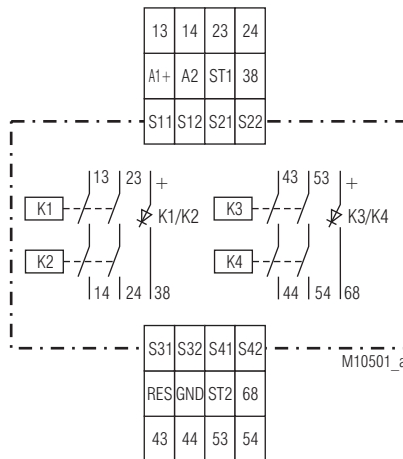




Product Description

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 574) and safety mats, edges and tape switches. Simply select 2 out of 5 safety functions on rotary switches - ready. This reduces divers types of safety modules in stock and simplifies your disposition.

Circuit Diagram



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, 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

Your Advantage

- 2 independent, separately adjustable safety functions:
 - 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

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: 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



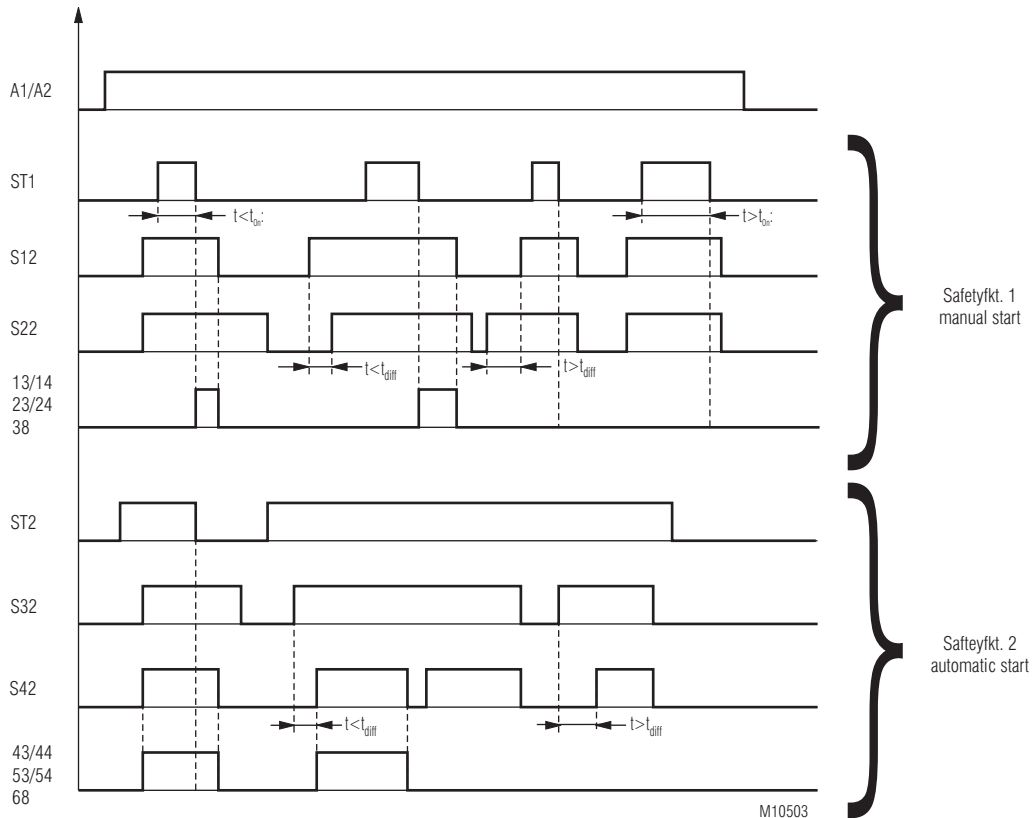
Application

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:	on, when relay K1 and K2 energized (safety function 1) flashes at external errors of safety function 1
green LED K3/K4:	on, when relay K3 and K4 energized (safety function 2) flashes at external errors of safety function 2

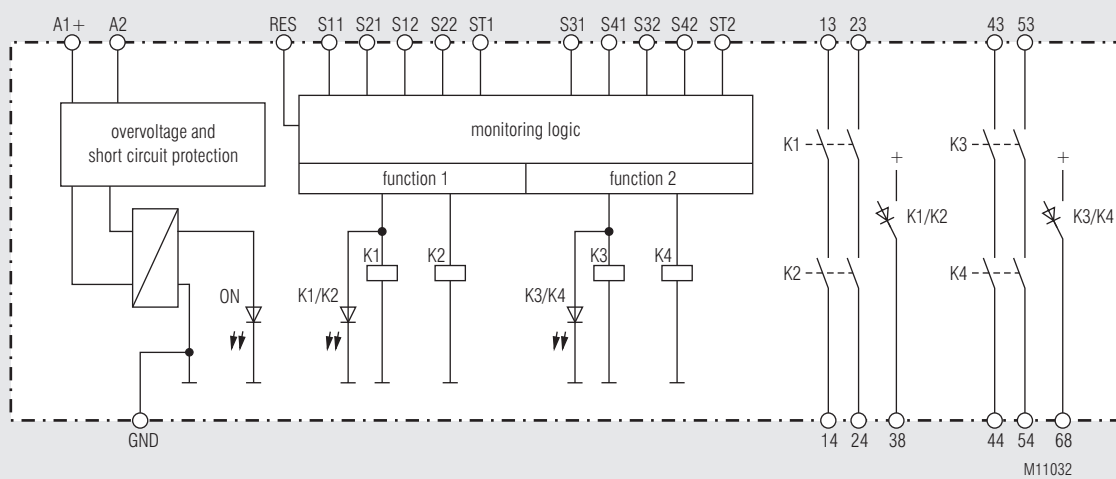
Function Diagram



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

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

Block Diagram



Practical Notes

Operation mode

With the potentiometer on the front plate the operation mode can be adjusted. The adjustment must be required before energized. 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	

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 ($0.1 \text{ s} < t_{\text{ON}} < 3 \text{ s}$).

A line fault is detected if the On-button more than 10 s is actuated. The output contacts of the adequate 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 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 simultaneous 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	without cross fault detection
6	E-Stop	
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. 3.2 W
Short-circuit protection:	Internal PTC
Overvoltage protection:	Internal VDR
Duty-cycle ON button:	$0.1 \text{ s} < t_{\text{EIN}} < 3 \text{ s}$
Duty-cycle Reset button:	$> 3 \text{ s}$
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 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

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: 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 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

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 $\cos \varphi = 1$: $> 1.5 \times 10^5$ 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 gL IEC/EN 60 947-5-1

Mechanical life: 10×10^6 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:	- 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 mm ² solid oder stranded ferruled (isolated) or 2 x 0,25 ... 1,0 mm ² 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 mm ² solid or stranded ferruled (isolated)	
Insulation of wires or sleeve length:	10 mm	
PT		
Cross section:	1 x 0,25 ... 1,5 mm ² 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. 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

Technical Data**Safety Related Data****Values according to EN ISO 13849-1:**

Category:	4	
PL:	e	
MTTF _d :	134.5	a
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)

Ergebnisse nach 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⁾ :	1	
DC _{avg} :	99.0	%
SFF	99.6	%
PFH _D :	3.89E-10	h ⁻¹
PFD:	3.27E-05	
T ₁	20	a (year)

¹⁾ 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:

Ambient temperature 55°C	Pilot duty B300, Q300 5A 250Vac Resistive or G.P. 5A 24Vdc Resistive
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Ambient temperature 40°C:	Pilot duty B300, Q300 8A 250Vac Resistive or G.P. 8A 24Vdc G.P.
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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

Ordering Example

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

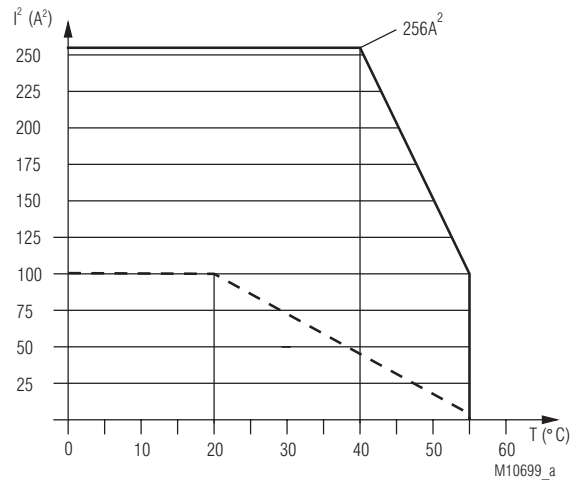
PS (plug in screw):
pluggable terminal blocks,
with screw terminals

PT (plug in Twin cage clamp):
pluggable terminal blocks,
with cage clamp terminals 2-wire

Contacts

Type

Characteristics



device free-standing
max. current at 55°C over
4 contact path = 5A $\hat{=}$ 4x5²A² = 100A²

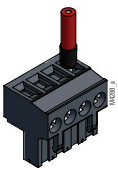
device mounted without distance heated by
devices with same load,
max. current at 55°C over
4 contact path = 1A $\hat{=}$ 4x1²A² = 4A²

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

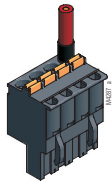
I_1, I_2, I_3, I_4 - current in contact paths

Quadratic total current limit curve output contacts

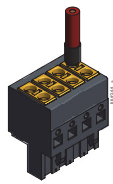
Options with Pluggable Terminal Blocks



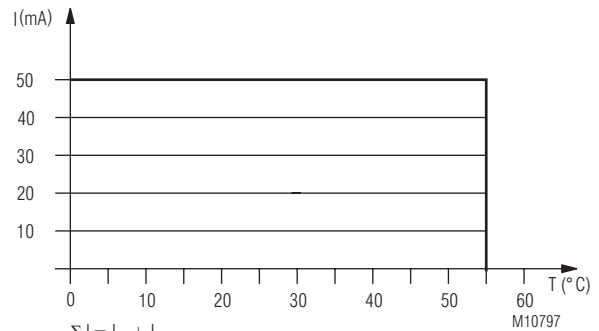
Screw terminal
(PS/plugin screw)



Cage clamp terminal
(PC/plugin cage clamp)



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



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

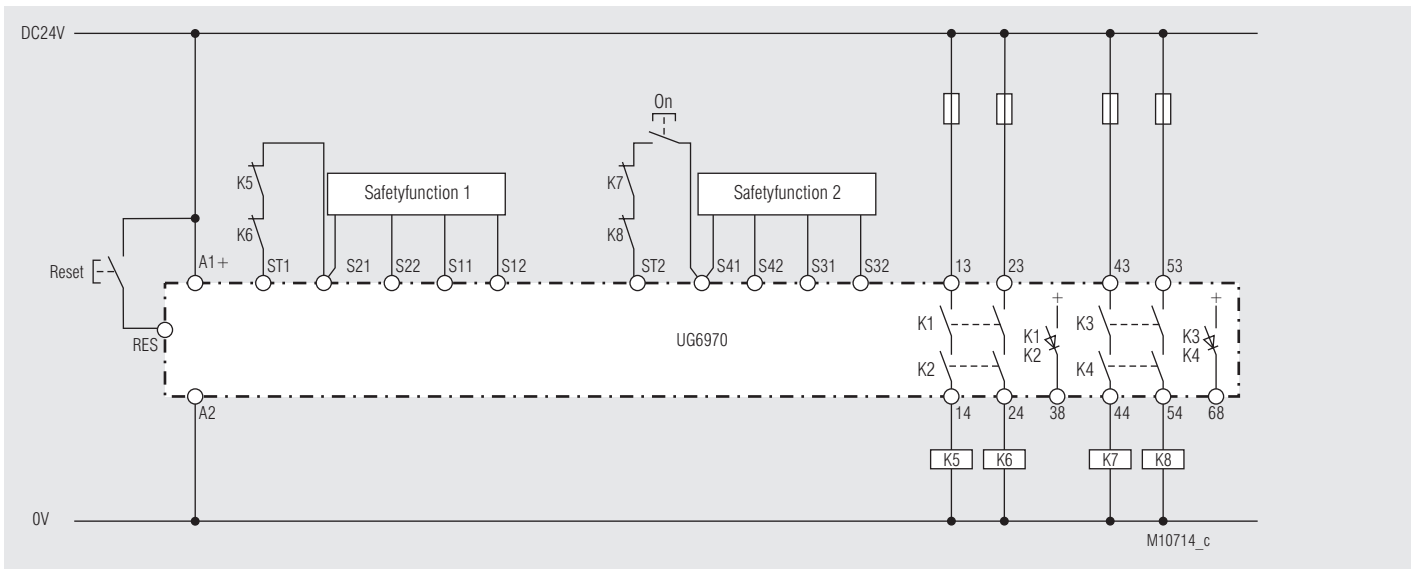
z.B. : $\Sigma I = 35\text{mA} + 15\text{mA} = 50\text{mA}$

I_{38} - current semiconductor output 38

I_{68} - current semiconductor output 68

Quadratic total current limit curve semiconductor monitoring outputs

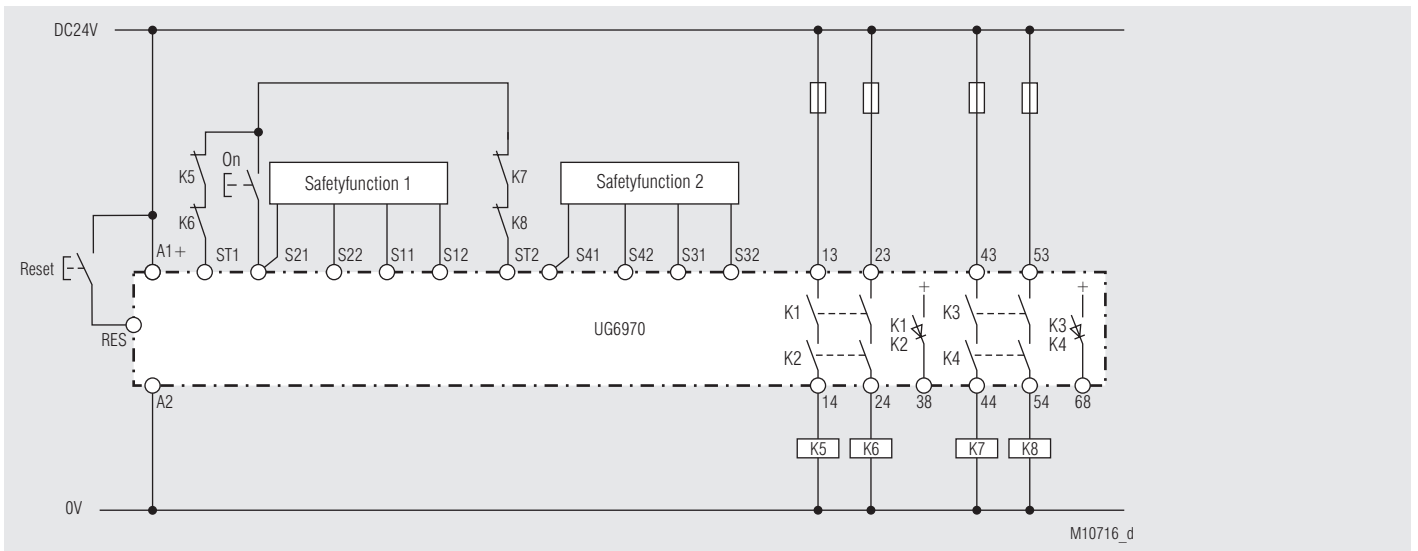
Application Examples with safety function



Operating mode: 3 (Fkt1=AUTO ; Fkt2=MANUAL)

Safety function 1: see page 7, Auto-Start

Safety function 2: see page 7, Manual-Start

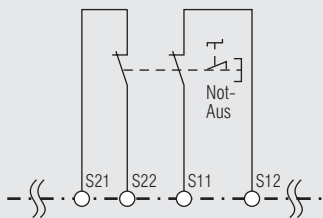


Operating mode: 5 (MANUAL with common button)

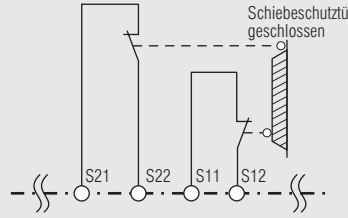
Safety function 1: see page 7, Manual-start with common button

Safety function 2: see page 7, Manual-start with common button

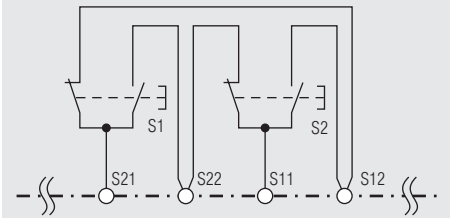
Application Examples with safety function 1



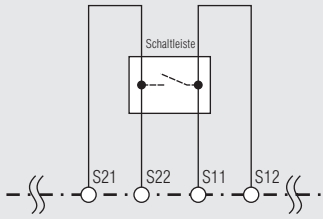
Fct.: E-stop (1),
with cross fault detection
SIL 3, PL e, Cat. 4



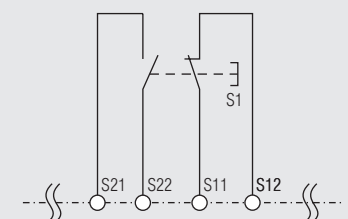
Fct.: Safety gate (2),
with cross fault detection
SIL 3, PL e, Cat. 4



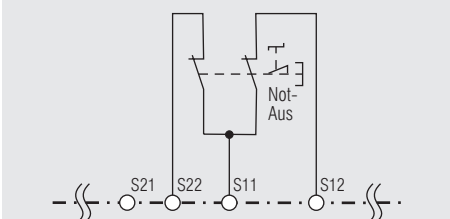
Fct.: Two-hand control (3),
with cross fault detection
SIL 3, PL e, Cat. 4
Type III C to EN 574



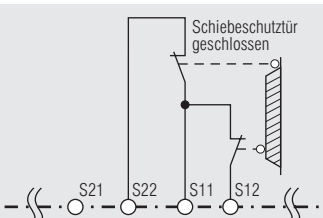
Fct.: Safety mat / Safety edge (4),
with cross fault detection
SIL 3, PL e, Cat. 4



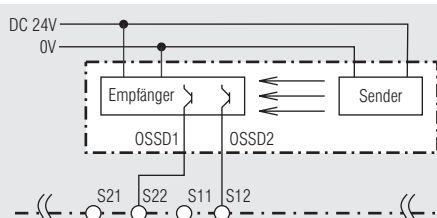
Fct.: Exclusive or contacts (5),
with cross fault detection
SIL 3, PL e, Cat. 4



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 $\hat{=}$ S31, S12 $\hat{=}$ S32, S21 $\hat{=}$ S41 and S22 $\hat{=}$ S42.

