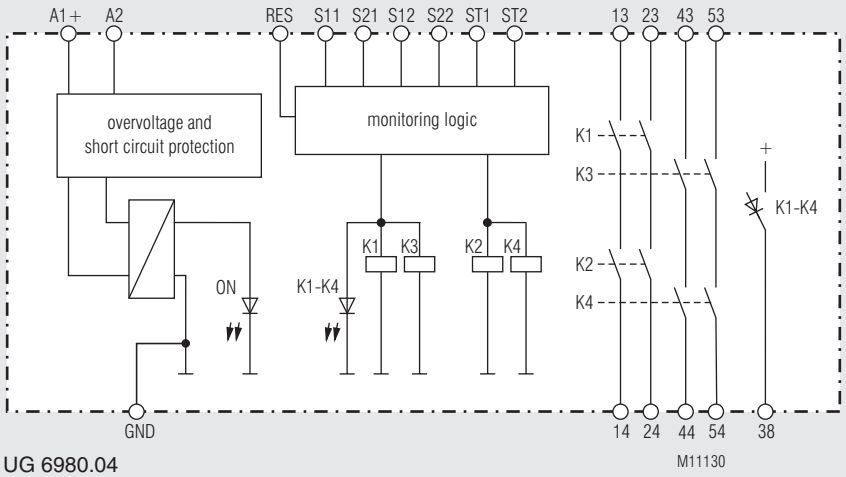
t_{diff}: max. time delay for simultaneity demand
dependent on selected safety function
E-Stop, safety gate, safety mat t_{diff}: max. 3s
Light curtais t_{diff}: max. 1s
Two-hand control t_{diff}: max. 0,5s
other times on request

t_{Ein}: max. actuation time of start button
Standard t_{On}: max. 3s
other times on request

Block Diagram



UG 6980.02



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Practical Notes

Operating mode
Manual or auto start is chosen by wiring. On manual start S21 has to be connected to ST1! via an NO push button. For auto start S21 is connected to ST2. If both inputs are connected to S21 the unit goes into safe failure mode. A restart or new start of the device has to be made. When selecting the safety function 2-hand control (4), only automatic start is possible.

Line fault detection e.g. monitoring of ON-button
If the On-button pressed more than 3 s the adequate output contacts of the safety function can't be switch. The output contacts can be energized when the On-button pressed again (0.1 s < t_{ON} < 3 s).
A line fault is detected if the On-button more than 10 s is actuated. The output contacts of the adeauate safety function can only be energized with a reset or re-start with on an off switching of power supply.

ATTENTION - AUTOMATIC START!

According to IEC/EN 60 204-1 part 9.2.5.4.2 and 10.8.3 it is not allowed to restart automatically after emergency stop.
Therefore the machine control has to disable the automatic start after emergency stop.

Reset and external failures:
The reset input is used to reset external failures (application failures or removable external failures as e.g. a line fault on reset button). If the reset signal is connected to the input for more than 3 sec the unit makes a reset. A new reset is only possible when the reset signal had been switched off temporarily.
If an external failure occurs because both input channels of a safety function did not switch on or off within the simultanious time, a reset is only possible if both channels are switched to off state after removing failure cause.

Setting
On the variant /0_ _ the safety function can be set via rotary switch.
Possible functions:

Fct.	Safety function	
1	E-Stop	cross fault detection
2	Safety gate	
3	Two-hand control	
4	Safety mat / Safety edge	
5	Exclusive or contacts	
6	E-Stop	without cross fault detection
7	Safety gate	
8	Light curtain	

Technical Data

Input

Nominal voltage U_N:	DC 24 V
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption:	typ. 1.9 W
Short-circuit protection:	Internal PTC
Overvoltage protection:	Internal VDR
Duty-cycle ON button:	0.1 s < t_{EIN} < 3 s
Duty-cycle Reset button:	> 3 s
Safety function	
Safety mat / safety edge (5)	
max. permitted safety edge contact resistance:	1000 Ω
switching current at short circuit:	typ. 15 mA at U_N
Light curtains (3)	
control current via S12, S22:	typ. 8 mA at U_N
Min. voltage on terminals S12, S22 when relay activated:	DC 10 V

Output

Contacts

UG 6980.02	2 NO contacts
UG 6980.04	4 NO contacts

The NO contacts can be used for safe braking.

Thermal current I_{th}:	max. 8 A (see quadratic total current limit curve)
Safety function	
E-Stop (1) (6), Safety gate (2) (7), Exclusive or contacts (5)	
Start up at U_N:	< 65 ms
Release delay at U_N and disconnecting the supply:	< 40 ms
Release delay at U_N and disconnecting S12,S22:	< 60 ms
Two-hand control (3)	
Start up at U_N:	< 110 ms
Release delay at U_N and disconnecting the supply:	< 40 ms
Release delay at U_N and disconnecting S12,S22:	< 60 ms
simultaneity demand:	max. 0,5 s
Safety mat (4)	
Start up at U_N:	< 85 ms
Release delay at U_N and disconnecting the supply:	< 40 ms
Release delay at U_N and disconnecting S12,S22:	< 60 ms
Light curtains (8)	
Start up at U_N:	< 35 ms
Release delay at U_N and disconnecting the supply:	< 40 ms
Release delay at U_N and disconnecting S12,S22:	< 25 ms
Switching capacity	
to AC 15 NO contacts:	3 A / AC 230 V IEC/EN 60 947-5-1
to DC 13 NO contacts:	2 A / DC 24 V IEC/EN 60 947-5-1
Electrical life	
at 5 A, AC 230 V cos φ = 1:	> 2.2 x 10^5 switching cycles
Perm. operating frequency:	max. 1800 switching cycles / h
Short circuit strength	
max. fuse rating:	6 A gL IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles
Semiconductor monitoring output (not safety):	max. 50 mA DC 24 V, plus switching

Technical Data

General Data

Nominal operating mode:	continuous operation	
Temperature range		
Operation:	- 15 ... + 55 °C	
Storage:	- 25 ... + 85 °C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour according to UL subj. 94	
Vibration resistance:	Amplitude 0,35 mm Frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Klimate resistance:	15 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Terminal block with screw terminal		
Cross section:	1 x 0.25 ... 2.5 mm² solid oder stranded ferruled (isolated) or 2 x 0.25 ... 1.0 mm² solid or stranded ferruled (isolated)	
Insulation of wires or sleeve length:	7 mm	
Terminal block with cage clamp terminals PC		
Cross section:	1 x 0.25 ... 2.5 mm² solid or stranded ferruled (isolated)	
Insulation of wires or sleeve length:	10 mm	
PT		
Cross section:	1 x 0.25 ... 1.5 mm² solid or stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Wire fixing:	captive slotted screw or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 210 g	

Dimensions

Width x height x depth:	
UG 6980 PS:	22.5 x 110 x 120.3 mm
UG 6980 PC, PT:	22.5 x 120 x 120.3 mm

Technical Data

Safety Related Data

Values according to EN ISO 13849-1:

Category:	4	
PL:	e	
$MTTF_d$:	262.6	a (year)
DC_{avg}:	99.0	%
d_{op}:	365	d/a (days/year)
h_{op}:	24	h/d (hours/day)
t_{cycle}:	3600	s/cycle
	≙ 1	/h (hour)

Values according to IEC/EN 62061 / IEC/EN 61508 / IEC/EN 61511:

SIL CL:	3	IEC/EN 62061
SIL:	3	IEC/EN 61508 / IEC/EN 61511
HFT*):	1	
DC_{avg}:	99.0	%
SFF:	99.7	%
PFH_D:	1.88E-10	h^{-1}
PFD:	.,61E-05	
T_1	20	a (year)

*) HFT = Hardware failure tolerance

The values stated above are valid for the standard type. Safety data for other variants are available on request.

The safety relevant data of the complete system has to be determined by the manufacturer of the system.

UL-Data

The safety functions were not evaluated by UL. Listing is accomplished according to requirements of Standard UL 508, "general use applications"

Switching capacity for .02:	Pilot duty B300, Q300 8A 250Vac Resistive or G.P. 8A 24Vdc Resistive
Switching capacity for .04	
Ambient temperature 55°C	Pilot duty B300, Q300 5A 250Vac Resistive or G.P. 5A 24Vdc Resistive
Ambient temperature 40°C:	Pilot duty B300, Q300 8A 250Vac Resistive or G.P. 8A 24Vdc G.P.
Wire connection::	60°C / 75°C copper conductors only
PS-terminal:	AWG 28 - 12 Sol/Str Torque 0.5 Nm
PC-terminal:	AWG 24 - 12 Sol/Str
PT-terminal:	AWG 24 - 16 Sol/str

Technical data that is not stated in the UL-Data, can be found in the technical data section.

Standard Type

UG 6980.02PS/61 DC 24V

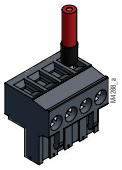
Article number:	0065427
• Safety function:	wählbar
• Output:	2 Schließer
• Nominal voltage:	DC 24 V
• Width:	22.5 mm

Ordering Example

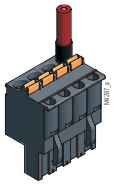
UG 6980 ._ _ _ _ / _ 00 /61 DC 24 V

- Nominal voltage
- UL-approval
- Safety function
  0 = adjustable
- Type of terminals
  PC (plug in cage clamp):
  pluggable terminal blocks,
  with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks,
  with screw terminals
  PT (plug in Twin cage clamp)
  pluggable terminal blocks
  with cage clamp terminals 2-wire
- Contacts
- Type

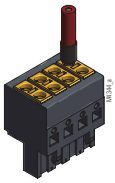
Options with Pluggable Terminal Blocks



Screw terminal
(PS/plugin screw)

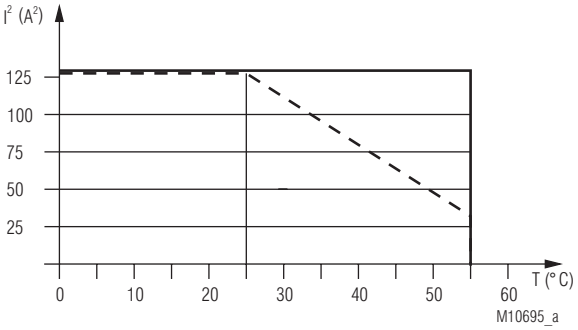


Cage clamp terminal
(PC/plugin cage clamp)



TWIN Cage clamp terminal
(PT/plugin TWIN cage clamp)

Characteristic



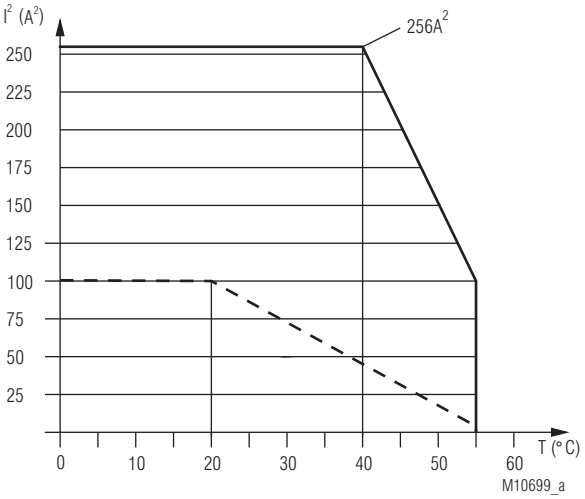
device free-standing
max. current at 55°C over
2 contact path = 8A ≙ $2x8^2A^2 = 128A^2$

device mounted without distance heated by
devices with same load,
max. current at 55°C over
2 contact path = 4A ≙ $2x4^2A^2 = 32A^2$

$$\Sigma I^2 = I_1^2 + I_2^2$$

I_1, I_2 - current in contact paths

UG 6980.02
Quadratic total current limit curve



device free-standing
max. current at 55°C over
4 contact path = 5A ≙ $4x5^2A^2 = 100A^2$

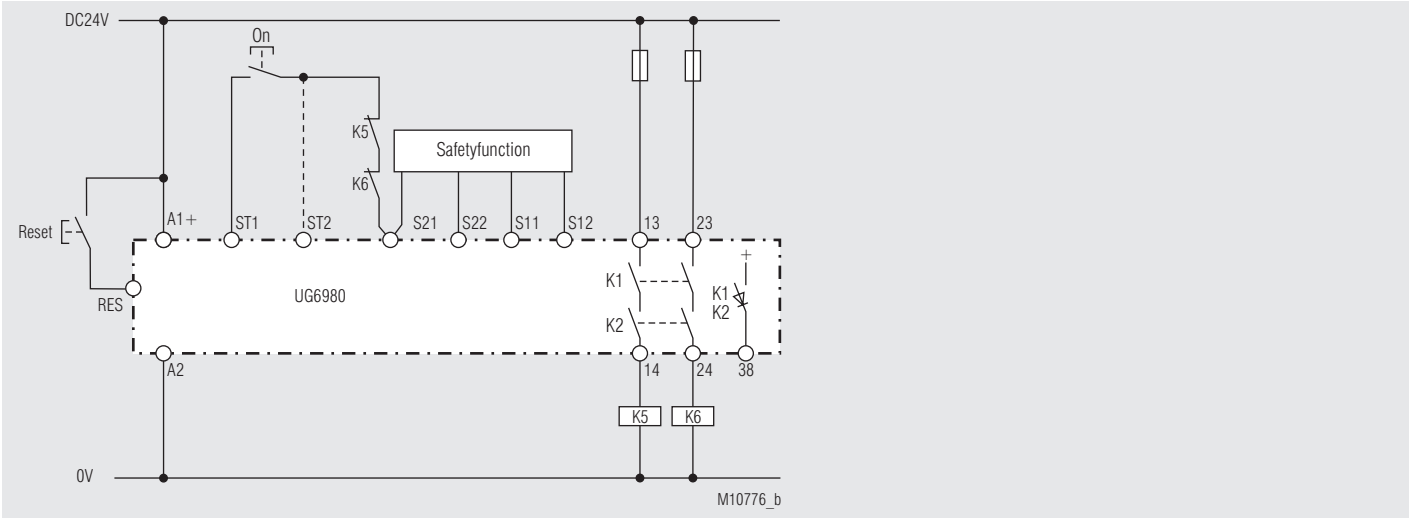
device mounted without distance heated by
devices with same load,
max. current at 55°C over
4 contact path = 1A ≙ $4x1^2A^2 = 4A^2$

$$\Sigma I^2 = I_1^2 + I_2^2 + I_3^2 + I_4^2$$

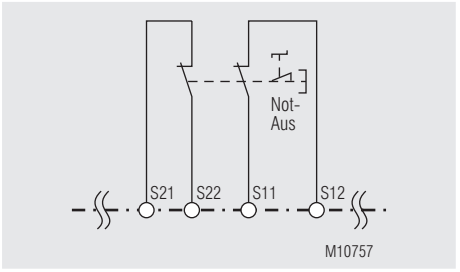
I_1, I_2, I_3, I_4 - current in contact paths

UG 6980.04
Quadratic total current limit curve

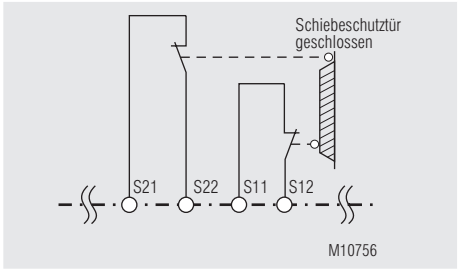
Application Examples with safety function



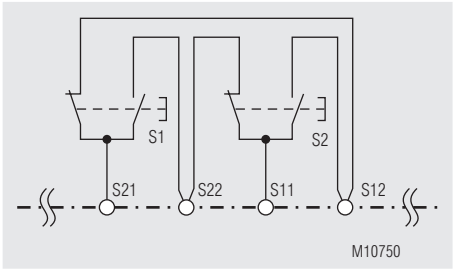
Safetyfunction: see below, Manual-Start (for automatic start make a bridge to ST2 instead of ON button).



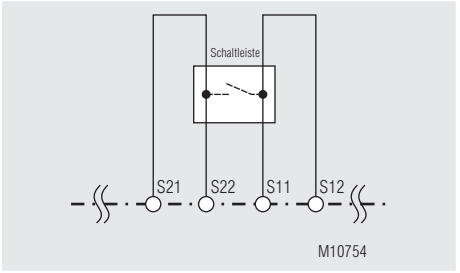
Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4



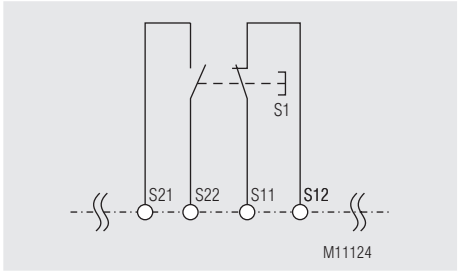
Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4



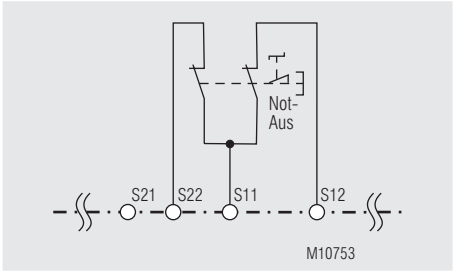
Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN 574



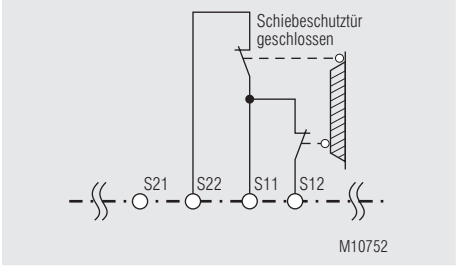
Fct.: Safety mat / Safety edge (4),
with cross fault detection
SIL 3, PL e, Cat. 4



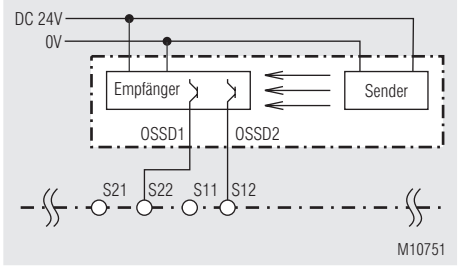
Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Kat. 4



Fct.: E-Stop (6),
without cross fault detection
SIL 3, PL e, Cat. 4 [1]



Fct.: Safety gate (7),
without cross fault detection
SIL 3, PL e, Cat. 4 [1]



Fct.: Light curtain (8),
without cross fault detection
SIL 3, PL e, Cat. 4 [2]

[1] To achieve the stated safety classification the wiring has to be done with crossfault monitoring.
[2] To achieve the stated safety classification light curtains with selftest (type 4) according to IEC/EN 61496-1 have to be used.