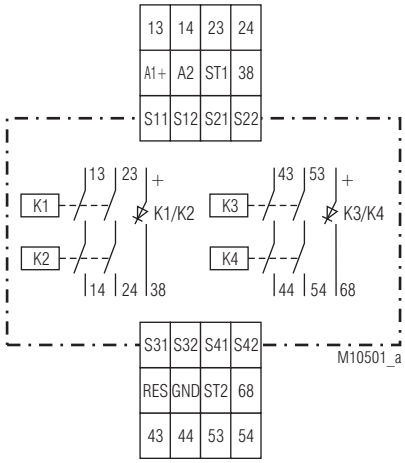
SAFEMASTER C
Multifunctional Safety Module
UG 6970

0269010

Product Description

The multifunctional safety module UG 6970 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 ISO 13851) and safety mats, edges and tape switches. Simply select 2 out of 6 safety functions on rotary switches - ready. This reduces divers types of safety modules in stock and simplifies your disposition.

Circuit Diagram



Your Advantage

- **2 independent, separately adjustable safety funcions:**
  - E-Stop
  - Safety gate
  - Two-hand control
  - Safety mat / Safety edge
  - Exclusive or contacts
  - Light curtain
- Only one device, two safety functions at the same time
- Manual or auto start
- Protection against manipulation by sealable transparent cover

Features

- **According to**
  - **Performance Level (PL) e and category 4 to EN ISO 13849-1**
  - **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: 2 NO contacts per safety function
- 1 semiconductor output per safety function
- LED indicator for operation, safety function 1, 2 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 · UKCA

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 61496-1, 2-hand controls for presses as well as other production machinery with dangerous closing action (Type III C to EN ISO 13851) and for safety mats, safety edges and tape switches with a max. switching current of 15 mA.

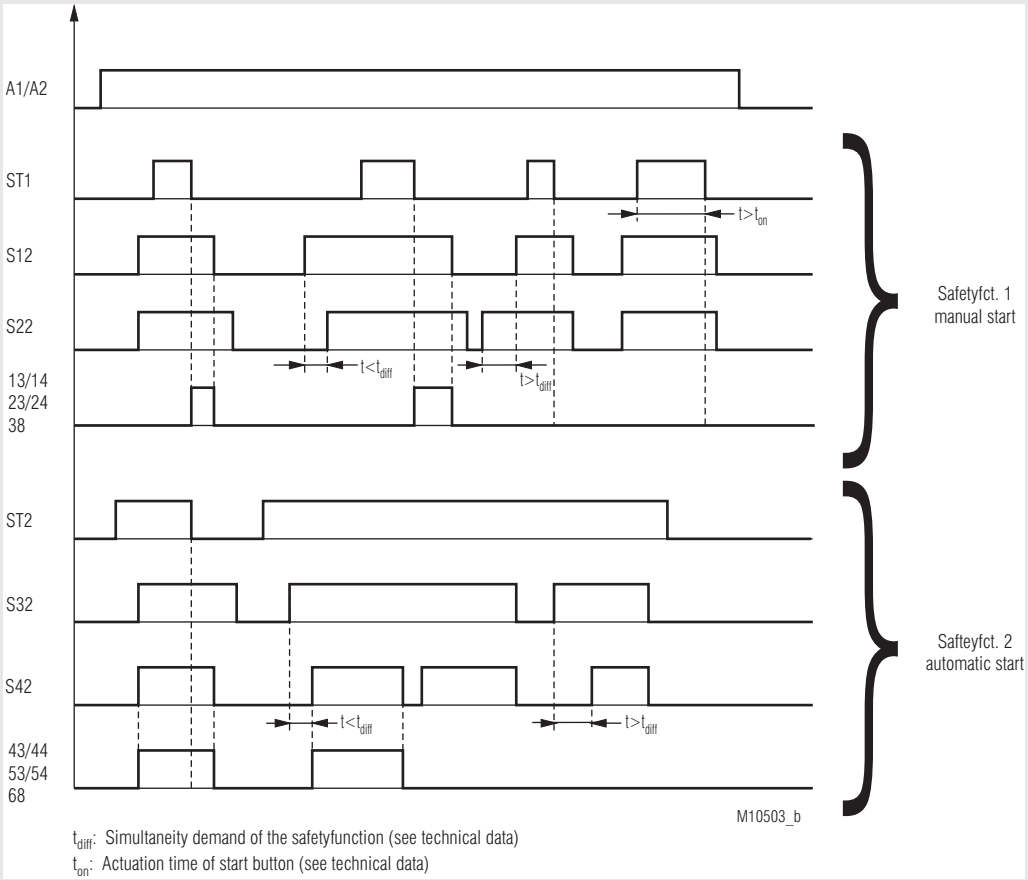
Connection Terminals

Terminal designation	Signal description
A1 +	DC 24 V
A2	0 V
13, 14, 23, 24, 43, 44, 53, 54	Forcibly guided NO contacts for release circuit
38, 68	Semiconductor monitoring output
GND	Reference potential for Semiconductor monitoring output
S11, S21, S31, S41	Control output
S12, S22, S32, S42, ST1, ST2, RES	Control input

Indicators

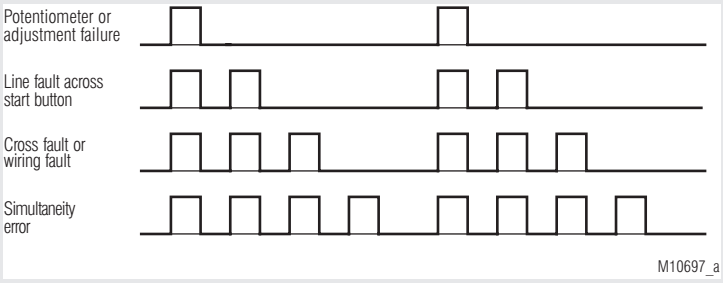
Green LED ON:	On, when supply connected
Red LED ERR:	On, at internal error Flashes at external error
Green LED K1/K2:	On, when relay K1 and K2 energized (safety function 1) Flashes at external errors of safety function 1 (see flashing codes)
Green LED K3/K4:	On, when relay K3 and K4 energized (safety function 2) Flashes at external errors of safety function 2 (see flashing codes)

Function Diagram

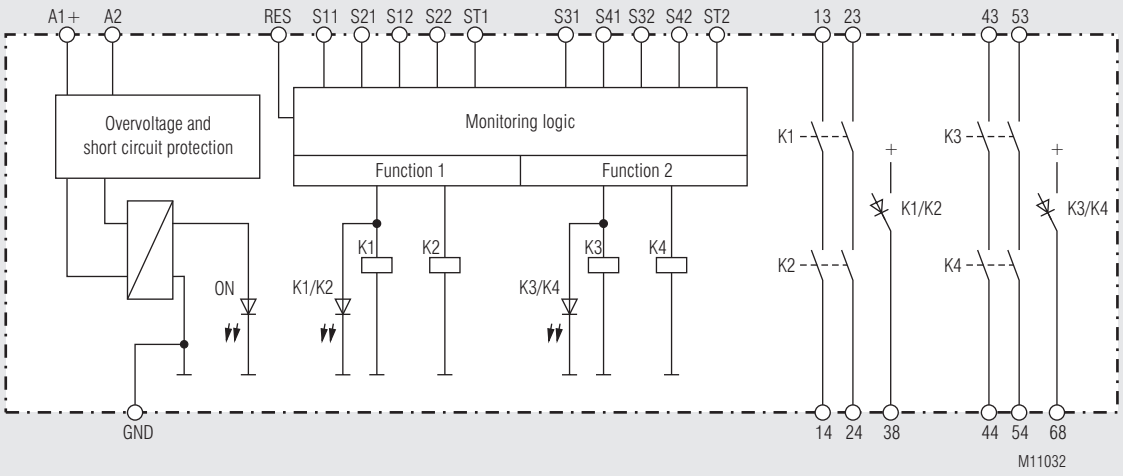


t_{diff}: Simultaneity demand of the safetyfunction (see technical data)
t_{on}: Actuation time of start button (see technical data)

Fault Indication by Flashing Code on K1/K2 resp. K3/K4



Block Diagram



Practical Notes

Operation mode
With the potentiometer on the front plate the operartion mode can be adjustet. The adjustment must be required before energizied. Adjustment during energization is not allowed.
Only an automatic start at safety function two-hand control (3) is possible.

Start	Fkt. 1	Fkt. 2
1	MANUAL	MANUAL
2	MANUAL	AUTO
3	AUTO	HAND
4	AUTO	AUTO
5	MANUAL with common button	

Fkt. 1:
For manual start S21 must be connected via a pushbutton to ST1. For auto start S21 has to be linked to ST1
Fkt. 2:
For manual start S41 must be connected via a pushbutton to ST2. For auto start S41 has to be linked to ST2.

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.

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 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.
If an external failure occurs in only one safety function, only this function will be disconnected. The second safety function still continuous to work.

Function setting
The variants with selectable safety functions have 2 potentiometers Fkt.1 and Fkt.2 to select the required function. The following functions are possible:

Fkt. 1 / Fkt. 2	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	

Operating Potentiometer

Poti "t_{Fkt}"	Adjustment of delay function
Poti "t_{max}"	Adjustment of time range
Poti "t"	Fine adjustment at time range

Technical Data

Input

Nominal voltage U_N:	DC 24 V
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption:	Typ. 3.2 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 (4)	
max. permitted safety edge contact resistance:	1000 Ω
switching current at short circuit:	Typ. 15 mA at U_N
Light curtains (8)	
control current via S12, S22 e.g. S32, S42:	Typ. 8 mA at U_N
Min. voltage on terminals S12, S22 e.g. S32, S42 when relay activated:	DC 10 V

Output

Contacts	2 NO contacts per safety function	
The NO contacts can be used for safe braking.		
Thermal current Strom 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 or S32, S42:	< 60 ms	
Simultaneity demand:	< 3 s	
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 or S32, S42:	< 60 ms	
Simultaneity demand:	< 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 or S32, S42:	< 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 or S32, S42:	< 25 ms	
Simultaneity demand:	< 1 s	
Switching capacity		
to AC 15	3 A / AC 230 V	IEC/EN 60947-5-1
to DC 13		
1. safety function:	2 A / DC 24 V	IEC/EN 60947-5-1
2. safety function:	3 A / DC 24 V	IEC/EN 60947-5-1
to DC 13		
1. safety function:	4 A / DC 24 V at 0.1 Hz	
Electrical life		
at 5 A, AC 230 V cos φ = 1:	> 1.5 x 10^5 switching cycles	
Permissible operating frequency		
1. safety function:	max. 1800 switching cycles / h	
2. safety function:	max. 360 switching cycles / h	
Short circuit strength		
max. fuse rating:	6 A gG /gL	IEC/EN 60947-5-1
Mechanical life:	10 x 10^6 switching cycles	
Semiconductor monitoring output (not safety):	1 per safety function max. 50 mA DC 24 V, plus switching (see quadratic total current limit curve)	

Technical Data

General Data

Nominal operating mode:	continuous operation
Temperature range	
Operation:	- 25 ... + 60 °C (see quadratic total current limit curve) At an altitude of > 2000 m the maximum permissible temperature reduces by 0.5°C / 100 m
Storage:	- 40 ... + 85 °C
Altitude,	
Clearance and creepage distance	
rated impulse voltage / pollution degree:	IEC 60664-1 ≤ 2000 m > 2000 m up to ≤ 4000 m 4 kV / 2 2.5 kV / 2
EMC	IEC/EN 61326-3-1, IEC/EN 62061
Interference suppression:	Limit value class B EN 55011
Degree of protection	
Housing:	IP 40 IEC/EN 60529
Terminals:	IP 20 IEC/EN 60529
Housing:	Thermoplastic with VO behaviour according to UL subj. 94
Vibration resistance:	Amplitude 0,35 mm Frequency 10 ... 55 Hz,IEC/EN 60068-2-6
Klimate resistance:	25 / 060 / 04 IEC/EN 60068-1
Terminal designation:	EN 50005
Wire fixing:	Captive slotted screw or cage clamp terminals
Mounting:	DIN rail IEC/EN 60715
Weight:	Approx. 275 g

Dimensions

Width x height x depth:	
UG 6970 PS:	22.5 x 110 x 120.3 mm
UG 6970 PC, PT:	22.5 x 120 x 120.3 mm

UL-Data

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

Ambient temperature:	- 15 … + 55 °C
Altitude:	≤ 2000 m
Switching capacity:	
Ambient temperature 55°C	Pilot duty B300, R300 5A 250Vac Resistive or G.P. 5A 24Vdc Resistive
Ambient temperature 40°C:	Pilot duty B300, R300 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 6970.04PS/61 DC24V

Article number:	0065426
• 1st Safety function:	Adjustable
• 2nd Safety function:	Adjustable
• Output:	2 NO contacts per safety function
• Nominal voltage:	DC 24 V
• Width:	22.5 mm

Variants

UG 6970 .04 _ _ / _ _ 0 /61 DC 24 V

- Nominal voltage
- UL-approval
- 2. Safety function
  0 = Adjustable
- 1. 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

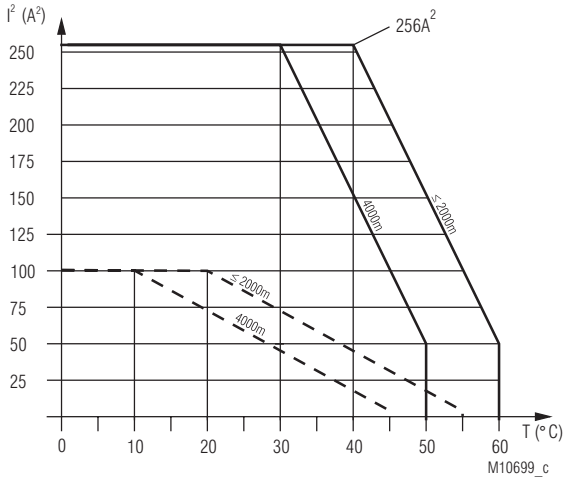
Troubleshooting

Failure	Potential cause
LED "ON" does not light up	- Power supply A1+/A2 not connected
LED "ERR" flashes in relation 1:1	- Under- or overvoltage (check power supply A1+/A2)
LED "ERR" flashes in relation 4:1	- External failure (see flashing code)
LED "ERR" continuously on	- System error (if cannot be removed after restart unit must be replaced)

Maintenance and Repairs

- The device contains no parts that require maintenance.
- In case of failure, do not open the device but send it to manufacturer for repair.

Characteristics



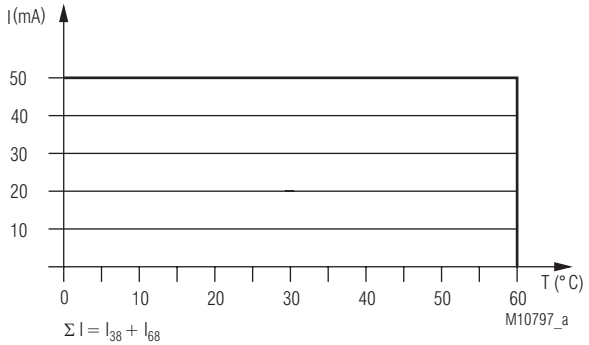
Device free-standing.
Max. current at 60°C(≤ 2000m) or 50 °C (4000m) over 4 contact path = 3,5A ≙ 4x3,5²A² = 100A²

Device mounted without distance heated by devices with same load.
Max. current at 55°C(≤ 2000m) or 45 °C (4000m) over 4 contact path = 1A ≙ 4x1²A² = 4A²

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

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

Quadratic total current limit curve output contacts.
From an altitude of > 2000 m the curve is adjusted by - 0,5 °C / 100 m (see example for 4000 m).



$\Sigma I = I_{38} + I_{68}$

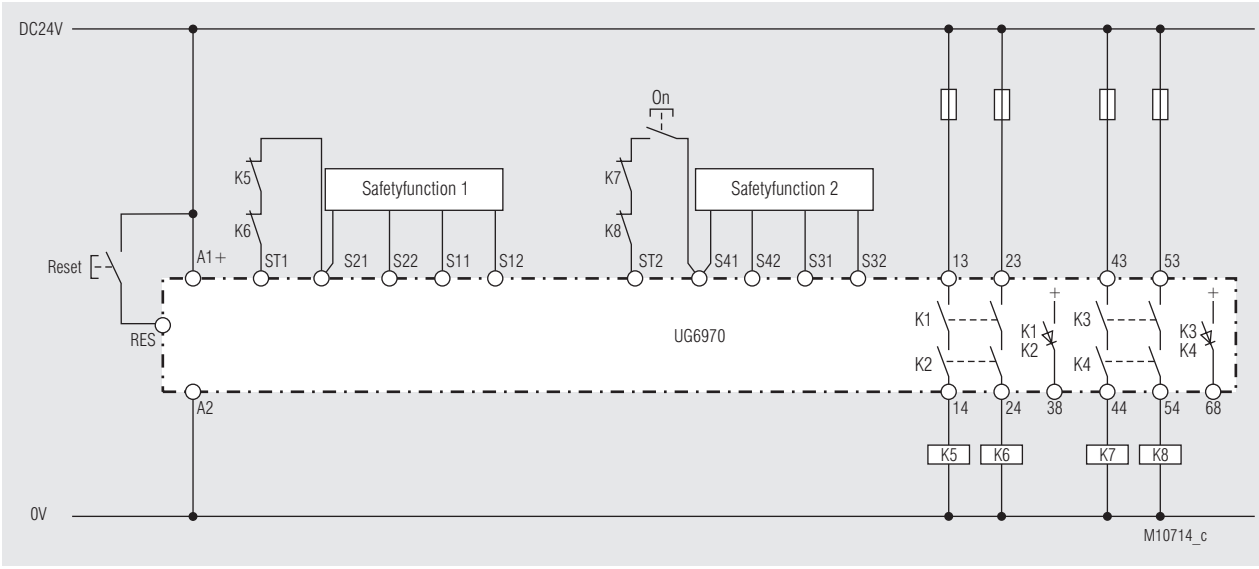
z.B. : $\Sigma I = 35mA + 15mA = 50mA$

I_{38} - Current semiconductor output 38

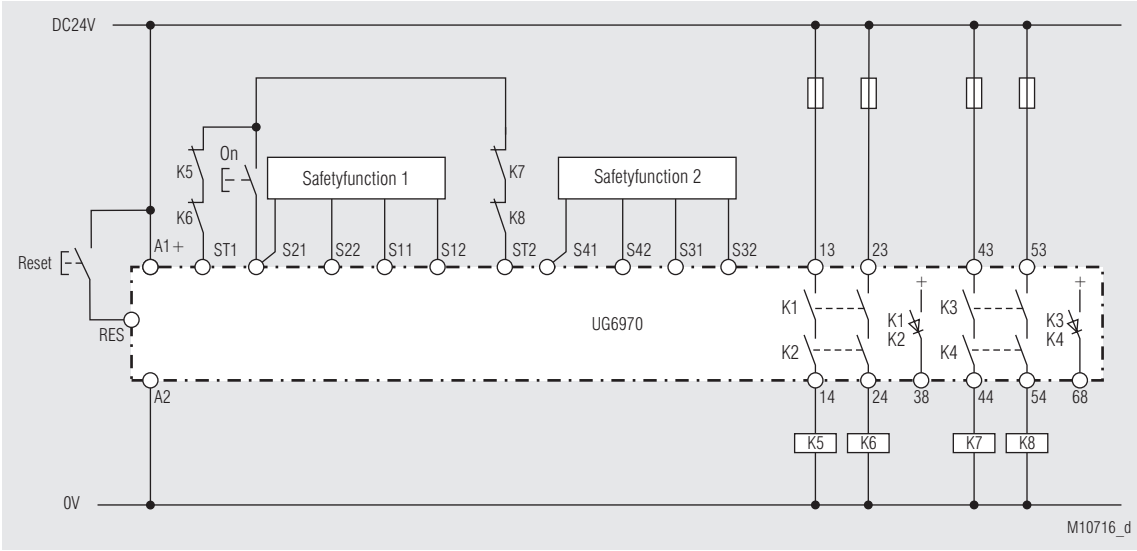
I_{68} - Current semiconductor output 68

Quadratic total current limit curve semiconductor monitoring outputs.

Application Examples with safety function

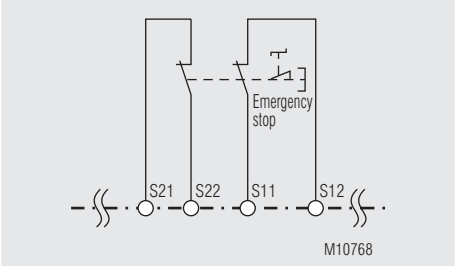


Operating mode: 3 (Fkt1=AUTO ; Fkt2=MANUAL)
Safety function 1: see page 7, Auto-Start
Safety function 2: see page 7, Manual-Start
Contact reinforcement by external contactors. The correct function of the external contactors is monitored by connecting the NC contacts into the start circuit (Fkt.1: terminals S21-ST1, Fkt.2: S41-ST2).

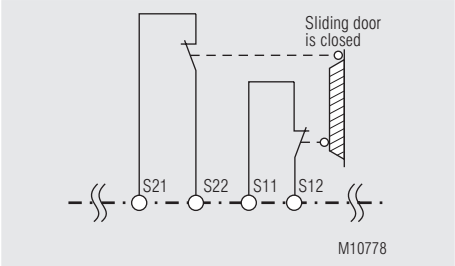


Operating mode: 5 (MANUAL with common button)
Safety function 1: see page 7, Manual-start with common button
Safety function 2: see page 7, Manual-start with common button
Contact reinforcement by external contactors. The correct function of the external contactors is monitored by connecting the NC contacts into the start circuit (Fkt.1: terminals S21-ST1, Fkt.2: S41-ST2).

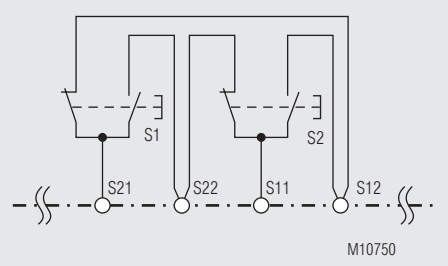
Application Examples with safety function 1



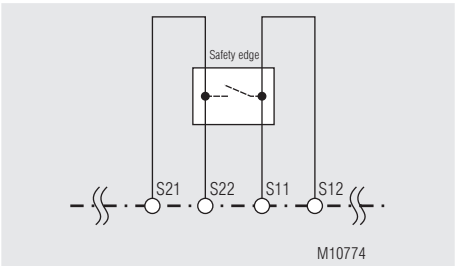
Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4



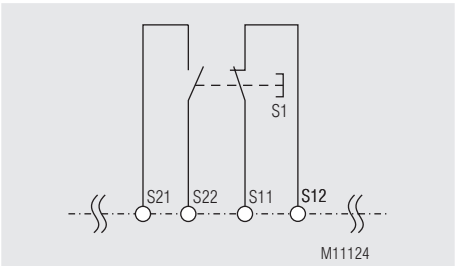
Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4



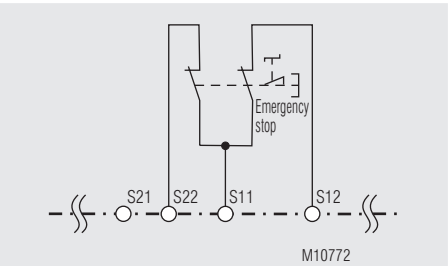
Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN ISO 13851



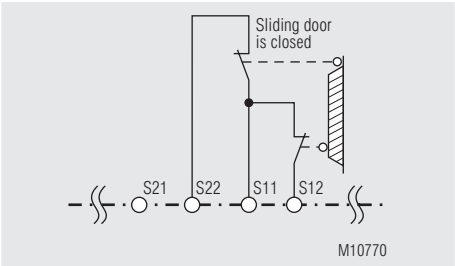
Fct.: Safety mat / Safety edge (4),
with cross fault detection
SIL 3, PL e, Cat. 4



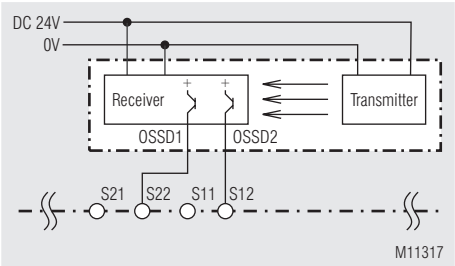
Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Kat. 4



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.

Application Examples with safety function 2

The safety function 2 is connected as well as safety function 1, but S11 ≙ S31, S12 ≙ S32, S21 ≙ S41 and S22 ≙ S42.